ACCE-GOV: A New Theoretical Framework for Cloud Computing Adoption for E-Government System in Developing Countries (Saudi Arabia Perspective)

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Doctor of Philosophy

Naif Ali Al Mudawi

School of Engineering and Informatics Department

University of Sussex

United Kingdom

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Declaration

I hereby declare that this thesis has not been and will not be, submitted in whole or in part to another University for the award of any other degree.

Signature: Naif Ali Al Mudawi

Acknowledgement

All praise goes to Allah (ﷲ) for His power and guidance. It is Allah who has given me the enthusiasm and strength to complete this thesis.

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Publications

Conferences

- Al Mudawi N, Beloff N, White M. Cloud computing in government organizations: towards a new comprehensive model. 2019 IEEE SmartWorld, Ubiquitous Intelligence & Computing, Advanced & Trusted Computing, Scalable Computing & Communications, Cloud & Big Data Computing, Internet of People and Smart City Innovation 1473-1479 19 Aug 2019.

Journal

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Abbreviations

AGFI	Adjusted Goodness-of-Fit Index
AC	Adoption Cloud computing
AT	Attitude
ASV	Average Shared Squared Variance
AVE	Average Variance Extracted
AW	Awareness
CMIN/DF	Chi-square/Degree of Freedom
CFI	Comparative Fit Index
CM	Compatibility
CP	Competitive pressure
CO	Complexity
CR	Composite Reliability
CFA	Confirmatory Factor Analysis
DOI	Diffusion of Innovation
E-Government	Electronic Government
E-Services	Electronic Services
GFI	Goodness-of-Fit Index
G2B	Government to Business
G2C	Government to Citizens
G2E	Government to Employees
G2G	Government to Government
ICT	Information and Communication Technology
IFI	Index of Fit
IS	Information Systems
IT	Information Technology
KSA	Kingdom of Saudi Arabia
MSV	Maximum Shared Squared Variance
NFI	Normed Fit Index
RP	Regulations
RMSEA	Root Mean Square Error of Approximation
SE	Security

SQ	Service Quality
SRMR	Standardized Root Mean Square Residual
TAM	Technology Acceptance Model
TR	Technology Readiness
TOE	Technology-Organisation-Environment
TRA	Theory of Reasoned Action
TM	Top Management Support
TU	Trust
TLI	Tucker–Lewis Index
UTAUT	Unified Theory of Acceptance and Use Technology
UK	United Kingdom

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Abstract

Electronic government (e-government) systems formed from the aggregation of various government organisations providing online services through web interfaces have become more common. This is a consequence of increasing use of the Internet to access information and services whereby governments engage new technologies to provide information and data to increase the effective adoption of their organisations' online services. One technology that serves to enhance the provision of online services is cloud computing. A cloud is a model that functions as a parallel system and a distributor; and consists of a set of interconnected virtual machines that are dynamically displayed and connected to share the service that has been established by the service provider. Therefore, if e-government organisations systems suffer from numerous barriers to the adoption of new technologies, that would have various impacts on the development of effective e-government. Most of the government organisations have been suffering to overcome the issues in the IT infrastructure of the e-government system. This research thus also assists the government decision-makers to understand these factors in seeking to improve e-government systems.

The research aims to determine and examine the more critical factors that influence the adoption of cloud computing in an e-government system takes into account the experiences of top government management and IT employees in government organisations. The theoretical research model of adoption of cloud computing in e-government based on a Technology, Organisations and Environment (TOE) framework with extending a Social context. Consequently, a conceptual framework has proposed the successful development and adoption of cloud computing in the e-government system (ACCE-GOV).

The research method has been applied a mixed methods research methodology; with quantitative (survey) and qualitative (semi-structured interviews) methods used in a complementary manner. The main method of data collection was quantitative and utilised a survey questionnaire. The target sample size was around 383 respondents. The quantitative data was analysed using descriptive statistics as well as the structural equation model (SEM). The qualitative research data were collected via 8 detailed semi-structured interviews to represent the perspectives of senior IT managers in eight Saudi government organisations. A thematic analysis was carried out to analysing data.

The results of research make a significant contribution to investigate the critical factors that should be taken into account by the Saudi government to develop an e-government system via the adoption of cloud computing. This research investigated the critical factors identified in the theoretical framework (ACCE-GOV). The research findings provide valuable information for top management in Saudi government organisations about what needs to be considered for enhancing the adoption of cloud computing in e-government system. This study has confirmed that there is a significant relationship between both trust and attitude with the adoption of cloud computing, however, an awareness and compatibility show that no significant relationship with the adoption of cloud computing for e-government systems.

Chapter 1: Introduction

1.1 Introduction

Due to the rapid development of global information and communication technology (ICT) to improve the concept of "electronic Services" e-governments around the world have been motivated to implement electronic government (e-government) to be delivered online. Many governments seek to establish an e-government system that is largely concentrated on reducing costs and developing the quality of government services. Governments have made e-government systems a high priority in the transformation from traditional processes to e-government services Moreover, there are some researchers who believe that the adoption of ICT has influenced by regulations and policies of government organisations (Ziemba, 2019; Purnomo and Kusnandar, 2019). Many researchers have shown that ICT can enhance the public sector's ability to deliver and improves the performance of government services by providing interaction with citizens and businesses (Lawrence and Tar, 2018).

Governments seek to achieve a better future and to take advantage of the potential to revolutionize the relationship between government and citizens through new technologies. Tremendous developments in digital technology enable the exploitation of opportunities to strengthen the e-government system especially the development of e-services (Pisirir *et al.*, 2019; Khayer *et al.*, 2020). Governments in the Middle East have recognized the importance of information technology in improving and sustaining their economies. However, there are many issues and challenges that are a barrier to the provision of an effective infrastructure in order to deliver distinctive services. Accordingly, several studies (Lemay et al., 2018; Tawalbeh et al., 2016) focused on understanding the factors influencing the implementation of e-government systems, as well as exploring the implications of adopting new technologies for government systems. This highlights the need for governments and decision-makers to understand which factors affect adoption. Most governments seek to provide online services with high quality to citizens and businesses by adopting modern ICT for public sector organizations, citizens and businesses in order to increase efficiency in the public sector (Dombeu, 2017). Therefore, these governments spend huge sums of money to create a reliable and accessible e-government system.

There are many challenges faced by governments in developing countries in this regard, especially by the Saudi government. The government has invested significant efforts in the take-up of government online services; and the IT administration has been given high attention.

These challenges have included the lack of an IT infrastructure, and accordingly the government has spent millions on improving the IT network and hardware (Zhang et al., 2018). A number of studies (Chen et al., 2017; Hansen et al., 2018) have also shown that challenges to successful implementation of e-government systems include whether the organisations have accepted technology or not; so many have looked into factors in which that influence adoption. Moreover, with rapid technological development, using technology, cloud computing has become one of the five technologies (Internet of Things (IOT), Machine learning, Virtual reality (VR), Touch commerce and cloud computing) that have been adopted in many sectors (Oliveira et al., 2014). Many governments have adopted cloud computing in various services to overcome some of the challenges and obstacles to successfully implementing e-government systems (Khayer *et al.*, 2020). In this pursuit, the benefits of cloud computing that have contributed to this end are virtualization, distributed computers, computing facilities, networks and web services features (Cellary and Strykowski, 2018). In addition, cloud computing is an IT model, enabling access from anywhere to shared sets of configurable resources (such as computer networks, servers and storage); which results in minimal administrative effort over the Internet (Thiel, 2016). Therefore, in its efforts to establish an e-government system for Saudi Arabia the government has needed to adopt new technologies in order to overcome the IT obstacles. One of these technologies that could guide IT administration to spread its system around the country is cloud computing.

The aim of this research was to fill the gap in the research literature through conducting empirical research on the adoption of cloud computing in e-government systems in the Saudi context. This research has explored the influences, challenges and issues related to factors influencing the adoption of cloud computing in e-government system, from the view of top management and IT administration and the Saudi government. Moreover, it further proposes a conceptual framework for the adoption of cloud computing to provide a way of exploring and understanding the significant factors that influence the adoption of cloud computing.

1.2 Background

Many governments in the Middle East have been relying on the use of e-government systems. Saudi Arabia is considered one of these countries, and has various notable characteristics including its geographical location, its economic strength and the variety of resources of income (Al-Balushi *et al.*, 2016). However, there are obstacles and challenges that face the Saudi

government in implementing e-government systems in all government organisations. Some studies have shown that Saudi government has made significant development in implementing e-government systems, but further efforts are required to develop these e-government systems if organisations are to be successfully encouraged and facilitated to use them (Burda and Teuteberg, 2015; Wu and Chen, 2014).Therefore, there should be a stronger intention by government organisations to accept and adopt appropriate technology in e-government systems, while continuing the traditional methods of receiving the government services. The idea of an e-government system had been established in Saudi Arabia in 1998 (Alshehri, 2012). Based on the rapid increase in economic and social development, there has been a trend in the implementation of e-government systems to provide better services, improve the quality of government transactions and ensure the adoption of e-government systems between government organisations (Wong and Jackson, 2018). However, there are still many factors including inadequate IT infrastructure that impede the implementation of digital transformation. This requires the government to take into account how to improve e-government systems.

Globally, Saudi Arabia ranks 19th in size of economy (CITC. 2018); and is considered one of the strongest and fastest-growing economies worldwide which is partly due to having a strong political system, a young population and large economic diversification. However, Saudi Arabia is still at an early stage for investing in all domains, especially in the IT sector. Moreover, The Saudi e-government system is influenced by many influences factors, such as the policy of the government, the social and cultural features of organisations, increasing confidence in using e-government, attitudes about technologies and the lack of IT infrastructure readiness (Bose *et al.*, 2013). Moreover, security is one of many factors that have a multidimensional construct impact on the adoption of cloud computing (Zhang *et al.*, 2018; Oliveira *et al.*, 2014). However, one of the important aspects for the success of e-government system in developing countries is leadership support in the adoption of new technologies. In addition, there is the reliance on government support, but this has not yet reached the level of totally accepting the adoption of new technologies like cloud computing in e-government (Ali and Ali, 2015). According to The United Nations e-Government Survey (2018), Saudi Arabia's e-government systems is ranked No.52 worldwide (UN, 2018). This due to lack of improvement comparing with other governments systems. This is shown below in Table 1.1.

Saudi Arabia World e-government ranking						
Year Ranking	**2008**	**2010**	**2012**	**2014**	**2016**	**2018**
World Ranking	**40**	**38**	**41**	**36**	**44**	**52**

Table 1.1: Saudi E-Government System World e-government ranking

Recently, the adoption of cloud computing takes into account the advantages of reduced costs and better use of the existing resources of the IT infrastructure. Furthermore, cloud computing is a model that provides a way to connect and store resources in a perfect and secure environment over the Internet (Zhang and Chen, 2010). This technology thus arguably provides the best way to overcome the problems of e-governments systems facing financial challenges and an increasing volume of data. Therefore, top management in government needs to provide services by finding better procedures economically as much as possible without compromising the desired quality of service. Adoption of cloud computing connects large groups of resources through networks either private or public (Liu, 2018). This technology helps achieve infrastructure construction and provides a dynamically scalable infrastructure that is flexible and efficient, providing better collaboration between government agencies and organizations. The benefits that have been associated with adopting cloud computing in e-government systems are increasing trust, improving the economy and generating revenue.

Until now, it has been found that previous research focused primarily on the internal factors impacting the adoption of cloud computing in e-government systems, rather than focusing on the organisations' acceptance of these services (Jones *et al.*, 2017; Senyo *et al.*, 2016). In fact, the adoption of cloud computing technology has played an important role in recent years. Therefore, it has become more suitable for any organisations suffering from a lack of IT infrastructure to make use of it. Furthermore, exploiting ICT like cloud computing has been shown to have many positive effects on the transaction processes of government organisations. Cloud computing technology has played an important role in recent years. It is clear that governments seek to use ICTs to enhance service delivery to citizens by significantly improving the efficiency and

effectiveness of public services (Kim and Group, 2015; Stefanou and Skouras, 2015). Governments of the developing world thus need to consider the benefits of the adoption of cloud computing technology in e-government systems.

This research discusses the key factors of adopting cloud computing in e-government that affect performance in developing countries, particularly the Saudi government's system. This chapter presents the research contribution of investigating adopting cloud computing in e-government systems, the motivation for this adoption and its value and significance. Moreover, the objectives of this research and the key research questions addressed are outlined. Consequently, this research will attempt to fulfill a critical knowledge gap and provides a valuable insight into the significant factors that influence the adoption of cloud computing in e-government systems in Saudi Arabia; which will be of interest to researchers, the ICT industry and for top management who are seeking to find strategies that improve government systems.

1.3 Research Problem

The Saudi government has given a high level of priority to the development of e-government systems to a high standard of quality. In other words, the Saudi ICT sector has become one of the fastest growing in developing countries (Oni et al., 2017). As a consequence, this technological innovation reflects how the performance of government organisations has improved in recent decades (Joshi and Islam, 2018). However, Aizstrauta *et al.*, (2015) and Alateyah *et al.*, (2012) clarified that there were a number of issues that pose challenges to an e-government system on a local data centre. These challenges are presented as a shortage of IT professionals employed by the Saudi government, limited financial resources, changeable patterns of organisations, lack of accessibility in some government facility services, the lack of national government systems, and the underutilization of e-government systems.

One of the major challenges facing Saudi government organisations is the spending of huge budgets to improve and maintain IT infrastructure (Marzuki and Arshad, 2016). Moreover, most organisations have tended to use more resources and pay much more than was actually needed. Saudi government organisations need continuous development in order to benefit from e-government systems and facilitate the provision of services. Reports on e-government transition are conducted by the e-government Program (Yesser) to investigate the transition rate of various government agencies, in order to ensure a successful transition. These reports reveal that the total number of government organisations is 119, 31 of which have complete e-government

systems, 11 have incomplete e-government systems, and 77 have only basic e-government systems (Yesser, 2019). This is shown below in Table 1.2. Thus, lack of improvement in Saudi e-government systems has led to a fall in the rank position of Saudi e-government in the world-wide ranking (see Figure 1.1). Organisations who have adopted cloud computing that can then concentrate on their core business rather than spending a huge amount on IT infrastructure. Government organisations would be better off paying to utilise cloud computing rather than paying for more resources than they actually need. A study conducted by Liang, (2012) showed that one of the top five most valuable systems ensuring successful adoption of technologies is cloud computing technology.

Number of Government organisations	
Number of Government organisations have completed of e-Government system	31
Number of Government organisations have not completed of e-Government system	77
Number of Government organisations have basic complete of e-Government system	11
Total Number of Government organisations	119

Table 1.2: Number of e-Government organisations (source: Yesser, 2019)

Based on these challenges, this research embarks on further exploration of the current situation of the Saudi e-government system in government organisations in the public sector. Furthermore, it addresses several of the issues and challenges that have confronted the Saudi e-government system, such as the evaluation of quality services and the development processes for e-government systems through ICT. Additionally, this research will provide a comprehensive research model that can improve the current e-government system in Saudi Arabia based on four crucial dimensions - the technological, organisational, environmental and social contexts that affect the adoption of cloud computing for e-government systems. Government organizations will have to consider several factors that impact adopting cloud computing for e-government systems; and that it would lead to a failure of the e-government system and be financially harmful if a prior study is not conducted in adopting any new technology. In this case, in order for top managers to make a correct decision, they need to consider all the factors

involved that contribute to adoption as well as understanding what factors may prevent government organizations from adopting cloud computing.

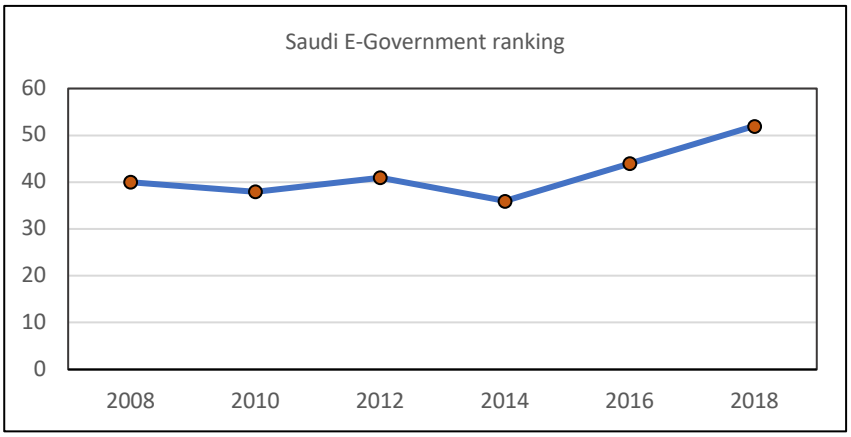

Figure 1.1: Saudi E-Government System World e-government ranking

As a result, this research will fill an existing research gap by identifying the influential factors from the perspectives of both senior management and IT administration which can be considered a novel contribution in the field of e-government systems in Saudi government organisations. Consequently, the study proposes a conceptual framework for the adoption of cloud computing in the e-government system in the Saudi government. There was a lack of previous studies which explored adopting cloud computing in e-government systems from the perspective of government senior management and IT administrations. This research also explores the four crucial dimensions of adopting cloud computing in e-government namely: the technological, organisational, environmental and social contexts. Hence, the development of an effective conceptual framework to encourage the government to develop e-government is based on the Technology, Organisations, and Environment (TOE) Framework, while being extended to include social characteristics which makes a distinctive contribution.

1.4 The Research Scope

Rapid ICT development has provided some opportunities for governments to improve their services; and many governments take into account the effective use of IT in government systems (Torres *et al.,* 2018). Moreover, one of the key points of interest in the field of Information Systems (IS) has been focused on issues which are significant for many governments around the world. These issues are focused on IT infrastructure and which are appropriate for the adoption of new technologies in government systems. Thus, this study offers valuable understanding

for top government management to guide and determine the adoption of cloud computing in e-government systems. In view of that, the research scope is based widely on the areas of e-government systems in the Saudi government organisations in order to enhance and support the government to provide an effective system over the Internet. A review of recent research conducted on government systems in the Saudi government shows there is a lack of research that attempts to evaluate the efforts of the Saudi government; particularly, in adopting new technologies such as cloud computing.

1.5 The aim and objectives of the research

The aim of this research is to investigate to what extent will the critical factors affecting government confidence in the Saudi government sector influence the adoption of cloud computing in e-government systems based on the TOE framework. It will consequently assist in implementing and providing the advantages of the adoption of cloud computing in Saudi government organisations. This aim can be achieved through the following objectives:

1.5.1 Research objectives

- *To examine the existing issues of e-government systems in terms of efficiency, quality of online services and to review the current prototype framework of e-government systems.*
- *To identify the challenges and benefits of cloud computing in implementing e-government systems effectively from a review of the literature.*
- *To examine and explore the critical factors of adopting cloud computing in e-government systems from the perspectives of senior management in government organisations. (Through interviews)*
- *To investigate from the perspectives of senior management in government organisations and IT managers the critical factors that affect adopting cloud computing for e-government systems in the public sector. (Through questionnaires)*
- *To develop and evaluate an appropriate conceptual framework that can be utilised to investigate and implement the adoption of cloud computing for e-government systems in developing countries.*

1.5.2 The research Question

To what extent will the critical factors affecting government confidence in the Saudi government sector influence the adoption of cloud computing in e-government systems?

1.5.3 The research Sub-questions

- *What are the existing issues of e-government systems in terms of efficiency and the quality of online services?*
- *What are the major challenges and benefits of cloud computing in implementing e-government system effectively in government organisations in the public sector?*
- *What are the factors that prevent the Saudi government from adopting cloud computing in e-government systems in government organisations in the public sector?*
- *According to senior IT managers, which factors influence government organisations to adopt cloud computing in e-government systems, and to what extent?*
- *What is an appropriate a conceptual framework that can be utilised in developing countries and be applicable to the Saudi government in adopting cloud computing in e-government systems?*

1.6 The research Hypotheses

This study has presented hypotheses that investigate influences to adopt cloud computing in e-government in Saudi Arabia, an explanation of the factors that have influenced the intention of government organisations to adopt cloud computing. The research hypotheses as follow.

H1: Perceived relative advantages have a direct and positive influence on the intention to adopt cloud computing for e-government systems.

H2: Higher Compatibility positively influences the intention to adopt cloud computing for e-government systems.

H3: Higher Complexity negatively influences the intention to adopt cloud computing for e-government systems.

H4: There is a positive relationship (direct correlation) between the high services quality and the intention to adopt cloud computing for e-government systems.

H5: High level of security (data protection) positively influences the intention to adopt cloud computing for e-government systems.

H6: Top management support influences positively the intention to adopt cloud computing on e-government systems.

H7: Technology readiness influences the intention to adopt cloud computing on e-government systems.

H8: Existence of a competitive pressure influences positively the intention to adopt cloud computing on e-government systems.

H9: A less stringent regulatory environment will have a positive influence on the adoption of cloud services.

H10: High level of trust in cloud computing positively influences the intention to adopt cloud computing for e-government systems.

H11: High level of awareness positively influences the intention to adopt cloud computing for e-government systems.

H12: Positive attitude on cloud computing positively influences the intention to adopt cloud computing for e-government systems.

1.7 Research Contributions

All research should make a significant contribution to the totality of knowledge. In this case, the areas of knowledge that this research seeks to benefit are concerned with implementing e-government effectively, and how governments can be made more fully aware of the benefits and challenges of the adoption of cloud computing for e-government systems.

1.7.1. This research makes a significant contribution to the existing research on the adoption of cloud computing for e-government systems by developing a framework for evaluating the e-government system in Saudi government organisations. This contributes to knowledge about factors that impact e-government systems in Saudi government organisations in terms of how they affect the adoption of cloud computing. Moreover, being the first in-depth study to evaluate the adoption of cloud computing for e-government systems in Saudi Arabia, this research demonstrates the practical significance of evaluating e-government systems from this particular perspective. In addition, previous studies (Alenezi *et al.*, 2015; Mohammed *et al.*, 2016) that have shown the factors that influence the successful implementation of e-government in Saudi Arabia. Previous studies have generally focused on acceptance of e-government from the Saudi citizens' perspective, whereas this research explores acceptance from the point of view of the top managements, in order to

provide a more comprehensive view. Therefore, this research evaluation can help e-government decision-makers in government organisations in Saudi Arabia to understand more fully the factors that need to be considered when making decisions about adopting cloud computing for e-government.

1.7.2. The research considers a variety of factors in four dimensions: the technological, organisational, environmental and social contexts through using the research model to investigate the critical factors affecting the adoption of cloud computing for e-government systems. Several previous studies (Alateyah, 2014; Alkhwaldi et al., 2018) have aimed to utilize and amend one comprehensive framework, such as the TAM, DOI or TOE model which have all been applied in the Saudi context. In contrast, this research framework (ACCE-GOV) is uniquely designed to use these four dimensions, which are based on integrating the TOE model with the DOI model, to assess the influences on the adoption of cloud computing for e-government systems. To date, no such comprehensive framework has been developed for the e-government context. The findings of this research will provide an improved conceptual framework model which can be used to assess the influences on the adoption of technological innovations such as the Cloud for e-government in contexts similar to Saudi Arabia. This should lead to a rise in awareness about how the level of service quality can be improved and financial waste on ICT reduced by the adoption of cloud computing.

1.7.3. This theoretical framework can be generalized to investigate the influence of various factors on the adoption of cloud computing for e-government in a range of related contexts. The advanced ICT that has been applied in government systems has been addressed by other studies (e.g. Al-Rashedi, 2014; Kumar et al., 2018) who identified the critical factors in the implementation of e-government systems. Drawing on these prior studies has highlighted the benefits of adoption of advanced ICT for the e-government system in Saudi Arabia and considering its acceptance in the light of the purpose-built theoretical framework. Although this research focuses on Saudi Arabia it reviews the literature which considers a variety of technology acceptance factors in four dimensions: the technological, organisational, environmental, and social contexts and builds the research model to investigate the critical factors which impact on the adoption of cloud computing for e-government system. This new knowledge will therefore be particularly

relevant to developing countries and specifically Saudi Arabia and other Gulf countries (Oman, Bahrain, Kuwait, the UAE and Qatar) because they share similar customs, similar cultural values, traditions and tribal relationships that lead to them having the similar government characteristics. The research model can be used as a starting point for researchers in these countries who wish to gain a deeper understanding of factors which influence the intention to adopt cloud computing for e-government in their national contexts.

1.7.4. This research employs a parallel mixed methods research methodology to fulfil research objectives with the use of confirmatory analysis of quantitative and qualitative data. It therefore provides insights on how a mixed-methods approach can be applied to evaluate factors that influence the adoption of cloud computing for e-government systems in ways that can both lead to generalisations and to have a richer and more comprehensive understanding of the research phenomenon. These findings of this research will provide a development framework model (ACCE-GOV) based on cloud computing that applied a mixed-methods approach to evaluate the effectiveness of e-government systems and factors influencing adoption of cloud computing for e-government as no such comprehensive framework has been developed for the e-government organisations context. It will certainly help government organisations to evaluate their e-government system and make informed decisions about adopting the Cloud for those e-government systems. Also, the framework model (ACCE-GOV) can be applied in similar contexts.

1.8 Thesis Structure

Chapter1 Introduces: This chapter introduces the research scope as well as the motivation for the research, the research aim and objectives and highlights the structure of the thesis.

Chapter2 Literature Review: This chapter comprises a comprehensive critical and systematic review of the current literature on the adoption of cloud computing in e-government, with a particular focus on the most critical factors influencing government organisations. Several main principles of e-government are presented, such as the definition of cloud computing and e-government, types of cloud computing and the benefits and challenges of cloud computing.

Chapter3 Research Model: This chapter introduces the research model for the adoption of cloud computing in e-government by addressing various development hypotheses leading to the

modification of the research's proposed model. The TOE framework and previous studies that adopted the TOE framework are reviewed, also the critical independent factors based on the TOE model which influence the adoption of cloud computing in e-government are discussed. Various adoption models are provided and evaluated.

Chapter4 Research Methodology: The chapter describes the research methodology, the methods of data collection, analysis procedure, sample size as well as validity measurement and reliability tests. It also discussed the research model for the adoption of cloud computing in e-government that will be examined in the chapters that follow.

Chapter5 Quantitative Analyses: Presents a descriptive data analysis, which includes an overview of the research questionnaire, data screening and the results of the participants' demographic analysis. Also, it presents data analysis of the results of the quantitative study; and highlights the procedures undertaken to analyse the quantitative study data and report results. The chapter begins by discussing an overview of the procedures of data analysis carried out in this study. It discusses the model assessment based on the results of the measurement scale analysis. The chapter begins with an introduction to the SEM technique used in the assessment procedure. This is followed by assessments of the measurements for the model assessment and the structural model. The chapter then presents a description of how raw quantitative data will be prepared for analysis; followed by a discussion of the results of the quantitative data analysis.

Chapter6 Qualitative Analyses: This chapter explains, and analyses data collected by semi-structured interviews conducted with top managers in government organisations and IT administrators in Saudi Arabia. Moreover, it focuses on the procedures undertaken to analyse the qualitative data and reports the qualitative data collected through interviews. The thematic analysis technique is outlined and there is a discussion of the approach to thematic analysis used with data collected by semi-structured interviews. Finally, the findings of the thematic analysis are then reported through the use of a set of themes.

Chapter7 Discussion and Conclusion: This chapter confirms the answers to the research questions that have been addressed in this research. It summarizes the results of the questionnaires and supports the analysis of research findings with findings obtained from the independently analysed qualitative data. These findings are further supported by the results of previous studies of adopting cloud computing. Furthermore, the chapter also provides the implications of the findings and identifies the contribution of this study to the literature of critical factors for

evaluating the adoption of cloud computing in e-government in the Kingdom of Saudi Arabia (KSA). Finally, it presents a new framework for evaluating the adoption of cloud computing in e-government organisations in the Saudi context. The chapter addresses the limitations of the study and recommends future research directions Some recommendations for maximising the public value created through e-government are also made in this chapter. Finally, some suggestions for further research in this domain are also presented.

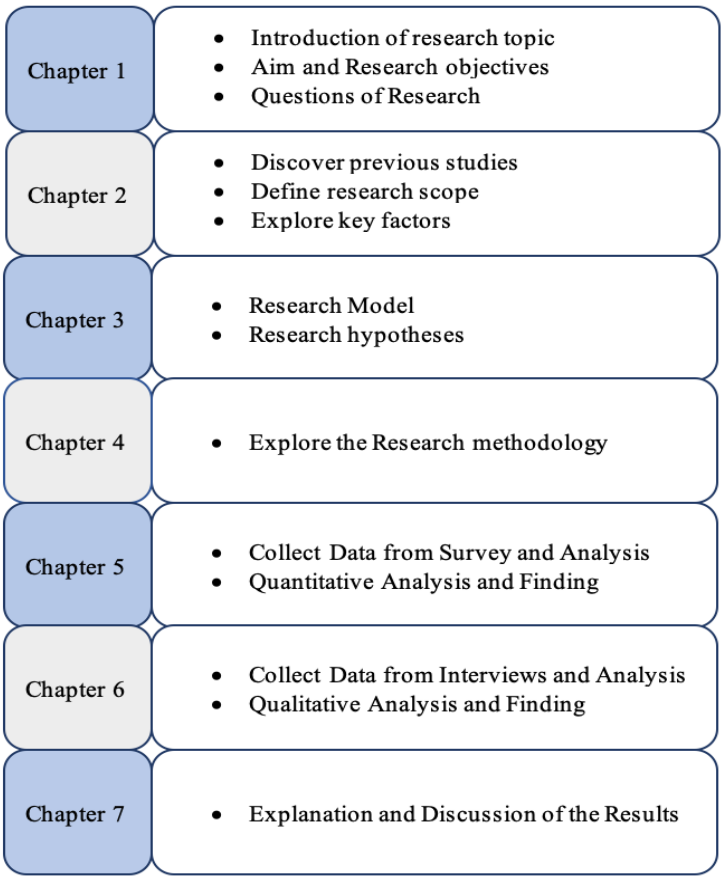

Figure 1.2: Research phases

1.9 Summary

This chapter has provided a brief background of the e-government system context and the related advantages of adopting cloud computing. Furthermore, the motivation that has driven this research has been outlined. The aim and objectives of this research has been presented, and the significance of the research discussed. Finally, the research design and structure has been briefly provided.

Chapter 2: Literature Review

2.1 Introduction

This chapter aims to review the previous research literature to identify what is known and now known in order to locate the knowledge gap of the research. The chapter reviews the relevant models and studies related to electronic government and cloud computing. It begins with an overview and concept of e-government and cloud computing and outlines several models of these two systems addressed by organizations and researchers. This chapter also presents in detail the relevant and important studies of e-government that were carried out in both developed and developing countries. It concludes by addressing the challenges and benefits of the adoption of cloud computing in government systems.

2.2 E-government: An Overview

Recently, given the growing populations in developed countries, their economies and life expectancy rates have both been improving. In view of this, governments have sought to improve their online service systems with the intention of making the delivery of e-government more efficient and effective (Meftah *et al.*, 2015). Implementing online service systems, however, is a challenge at local, national and international levels, and this is especially so in developing countries (Abu-Shanab, 2017; Alateyah *et al.*, 2013).

Studies over the past decade have provided important information on e-government, considered as Information Communication Technologies (ICT) application in the public sector and which assists the government in providing online services for citizens more effectively (Sheng and Trimi, 2006). The term ‘e-government’ gained common usage in 1993 (Cordella, 2007). Moreover, e-government systems were implemented by many governments around the globe in the late 1990s, to deliver information and services to citizens, organisations and the business sector for example, the process of a tax payment (Irani *et al.*, 2006). At first e-government was defined too narrowly as providing online services. The concept of e-government is not limited to providing information but needs to be commensurate with users’ service requirements and to be compatible with modern technology. E-government seemed like one of the best methods in providing full availability online and evolving public services over the Internet and became defined a the use of the Internet to provide government information and services to citizens

(Kasubiene and Vanagas, 2007). In other words, E-government uses ICT, such as sharing network resources, and providing internet services by government organisations.

Moreover, identifying any lack of infrastructure and the requirements of developing online services are government essentials in the transformation of government organisations services to e-services. The efforts of government agencies to revolutionise the development of services through the provision of rapid services and having a clear vision of the use of these services can be a reason to make a strong relationship between government organisations (Yildiz, 2017). The existing e-government systems in developing countries face many direct and indirect challenges to their successful implementation such as culture, social factors, facilitating conditions, lack of resources and limited technical experience (Singh and Srivastava, 2018). Moreover, identifying the factors that cause the failure of e-government systems in developing countries may lead to enhancing the improvement of e-government by improving the interactions between government organisations and citizens (Klems *et al.*, 2009). Some studies on e-government have shown that most governments have taken action from a technological approach, that seeks to take advantage of investment in new technologies for the development of e-government systems (Alzahrani *et al.*, 2017). Thus, any limitations on using ICT benefits by governments could result in missing out on opportunities to deliver online services and impact on the adoption of e-government systems by the public.

Therefore, this research will contribute towards identifying a number of factors that may assist decision-makers in Saudi Arabia to develop a successful e-government system. Research is still being undertaken to find suitable solutions to meet the requirements of e-government systems in order to increase the efficiency, performance and effectiveness of government organisations. To illustrate, in the Middle East countries, there is no service that allows the public to access government services and information through new ICT. So, cloud computing one of the suitable technologies that may overcome the IT infrastructures issues. Some studies (Oseni *et al.*, 2015; Purnomo and Kusnandar, 2019) highlight the main goals of e-government systems, such as improving public transparency and their potential to promote social democracy. Consequently, this investigation will address four main factors: technological, managerial, environmental and social. This research will highlight key requirements in light of the rapid development of technology and focus on using the latest technologies to develop e-government. Moreover, it will analyse many of the significant factors that are the cause of e-government

development in developing countries, especially in Saudi Arabia. As the literature suggests, the impact of e-services is differs depending on the techniques used. Therefore, this study attempts to clarify the role of cloud computing in reducing the challenges of e-government and promoting the adoption of e-government.

A large amount of literature has discussed the concept of e-government. These studies have defined e-government as an effective model that uses ICT for interaction between citizens, organisations and employees with the government. In order to use the benefits of online services provided by governments it is essential to reduce the gap between governments and stakeholders by improving communication and allowing optimal use of the online services (Ke and Wei, 2004). This research focuses on the internal and external impact of various factors in different dimensions on the adoption of cloud computing to enhance e-government systems.

2.3 Types of Interactions in e-Government

In general, e-government facilitates many interactions between online service users and their government; in other words, e-government can be used for the purpose of transferring government services among various government organisations, individuals and the business sector (Joshi *et al.*, 2017). Enhancing communication internally among government departments and external interactions with citizens, extends the participation of other users in decision-making and supports the government in developing communication methods. These interactions will be explained in more detail and are shown in Figure 2.1.

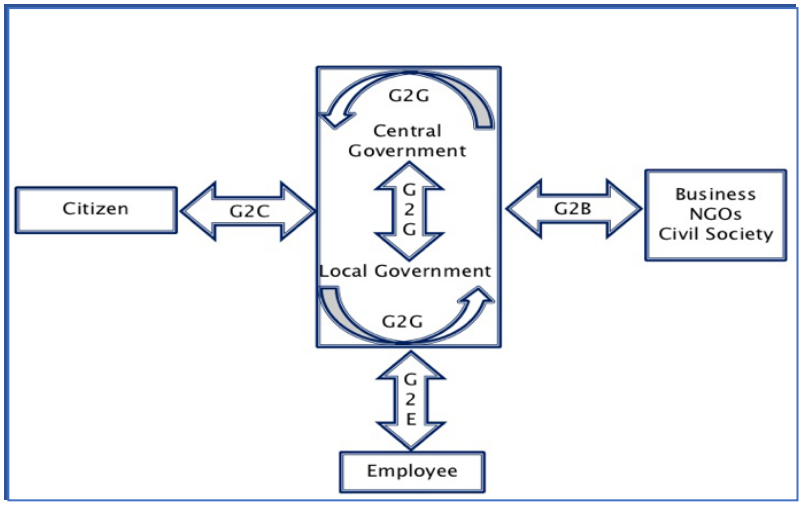

Figure 2.1: Types of interactions in e-government (Onu, 2015)

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2.3.1 Government to Government (G2G)

In this type, the interaction not only involves government action to restructure government processes, but is also a mechanism to increase the provision of services among the various government agencies (Almarabeh *et al.*, 2016). In addition, ICT enables an improvement of communication, data sharing and data access in order to develop the functionality of other government agencies. This kind of interaction could be done among government organisations as well as between different levels of government agencies (as shown in Table 2.2). The objective of G2G is to increase efficiency, performance and production (Joshi *et al.*, 2017). It is assumed that, if there is more understanding of the concept, it is easier to implement. Thus, one of the objectives of this research is to understand the concept and theory of e-government by exploring the main challenges to adoption of the cloud in e-government.

2.3.2 Government to Citizens (G2C)

In this case, the interface is designed for interaction between government and citizens to allow highly efficient use of public services provided by the government. In addition, interaction of this type will encourage citizens to communicate with the government while making use of the public services that are available. This increasing use of public services in an easily accessible manner as well as an improvement in the quality of services can be achieved by providing feedback on the services that are used (as shown in Table 2.2). The main objective is to connect the government to the citizens both continuously and effectively (Almarabeh *et al.*, 2016). In this type of interaction, there are benefits to the government as the system will contribute to strengthening communication between citizens and governments. Further, it increases the strength of the economy by enabling efficient communication and maintaining the quality of services (Bala and Verma, 2018). Hence, the important challenges relating to developing countries are to develop other sectors such as education, health and the economy, as a result, less importance is given to developing ICT which makes government organisations are not providing their services electronically. As e-government requirements meet the growing needs of citizens and governments, this leads to the pursuit of governments in developing countries to take advantage of ICT and promote a more efficient understanding of all e-services.

2.3.3 Government to Business (G2B)

In this area, the government provides a process that raises the productivity of facilities in the business sector. G2B aims to create an environment of communication between government and commercial organisations with greater transparency. The G2B has initiatives that can assist the business sector in dealing with government, such as licenses and permits, which can save time and reduce operating costs. This contribution would be the creation of an environment that promotes trade, tourism and investment for companies (as shown in Figure 2.2).This could assist in providing an enabling environment for companies to perform more efficiently (Klems *et al.*, 2009). Moreover, this type of interaction with the e-government system provides assistance and support to staff with low incomes, or others. The main objective of this e-service is to manage the interaction and encourage the process of related enterprise companies (Batara *et al.*, 2017). Hence, as developing countries have a large number of organisations suffering from a weak IT infrastructure and lack of e-government services, this should be the governments' focus, because it is an important factor in the overall development of e-government systems.

2.3.4 Government to Employees (G2E)

The interaction of this type is between the government and their employees, because, unlike many other organisations, the government usually has the largest number of employees. This is a regular interaction process by use of ICT tools to increase the interaction between governments on one side and employees on the other with more efficiency and a high level of satisfaction (Joshi *et al.*, 2017). Furthermore, it contributes to improvement of skills and understanding of information technology in order to provide opportunities to improve the quality of life and performance of employees (as shown in Table 2.2). Thus, using information technology in the public sector has led to many changes for organisational and government agencies. However, these organisational changes vary from country to country. The development of technology has undoubtedly improved communication between governments and stakeholders. As a result, e-government will certainly cause regulatory changes as well.

2.4 Cloud Computing: An Overview

With the explosion of Internet technology, there is increasing pressure on existing storage in computing facilities. This has led providers of Internet services to use commodity-centric computers as their platform (Kumar *et al.*, 2018). Cloud computing has become a very useful strategy for Information Technology (IT) users and Internet service providers (ISPs) (Almutairi and Thuwaini, 2015); thus, some countries around the world have invested in this technology and the United States of America and Japan have built cloud computing frameworks as a national strategy (Ian et al., 2008). There are several definitions of cloud computing that have been proposed by expert researchers in the field. This section explores the advantages of cloud computing that may serve to enhance adoption in several fields and provides some definitions from different researchers' perspectives. According to Qian *et al.*, (2009) cloud computing is a new model providing computer infrastructure and the availability of computer system resources over the internet. This model aims to transform this infrastructure into a network available everywhere, which contributes in reducing costs associated with device management and software resources. Cloud computing is a progressive technique that has introduced a new paradigm by providing a logical model (Asiaei and Nor, 2019). Its use has changed the means of consuming information technology by providing a model that delivers on-demand services over the Internet (Ahmad and Khan, 2015). Cloud computing is becoming increasingly popular worldwide; therefore, organisations have used and applied cloud computing to provide online services. This started with e-business, e-commerce, and e-government to achieve the benefits, including improving the quality of service delivery to public sectors. In addition, cloud computing is working to overcome many of the barriers facing governments (Zwattendorfer and Tauber, 2013).

In fact, developing countries seek to follow developed countries where cloud computing enables the utilisation of the same IT infrastructure, datacentres and applications, as well as access and sharing of resources (Wang *et al.*, 2010). For instance, cloud computer in developed countries can assist governments to share and access data, as well as using the communication infrastructure around the world. As a result, with regard to the cloud in developing countries, the observation is that it will reduce infrastructure costs, and help government organisations and the business sector to evolve more rapidly. Moreover, cloud services provide adoption with flexibility in increasing use if demand increases (Stergiou *et al.*, 2018). This research will present the critical influences factors to adopt cloud computing in government systems.

Cloud services are provided on a pay-as-you-use basis. This could encourage the government to adopt cloud computing services (Alsharari *et al.*, 2020). Thus, one of the most common challenges facing e-government is to ensure the establishment of e-government infrastructure, especially for a developing country such as Saudi Arabia. Therefore, cloud computing is one of the best alternative solutions to overcoming the high cost of establishing the infrastructure, challenges and other obstacles that face e-government in order to have more trust, accessibility, authentication and ease of use. However, governments have specific obligations in relation to the purchase of cloud services; thus, they should have a clear understanding of architectural frameworks, at both the technical level and in regard to information management in cloud computing. This establishing phase clearly requires an important strategy towards the adoption of effective and reliable e-government.

2.5 Deployment Models

The current organisational structure of each model is the most complex and can be divided into several sub-classes and depends on the purpose of the system that is designed. In addition, these divisions have advantages that contribute to the ability to increase using applications or flexible management by users. Also, the cloud allows division into sub-classes provides unlimited storage, a high capacity and efficiency. In cloud computing, the deployment models have been defined in four categories (as shown in Table 2.3). (Dillon *et al.*, 2010). The section below offers further explanation about the types of deployment model.

2.5.1 Public Cloud (external cloud)

Public Cloud is a model providing services obtained through the Internet, such as applications and storage. Public Cloud provides free services available to everyone and can be more accessible and commonly used. Moreover, this approach allows organisations to increase cost savings and the data centre does not require dedicated capacity. So, it is suitable for a large workload without deployment and maintenance obligations. For organisations that do not use cloud deployment, this is the fastest way to reap the advantages of cloud computing wherein the virtualisation server has the benefits of utilisation efficiency. On the other hand, there are some disadvantages, including concerns about data security in public domains, including loss of data and limited configuration (Rao *et al.*, 2013). Therefore, the use of public cloud computing is one of the solutions by which governments can provide online services to citizens, business,

non-profit organisations and other government organisations at a lower cost and with quality in production.

2.5.2 Private Cloud

This is proposed for deployment by a single organisation or other trusted organisations, sharing all the resources with all members of the organisation, in which data can only be accessible for internal users. This model is suitable for large organisations that have a focus on privacy and data security and prompt users to change the way of working, so, it will be an expensive investment to begin with, but suitable for organisations that wish to reduce cost in the long run. Also, the biggest benefit of this model is that it allows customers to have full configuration for data with more accessibility, which uses the virtualisation server benefits to obtain utilisation efficiency. The disadvantages are that it can make the implementation processes more complex, generate a high cost in the long term for small organisations and implementation can be very time-consuming or more costly overall (Rao *et al.*, 2013). Also, some organisations have a large number of customers, and this system is not suitable for a large workload due to lack in IT infrastructures. In addition, the use of this type of cloud will reduce the government costs incurred by establishing direct contact between the private sector, government agencies and the public sector through creating a single portal to integrate the various agencies in the government.

2.5.3 Community Cloud

The purpose of this model is operation and deployment for a group of organisations that have shared interests and characteristics (Durao *et al.*, 2014). Usually, another trusted organisation acts as an intermediary between organisations that have similar common interests as a cloud provider, which allows them to share cloud resources. Furthermore, this cloud could contribute to the combination of the provision of distributed resources from network computing and control of distributed systems. This is purposed to increase using the self-management of automatic computing which has full configuration for the private cloud models part and limited configuration for the public part by using the virtualisation server to have the benefits of utilisation efficiency. It also depends on the number of participants, the amount of dedicated capacity and greater accessibility the datacentre requires. For organisations that have a large number of participants, it is suitable for handling the large workload.

2.5.4 Hybrid Cloud

A set or a combination of cloud models, such as between public cloud, private cloud and community clouds, is called a hybrid cloud. In many cases, the purpose of organisations using this type of cloud is the occurrence of resource bottlenecks for clouds; private cloud resources can be added to overcome these bottlenecks in the public cloud. In addition, this is appropriate for use by organisations that have the purpose of reducing costs while maintaining privacy and data security by using server virtualisation gained through utilisation efficiency with more accessibility based on number of participants. The disadvantage is that the integration of different architectures is becoming more complicated, having high configuration but limited depending on the community policies. This could make the model likely to end either as public computing or a private cloud due to the complexity. Therefore, depending on the number of participants, the datacentre requires a dedicated amount of capacity suitable for handling the large workload.

Many organizations consider the effect of storage data and flexible access from anywhere as one of the more persuasive reasons to adopt cloud computing. According to Durao *et al.* (2014), in 2002, Amazon.com played an important role in cloud computing by developing a method by which data can be stored and accessed via Amazon Web Services. Further, many studies have shown that cloud computing refers to a set of innovative principles and integrates a large number of research fields, such as distributed computing, computer networks and virtualization (Malhotra *et al.*, 2014). Furthermore, in cloud computing, customers prefer to use external resources provided by Internet service providers rather than relying on their actual resources, which encourages organisations to invest in cloud computing.

2.6 Cloud Computing Architectures

The National Institute of Standards and Technology (NIST) has summarised the cloud computing architecture as a self-service that is able to access networks everywhere, with sharing of resources and more flexibility (Mell and Grance, 2011). The rapid transfer of consumers towards cloud computing has increased the demand for more deployment models. This demand is usually based on the purpose of these models and the requirements for customer management. Therefore, cloud computing systems can be thought of as comprising three service models, which are Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS), (as shown in Figure 2.2) (Dillon et al., 2010). The section below will describe

in more detail and the following table shows a very clear of differences between the various Cloud Service Models.

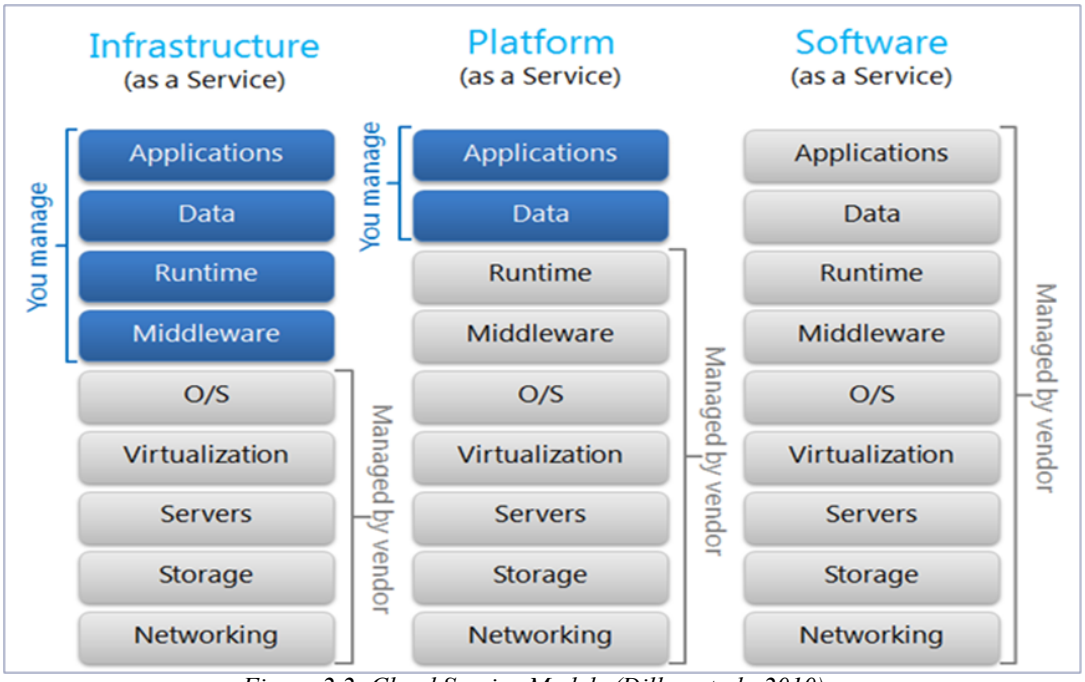

Figure 2.2: Cloud Service Models (Dillon et al., 2010)

2.6.1 Software as a Service

The model distributes software that hosts applications through the service provider and then delivers them to users over the Internet. This model has contributed to increasing use of applications that support web services. In addition, it provides software that allows the user to purchase and install on a personal computer. This can be available to customers over the Internet hosted by the service provider and has become increasingly pervasive in the core technologies that support web services. This has made the service increasingly available for supporting user access from more regions around the world; examples include Gmail and Apps from Google (Chang *et al.*, 2013). In fact, the adoption of cloud computing has increased as the public adopts the latest technology, providing governments with features that facilitate the easy operation of government services. On the other hand, some governments in developing countries face limited resources, lack of efficient services and reliable suppliers, which may lead to the failure of these systems. Therefore, investing in cloud computing will be an important development in the

implementation of e-government, in order to overcome the limitations of an infrastructure that is inadequate due to the lack of reliable suppliers.

2.6.2 Platform as a Service

The aim of this service model is an extension of Software as a Service (SaaS). It allows using applications, storage of the data and sharing the network resources over the Internet. The service delivery model will assist the users to get virtualised servers which should have associated services for providing applications or developing new ones. Additionally, the PaaS includes platforms for building and processing customised web-based applications. This allows IT managers or end-users to use applications and run services via the Internet, all without downloading software or installation. Examples in this model include Salesforce's Force.com and Microsoft's Azure (Chang *et al.*, 2013). Therefore, cloud computing supports large areas of unlimited data storage, where users can store what is involved in the application and allow it to be used anywhere. Adopting cloud computing contributes to the diffusion of technical use among organisations, which assist in increasing the success of the e-government system.

2.6.3 Infrastructure as a Service

The purpose of this service model is as a dedicated model in which the organisation uses the equipment used to support operations, including a provision of networks, clusters or virtual servers, processing and networks storage. The service provider provides all equipment that is used to operate and maintain the servers. Moreover, the capability is provided by the consumer's provider. It allows the consumer to be able to deploy and use the appropriate programs, such as Amazon's Elastic Compute Cloud (EC2) (Chang *et al.*, 2013). Thus, the adoption of cloud computing models in electronic systems will increase the deployment of their adoption and improve performance, which is useful for governments in developing countries that seek to develop e-government with a limited infrastructure. This contributes to enabling easy and efficient network access everywhere for the participants of configurable computing resources.

2.7 Overview of Saudi Arabia

This section explains why this research has chosen to investigate the Saudi e-government system. This system is one of the e-government systems in developing countries that has grown rapidly. Therefore, the research context will briefly overview its location, e-government system, and the challenges for ICT, to gain a deeper understanding.

The Kingdom of Saudi Arabia (KSA) has a strong global economy. It is one of the richest countries in the Middle East and is located at the centre of the Islamic world. This geographical location gives it global importance as the centre of Islam, which leads to the visits of more than three million Muslim pilgrims (for the holy festivals of *Haj* and *Umrah*) every year to the two Holy Mosques the Masjid-al-Haram in Mecca and the Masjid-e-Nabwi (the Prophet Mosque) in Medina, as well as being of interest to Muslims around the world, as they face Mecca to pray five times each day. Moreover, the third Kingdom of Saudi Arabia was established in 1932 by King Abdul Aziz bin Abdul Rahman Al Saud who was the first ruler of the Kingdom; and since then Saudi Arabia has adopted monarchy as its system. Saudi Arabia is rapidly growing in economic terms, as shown by the significant transformation in many aspects of the economic life of its people. Thus, it has transitioned to a modern economy led by the petroleum and petrochemical sectors (Global Alliance of SMEs, 2016; United Nations, 2016).

2.7.1 The Location of the Kingdom of Saudi Arabia

The KSA is located in the western part of the continent of Asia and is the largest country in the Arabia Peninsula, with an area of 2,149,690 square kilometers (Freeworldmaps, 2018). The KSA is bordered by the Red Sea from the west, to the south by the Sultanate of Oman and the Yemen Republic and the United Arab Emirates, Qatar,،Bahrain and the Arabian Gulf from the east, and to the north by Kuwait, Iraq and Jordan (as shown in Figure 2.3). Riyadh City is the capital of the KSA and is located in the central region (GASTAT, 2018; Freeworldmaps, 2018). the country is a member of the G20 and the 17th largest exporter in the world, earning its status as a strong economic centre by being classified as a high-income country by the World Bank in 2017. Moreover, the eastern part of Saudi Arabia is the most important source of income for the economy, as it holds the second largest oil reserves in the world, gas fields and petrochemical factories, According to official data issued by the Saudi General Organization for Statistics, the population of Saudi Arabia in estimated to be approximately 23 million Saudis nationals (10,575,895 males and 10,192,0723 females) (and is expected to reach 26 million by 2020) of which 52.5% are males and 47.5% females. The population of non-Saudi residents is estimated at around 11 million (8,028,355 males and 3,677,643 females). The average age of the population of Saudi Arabia is 28.8 years (GAS, 2018). Additionally, the average age of the population of Saudi Arabia during the period 2008 to 2018 ranges from 28,4 to 34 years. 75.14% of the population had completed their education to different levels; with 37.36%, of those

educated achieving under-graduate or post-graduate education. Such statistics should assist the government to effectively make contact with citizens in order to achieve the goals of a national transition to the digital system of government rather than just using the traditional methods.

Figure 2.3: Map of Saudi Arabia (Freeworldmaps, 2018)

2.7.2 Information and Communication Technology (ICT) in Saudi Arabia

The introduction of any kind of new technology to systems brings many risks which may occur through implementation and the method of use. In recent years, the Saudi government has paid significant attention to the impact ICT has had on economic growth of governments around the world (Qwaider, 2013). Moreover, the technology revolution has afforded many benefits to governments by providing infrastructure needs and ease of control. In addition, government services have been able to meet the requirements of users in government systems or e-service providers (Irani *et al.*, 2006; Kaur and Kaur, 2014). For instance, the rapid spread of IT applications has had an impact in many sectors, with the aim of improving productivity and improving the performance of services in various fields, such as healthcare, education, trade, education and government. However, in Saudi Arabia, IT is still a relatively modern technology compared to other developed countries, such as the United States, the United Kingdom and Germany (Al-

Tourki *et al.*, 2012). Therefore, many sectors, from both the public and private organisations, have invested in information technology systems in one way or another to develop and improve the efficiency and effectiveness of e-services, which has made developing such services an important government priority.

Moreover, Saudi Arabia has seen one of the most rapid developments of the ICT market in the Middle East region. In addition, the Saudi government seeks to encourage innovation and investment using IT systems through the work of global seminars, in order to attract investors to contribute to the growth of the economy and the adoption and application of modern and advanced information technology systems (Qwaider, 2013; Alateyah, 2014). However, there are many problems facing the spread of information and communication technology in Saudi Arabia, which is one of the most complex countries because of the diversity of its problems (Alshehri *et al.*, 2012). These problems are not limited to scientific challenges, but also, include more importantly, cultural differences, educational levels, political systems and its economic and social level. The following sub-section will present the most important factors affecting the provision of e-services, such as ICT infrastructure, Internet penetration and other factors. It also provides some important indicators about the real situation of the e-government system in Saudi Arabia.

2.7.3 ICT Infrastructure

The strength of systems in many countries around the world refers to the availability of national infrastructures in various aspects of life; this assists the rapid development of economic, educational, scientific, technological, social, communication and healthcare facilities. In addition, in 2003, the Saudi government established the Ministry of Communications and Information Technology (MCIT) to control the IT systems that contribute to the development of future IT services plans (CITC, 2016).

Alshehri and Drew (2010) conducted a study to identify the challenges facing the development of ICT in Saudi Arabia. It found that the main factor was lack of planning in the implementation of information technology and lack of human resources in terms of IT experts. In addition, there was insufficient government support for government organisations in order to maintain IT development. Accordingly, the government proposed a strategic plan that could contribute to the development of the use of technology and assist government institutions in finding ways to invest in IT development. Thus, this study emphasises influences that have an

effect on ICT infrastructure. The Saudi government has been shown to affected by various factors that have an impact on the development of knowledge technology; and it is trying to reduce these influences in order to increase reliance on the e-government system. Alshehri et al. (2012) conducted a study focused on some of the significant challenges to e-government system in Saudi government. The results indicate that all Saudi government organisations still suffer from unreliable and unresponsive technical support, which affects the infrastructure of e-services. (Drew *et al.*, 2012; Alateyah, R. R. M. Crowder, *et al.*, 2013). There was a lack of expertise in training staff about e-government systems, which impacted on the success of those systems. Thus, the Saudi government has encouraged government ministers and organisations to pursue the development of ICT and associated IT infrastructure to achieve the appropriate e-government systems. In this research, emphasis will be given to the technical factors that impact the adoption of e-government in the implementation of cloud computing.

The above discussion clearly explains that ICT infrastructure is one of the key factors in the success of e-government systems. Thus, it plays a role in the adoption of the systems and their effectiveness, because of the rapid development of the ICT, which affects the requirement for the development of these systems to employ modern technology. Additionally, ICT infrastructure has become more complex in system design (Bertot *et al.*, 2010). It is important to know all the factors that may reduce dependence on services directed through the web. Therefore, in the developed world, governments are paying attention to infrastructure because it has an impact on the effective delivery of services across government systems. In contrast, governments in developing countries are still suffering from a lack of reliable and integrated ICT infrastructure that would facilitate provision of an e-government system with a high level of quality.

2.7.4 Internet

The Internet infrastructure is an issue that is one of the key considerations for any successful adoption of e-government system. In April 1997, the Internet became officially authorised for use (CITC, 2016). The government has begun to pay attention to the provision of Internet services by allowing the increase of Internet service providers; and there is clearly competition between domestic and international companies for mobile phones and the Internet market (Drew *et al.*, 2012). This has rapidly multiplied the number of Internet users, making the Saudi Internet market the biggest growth ICT market in the Middle East. Moreover, in December 2017, the percentage deployment of Internet users was 80%, which was estimated to be 18 million, while

in 2020 this number had increased to reach 24 million, an increase of 91 %. The KSA is thus one of the fastest growing global markets in the sector. Additionally, the Internet can be easily accessed, allowing the user to be connected to the Internet at any time and communicating with everyone everywhere (CITC, 2016). Consequently, the impact of Internet accessibility in Saudi Arabia has led to changes in Saudi society in all respects, including education, economy and healthcare. Therefore, it has assisted developing the national economy and facilitating the interaction of Saudi society with different cultures around the world (Akkaya *et al.*, 2012; Alzahrani *et al.*, 2017). Moreover, it has contributed to overcoming Saudi issues and concerns for education everywhere at all levels. The Internet has become an essential part of modern Saudi society, which will help increase awareness and accessibility to e-government services and other online services (as shown in Figure 2.4)

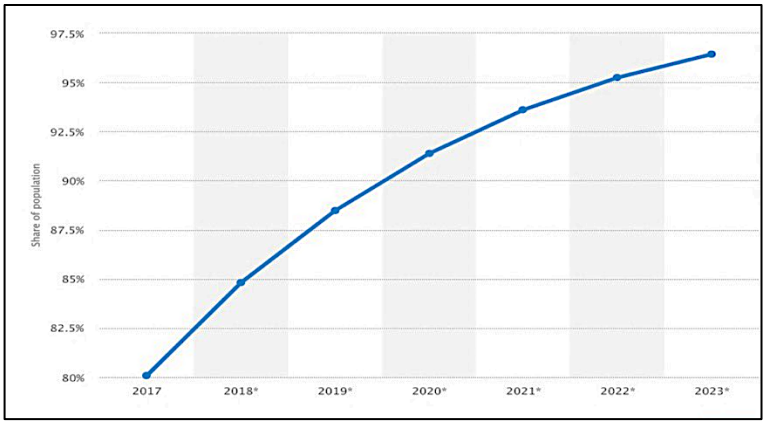

Figure 2.4: Internet growth in the KSA (source: CITC, 2018)

2.7.5 The Saudi e-Government Initiative

The Kingdom of Saudi Arabia began implementing the national e-government program in 1998 (Alshehri *et al.*, 2012). In particular, in 2005, the Saudi Arabian government introduced an e-government program called 'Yesser', which has been implemented in large cities. The Saudi government recognises that the development of e-government systems will result in enormous benefits and believes that the implementation of e-government and the digital transformation process will contribute to developing the national economy. Moreover, the government has endeavoured to enhance the participation of government departments in contributing to its implementation in order to strengthen the partnership between the governmental organisations. According to Ali S. AlSoma, (n.d.) in 2005, there was a cooperation between the Ministry of

Communications and Information Technology (MCIT) and the Ministry of Finance (MF) to establish the e-Government 'Yesser' program, which included the formulation of a plan to provide services and government transactions electronically, which could contribute to the national economy and the business sector.

Therefore, like other governments around the world, the Saudi government is attempting to achieve the goals of transforming the e-government initiative and ensuring its success. Recently, the tremendous development of ICTs, especially Internet-based technologies, has created a more complex technical environment for governments around the world (Almarabeh *et al.*, 2016; Kaur and Kaur, 2014). The Kingdom of Saudi Arabia has been keen to adopt ICT systems and activate their use to achieve an information society and a digital economy, as well as high rates of welfare for its citizens and residents and to facilitate their lives. In order to reach this vision, the government has taken continuous steps in developing an e-government system and in spreading the concept of electronic transactions in various government agencies. According to the United Nations e-Government Survey, 2016, Saudi Arabia ranked 44th out of 193 countries in the world. In addition, it is among the top 20 countries in the world for e-services and ranked eighth among 47 leading e-government countries in Asia (United Nations, 2016). This development reflects the great interest shown by the Saudi government and its unlimited support in providing the best performance of e-government.

Over the past ten years, the Saudi government has spent approximately £527 million on designing and building a unified electronic system in order to encourage citizens to adopt e-government services (Ali S. AlSoma, 2016). Due to the weakness of infrastructure and lack of development plans for the existing system, there has been a lack of adoption of electronic services by citizens. Thus, the Saudi e-government system is still facing many obstacles in the way of providing information, difficulties in access to services and increasing financial cost in the development of e-government in order to enable citizens to adopt e-government services. The Saudi e-government system (Yesser) is shown in Figure 2.6.

According to Ali S. AlSoma, (n.d.) and the 'Yesser' program, the Saudi government has been implementing e-government in several stages. The Saudi government has adopted a national strategy for each five-year plan, which has established the e-government program (Yesser) to be prepared and implemented in collaboration with government agencies. The first e-government implementation plan was completed from 2006 to 2010 and the second implementation

plan was launched from 2012 to 2016. In the first phase, the Saudi government's goal was to provide an e-government system to stakeholders and the public sector, such as citizens, the business sector and government organisations, by focusing on providing the best services to all stakeholders and users and increasing the efficiency of government organisations to improve their performance more effectively. Therefore, the implementation of e-government transactions afforded potential benefits, reducing the centralisation of e-government transactions as much as possible, thereby contributing to raising the performance level of government organisations transactions through increased investment returns, and providing users information with high accuracy in a timely manner (Alateyah, 2014).

The Saudi government believes that the above vision can be achieved by following specific objectives: firstly, Saudi government was to provide better services by the end of 2010, by using e-government systems which would offer the most effective, most secure and integrated services and offering easy access, by creating multiple electronic channels. Secondly, increasing internal efficiency and effectiveness through a strong infrastructure for e-government; and improving the public's perspective on adopting e-government for their interactions with the government by applying a culture of cooperation and innovation. Thirdly, contributing to the prosperity of the country through adopting the latest technology; this would also contribute to the success of e-government (Yasser, 2006). This gives direct benefits to citizens, institutions, government employees and the government itself. Therefore, there will be growth in the national economy and sources of income through the implementation of the Yesser system (Al-Nuaim, 2011). If adopted and implemented correctly, the productivity and efficiency of the public sector will certainly increase, reducing the use of paper for documentation, as all information will transfer to a digital format. Also, this will contribute to reducing the time involved in conducting operations through the provision of government services and, thus, will increase the efficiency of services. It will also enable easy access to information and services, which increases the number of citizens and businesses demanding the services, thus raising the productivity of the national economy. The Saudi government has created the Yesser program to launch with its attendant principles, (as shown in Figure 2.5), in order to realise the vision in implementing the objectives of e-government (Ali S. AlSoma, 2016) .

Principle 1	Unified version, priorities, standards, and framework
Principle 2	Not only technology, but much more.
Principle 3	Reduce centralization as much as possible.
Principle 4	Develop once, use many times

Figure 2.5: The four principles of the Yesser program (Yesser, 2006.)

Yesser achieved the first stage during the four years from 2006-2010, and the second stage was implemented from 2012 to 2016. At this stage, the Yesser program cooperated with other organisations, such as universities, private sector companies and the public sector in Saudi Arabia, and the focus was on government organisations and stakeholders, so that they better served all stakeholders and users. In addition, it sought to develop and realise the vision in implementing the four strategies and objectives related to e-government (MOECCWW, 2015; Alateyah, R. R. M. Crowder, *et al.*, 2013). This was done by relying on the investigation of the main factors and the participation of the various government organisations in implementation by creating an approach that assisted the success of e-government by predominantly changing the culture of community employees and government agencies rather than by introducing advanced technical solutions (Qwaider, 2013).

Consequently, the key to the successful implementation of the plan is the implementation of human resources initiatives, ICT development and a reduction of centralisation within the institutional framework. The implementation of initiatives in various sectors was to improve e-services and common national applications, which would contribute to the government reaping the benefits of e-government through the success of electronic services. Therefore, the Saudi government sought to achieve its e-government goals through the integration of government agencies in order to provide better services to customers and enhance the efficiency of the government sector.

This e-government system is still in the early stages of implementations, as the Saudi government is concentrating on the need for more effort. For example, a clear vision of the final implementation is clearly lacking and will adversely affect the adoption of e-government at all levels (Qwaider, 2013). In addition, the lack of a unified e-government system means that most government organisations operate separately. Therefore, it is best that government departments

be involved in a unified system to work together to provide better services to all stakeholders, which will contribute to an improvement in classification for the e-government system, as Saudi Arabia currently ranks No. 44 according to the United Nations assessment of e-government development (Nations, 2018). Therefore, Saudi Arabia is concerned with the adoption of an effective modern system, which is slowly and gradually being updated.

Additionally, Saudi Arabia is characterised by diverse sources of income and strong economic growth, but it is always moving carefully forward, taking into account aspects that have an impact on the adoption of e-government systems, such as social, religious, cultural and economic factors. On the other hand, the Yesser program still suffers from certian challenges. The most significant being a delay in connecting to the government services (Alateyah, 2014). This affects the provision of government services, which leads to its non-adoption by users. Moreover, it gives a negative image to users which similarly impacts the readiness of e-government to resolve the delay. Several studies have shown that e-government systems aim to provide government information and services, as well as to contribute to a strong exchange of information in various sectors and to change the negative image many users have about the performance of e-government, such as government institutions, investors and individuals, all of whom have a role to further economic development and enable participation in assisting public sector decision-makers (Gebba and Zakaria, 2015; Al-Tourki *et al.*, 2012). In the e-government initiatives context, there are many different challenges and factors that impact on the employment of e-government initiatives. Therefore, the Saudi government seeks to revolutionise the previous plans, and create a new 2030 vision for the government to develop public service sectors such as health, education, ICT and entertainment.

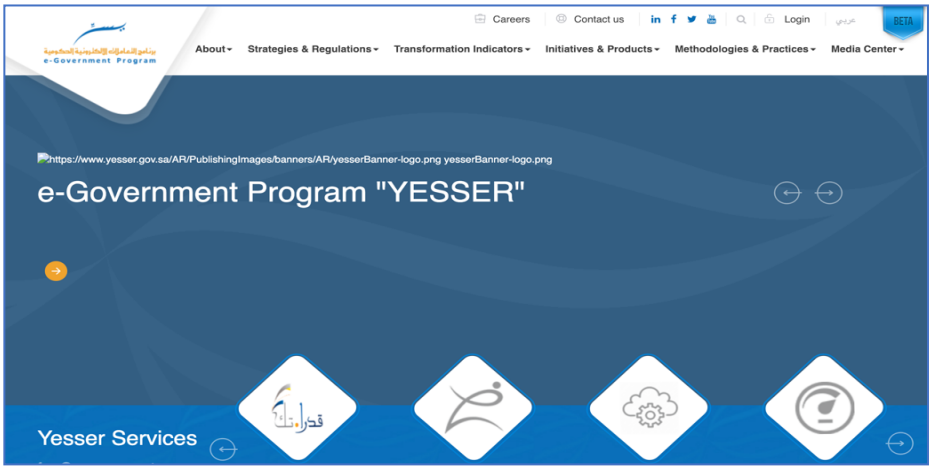

Figure 2.6: The Saudi e-government system (Yesser) program (Yesser, 2019)

2.7.6 The Saudi National Portal (SAUDI)

The Saudi government has established the National Portal "SAUDI" to connect all government organisations with a coherent e-government system as shown in Figure 2.7. This Saudi portal offers an interface that includes a variety of e-services that allow individuals, government, businesses and visitors to access it (SADAD, 2015). This portal is responsible for managing the database that works on digital transformation in systems for government organisations.

Figure 2.7: The Saudi National Portal (SAUDI) (SADAD, 2015)

2.7.7 Abshir Portal Program

In 2013, the Saudi government established a portal called the Abshar portal which was implemented by the Ministry of the Interior (MOI). The MOI provides a package of services to facilitate citizens and organisations to conduct government transactions totally electronically in order to reduce the numbers conducted by the traditional method (Absher, 2016). The Abshar portal provides e-services such as applying for a passport, status card, birth certificate, and online payment of transportation fee. Moreover, it is one of the most important portals for e-government systems in Saudi Arabia and is shown in Figure 2.8.

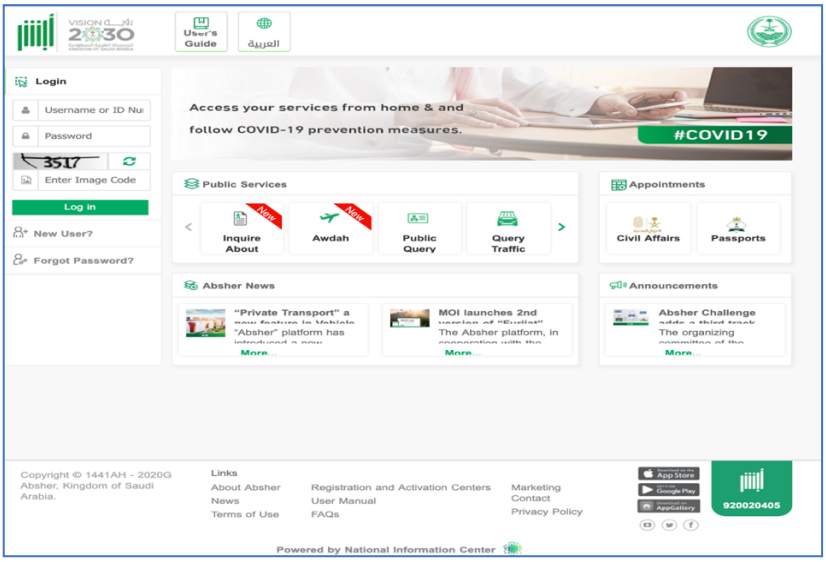

Figure 2.8: The Ministry of the Interior Absher Portal (Absher, 2016)

2.8 Comparison of E-government in Developed and Developing Countries

Most governments around the world are seeking to adopt and implement mechanisms to reform public sector institutions through participation in decision-making, improving the quality of e-services and transactional efficiency and strengthening the relationship between citizens and investors on one hand and the government on the other (Lopes, 2017). In improving their services, they are reaping new benefits from the infrastructure and the utilisation of technical development in order to increase the sources of income to the national economy and to improve people's standard of living.

According to survey carried out by the United Nations in 2018, 90 countries provided a unified portal to secure the provision of public information or services over the Internet, and 148 countries allowed online transaction services. Table 2.1 shows the top 10 countries in the e-government development index. The questionnaire used adopts the following criteria: Easy access to online services, the level of internet infrastructure, and provision of integrated platforms through the Internet through the provision of services for e-government. The survey revealed that Denmark was the leader with a rating of 0.9195 in e-government development followed by Australia with a rating of 0.9053, and then the Republic of Korea with a rating of 0. 0.9010. Table 2.6 shows the top 10 countries in the E–Participation Index for the implementation and adoption of e-government services (UN, 2018).

Top 10 Countries in E–Government Index			Top 11 Countries in E–Participation Index	
Country	**Index**	**Region**	**Country**	**Index**
Denmark	0 .9150	Europe	United Kingdom	1.0000
Australia	0.9053	Oceania	Japan	0.9831
Republic of Korea	0.9010	Asia	Australia	0.9831
United Kingdom	0.8999	Europe	Republic of Korea	0.9661
Sweden	0.8882	Europe	Netherlands	0.9492
Finland	0.8815	Europe	New Zealand	0.9492
Singapore	0.8812	Europe	Spain	0.9322
New Zealand	0.8806	Oceania	Singapore	0.9153
France	0.8790	Europe	Canada	0.9153
Japan	0.8783	Asia	Italy	0.9153

Table 2.1: Top 10 World E-government Leaders (United Nations, 2018b)

2.8.1 E-Government in Denmark

Denmark is among the top 10 countries in the world in adopting e-government systems. E-government strategies and initiatives have been initiated with the design of the Civil Service Computing Program call ‘eGovernment’, which aims to improve public administration and digital transformation of services using ICT (Ke and Wei, 2004). Based on the United Nations e-government survey in 2018, the Danish e-government is ranked first on the worldwide e-Government development list, achieving a high indicator of 0.9150 (United Nations, 2018b). As clearly observed, the Danish government is a good example of advanced development in e-government, implementation and adoption. Moreover, their clear plan has contributed to improved and increased user access to e-services as well as the participation and collaboration of stakeholder groups in the design and implementation of e-government. Denmark is ranked No.3, achieving a high indicator of 0. 9150 (UN, 2018).

2.8.2 E-Government in the United Kingdom

The United Kingdom e-government is one of the leading systems in this field. In 1994, the Central Computer and Communications Agency (CCTA) established a website called 'Open.gov.uk', which provides an e-government system under the responsibility of the Cabinet Office. Furthermore, the UK Government's current system is GOV.UK, which was adopted in 2011 and officially launched in 2012 with a full service. Thus, it is one of the most successful systems around the world. In 2018, the United Nations e-government Survey revealed that the United Kingdom ranks third in the list of countries that rely on e-government systems to provide efficient, accountable and transparent services through e-government. The e-government Development Index (EDI), which was conducted in 193 countries for e-Government Digital Service, shows that the United Kingdom has achieved a high indicator (0.9193) (UN, 2018). The UK government still continues to develop e-government in order to provide the best e-service in the world.

2.8.3 E-Government in the Republic of Korea

The implementation of the Republic of Korea's e-government has established its first phase which created an administrative database and facilitated citizens' access to online services. The Republic of Korea's e-government vision was set up to develop its IT infrastructure. This required the introduction of about 31 plans for e-government in order to connect government organisations with a unified gate (Jonathan *et al.*, 2015). In 2011, the Republic of Korea developed a strategy called 'Smart government' which was implemented and adopted in 2015 (Kurdi *et al.*, 2016). The south Korean government attaches great importance to the value of e-government, which will contribute to the success of its development plans, help transform into a knowledge-based economy, increase the national economy and improve the quality of government services. According to a United Nations e-government survey in 2018, based on the e-government Development Index, the Korean Republic is ranked No.3, achieving a high indicator of 0. 9010 (UN, 2018).

2.8.4 E-Government in the United Arab Emirates

The United Arab Emirates (UAE) is ranked 20th in the world and the first among the Middle East countries in the use of ICTs to promote competitiveness, development and delivery of electronic services (Zakaria, 2013). In April 2000, Dubai's e-government initiative was launched

and aimed to change the traditional method of paying fees via government services. In 2016, the Government of Dubai decided to add new services that contributed to increasing the adoption of e-government by citizens and residents, such as e-Passport and e-Payment, using the benefits from the development of ICT and their ability to transform into e-government (Al-Tameem, 2008; Dubai Government, 2018). Dubai's e-government department and e-Government in the UAE have attempted to overcome all challenges facing their e-government development in an effort to improve their e-government systems (Alnuaimi *et al.*, 2011). This has improved the ranking of e-government in the United Arab Emirates; and, based on the United Nations e-government survey 2018, it was ranked at 20, achieving a high indicator (0.8790), which includes it among the group of emerging leaders in the development of e-government around the world (UN, 2018).

2.8.5 E-Government in Bahrain

Bahrain has become one of the first countries in the Middle East to have adopted e-government. In 2007, the government of Bahrain recognised the significance of e-government and decided to implement an e-government system and to provide and support plans for the development of the e-government program (Ali, 2015). The Information and E-government Authority (IEA) is responsible for implementing the policies and legislation for the adoption of e-government, providing the required services to citizens, facilitating communication between government agencies, establishing an e-government portal providing all electronic services, and providing the training and technical support to government agencies. Moreover, between 2007-2010, the e-government department was officially adopted online services and provided more than 75 services for citizens and stakeholders' institutions (Wong and Jackson, 2018). The success of such an initiative is reflected in the high satisfaction rate of its customers, obtaining a satisfaction level of 80% in 2018. This contributed to Bahrain being ranked first of 25 in the Middle East, according to the United Nations global survey of e-government 2018, achieving a high indicator of 0.7734 (Al-Zuabi and Mahmud, 2011; UN, 2016; Ega.gov.bh, 2018).

2.9 Existing Cloud Computing Adoption Frameworks and Models

Over the past two decades, intensive research has been conducted using different models to investigate how to adopt different types of information technology in organisations. Some research considers the adoption of new technologies using the TOE Model, which facilitates identifying the most important factors affecting such adoption. The TOE model has contributed to

predicting factors that impact the adoption of cloud computing by IT researchers; and numerous studies have been conducted to examine and identify the factors influencing the adoption of cloud computing in organisation systems. Based on previous research, it is suggested that the measurement of any success of new technologies, depends on the context of the system or organisations (Camargo and Wang, 2015). In fact, additional variables from the literature are sometimes included to extend the TOE model for further development and validation of the model (Niknejad *et al.*, 2016). Thus, many researchers have attempted to expand or redefine the original model in order to understand the capabilities and factors that have a strong relationship in influencing the adoption of cloud computing such as the technological, organisational and environmental factors. This section will present various studies and approaches regarding adopting cloud computing in different sectors in order to explore the extent to which the impact of these factors is considered in them.

A review was made of the literature about the TOE framework; which was adopted by Low et al. (2011) who investigated the factors affecting organisations belonging to the high-tech industry in adopting cloud computing (As shown in Figure 2.9). The aim of this study was to identify and understand relationships between factors by identifying the technical factors that have an impact with regard to the organisation. Therefore, the adoption of technological innovation has been largely determined by the characteristics of the innovation. Moreover, in this study, eight factors were examined; namely firm size, relative advantage, complexity, compatibility, top management support, technology readiness, trading partner pressure and competitive pressure. The study found that there was a strong relationship between factors such as comparative advantage, top management support and competitive pressure in regard to having a significant impact on the adoption of cloud services. The study recommended that these factors help organisations in considering their investments in cloud computing.

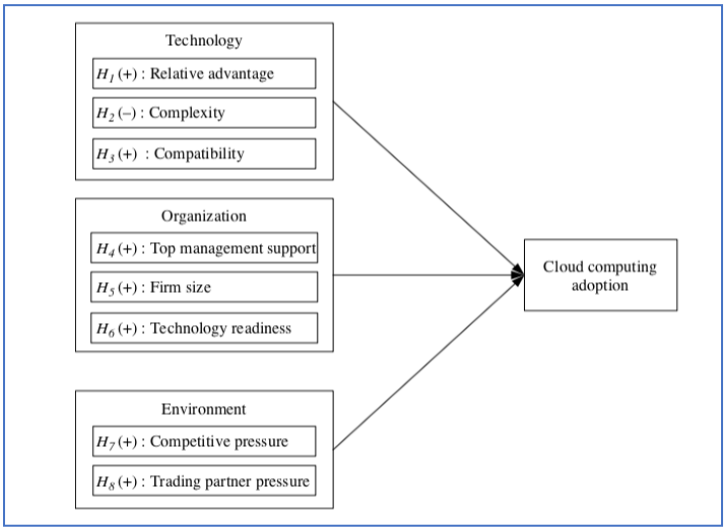

Figure 2.9: Conceptual model for the adoption of cloud computing (Low et al., 2011)

A study by Abdollahzadehgan *et al*. (2013) used the TOE model in investigating small and medium size enterprises (As shown in Figure 2.10). Data analysis revealed that technology readiness and competitive pressure had a negative impact on technology acceptance; and that it was important to evaluate organizational conditions for adopting cloud computing. The same study found that top management has a positive influence on intention to adopt cloud computing. Another study by Alkhater *et al.* (2014) found that the culture, the lack of competition and the lack of regulations and policies in developing countries have hindered the use of technology and its adoption by organisations. Additionally, there is a significant influence of individual characteristics (top management support) on an organisation's adoption of technology (Kuiper *et al.*, 2014; Borgman *et al.*, 2013). Furthermore, other studies have suggested the inclusion of top management support and technology readiness in the organisation context as factors that may influence the adopting. Thus, investigating these factors helps to identify the effect on the organisation as regard to attitudes toward the adoption of technology.

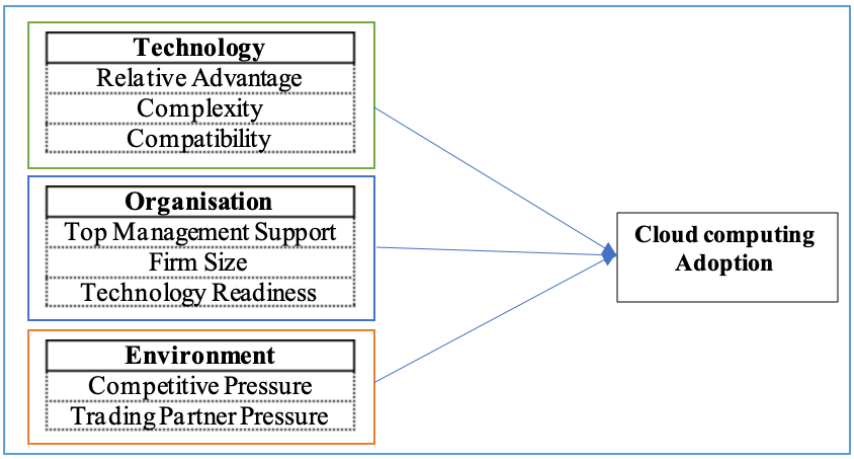

Figure 2.10: Cloud Adoption Framework (Abdollahzadehgan et al. 2013)

An investigation of the factors that have contributed to the success of cloud adoption, such as security, privacy, reliability, availability and the regulations need to be carried out to understand how these factors impact on the successful adoption of cloud computing in organisations, also in terms of how they may influence attitudes to technology acceptance and adoption.

Awa and Ojiabo (2015) examined the factors that affect the adoption of cloud services in small and medium-sized enterprises (SMEs) in regard to the provision of e-government in Jordan based on the TOE model (As shown in Figure 2.11). The study sample was acquired through an online survey with 1,200 participant decision-makers and conducted in 16 different government organisations. The study found that ICT infrastructure and perceived compatibility have a positive influence in relation to size of organisations, and cloud security and cost flexibility have a positive influence on trading partners' readiness in organisational to adopt and were significant variables in increasing the adoption of cloud services in organisations. This research was one of the studies conducted on acceptance behaviour in developing countries; and revealed the intention of top management to use was reflected in the organisation's position on the adoption of technology. Thus, investigation of these factors helps to identify the effect of attitudes toward the adoption of technology on the organisations.

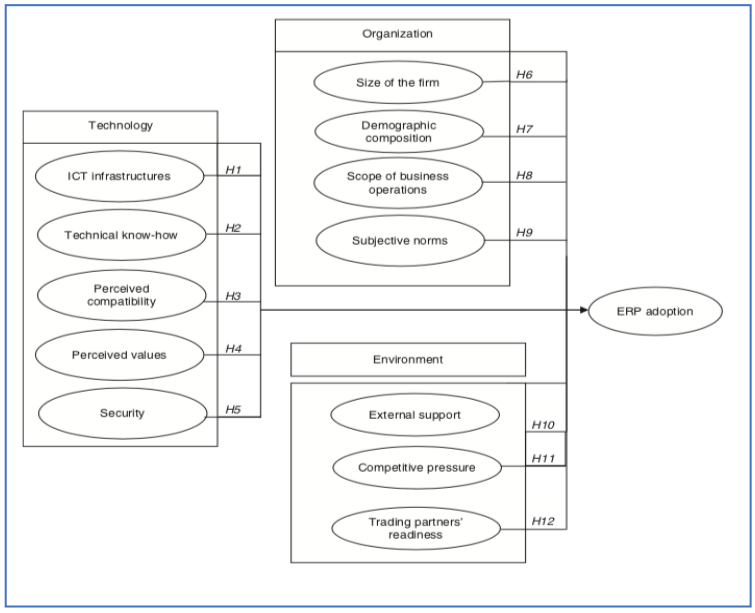

Figure 2.11: Proposed framework explaining ERP adoption within TOE (Awa and Ojiabo, 2015)

Some scientists and researchers have discussed the contributions that cloud computing can make towards providing computer infrastructure and services (Alkhwaldi *et al.*, 2018; Ali *et al.*, 2015). Current research is focused on the factors that affect cloud computing, such as costs, benefits and cloud-based security, at the organisational level within SMEs (Andergassen *et al.*, 2017). However, there has been no attention from previous research on the adoption and use of cloud computing in government organisations and how contextual factors can affect the diversity and adoption of cloud computing. Thus, governments in developing countries often face a low economic level and complex political constraints that limit the ability to invest and improve ICT to compete on the global stage.

A study by Alqahtani (2016) focused on integrating the existing e-commerce system in Saudi Arabia in private sectors with cloud computing, using the TOE model. The data were collected by survey in which 659 people participated. The study found that awareness, relative advantage, cultural environment and organisational attitudes have an influence on the intention of organisations to adopt cloud computing. Thus, there have been recommendations from previous studies to address the issues surrounding cloud-related industry concerns, including the need to issue guidelines for effective provision of services. These recommendations pertain to what government organisations face and there is no mention as to how external factors have an impact, such

as the social context, or technical development in terms of usefulness, ICT infrastructure, technology risk and intention.

The adoption of technological innovation is connected to the usefulness of innovation and how it is consistent with the objectives of the organisations. One of the previous studies conducted by Wang and Lo (2016) aimed to determine the factors affecting the adoption of cloud computing among government agencies in Taiwan (As shown in Figure 2.12). The data were collected through 342 government agencies in Taiwan. Based on the findings, this study found that factors that have an influence on the adoption of technologies were perceived benefits and technology readiness which has a strong effect on the adoption of cloud computing. Thus, this study focused on a limited number of factors from the organisational perspective, and these need to cover a wider scope in order to understand what influences organisations to adopt and innovate technology.

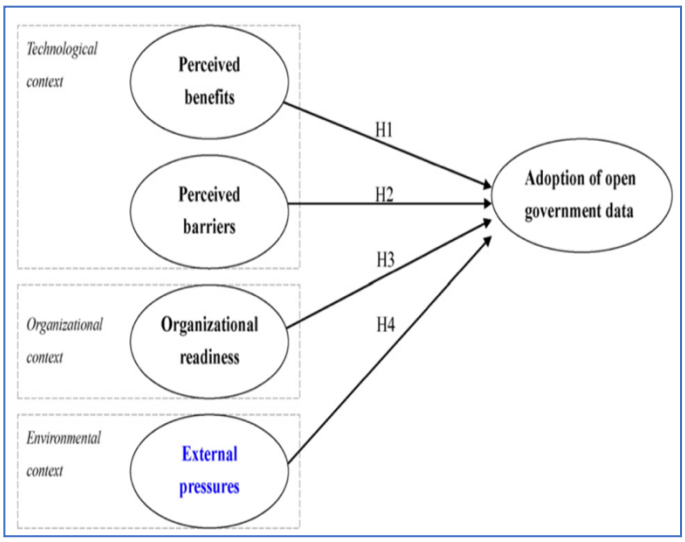

Figure 2.12: Proposed model for evaluating the adoption of OGD (Wang and Lo, 2016)

Some previous studies have identified several factors affecting the adoption of cloud computing. In the organisational context, systematic assessment of these factors may contribute to the appropriate decisions for the adoption of cloud services being made, as the determinants affecting the adoption of cloud computing can be properly assessed. Martins *et al.* (2016) developed a model based on the TOE framework for measuring factors affecting the adoption of

cloud services for organisations in the manufacturing sector in Portugal (As shown in Figure 2.13). The study analysed data collected from 369 companies in Portugal which were used to test the relevant assumptions. The authors found that the factors that have a strong relationship to the direct impact of cloud adoption in organisations were security concerns, technological readiness, regulatory support and the organisation's size. However, this study also revealed that cost savings, relative advantage, compatibility, complexity, technology competence and top management support had a moderating effect on adopting the cloud. Thus, to understand the factors that are most significant requires integrating other factors in order to understand how they contribute to making decisions about adopting the cloud. Therefore, the intention of organisations to use new technology depends on other factors, such as competitive pressure, trust, and IT readiness. Therefore, innovation in the context of technology, organisation and the environment in the organisation needs to be measured contemporaneously with beliefs and attitudes toward the adoption of cloud computing.

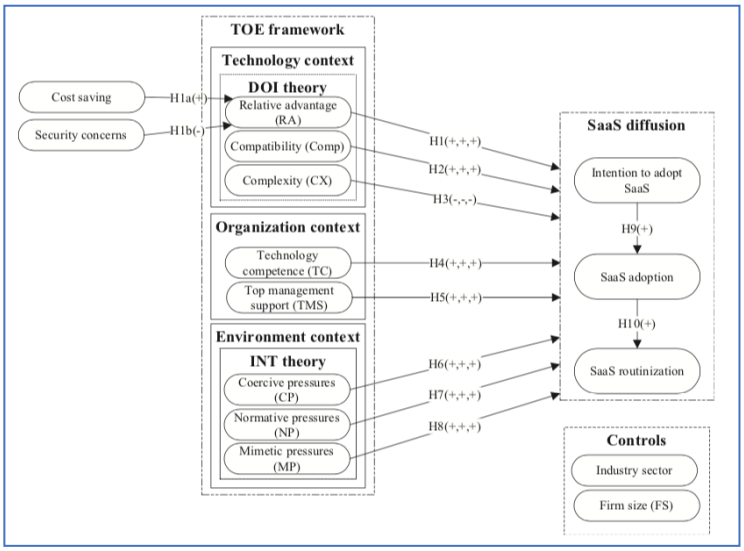

Figure 2.13: SaaS diffusion conceptual model (Martins et al.; 2016)

Sabia et al. (2016) proposed a conceptual model for evaluating the adoption of cloud computing in organisations. This conceptual model is based on important theories of company-wide adoption of the TOE framework and DOI theory. In this study, data were collected from 265 companies to test and examine the model. The study examined the following factors: cost savings, relative advantage, top management support, complexity, and compatibility; and found that all these factors had a positive influence on the intention to adopt cloud computing. As

previous models are based on how to integrate the organisational system with cloud computing, there is a lack of identification of factors that are not predictable after the migration of existing systems to the cloud. Thus, in the Saudi e-government context, the factors that influence the adoption of cloud computing in e-government, such as security, ICT infrastructure, awareness and organisations readiness require verifying.

Many governments indicate a need to understand the various perceptions of cloud computing that exist in investigating the development and adoption of cloud services in e-government. Al-Badi et al. (2017) proposed a model based on the TOE model. In their extensive study of the determining factors, many interviews were conducted with employees in the government in Oman. Their model explores factors in the organisational context that have a direct impact in either restricting or encouraging the adoption of technological innovation. Furthermore, the results showed that culture had little impact on the adoption of e-government. There is a positive relationship between relative advantage and compatibility, while there is a negative relationship between the size of the organisation and the ICT infrastructure. Moreover, organisations that have sufficient financial and human resources need to explore some factors that affect the adoption of cloud services from different angles so as to fully understand what the issues are to adopt the cloud.

Similarly, a study was conducted by Alshura *et al.* (2018) to investigate the factors affecting the adoption of e-government in Jordan based on the TOE model. The study sample was small and limited to 64 people; and examined the impact of culture, ICT infrastructure ICT skill, top management support, organizational cultural, regulatory relative advantage, environment, competitiveness, complexity, trialability, compatibility, and observability in adopting cloud services in e-government in Jordan. Readiness, technology and security in organisations were found to play a role in adopting new technology in order to increase the level of confidence in the users of e-services. This study found that the most important issues affecting the adoption of cloud computing in government organisations were factors relating to the organisational environment. In a government environment, it is difficult to make decisions without the permission of the authorized senior leaders.

The research articles reviewed above relate to the adoption of cloud computing in different online system and mainly address the critical factors that can be determined through identifying gaps in other studies about the significant factors that influence technology adoption in e-

government. The current research tries to examine factors that influence the adoption of cloud computing in e-government in four dimensions, which are the technological, organisational, environmental and social context in order to gain a deep understanding of what encourages and hinders the successful adoption of the cloud in this context.

2.10 Challenges for E-Government in developing countries

E-government refers to the government employment of information communication and technology in the provision of quality services to the citizens and organisations. The technology enables citizens to have convenient access to services and engage in democratic activities. E-government enables the public to access information concerning the government; and plays a crucial role in processing information for the management of citizens and businesses by the government. The e-government initiatives may include a citizen-centric portal, online income tax, land and property system, e-learning, e-social services, a government to employee portal and an integrated financial management system (Alkhwaldi *et al.*, 2018). However, e-government has also been associated with numerous challenges that often make it difficult for it to be implemented in developing countries.

2.10.1 ICT Infrastructure

An inadequate ICT infrastructure is one of the major barriers to implementing e-government in the developing countries. The government of a developing nation lacks the resources for establishing ICT infrastructure that is vital for e-government (Joshi and Islam, 2018). The resources required for the implementation of the e-government system include digital technology, internet network coverage and communication tools (Nunes *et al.*, 2017). The low availability of network coverage of the network in the developing countries restricts people from accessing e-government (Mohammed *et al.*, 2016). An Internet network is an essential factor for the utilization of services provided in the e-government websites and applications.

2.10.2 Security and Privacy

Privacy and security are critical elements of concern in the establishment of e-government in the countries around the world. However, this element can be a barrier to the implementation of e-government in the developing countries (Meiyanti *et al.*, 2019). The developing countries lack a proper strategy to assure their citizens that their information is protected from unwanted and unauthorized third parties (Khan *et al.*, 2013; Waller and Genius, 2015). Therefore, the site

will be vulnerable to misuse and cyber-attacks. Additionally, governments are incapable of safeguarding the information collected about their citizens in the country. Subsequently, citizens in the developing countries have little confidence in the privacy and security of their data in the e-government portal and websites applications (Choi *et al.*, 2017). Governments should therefore devise policies that promote security and privacy in e-government, which will promote and instil privacy and safety confidence in the citizens

2.10.3 Top management support

The management of the governmental institutions can contribute to the difficulty of implementing e-government. E-government is not effective in the developing countries because the department managers are not always committed to implementing it and supporting its establishment by governments (Singh and Srivastava, 2018). The local culture may discourage ICT managers from advocating the utilization of information and technology in the delivery of services in the developing countries (Zhao *et al.*, 2014). Organizational culture in the developing countries is often characterized by corruption and cronyism, which make it challenging for the government to implement ICT innovation in various departments.

2.10.4 Social influence

Social factors have created challenges in the embracement of e-government in the developing countries around the world. The social factors include the education and income of the people which have a significant impact on citizens adopting e-government in the developing countries (Alkhwaldi *et al.*, 2018). Many citizens lack the education and skills needed for operating and accessing online services from the government portal websites (Walser *et al.*, 2016). Additionally, the citizens with low incomes cannot afford the computer accessories and internet required to access the government portal websites.

2.10.5 Lack of awareness

A lack of awareness of the existence of e-government in the developing countries has hampered the adoption of the technology to access various government information and services digitally. The majority of the citizens tend to use traditional ways of accessing government services since they are unaware of e-government services (Shareef *et al.*, 2016). Therefore, lack of awareness deters embracement of e-government in the developing nations (Bakunzibake *et al.*, 2016; Bertot *et al.*, 2010). Therefore, governments that seek the accreditation of citizens and

organizations for their online services should be concerned about the awareness of the users of these online services.

2.10.6 Accessibility

The government is mandated to ensure that citizens can access relevant essential services from the e-government system. Citizens should be able to easily access the e-government services regardless of their geographical location in the country or challenging conditions (Azab *et al.*, 2009). However, e-government is of limited accessibility to a highly illiterate population and residents of areas with poor internet connectivity in the developing states (Al-Faries *et al.*, 2013). Additionally, e-government cannot be accessed by large numbers of people unable to use Internet services; this is especially important for older people, many of whom have reduced vision, loss of fine motor control and other disabilities; in the society due to improper design of the e-government portal and this needs to be taken into account when designing an e-government portal. The e-government websites and applications in the developing nations often do not accommodate the needs of blind, deaf and physically impaired people if they are to access the services provided by the government.

2.10.7 Availability

One of the challenges facing the adoption of services in developing countries is the lack of access to information and e-government services (Nemeslaki *et al.,* 2016). According to the previous studies, the limits of infrastructural resources, such as Internet access and a lack of computers for the majority of citizens, leads to a digital divide, and therefore can adversely affect the adoption of e-government (Lowell and Morris, 2019). Moreover, the unavailability of qualified ICT personnel has significantly contributed to challenges for implementing e-government in developing countries due to the technical issues involved in providing a high quality e-government system. Consequently, the nation's personnel with ICT skills play a vital role in the development of e-government (Siddiquee, 2016). Additionally, ICT professionals are essential to the training of the ICT personnel who will be contributing to solving technical problems and the maintenance of e-government. Furthermore, service providers and operators of e-government require frequent training to keep pace with changes in technology around the world.

2.10.8 Lack of common services

The developing countries experience a high level of poverty that has been associated with the lack of common services. These common services include electricity, healthcare, education, and e-government services accessible from citizens' residential areas in the developing countries (Ruhode, 2016). As governments usually prioritise investing in the basic common services rather than in information communication and technology, e-government is not implemented effectively in many developing countries around the world.

2.11 Challenges in adopting cloud computing in e-government

Cloud computing is a product of the epoch of technology, which has been utilized to improve communication and delivery of services in businesses and governments around the world. Governments everywhere are moving with the advancement of technology by investing in cloud computing for their e-government systems. However, the adoption of cloud computing for e-government has faced numerous challenges that make it a debatable issue for its establishment in a nation.

2.11.1 Privacy Risk

Privacy is one of the perils facing cloud computing in e-government. Cloud computing does not have the features of storing and processing information at the local organizational level as this is conducted by a third party (Ebadi and Navimipour, 2019). The involvement of a third party in storing information potentially exposes cloud computing information to unauthorized and unwanted users who may access citizens' confidential data (Bakunzibake *et al.*, 2016). Additionally, the third-party tendency to store cloud computing information in various areas makes people lose confidence in its privacy. The vulnerability of computer clouding compromises the rights of people to have privacy for any of their sensitive information utilized in e-government system (Narwane *et al.*, 2019). The integration of cloud computing with e-government means that abundant sensitive information is contained within the technology. Precisely, the stored information tends to be delicate and sensitive, which make it dangerous to fall into the hands of a malicious party (Sandu and Gide, 2018). Therefore, although cloud computing has produced significant benefits to establishing e-government as its sophisticated technology provided leverages fixed weaknesses that had developed in the employment of e-government; governments have been wary of implementing e-government due to the security issues facing the websites,

portals and applications (Bertot *et al.*, 2014; Hon and Millard, 2018). The security factors deterring the establishment of e-government include distortion of servers and inaccessibility of government services during particular scenarios such elections and other voting periods in a nation (Yang *et al.*, 2017). On the other hand, the introduction of cloud computing has enabled the government to counter the challenges faced in establishing e-government (Oseni *et al.*, 2015). Thus, the integration of e-government with cloud computing has shifted data security concerns from the government to the cloud providers who are mandated to ensure the e-government data is secure. Despite the dedicated effort to ensure security is provided in the cloud-based e-government, the system cannot be entirely secured.

2.11.2 Technology Readiness

Cloud computing is readily available to be integrated into e-government; the government simply needs to lease cloud services from a cloud computing provider as a third party (Wang *et al.*, 2010; Liang *et al.*, 2017). If the provider fails to reach a consensus with the government about adopting the technology in e-government, the government may not access and utilize cloud computing services due to lack of IT infrastructure and expertise needed to integrate the systems with cloud computing.

2.11.3 Reliability

Although the cloud is generally a successful system that can result in high quality e-government operations across a range of service-oriented departments, governments are concerned about its reliability (Senyo *et al.*, 2016). A system failure based on cloud services results in the stoppage of numerous services that are crucial in the running of the government operations in the public and private sectors. Therefore, such a failure may lead to massive losses of finances that are generated through operations that occur in the e-government websites and applications (Alateyah *et al.*, 2013). Additionally, the system failing incurs distrust in the users of cloud computing integrated into the e-government (Scuotto *et al.*, 2018). Potentially citizens' distrust of cloud-based e-government stimulates people to rebel against utilizing the technology. Furthermore, the failure of a cloud computing system may result in vast loss of data and security breaches of the e-government system (Lian, 2015). Moreover, the data loss cannot be compensated, which is a big blow to the governments who are investing in the cloud-based e-government, since the lost information is irreplaceable.

2.11.4 Security Concerns

Security is a fundamental issue required for the establishment of cloud-based e-government in countries around the world. Security deficiencies in the cloud computing technology exposes the e-government to confidentiality and integrity risks to sensitive information. The inadequate state of security in the cloud-based e-government incurs distrust in the users of the e-government services (Lian, 2015; Bakunzibake *et al.*, 2016). Therefore, the government should consider selecting a cloud computing provider who has established high-security measures that protect operations integrated with the technology.

2.11.5 Accessibility

The providers of cloud computing have elicited issues of concern in the employment of this innovative technology. The governments employing e-government are restricted from controlling cloud computing technology; therefore, cloud computing generates trust issues about the effective utilization of the technology (Palvia and Sharma, 2017). The third party owning the cloud has complete access to sensitive information concerning the citizens and government operations; therefore, the technology raises issues about intellectual property and personal information, which are crucial to instilling trust and confidence in e-government users (Pratono, 2016). Cloud computing thus creates a challenge when it is integrated with e-government. The management of the cloud computing is mandated to control the accessibility of the e-government information that is stored via the technology (Ali *et al.*, 2016). Therefore, the technology providers have to establish a management interface to ensure that only authorized individuals can access the e-government website portals and applications.

2.11.6 Trust in the Internet

Governments may have minimal trust in the storage of confidential and classified information on the internet. A government tends to take control of everything concerning the affairs of their citizens through directly protecting sensitive information (Hustad *et al.*, 2019). However, the provision of cloud services by a third party impedes them from being in control of their sensitive information (Al-Khateeb *et al.*, 2015). Additionally, a government does not have the power and mandate to control activities that occur in the cloud. Therefore, most governments around the world tend to have little trust in the storage of data using internet mechanisms. Governments are aware of malicious online fraud, which is rife on the internet, which diminishes

their trust in Internet-related technology. Therefore, governments may be reluctant to invest in cloud-based e-government.

2.12 Benefits of adopting Cloud Computing for E-government

Cloud computing has recently been merged with the e-government system of countries around the world. The innovative technology has a considerable amount of benefits that make it a vital asset to the provision of information and services to citizens and business. The benefit generated from adopting cloud computing comprise flexibility, efficiency, availability, reliability, system integration and other numerous benefits.

2.12.1 Scalability

Cloud computing has a high scalability aspect that makes it easily integrated into e-government systems. The technology is regarded as scalable as it can be configured with IT resources such as servers and hard drives (Jimenez *et al.*, 2014). Therefore, a government can integrate cloud-based e-government with the various essential operations that occur in the country. Additionally, the capacity of the cloud computing is not fixed but can be broadened through external configuration (Ooi *et al.*, 2018). The scalability of cloud computing makes it suitable for it to be integrated into the e-government of developing countries (Alkhater *et al.*, 2014). Cloud computing technology is also suitable to be adopted in the dynamics that are occurring in the growth of businesses in the developing countries.

2.12.2 Availability

Availability is an impressive attribute of cloud computing that makes it appropriate for e-government users. Cloud computing provides opportunities to enhance access to many information resources through e-government that was previously unavailable in the traditional system (Al-Faries *et al.*, 2013). E-government users require services and information from the e-government websites and portals day and night throughout the year (Imhanwa *et al.*, 2015). Accordingly, the employment of cloud computing mitigates the impacts of technical problems in traditional systems that may result in loss of data and break down of services for citizens. Governments need relevant back-up technology to cater for a storage facility in case of technical issues in e-government (Lian, 2015). Hence, cloud computing can provide suitable mitigation measures for recovering the valuable and sensitive information in the e-government system (Jones *et al.*, 2017). The e-government applications and website will be distributed to different

cloud centres, which are located in premises around the world. Thus, the collapse of a single cloud centre will not break down e-government operations, since it has been linked with the innovative technology in a different region.

2.12.3 Flexibility

The adoption of cloud computing in e-government creates flexibility in the government's system; as cloud-based e-government can be utilized at different levels and sectors in the government (Sandu *et al.*, 2018). Cloud computing has different models that enable ICT experts to configure to business expectations and organization (Almarabeh *et al.*, 2016). Businesses in the private sector may employ the Cloud hybrid computing model that has significant benefits for the organization. The businesses gain the leverage that is experienced by the public and private models.

2.12.4 Reliability

Cloud computing adoption in e-government has enhanced reliability in the provision of services to organizations and citizens. A properly implemented e-government includes efficiency and user satisfaction elements in the government strategies (Joshi *et al.*, 2017; Sivarajah *et al.*, 2017). The integration of cloud technology into e-government enables easy improvement of the quality of service delivery and increases the reliability to its citizens and businesses. Additionally, as a basic e-government system may not be able to solve various problems that arise in the absence of sophisticated technology, cloud computing may provide a technical and economic solution.

2.12.5 Cost reduction

The establishment of e-government requires a high financial investment to implement the system nationally. It involves the purchase of ICT equipment and software essential for the proper delivery of services to citizens and businesses (Alkhater *et al.*, 2014). Additionally, the government will need to hire ICT professionals that will handle and maintain the e-government system (Al-Khateeb *et al.*, 2015). However, the incorporation of cloud technology will provide a positive opportunity incurred in the establishment of the system; as it eradicates the upfront and operation cost incurred in the running of the e-government without this technology.

2.12.6 Pay as you use

Cloud provider advocate the use of pay as you go pricing, which enables the government to save a massive amount of money. Additionally, investment in cloud computing enables the e-government managers to eliminate the cost of power, storage facilities and space for operation (Weerakkody *et al.*, 2015). Therefore, cloud computing is a cost-saving technology that diminished the investment needed for e-government.

2.12.7 Quality of service

Cloud computing has enhanced the quality of services provided in e-government systems. Cloud-based e-government is readily available on the internet whereby citizens can retrieve vital information on time (Alenezi *et al.*, 2015). Additionally, cloud-based e-government enables the establishment of support available to aid users and to respond to the relevant claims and issues (Ahmad and Khan, 2015). Therefore, the e-government systems can be of high quality and satisfying to the citizens and businesses who are the primary users of the technology.

2.12.8 Systems Integration

The integration of the cloud computing with e-government eases the management of the system. Cloud computing eradicates the need for intensive management of the e-government portal and applications (Ilmudeen *et al.*, 2018). Cloud computing has the aspect of on-demand self-service in the presence of a secure interface that allows authorized individuals to access e-government information and services (Wu *et al.*, 2016; Ali *et al.*, 2018). Therefore, the government will not be required to employ people to control and monitor who is authorised to access the e-government services and information. Furthermore, the government is aided by cloud providers in the management of the cloud security in the e-government system; as the service provider has a mass of resources, which are employed to enhance security for the e-government system.

2.12.9 Virtualization

The investment of cloud computing in e-government has enhanced the virtualization of the entire system. The services are conducted online and information in the cloud storage services make the virtualized environment accessible via Web applications or Web services through the internet. Additionally, the online storage of information elicits transparency and accountability of employees utilizing the services (Bertot *et al.*, 2014; Hidayanto and Purwandari, 2017). The use of a multiple data centre makes cloud computing appropriate for continuity businesses and

suitable for disaster recovery (Oseni *et al.*, 2015). The cloud storage has contributed to safety and the prevention of theft of information and gives flexibility to end users for accessing these services from any internet enabled devices.

2.13 Summary

Developing countries should implement e-government to catch up with the reign of technological development around the globe; and embracing e-government will have significant benefits to the citizens and the government. Additionally, the incorporation of cloud computing technology into e-government will yield excellent benefits for developing countries. Cloud computing has contributed to the creation of a new business model, which is providing the best new methods for operating and managing services and data available via the Internet. This allows users to deploy quickly, provide resources and have easy access to online services through the possibility of expansion of the infrastructure. In addition, users are able to deliver and process information massively online. The Internet has been used mainly in e-government systems to provide e-services to citizens. For this, many governments have adopted cloud computing to provide better service.

This chapter has presented an overview of some issues and challenges related to e-government. This chapter is divided into several topics: firstly, the concept of e-government from the perspectives of different scientists was discussed, and a conclusion was reached that the general concept of e-government is not a fixed term and is subject to debate. Secondly, the concept of cloud computing was reviewed from a number of different angles; then there was a presentation of models in cloud computing with reference to the computer cloud structure. Thirdly, government systems in the Saudi e-government system were reviewed and the stages of development of the e-government were outlined as well as the motivations for the adoption of cloud computing in the e-government system. Fourthly, some of the e-government systems in developed and developing countries were described. Finally, some previous studies on the adoption of cloud computing in the provision of e-government systems were reviewed.

Chapter 3: The Research Framework

3.1 Technology Adoption Theories

Many models and theories have been proposed in previous studies. This chapter will be present the most common models that could be used to measure the appropriateness of a new adoption of cloud computing in e-government systems. There are models that have been widely adopted to analyse IT research, involving the Technology Acceptance Model (TAM), the Diffusion of Innovations (DOI) theory, Unified theory of acceptance and use of technology (UTAUT), Theory of Reasoned Action (TRA) and the Technology Organisation Environment (TOE) framework. The following section reviews cloud adoption models proposed in many previous studies. These studies have been examined and the factors that significantly impact on the enterprise's decision to adopt cloud computing identified.

3.1.1 Technology Acceptance Model (TAM)

The TAM is a model designed by Davis in 1986; and proposed a theory of technology acceptance in information technology. Several studies have shown that the TAM model is an appropriate model for clarifying the acceptance of technology in IS research (Lemay *et al.*, 2018; Verma *et al.*, 2018), as well as the impact of external factors on attitudes and internal intentions. The TAM theory affords an analysis of the effect of two variables (perceived utility and perceived ease of use) in order to identify the intention of the user to use a new technology through external factors influenced by internal attitudes and intentions (Jan and Contreras, 2011) . The components of the Technology Acceptance Model (TAM) are shown below in Figure 3.1.

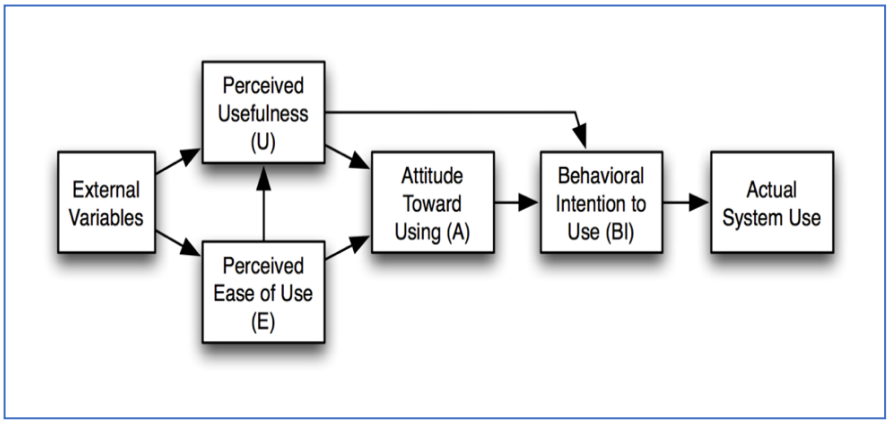

Figure 3.1: TAM model (Davis, 1989)

However, research has consistently shown that the TAM model ignores the social factor which aims to verify the social variables, which are part of the subjective criteria of personal intention to use technology (Kurdi *et al.*, 2016; Taherdoost, 2018; Verma *et al.*, 2018). For example, the social norms factor outlines how a positive personal perspective about using technology can have a positive impact on intention to use. The perceived usefulness factor (U) refers to *"the degree to which a person believes that using a particular system would enhance his/her job performance"* (Davis, 1989). The perceived ease of use (E) factor refers to "*the degree to which a person believes that using a particular system would be free from effort"* (Davis, 1989).

A search of the literature reveals that several studies have been published which find that the TAM framework clearly identifies factors that are to be measured and verified in organisations. The factors in this framework have been considered suitable to be included in a framework designed to meet more specific requirements. Previous research has highlighted many advantages of the TAM model, such as focusing on intelligibility and the comprehensiveness of factors that can be measured, measuring factors from the perspective of users and the influence of cultural factors in adopting technology (Arpaci, 2019; Bach *et al.*, 2016). Accordingly, the TAM was used to determine the critical factors affecting organisation adoption. In this area, there is emphasis on two main factors, ease of use and usefulness as perceived by the end users. To illustrate, the ability to adapt identifies relevant factors from the perspective of users as well as organisations, such as services quality, awareness and trust. The importance of the two constructs in the TAM lies in emphasising the different external variables, such as cultural influences, pervasive behaviour, perceived systems performance and personal innovations (Taherdoost, 2018; Verma *et al.*, 2018). Therefore, e-government systems need to measure the satisfaction of users and the quality of services provided from their perspective, which can be provided by TAM models.

3.1.2 Unified theory of acceptance and use of technology (UTAUT)

The UTAUT model was designed by Venkatesh, Morris, and Davis in 2003. This model aims at clarifying behavioural intent in the use of technology and its consequent changes. The researchers created a unified model incorporating eight components from other models which were social cognitive theory, TRA, x DOI, DOI, and TAM a model of PC utilisation, a motivational model and a combined TAM and TPB model (Abrahão *et al.*, 2016; Martins *et al.*, 2014). The UTUAT model was validated in four trade organisations in different fields, and the model

was able to explain 70% of the variance in the intent to use the technology. The behaviour intention to use the technology has three determinants, performance expectancy, effort expectancy, and social influence (Howard *et al.*, 2017). The actual use of technology has two determinants, facilitating conditions and behaviour intention.

The UTAUT has been an important model in the study of the adoption of technology in organisations. In addition, the UTAUT model contains four moderators (gender, age, experience and voluntariness of use) (Boonsiritomachai and Pitchayadejanant, 2018). Venkatesh *et al.* defined performance expectancy as the "degree to which an individual believes that using the system will help him or her to attain gains in job performance." Effort expectancy was referred to as "the degree of ease associated with the use of the system", while social influence was defined as "the degree to which an individual perceives that important others believe he or she should use the new system." Finally, facilitating conditions was explained as "the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system" (Venkatesh *et al.*, 2003; p. 458). Thus, the UTUAT model can be used to classify technology users into different groups, such as employees, consumers and citizens; and contributes to determining the most influential factors in technology adoption in these groups.

Literature published about the UTUAT generally considers it provides a useful account of how the intention of acceptance behaviour has influence through the first three constructs "*effort expectancy, performance expectancy, and facilitating conditions*". The intention of acceptance behaviour is defined as "*the person's subjective probability that he will perform the behaviour in question*" (Fishbein and Ajzen, 1975; p288). while the facilitating conditions construct has an influence only on the behavioural intention construct. The behavioural intention construct influences the actual usage of technology construct (Mell and Grance, 2011). Figure 3.2 below shows the elements of the UTUAT model.

Some research has applied empirical investigations into UTUAT, and it is one of the most popular models used in studies in various fields, including business administration and information systems (Bawack and Kala Kamdjoug, 2018). However, a number of factors that have a high influence in the relationship of organisations and the intention to adopt technology are not taken into consideration. Moreover, it does not address the impact of organisational norms that have been verified in other theories. In addition, the UTAUT seeks to understand adoption

from the perspective of future intention and the actual frequency of use of the system (Cao and Niu, 2018). However, research on the UTAUT models has been largely restricted to limited comparisons focusing on the adoption of technological aspects and provides only limited guidance on how to influence the use of technology. Thus, the UTAUT focuses on variables that drive users to adopt technology that has already been introduced without organisations' participation, and this feature makes the models less useful, even though they have an impact on understanding the adoption of technology.

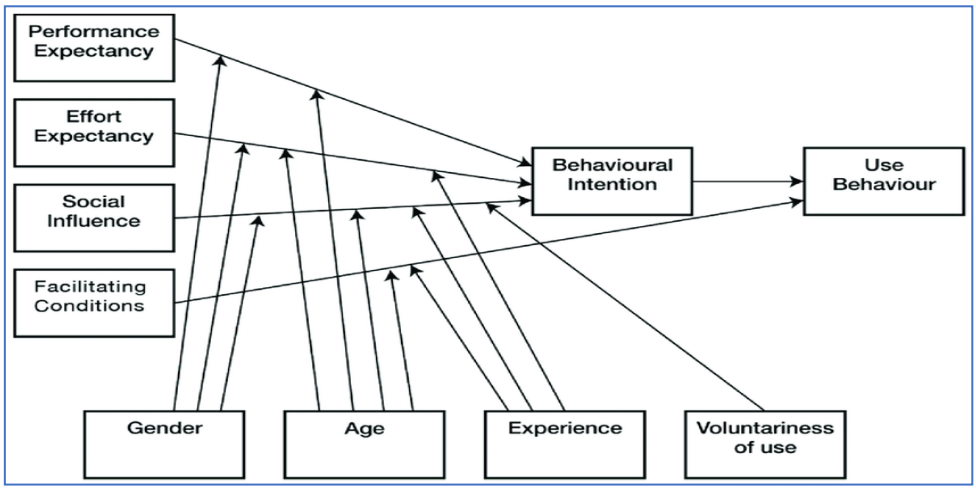

Figure 3.2: The Unified Theory of Acceptance and Use of Technology model (Venkatesh et al., 2003)

3.1.3 Diffusion of Innovation Theory (DOI)

Diffusion of innovation (DOI) was first designed by Rogers in the 1960s, the purpose of which was to study the dissemination of innovation in society. In 1995, the DOI theory model was further developed by Rogers to analyse and discuss users' adoption of new technology through its implementation in electronic systems (Aizstrauta *et al.*, 2015). The DOI theory is an important model for determining the factors that influence innovation, and provides a suitable basis for IS research that can develop the ability to measure users' perceptions in IT adoption.

To date, the DOI theory has received considerable attention in the research literature. DOI indicates that individual adoption of innovation is divided into five categories as follows "*(a) Relative advantage (b) Compatibility (c) Complexity (d)Trialability (e) Observability"* (Goldkuhl, 2009). Figure 3.3 below shows the elements in the diffusion of innovation theory (Agag and El-Masry, 2016).

In the literature on the DOI framework, the relative importance of its adoption has been subject to considerable discussion. The DOI framework was found to lack some factors that are critical and have an important impact in analysing the adoption of new technology, especially e-government systems. It does not, for example, measure the confidence of organisations in technology and the perspective of users in trusting the technology and services provided, social and cultural factors and awareness of technology (Wong and Jackson, 2018). It is clear that, among the variables of the DOI framework, it is found that the factor of observability can be measured by the adoption of technology from the perspective of the user or organisation. As such, it will be useful to examine this factor to achieve the objectives of this study. In addition, other variables in DOI are experimental factors, which are commensurate with the intention of organisations to adopt new technologies, including e-government systems.

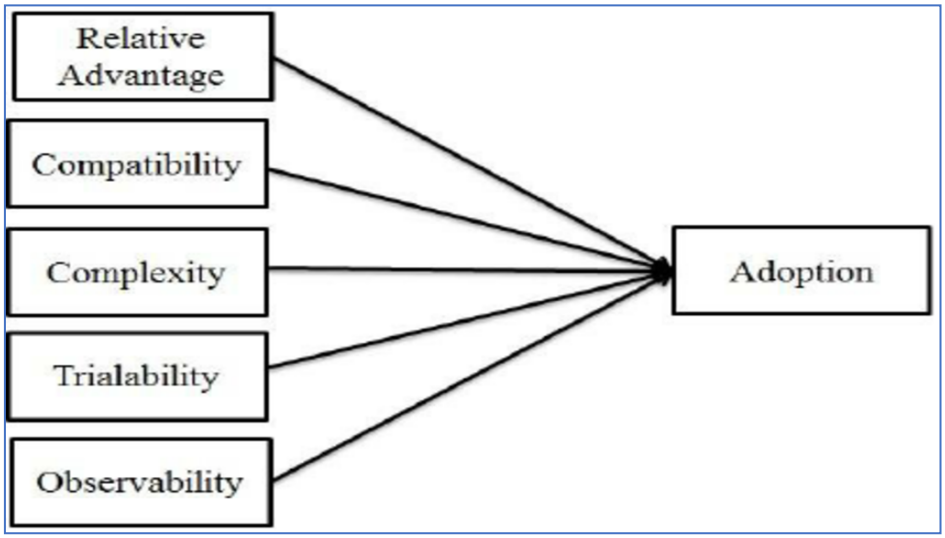

Figure 3.3: Diffusion of innovation theory (Rogers, 2003)

3.1.4 Theory of Reasoned Action (TRA)

The TRA was proposed by Fishbein and Ajzen in 1975. This theory is one of the fundamental theories in the field of social psychology and is used to evaluate human behaviour. This theory has proved successful in presenting the influence of intentions and behaviours in many areas in the adoption of technology. In the TRA, the most important determinants of an individual's behaviour are behavioural intentions (Mishra *et al.*, 2014); an individual's attitude and subjective norm affects their behavioural intention which in turn directly influences their actual use behaviour.

To date, large-scale studies have been performed to investigate the prevalence of TRA. It has contributed to determining how to target strategies through behaviour change and what factors are affected in the intention of the user to accept the new technology (Untaru *et al.*, 2016). In addition, it also explores the factors influencing human behaviour. In this theory, consideration is given to the adoption of systems by determining behavioural intention; and that can contribute to the promotion of awareness of the system (Fleming *et al.*, 2017; Mishra *et al.*, 2014). Moreover, the TRA considers the opinion of society about the intent to use the technology. The elements of the Theory of Reasoned Action are shown in Figure 3.4.

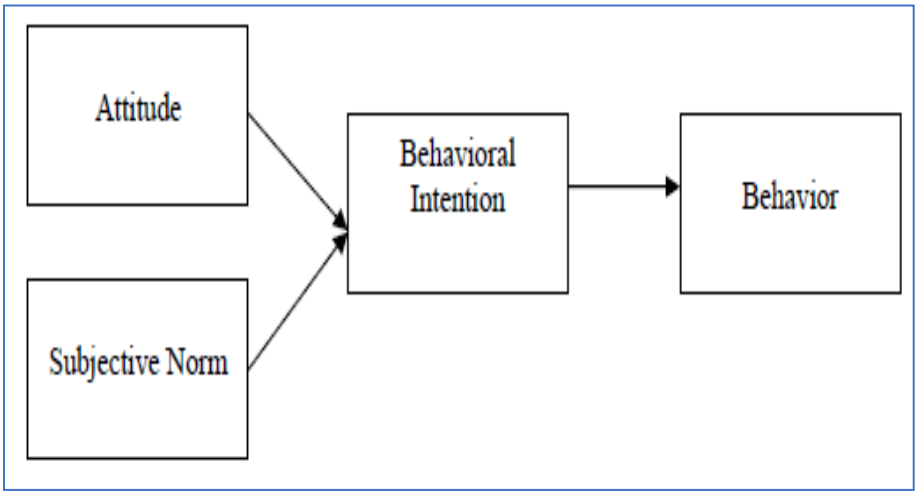

Figure 3.4: Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975)

In some previous studies, the TRA framework has been adopted but shown to have limitations (Oni *et al.*, 2017). The TRA framework needs to include some other important factors in order to effectively predict whether users adopt online services, such as reliability, trust, ease of use and availability. The TRA framework has been evaluated in terms of the adoption of technologies based on two concepts, the attitude toward behaviour and the subjective standards. Moreover, it is not sufficient to enable an understanding of the adoption and use of e-government systems in a comprehensive manner (Kim, 2015; Joshi *et al.*, 2017). However, most of the previous studies have focused on general attitudes toward technologies which have been shown to have a high influence on adoption. In addition, a comparison of the predictor variables has shown that attitudes have a higher influence than subjective norms, which are used in predicting the intentions of individuals to maintain the use of technology. Thus, the TRA framework is limited for examining the factors that influence technology adoption by governments. It is based

on the focusing on the attitudes of users which have exerted influence on the intention of individuals to adopt technologies (Hansen *et al.*, 2018). Therefore, the adoption of technology in organisations requires a comprehensive understanding of the use of e-government systems from different perspectives. It is necessary to discover the factors influencing the intention of the user as well as the organisation to adopt technologies.

3.1.5 Technology-Organisation-Environment (TOE) Framework

Tornatzky and Fleischer designed the TOE framework in 1990. This framework aims to identify the components of the organisation that influence the adoption of technological innovations (Tornatzky and Fleischer, 1990). The TOE model consists of three elements, which revolve around technological problems, internal and external factors, and organisations (AlBar and Hoque, 2017; Lin, 2014). The first element refers to the technological issues facing the organisation that intends to adopt technology, such as IT infrastructure, security, quality and hardware. The second factor refers to internal and external factors that have an impact on the organisation, such as competition in the market and regulations and policies, while the third describes the organisation in terms of the nature of its activity, size and the structure of its organisation.

That the TOE framework is analytical makes it an effective and comprehensive model, contributing to the analysis of factors that lead to many innovations in information technology (Camargo and Wang, 2015). In the TOE framework, there is a relationship with Rogers' theory of innovation diffusion, by focusing on both individual and organisational characteristics. Moreover, through studies that have been conducted, it is seen that the TOE framework assists in the adoption of technology in organisations (Borgman *et al.*, 2013). Therefore, in studies using this model, external influences have been found to be one of the primary factors that will influence the adoption of the technology. This factor is analysed through its four variables: financial aid, information technology awareness and the availability of an appropriate technology (Qasem, 2018). Accordingly, there are many advantages that have been highlighted for the TOE model. This could contribute to enhancing the development of an appropriate model through which the organisations will promote understanding in regard to innovation and technology adoption.

In addition, research has been found that the environment and technology factors of the organisations have been adopted as key factors strongly connected to the impact of technology adoption. Thus, it is noticeable that there is a similarity in the factors outlined in the framework and those related to the development of the e-government system. Accordingly, this framework recognises that it has the ability to reproduce the factors influencing the adoption of technology (Niknejad *et al.*, 2016; Arpaci, 2019). Thus, investors and decision-makers should be encouraged to realise the strength of the relationships between the users on the one side and the adoption of technology on the other. The following figure (Figure 3.5) shows the Technology-Organisation-Environment framework.

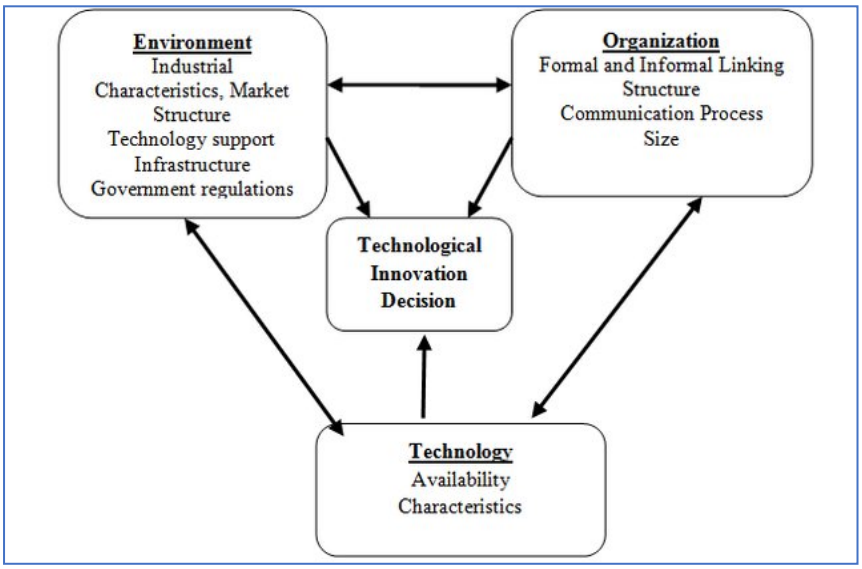

Figure 3.5: Technology-Organisation-Environment framework (Tornatzky and Fleischer,1990)

The TOE framework has been widely used to study the adoption of technology in organisations to identify the potential or actual impacts in innovation and new technologies (Dillon *et al.*, 2010). The TOE framework has flexibility and is effective in evaluating the performance of technologies and innovation. Furthermore, using the TOE framework to identify the feasibility of IT adoption in organisations enables the identification of critical factors which have direct and indirect impact through three main categories of factors, technology, organisation and environment (Lin, 2014). The TOE framework has been used not only to analyse factors on an organisational and individual level, but also provides a theoretical foundation for discussing adoption in the various areas in which innovation and technology adoption are intended.

Although extensive research has been carried out on the TOE framework, some researchers have suggested that there is a need for greater inclusion of other factors which directly affect decisions to adopt technological innovations in addition to those already included in the framework (Camargo and Wang, 2015). Therefore, the TOE framework seeks to verify how IT adoption processes and structures affect the adoption decision and implementation processes of technologies. The TOE framework context refers to identifying factors that play an important role in innovation and the adopting of technology through existing ones and which are equivalent to the existing technology.

Despite the fact that there are many reports in the literature on the outcome of the TOE framework, most do not explore the adoption of cloud computing in e-government; although, the implementation of the TOE framework has been prevalent in different fields (Bradford *et al.*, 2014; Sun, 2016). Consequently, the TOE framework has contributed to the discovery and evaluation of the appropriateness of the organisations in innovation and adoption of technology in improving the quality of the organisation and in keeping abreast of the technical developments of the past years. In view of this, the TOE framework should be used to investigate the factors influencing the adoption of cloud computing in government to deliver online services (Tsou and Hsu, 2015). Thus, this will increase the main motivation for government organisations to adopt the latest innovations, which will contribute to raising the efficiency of services provided by e-government system. Hence, using the TOE framework for e-government adoption of cloud computing is theoretically appropriate, contributing to an in-depth understanding of the factors according to the three main contexts. The TOE framework provides a deeper understanding to be able to answer the research question through the contexts derived from the literature including technological, organisational, environmental and social contexts.

Drawing on the previous discussion, a number of important points and research gaps must be considered. Firstly, there is a strong suggestion that social, technical, organisational and environmental contexts are important factors that must be involved in models exploring the adoption of cloud computing in e-government in order to achieve an understanding of an organisation's intention regarding the acceptance and adoption of computing services in e-government. Secondly, most of the previous studies on adoption of cloud computing in e-government have focused on one perspective, either the technical or the organisational perspective. Therefore, this study will use both a technical and organisational perspective and add other factors that

have an impact on technological adoption in order to understand the most important factors in the adoption of cloud computing in e-government. Studies have proposed the development of the TOE model in organisations in order to study and understand the intentions of organisations in adopting the cloud in e-services, as the intention to use the adoption of new technology is a very complex issue. Consequently, there is not a comprehensive model which combines the most important factors influencing the adoption of new technology.

3.1.5.1 Justification for adoption of the TOE model

The purpose of this study is to investigate the critical factors that influence the adoption of cloud computing in e-government system from the Saudi organisational perspective. Some studies have shown that the TOE model has been used in different contexts to evaluate the effectiveness of services and technological adoption in business sector (Aizstrauta *et al.*, 2015; Alateyah *et al.*, 2013; Borgman *et al.*, 2013 Hon and Millard, 2018; Mohammed *et al.*, 2017). Moreover, previous studies have identified that the technological variables are particularly important for understanding what the factors influence adoption of technologies that boost existing systems (Stefanou and Skouras, 2015). In addition, previous studies showed that it was appropriate to combine the important factors that affect the adoption of new technologies into one comprehensive model in different domain. (Alemeye and Getahun, 2015; Qasem, 2018). Consequently, some researchers have suggested extending the TOE model to measure other factors in a different context.

The TOE model comprehensively describes the process of innovation in the context of organisations. It focuses on three attributes of an organisation that have an impact on the adoption of innovation: technology, organisation and environment (Borgman et al., 2013; Bradford et al., 2014; Senyo et al., 2016). In the context of technology, these are the factors influencing the internal and external technology relevant to the organisation. In addition, technologies are available for potential adoption (Ahmad and Bsc, 2015; Bradford et al., 2014). On the other hand, the organisation context is related to the descriptive characteristics of the organisations, top management support, structure of organisations, human resources and the method of communication between organisation systems and appropriate IT infrastructures readiness (Niknejad et al., 2016). Moreover, the environment context refers to the characteristics of organisations including policies, organisational regulations, and pressure from the government and competitors and the values contained in the organisation's vision. Hence, the TOE model is used to identify

the important variables that have significant influence on innovation and adoption of new technologies in an organisation's systems context.

The TOE is an important model that can be applied to various contexts in organisations adopting ICT (Alqahtani, 2016). It is also beneficial to understanding by verifying the factors influencing the adoption of new technology in organisations systems context, which leads to a logical analysis of data about the more influential factors (Borgman et al., 2013). Thus, the TOE model affords a powerful, highly structured and valuable framework to predict user acceptance of technology in various areas that provides an explanation of how to influence the adoption of new technology. The adoption of cloud computing has been discussed in terms of developing frameworks. In Previous researches were reviewed to explore which factors in comprehensive theories enhance understanding of how new technologies are adopted. Thus, this study will take into account the TOE Model to explore and investigate the potential factors that affect the adoption of cloud computing in e-government by combining them into one comprehensive model.

3.2 Review of TOE Model for Cloud Computing Adoption

The literature review explored a range of research conducted using different models to investigate how different types of information technology in were adopted in organisations (Ali et al., 2018; Durao et al., 2014; Mohammed et al., 2016). Some research considers the adoption of new technologies using the TOE Model, which allows for identifying the most important factors affecting such adoption. The TOE model has contributed to predicting factors affecting the adoption of cloud computing by IT professionals (Ahmad and Khan, 2015). Numerous studies have been conducted to determine the factors influencing the adoption of cloud computing in organisations; and occurred in different contexts including E-business, the E-health sector, E-learning, government agencies, and both public and private organisations. The majority of these factors fell into three main categories: (a) technological context, (b) organisational context and (c) environmental context.

In the technological context, several common factors were studied in developed countries including relative advantage, complexity, compatibility, security and privacy, technological readiness, IT infrastructure and technology cost (Alshura *et al.*, 2018; Mohammed, Alzahrani, *et al.*, 2017a; Martins *et al.*, 2016; Almutairi and Thuwaini, 2015; Alkhater *et al.*, 2014; Kuiper *et al.*, 2014; Zwattendorfer and Tauber, 2013). The majority of these factors have not been tested so far in developing countries, which are the focus of this research study. These include quality

of service, security, relative advantage, reliability, privacy, compatibility, trust and complexity. Although, studies have shown that these are the main influencing factors that drive organisations to use and adopt cloud services, studies in developing countries (Jones *et al.*, 2017; AlBar and Hoque, 2017; Almutairi and Thuwaini, 2015; Durao *et al.*, 2014) have not examined these factors intensively, which play a role in increasing the intent to adopt the technology. Thus, studies carried out in developing countries have not provided evidence about the effect of organisational attitude towards the adoption of cloud computing or how factors affect the final decision-making processes of top management.

In the organisational context, most studies have tested the more important factors which impact the organisational adoption of cloud computing in developed countries. The factors that influenced the organisations included top management support, organisational resources, transactions and technology readiness. Moreover, studies have shown the importance of these factors and their ability to measure the extent of impact in organisations that have adopted cloud computing. In this regard, researchers (Stergiou *et al.*, 2018; Alkhwaldi *et al.*, 2018; Oni *et al.*, 2017) believe that these factors play an important role in organisations by promoting their desires and intentions regarding the adoption of cloud computing. Accordingly, this study will consider the aforementioned factors, including top management support and technical readiness, which positively influence the intention of the organisation related to the adoption of cloud computing. However, previous studies have shown that certain of these factors (the characteristics of organisations and organisational structure, including human resources and information resources) do not influence the adoption of cloud computing. Accordingly, these organisational factors are not included in the research model.

The environmental context has also been considered. Most of the previous studies have investigated the significant factors that have influenced the adoption of cloud computing in various sectors, including competitive pressure, business partners, regulations, physical location, regulatory support, and the competitive environment (Wong and Jackson, 2018). In addition, some studies (Martins *et al.*, 2016; Almutairi and Thuwaini, 2015) have shown that competitive pressure is one of the many factors that promote the adoption of new technologies. However, some of the environmental factors have been shown not to have a significant influence on the intention of adopt cloud computing (Mustapha *et al.*, 2017; Lal and Bharadwaj, 2016). These factors including trading partner collaboration, best practices, and trading partners' readiness.

These environmental factors do not play a role in the intention of organisations, as they were not crucial influencing factors that have a direct impact on the government adoption of cloud computing.

The review of the relevant literature on adopting cloud computing revealed the existence of different factors that are not part of the original TOE model (Wang and Lo, 2016; Camargo and Wang, 2015); namely, cloud provider competence, cloud provider characteristics, cloud provider presence and familiarity with the availability of cloud services to e-government system. The purpose of these studies was to examine and determine if they were critical in understanding the intention of organisations to adopt cloud computing (El Haloui and Kriouile, 2017; Mustapha *et al.*, 2017). Thus, this research will consider other factors including trust, awareness and the user's attitude to exploring the potential factors that affect the adoption of cloud computing by e-governments, which show as critical factors that promote the adoption of new technologies; and will combine them into one comprehensive model under social context.

Based on the arguments presented in this section and the existing critical literature review, it is also important that TOE is a model that has been verified in previous studies and integrated with a number of models for technology acceptance and extension. The TOE model has been used in various fields and has achieved results that have led to the identification of highly significant factors and the identification of problems based on the main categories. Thus, the study considers that the TOE model will be a suitable model to adopt and verify the factors that affect the adoption of cloud services in the provision of e-government systems in the Saudi government context.

3.3 Developing a conceptual framework and hypotheses for the adoption of cloud computing

Based on the literature review, it has been shown that few of the empirical studies discussed the adoption of cloud computing in government organisations. This research will develop a conceptual model to investigate factors related to motivation to adopt the e-government system of cloud computing in Saudi government (ACCE-GOV) and to explain the most important factors that enhance the government's adoption of cloud computing. The literature review has clearly demonstrated that some studies have discussed the TOE framework, and the DOI model as commonly used theories about the adoption of technology in different sectors (Camargo and Wang, 2015; Borgman et al., 2013). For example, there are studies on the adoption of cloud

computing in e-business (Awa and Ojiabo, 2015), e-healthcare (Bawack and Kala Kamdjoug, 2018; Tawalbeh et al., 2016), e-learning (Alajmi et al., 2018; Qasem, 2018; Sabi et al., 2016) and industry (Howard et al., 2017). Consequently, this study will consider the TOE model and the DOI model to have improved knowledge in the field. Alzahrani, et al. (2017b) state that three DOI innovation characteristics have been applicable to adoption of cloud computing, namely: relative advantage, complexity and compatibility. Some previous IS research (Hon and Millard, 2018; Martins et al., 2016) found that, trialability and observability have not been shown relevant to cloud-computing technology adoption.

The adoption of cloud computing is still in its early stages in the Saudi government organisations; and the government has been concerned about adopting new technologies due to the failure of some systems in relation to their adoption. It requires the use of intensive studies to help identify the most important factors that have an impact on cloud computing adoption in e-government. This study will develop a more comprehensive framework to investigate the adoption and use of cloud computing by e-government systems. This study will present hypotheses in order to verify the predictive relationship between factors influencing cloud computing. These factors were used in many previous studies, including relevant advantages, service quality, security and privacy, complexity, technology readiness, top management organisational support, regulations, trust, awareness and attitude In these aforementioned studies, these factors have been discussed as critical predictors of the adoption of cloud computing as shown in Table (3.7). Thus, the researcher has identified the most suitable and critical factors influencing the adoption of cloud computing in the Saudi e-government systems.

Studies	Factors											
	Technological					Organisational			Environmental		Social	
	Relative advantage	Service quality	Security	Complexity	Compatibility	Top management support	Technology readiness	Regulations	Competitive pressure	Trust	Awareness	Attitude
(Low *et al.*, 2011)	x			x	x	x			x			
(Abdollahzadehgan *et al.*, 2013)						x			x			
(Borgman *et al.*, 2013)	x			x	x	x						
(Alkhater *et al.*, 2014)	x	x		x	x	x	x	x		x		
(Awa & Ojiabo, 2015)				x	x							
(Alqahtani, 2016)						x		x			x	x
(Martins *et al.*, 2016)	x					x		x				
(Wang & Lo, 2016)							x		x			
Sabi *et al.* (2016)	x			x		x		x				
(AlBar & Hoque, 2017)	x			x	x			x	x			
(Alshura *et al.*, 2018)	x					x	x					

Table 3.1: Summary of studied factors that influence adoption of cloud computing

3.3.1 Technological Context

The key element of successful e-government is providing the appropriate technology (Lopes, 2017); as the development of E-systems requires an appropriate infrastructure of ICT, network, application and services (Waller and Genius, 2015). Technological factors play a crucial role in the success of any organization, and understanding this contributes to an effective knowledge base on the benefits of new technologies (Qasem, 2018; Senyo et al., 2016). Earlier research on the adoption of IT innovation has found that security and privacy are often a concern in the decision to adopt. The technical aspects of an organisation have many challenges that will affect the decision of top management to adopt cloud computing (Martins et al., 2016). Based on the literature review, (Hon and Millard, 2018; Wang and Lo, 2016; Hsu et al., 2014) it has been found that complexity, compatibility and relative advantage play a role in the adoption of cloud computing. A study by Tsou and Hsu (2015) found that the government's intention to improve the performance of organizations is related to the quality of existing IT infrastructure, which focuses on providing technological support for the adoption of cloud on e-government. However, the weakness of infrastructure and the lack of information technology are often a major factor in the lack of acceptance of new technologies or even a complete hindrance to the adoption of cloud computing for e-government (Misirlis et al., 2017). The systems of government in developed countries still suffer from the challenges of technologies (Al-Khateeb et al., 2015). According to previous studies, developing countries often prefer not to make technological investment because of a lack of trust in accepting new technology, and they rely on experiences and comments from other organizations before deciding to adopt new technology (Alkhater et al., 2014) Additionally, It has been found that the majority of the current e-government systems implementation is addressed around the concern of governments about the failure of systems, which affect the satisfaction of users (Alajmi et al., 2018). A number of researchers have demonstrated that ensuring the success of an e-government system depends on the initiation of the transformation to new technology (Agag and El-Masry, 2016). Palvia and Sharma, (2007) recommend that the success factor of an e-government organization is aided by effective technology. Many studies support this is an essential investment to deploy a successful e-government system. In the following subsection, an explanation of the factors that have influenced the intention of government organisations to adopt cloud computing is provided. These include relative advantage, compatibility, complexity, service quality and security.

3.3.1.1 Relative Advantages (RA)

Relative advantage refers to "The degree to which an innovation is perceived as being better than the idea it supersedes." (Rogers 1995, p 219). Comparative advantage drives organisations to switch to cloud computing if their adoption can reduce operational costs and improve service delivery (Dash and Pani, 2016). One of the most important innovations of innovation theory is perceived relative advantages (Wahsh and Dhillon, 2015). Based on previous studies, perceived relative advantage supports a positive and important relationship to the benefits of cloud computing. For example, easy access to services, reduced cost, compatibility and integrated solutions for different organisations with an integrated infrastructure (Chen and Kim, 2019). Therefore, there is an important and positive relationship between relative advantages of cloud computing and the intention of organisations suffering a lack of IT infrastructure that is supported by a wide range of studies (Gangwar et al., 2015; Lang et al., 2018; Martins et al., 2016). Therefore, relative advantages are likely to affect organisations' decisions that support the adoption of cloud computing, which suggests it is an important factor in understanding the adoption of this technology (Wang and Xiang, 2007). Tawalbeh et al., (2016) indicate that relative advantage has contributed to improving the negative image of some technologies, which has led organisations to adopt new information technologies. Based on the literature (Oliveira et al., 2014; Waller and Genius, 2015), many of the key issues facing adoption of new technology are significant differences between technical benefit and organisational systems in terms of consistency and convenience. Studies (Jäger et al., 2015; Sin et al., 2016) show that organisations consider the benefit of investment in cloud computing may be that it provides greater regulatory advantages. These benefits may contribute to improved service delivery efficiency, process quality, faster task performance and access to new features (Karim and Rampersad, 2017). Thus, this variable is a powerful factor of innovation IT. The adoption of cloud computing enhances organisations ability to access documents from anywhere, which means it is easier for organisations to enable their employees to share resources shared with other organisations, saving time and money (Huang, 2018).

In fact, the likelihood of government organisations adopting new technology increases when they expect that a relative advantage will add value to their services. Moreover, e-government system in organisations needing to avoid the costs associated with systems and maintenance of IT infrastructure can achieve various advantages by adopting cloud computing. Thus, in

developing countries, government organisations are able to increase resources and infrastructure through cloud computing that meet the requirements of e-government systems in government organisations in order to provide new services. The following hypothesis is therefore proposed:

H1: Perceived relative advantages have a direct and positive influence on the intention to adopt cloud computing for e-government systems.

3.3.1.2 Compatibility (CM)

The compatibility refers to: "The degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters". (Rogers, 1995, p.15) The compatibility of processes with the standards of organizations is considered an influential technological factor in the adoption of new technologies in organizations (Mohammed, Alzahrani, et al., 2017a). Based on the theory of diffusion of innovation, Karim and Rampersad, (2017) and Khalil, (2012) found compatibility to be one of the important factors predicting the adoption of information systems in organizations. Technical compatibility with organizational values is one of the dimensions of success for innovation. According to Senyo et al. (2016), competent innovations facilitate consumer understanding and use of technology, reflecting on organizations' improved service delivery and technological development services. Compatibility in technology is consistent with the organization's needs and impacts on consumer behaviour. Some previous studies (Ahmadi et al., 2017; Wahsh and Dhillon, 2015; Awa and Ojiabo, 2015) pointed out that the rapid change in technology requires organizations to achieve technical compatibility by adopting new systems technologies that enhance the compatibility between organizational objectives and improved operations. Lemay et al., (2018) and Chen et al., (2017) discussed that compatibility is one of the motivations that encourage the use of cloud computing. Compatibility is considered a vital determinant to motivate adoption of new technology that is seen to conform to current vision, values and staff skills (Maqueira *et al.*, 2017). The technologies' compatibility will facilitate organizations to meet the intention of the technology. Therefore, the compatibility of cloud computing allows organizations to adopt a new innovative technology. However, according to Martins et al., (2016) compatibility was not a significant predictor of adoption of information systems in organizations. Joshi and Islam (2018) suggest that cloud computing can be compatible with existing systems, as some organizations in developing

countries suffer from a lack of infrastructure but can benefit from improving services by adopting cloud computing technology. Hence, following hypothesis is proposed:

H3: Higher Compatibility positively influences the intention to adopt cloud computing for e-government systems.

3.3.1.1 Complexity (CO)

Complexity is described by Rogers (1995, p.15) as: "The degree to which an innovation is perceived as relatively difficult to understand and use". Lian et al (2014) state that understanding the level of perceived difficulty in adoption of cloud computing will influence the organization's intention to adopt the system or ignore it. In fact, the adoption of cloud computing contributes to e-services, saving the time to perform tasks, adapting applications with specialized cloud infrastructure and increasing the efficiency of data transfer (Mohammed, et al., 2017). One of the benefits of adopting cloud computing is the ease of use (Wahsh and Dhillon, 2015). According to Karim and Rampersad, (2017), cloud computing is inversely proportional to complexity in implementation. Technologies that involve complexity in the case of adoption and difficulties in understanding their use will create uncertainty about their adoption and not ensure the success of implementation (Gangwar et al., 2015). In contrast, cloud computing providers hide the complex aspects of cloud computing from the end user, who may have concerns about security and data privacy problems, and location of data store. In addition, the major concerns of organizations are that the adoption of cloud computing leads to the establishment of a new IT infrastructure (Ahmad and Bsc, 2015). Complexity and lack of understanding of new technology mean that organizations have more concern about the adoption of cloud computing (Verma et al., 2018). In fact, complexity is one of the most important challenges facing senior management that decide to shift current systems to new ones. Consequently, senior management need to understanding the level of complexity of new technologies if they are to provide the skilled personnel and resources to successfully implement them (Alqahtani, 2016; Panda, 2014). In addition, it requires a degree of experience that may be difficult to provide easily in the organization (AlBar and Hoque, 2017; Senyo et al., 2016; Hsu et al., 2014). Most organizations in the developing countries are still concerned about adopting new technology, because of the complexity associated with this adoption and the lack of skills, expertise and availability of IT resources to evaluate cloud computing. This research investigates the influences on the adoption

of cloud computing in e-government system in order to improve the delivery of services and increase the quality of performance in government organizations. Hence, the following hypothesis is proposed:

H2: Less Complexity positively influences the intention to adopt cloud computing for e-government systems.

3.3.1.2 Service quality (SQ)

Service quality refers to the result of comparing the system quality and level of satisfaction with the service and IT managers understanding of the way the system was implemented (Parasuraman et al., 1994). Service quality is an important factor for higher levels of management in the adoption of new technologies (Martins et al., 2016). There are many IS studies that discuss measuring service quality through various quality criteria. Jain and Aggarwal, (2018) and Santa et al., (2018) state that service quality could encourage users to invest in new technologies. Services quality of investment technology has increased the intention to adopt. One of the criteria that enables measurement of the service quality is responsiveness (Lang et al., 2018). Furthermore, the adoption of cloud computing enables easy access to information or documents from anywhere to enhance performance and improve the service provided (Gasova and Stofkova, 2017). Service quality is given a high degree of attention in various later IS studies (Silalahi et al., 2017). The government considers criteria such as easy access to system, availability, and freedom from system errors before investing in new technologies to enhance the performance of an e-government system (Gasova and Stofkova, 2017). Chiva et al., (2018) and Sá, Rocha and Pérez Cota, (2016) found that service quality could be developed through interaction between the cloud service provider and users who wanted to enhance the system's performance and provide access to services without obstacles. Some studies indicated that successful adoption of e-government systems is based on the service quality of the organisations that provide the services (Kao et al., 2015). Governments intend to achieve a higher level of performance while providing cost-effective results, using cloud computing in e-government systems (Durao et al., 2014). However, many of governments are still at the beginning of online transformation (Joshi and Islam, 2018). The use of cloud computing in the development of IT organizations to provide services is becoming more popular as they increase the frequency of operations and reduce cost (Jain and Aggarwal, 2018). Outsourcing digital storage can enhance the quality

of the service provided by organisations. In addition, deployment to a platform for applications through cloud service providers can easily help access to services and reliability without problems hindering the use of services by users.

In the developing countries context, governments wanting to implement or improve e-government systems continue to pay attention to the service quality of cloud computing (Alkhwaldi et al., 2018). This research focuses on the factors related to the impact of service quality of the adoption of cloud computing in e-government systems in organisations. In terms of e-government systems, service quality has been identified as a critical factor in determining the successful adoption of e-government (Yu et al., 2018). Hence, more attention needs to be paid to the provision of e-government systems through investment in technologies that have the ability to increase the reliability and speed of response that will increase the service quality of e-government. Thus, the exploration of the impact of this aspect on the adoption of cloud computing in e-government systems in organisations, led to the following hypothesis being proposed:

H4: High service quality has a positive influence on the intention to adopt cloud computing for e-government systems.

3.3.1.3 Security (SE)

Many researchers identify security issues as one of the most influential elements of users' trust in technology. Security in this context refers to the degree to which user and organisation information is safe and protected by the cloud storage provider (Lian, 2015). Bunyamin *et al.* (2019) also suggest that organisations should consider the technical measures based on policies and regulations to protect data, in order to prevent this information from falling into unauthorised hands. Governments need to put in place penalties to deter illegal access to data (Jianwen and Wakil, 2019). This type of legislation contributes to increasing the trust of organisations in adopting cloud in e-government system. Governments organisations are concerned about the level of security in transitioning to providing e-government system via adoption of cloud computing (Awa and Ojiabo, 2016; Alassafi et al., 2017). The IT investors require a level of security that will adequately protect users' data, while focusing on potential security issues to increase users' trust in technology (Wong and Jackson, 2018; AlBar and Hoque, 2017). The majority of studies reviewed state that security is an important concern in the context of the adoption of cloud computing in e-government systems. Many organisations are still suffering from a low

level of protection of personal and shared information. This can raise concerns about theft and creates a lack of trust in online technological services; and cloud service providers are focused on devising fundamental strategies to reduce the impact of security problems on the quality of service in e-government systems. According to Gasova and Stofkova (2017) in order to increase organisational adoption of cloud computing to improve e-government, the government should establish a strict security policy about protecting information and methods of storing it, with no unauthorised person allowed to access and use it.

In developing countries, e-government systems have suffered from frequent security breaches. Previous studies have shown that most users are concerned about privacy or security when using online services. Recently, there has been an increase in the number of users of service systems on the Internet. Despite various security strategies being designed, there is still a growing need to reduce the risks associated with e-transactions and increased protection can be provided through digital signatures and the encryption and guarantees offered via cloud computing providers. This research will examine the impact of security on the intention of government organisations in developing countries, especially Saudi Arabia to adopt cloud computing in e-government systems. Thus, the following hypothesis for the adoption of cloud computing is proposed:

H5: A high level of security (data protection) positively influences the intention to adopt cloud computing for e-government systems.

3.3.2 The organisational context

The organisational context refers to the set of values and performance that influence the adoption of cloud computing. The methods of administrative decision-making and top management policies, in turn, establish the structure. Moreover, reviews of the adoption of new technologies found that these factors and top management support were major influencers (AlBar and Hoque, 2017; Lal and Bharadwaj, 2016; Martins et al., 2016). Therefore, research into the organisational adoption of cloud computing has been explored to identify how it changes management, applicable technologies and internal integration, skills management, and external collaboration and integration (Hon and Millard, 2018; Stergiou et al., 2018; Lal and Bharadwaj, 2016). Some researchers have empirically investigated the fact that the relationship between organisational culture and top management support has positively affected the intention of adopting cloud computing in organisations (Bawack and Kala Kamdjoug, 2018; Gupta et al., 2016). Several studies

have shown that the TOE framework indicates that an organisation that has more top management support and great IT capabilities is more likely to invest in new technology (Qasem, 2018; Senyo et al., 2016; Borgman et al., 2013). Several authors (Alkhwaldi et al., 2018; Mohammed, Alzahrani, et al., 2017b; Mutimukwe et al., 2017; Onu, 2015) identified the most significant characteristics that positively influence the adoption process for cloud computing. These features include the IT infrastructure, the top management and the financial resources (Howard et al., 2017; Lian et al., 2014). According to the literature on the adoption of cloud computing top management is one of the strongest factors affecting the adoption process (Qasem, 2018; Camargo and Wang, 2015; Lian et al., 2014). Thus, this research takes into account the top management and technologies readiness as key influencing factors on the adoption of cloud computing. The following section discusses the organisational factors that influence the adoption of cloud computing.

3.3.2.1 Top management support (TM)

Top management support has an important influence on the adoption of cloud computing; and refers to the role of top managers in supporting decision-making that adopts and implements information technology in order to seek to develop the organisation with technological investments (Martins et al., 2016; Wang and Lo, 2016). A literature review of the adoption of cloud computing found that top management support is one of the most important factors affecting the adoption of IT at the organisational level (Lal and Bharadwaj, 2016; Wahsh and Dhillon, 2015). The understanding by top management of the features of cloud computing encourages the organisation to adopt it (Lian et al., 2014). In the context of e-government, the participation of top management in the development of ICT has led to a positive attitude related to decisions made on the adoption of cloud-based services (Mutimukwe et al., 2017; Kurdi et al., 2016). Top management support encourages IT employees to adopt the innovation as a means of improving organisational effectiveness; therefore, the adopting of cloud for e-government starts with the top management. According to Mohammed et al. (2017) a significant relationship exists between top management support and adopting technological innovations. Consequently, top managers with a pro-innovation attitude will facilitate the decision to adopt, as they believe that new innovations in computing are the answer to a successful implementation of e-government (Waller and Genius, 2015). Moreover, in developing countries, top management support is still suffering from poor levels of experience and a lack of staff skills. In the absence of sufficient

management support for new technologies for the implementation of e-government, more of the users are likely to return to traditional interactions (Lal and Bharadwaj, 2016; Lin, 2014). As this has indicated the degree of influence of the top management in relation to the adoption of cloud computing; the following hypothesis can be drawn:

H6: Top management support influences positively the intention to adopt cloud computing for e-government systems.

3.3.2.2 Technology readiness (TR)

Technology readiness is one of the critical factors that will influence the adoption of cloud computing in organisations (Sun, 2016; Tsou and Hsu, 2015). Technology readiness refers to the maturity level of the network technologies and enterprise systems which can adopt cloud computing. Technology readiness has a significant impact on leadership when it comes to making a decision on adopting the innovation (Chang *et al.*, 2019). Several studies have also found that that having a strong ICT infrastructure in any organisation is an important factor for success (Martins et al., 2016; Camargo and Wang, 2015; Gebba and Zakaria, 2015). In a similar study, Azam (2015) found that the readiness of an ICT infrastructure helps in the adoption of new technologies. Government organisations that give full support to the development of technology and communications encourage the promotion of development in government agencies. Consequently, technology readiness enhances user satisfaction in e-government systems (Bawack and Kala Kamdjoug, 2018; Boonsiritomachai and Pitchayadejanant, 2018; El Haloui and Kriouile, 2017). Governments provide essential platforms such as financial and technical resources, which are used to create a suitable environment to support a significant aspect of organisational competitiveness in relation to the adoption of technology (Wang and Lo, 2016). There is a positive influence on adopting new technologies which is based on technology readiness in organisations (Awa and Ojiabo, 2015; Liveri and Dekker, 2015). Many studies in the literature review found that organisations in developing countries have a lack of technical readiness, which means that the infrastructure of technology and human resources related to IT makes it difficult to adopt new technology (Alzahrani, et al., 2017b; Awa and Ojiabo, 2015). The adoption of cloud computing in developing countries will enhance the effectiveness of government systems and assist in overcoming the problems of technological infrastructure, that involves the desire to construct

a platform that can implement the application of IS related to cloud computing. These considerations have generated the following hypothesis:

H7: Technology readiness influences the intention to adopt cloud computing for e-government systems.

3.3.3 Environmental context

National technological development is related to the sources available and the routes of development that have rapidly become available as the technology itself develops (Verma et al., 2018). The environment refers to the place where organisations conduct their business and provide effective services to users, influenced by the nature of their competition in order to reach the goals and vision of the organisations themselves (Ebrahim and Irani, 2015). Furthermore, previous studies have revealed how environmental factors are critical for influencing how organisations and government agencies pay attention to the adoption of technology (Camargo and Wang, 2015). According to Lin (2014), environmental factors play a pivotal role in the investment in technologies. Moreover, according to Clohessy et al., (2014), the environmental context of culture and the increasing pressure on government organisations to deliver e-government system effectively has a significant impact on the adoption of the cloud. Rosli et al. (2012), stated that government policies are continually trying to improve their competitiveness in the context of providing the best services to citizens in order for them to rely on e-government system for all transactions. Consequently, this requires investing in cloud computing technology (Almarabeh et al., 2016; Cao et al., 2014). Studies have also shown that developing countries have regulations that hinder the government adoption of cloud computing (Alemeye and Getahun, 2015). However, the economic environment of the government of Saudi Arabia has witnessed rapid expansion due to its increased income from the production of oil and its derivatives (Martins et al., 2016). Thus, the public sector suffers from limitations in its use of technology due to the weakness of the strategic plans concerning the regulations about investment in information technology. Based on these discussed, the determinants of cloud adoption including the regulations of organisations and the competitive pressures will be considered in this research.

3.3.3.1 Competitive pressures (CP)

Competitive pressure refers to the degree to which the level of competition puts organisations under pressure to increase their efficiency in providing high quality (Awa and Ojiabo, 2015). Therefore, one of the most important steps to achieving the objectives of the organisation should be to take into account the performance of system quality (Chen et al., 2017). Sun (2016), suggested that the intensity of the competitive pressure to achieve the vision of the organisation is an important factor in the adoption of new technology. Some previous studies (Verma et al., 2018; Andergassen et al., 2017) discussed that investment in new technologies required an organization to have good technical qualities and training related to the next generation of technologies that are increasingly aware of the adoption of new technologies, including adopting cloud computing. Hidayanto and Purwandari (2017) stated that there is a relationship between the adoption of cloud computing and competitive pressure in organisations, which requires understanding in order to meet the market's requirements and increase operational efficiency. AlBar and Hoque (2017) found that competitive pressure drives enterprises to switch from older technology to new technologies such as cloud computing in order to achieve the increasing development required of them to improve their online system quality. Moreover, governments allows organisations to gain considerable IT advantages to improve their performance and to increase the efficiency of the electronic transactions that drive organisations in the context of competition (Hansen et al., 2018). Governments are very competitive at providing online services, and one way they can gain an advantage is by adopting new technology. Thus, e-government systems in government organisations developing countries still need to conduct comprehensive research to understand how adopting new technologies will meet competitive pressures to provide successful online systems. Based on the discussion above, it is suggested that:

***H8: Existence of a competitive pressure influences positively the intention to adopt cloud computing for* e-government systems.**

3.3.3.2 Regulations (RE)

Regulations refer to the rules and policies that are applied by organisations and, this context refers to those relevant to the adoption of IT innovations (Ibrahim, et al., 2017). Some previous literary studies have shown that government regulations have a positive effect by reducing the restrictions related to the adoption of new technologies (Azam, 2015). Karim and Rampersad

(2017) have stated that compliance with the government organisations' regulatory and legal frameworks is supportive of adoption. Governments organisations have the ability to promote drafting regulations in order to encourage organisations to invest in the adoption of new technologies such as cloud computing. Karim and Rampersad (2017) believe that it is not always easy to achieve compatibility between the requirements of public organisation regulations and adoption of cloud computing due to issues concerning access to sensitive information. Moreover, governments organisations often suffer from a lack of understanding of the rules and regulations of cloud service providers which impact adoption (Hsu et al., 2014). However, although the data centre is often outside of the geographic area of the organisation, cloud providers provide a guarantee that the data is not available to other countries in order to comply with the laws and regulations (Alqahtani, 2016). Chen et al (2017) stated that to encourage adoption, the organisation's regulations should fit with the organisations' intent to adopt cloud computing. Thus, e-government systems in developing countries need a requirement to have the formulation of appropriate systems or to update the existing regulations to facilitate the adoption of the cloud. Based on the debate above, the following hypothesis is suggested:

***H9: A less stringent regulatory environment will have a positive influence to adopt cloud computing for* e-government systems.**

3.3.4 Social Context

Social context includes values, attitude and trust, resulting from information and experiences that impact decisions and which influence how to interpret things (Boonsiritomachai and Pitchayadejanant, 2018). The social environment plays a role in influencing an organisations' intention and adoption of new technologies (Lin, 2014). Despite the benefits of cloud computing in all areas, most governments around the world still face many different challenges that hinder the adoption of cloud computing in e-government (Gupta et al., 2016). Some researchers (Fortino et al., 2018; Al-Badi et al., 2017) state that, in exploring the social contexts which may affect the adoption of cloud computing in e-government, there is a need to verify the critical factors. Some previous studies state that social factors, such the degree of awareness of the benefits of cloud computing. may be considered as one of the factors that impact cloud adoption for e-government (Chen et al., 2017). The social concepts, satisfaction, society, awareness, training and education together provide a useful framework for assessing the social environment in

which public organisations in civil society seek to adopt a new technology which will enhance the e-government system (Hansen et al., 2018; Fleming et al., 2017; Stefanou and Skouras, 2015). An understanding of the social context determines whether it is effective to invest in new technologies for e-government (Zhang et al., 2018). To illustrate, a study conducted by Santa et al., (2018) indicated that lack of awareness and lack of trust about the benefits of new technologies may be an obstacle to their adoption in e-government.

In this research, there is a consideration of social context to identify and examine the critical factors in supporting the intention of government organisations to adopt cloud computing for e-government systems, including trust, awareness, and attitude. These are presented in detail in the next section.

3.3.4.1 Trust (TU)

Trust can be generally defined as the degree to which government organisations trust e-government system and service that can be received from another party. Although trust in technology differs from the concept of trust in general, researchers point out that trust in technology occurs when users' expectations are met by interactions with technology being reliable (Santa et al., 2018). Trust is a crucial factor in influencing the adoption of new technology. Service providers attempt to build trust on all levels of online transactions through effective service quality and ease of use (Hansen et al., 2018). Governments need to be aware that trust in e-government to provide adequate services is an important consideration for adoption of new technologies (Tang et al., 2017; Albesher, 2015). Several researchers identified factors that may contribute to increasing users' trust in e-government (El Haloui and Kriouile, 2017; Agag and El-Masry, 2016). Prüfer (2018) identified that trust in cloud computing providers plays a significant role in the adoption of cloud computing for e-government. The provider of cloud computing is a key factor in measuring reliability because it is responsible for ensuring data is protected and unauthorised people are not allowed access.

In the context of developing countries, it is difficult for cloud service providers to determine the location of data storage because of the lack of infrastructures in these countries, so they have to store data abroad (Fortino et al., 2018). In addition, the adoption of cloud computing in online systems services means trusting service providers to control the location of data storage according to agreed systems and policies (Chen et al., 2017; Lopes, 2017). Government organizations

usually require that cloud providers protect their data from malicious activities to ensure a good level of mutual trust. Mutimukwe et al.,(2017) identified two key variables for trust in cloud computing: the reputation of the providing service and the perceived amount of service users. Differences in reputation also affect the users' levels of trust.

The literature review showed that understanding the role of trust in organizations is important to better understand investment in technology. Agag and El-Masry (2016) found that trust is one of the key variables in interpreting organizations' intention to adopt cloud computing. Other research in trust has focused primarily on user trust in e-services (Misirlis et al., 2017; Jones et al., 2017). Most of the literature reviewed took trust into account as a critical factor in influencing adoption of new technologies in e-government systems. This research focuses on the impact of trust on the adoption of cloud computing for e-government systems in organizations. The following hypothesis is therefore proposed:

H10: High level of trust in cloud computing positively influences the intention to adopt cloud computing for e-government systems.

3.3.4.2 Awareness (AW)

Awareness refers to "An understanding of the activities of others, which provides a context for your own activity" (Dourish and Bellotti, 1992; p.11), and plays an important role in identifying the characteristics of new technologies from other technologies; and influences how these are presented to investors (Wong and Jackson, 2018). The government seeks to increase citizens' awareness to encourage citizens to adopt e-government services (Oni et al., 2017). According to Joshi et al., (2017) cloud computing providers have identified that lack of awareness can limit the adoption of cloud computing in e-government systems. One of the major concerns regarding the deployment and use of cloud computing is the lack of awareness of the existence of related services, or that organizations can have the benefit of cloud computing in any further expansion (Joshi and Islam, 2018). Therefore, cloud computer providers rely on identifying barriers that prevent governments from adopting it for e-government. In developing countries, lack of awareness of the benefits of cloud computing in e-government is a critical factor for service providers (Lang et al., 2018). Furthermore, governments need to pay attention to e-government initiatives to ensure the adoption of effective technologies that improve the delivery of e-government

system to meet user satisfaction. Sivarajah et al. (2017) and Mohammed et al. (2016) found that the awareness of organizations about cloud computing was affected the other factors.

Indeed, the literature revealed that awareness of cloud computing has an impact on other factors, including quality, ease of use and organisational trust in e-services provided for the success of e-government (Abu-Shanab, 2017). Moreover, government organisations which have long IT experience are expected to be aware of the features of new technologies. Based on the literature, this research assumes that improving awareness about adopting cloud computing plays a key role in promoting the adoption of cloud computing in e-government systems. The following hypothesis was therefore developed:

H11: High level of awareness positively influences the intention to adopt cloud computing for e-government systems.

3.3.4.3 Attitude (AT)

In the context of this research, attitude refers to "positive attitudes toward the system and willingness to participate in the implementation and to accept the change brought to adopt new technologies" (Dourish and Bellotti, 1992, p.12). Cloud computing dramatically expands data storage capacity, making it easier to manage and synchronize data in different business environments; but its adoption is impacted by organisational attitude about the benefits of cloud computing (Wong and Jackson, 2018). Some studies have been conducted that show attitudes have an impact on organizational intention and behaviour towards investment in new technologies (Verma et al., 2018; Howard et al., 2017). Santa et al., (2018) suggested that decision-makers' attitudes towards adopting new technologies play an important role in determining their behaviour. Therefore, service providers seek to identify organisational attitude by understanding which qualities of cloud computing services are viewed with a positive attitude. Governments pay more attention to e-government services which require reliance on the latest technology to offer a service providing easy access and a high level of service quality (Kitsios et al., 2018; Sebetci, 2018). Cloud computing providers therefore focus on customer attitude about the advantages of cloud computing (Rocha and Cota, 2016). Other research has also shown that a significant relationship exists between an organisation's attitudes and adopting new technology (Huang, 2018; Fleming et al., 2017; Kao et al., 2015). Cloud computing providers have to increase the level of security and protection of information, and service quality in order to

influence organisational attitude to adopting cloud computing (More and Kanungo, 2017; Almarabeh et al., 2016).

Discussions in the literature demonstrate that awareness of cloud computing has an impact on other factors, including quality, ease of use, and organisational trust in considerations of e-services provided for the success of e-government (Abu-Shanab, 2017). Moreover, government organisations who have long IT experiences are expected to have awareness of the features of new technologies. Thus, in developing countries, governments attempt to shift to e-government systems that contribute to saving cost and time. This research seeks to investigate the influences of government organisations' attitudes toward cloud computing. Based on previous studies, an attitude toward cloud computing plays a key role in promoting the adoption of cloud computing. The following hypothesis is thus proposed to measure the impact of attitude toward adopting cloud computing on e-government systems.

H12: Positive attitude about cloud computing positively influences the intention to adopt cloud computing for e-government systems.

3.4 The conceptual framework for the adoption of cloud computing in e-government (ACCE-GOV)

Based on the perspectives of theories and indicators derived in assessing the performance of various e-governments discussed in the previous section, the theoretical framework proposes to examine to what extent these variables influence the adoption of cloud computing for e-government in Saudi Arabia. The theoretical framework develops on the basis of four theoretical concepts: (a) Technological context, (b) Organisational context, (c) Environmental context, and (d) Social context.

This model unites a number of theoretical perspectives to have a comprehensive model for understanding the factors that influence adoption of information technology and innovative new technologies. The theoretical models are the Technology and Environment Organisation (TOE) model integrated with critical factors from the Diffusion of Innovations (DOI) theory for a better understanding of regulatory decisions and the technologies related to adopting cloud computing,

This study proposes a model for the adoption of cloud computing in the Saudi e-government system (ACCE-GOV) in order to identify the factors most influencing the adoption of cloud

computing in the Saudi government sector. Thus, the idea of adopting cloud is still in the early stages in Saudi government organisations. Therefore, this research presents an integrated model (ACCE-GOV) that attempts to enhance the adoption of cloud computing in the e-government system in the Saudi government sector. As a result, these factors are combined and presented in the proposed model, as shown in Figure 3.6.

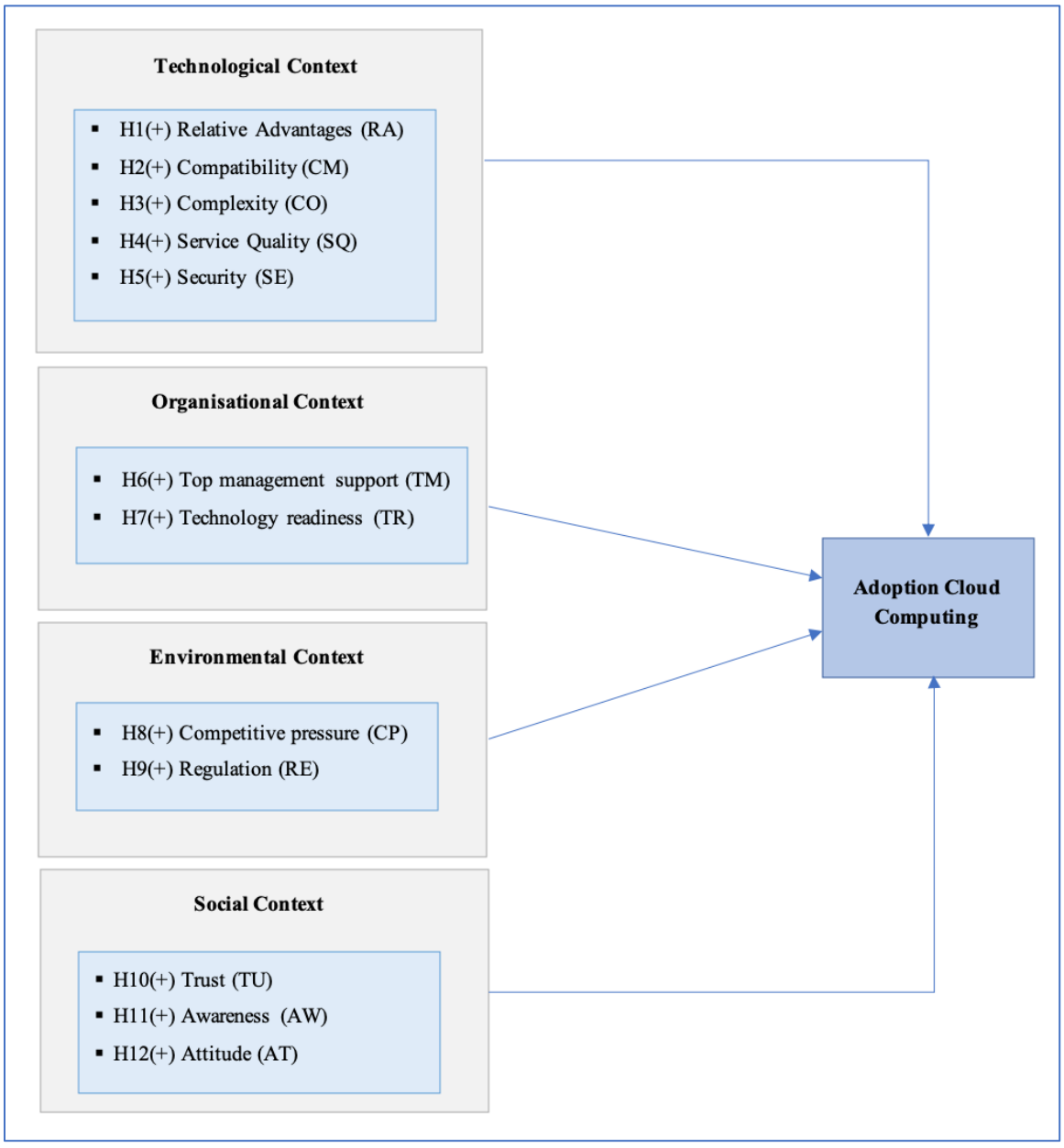

Figure 3.6: The conceptual framework for the adoption of cloud computing in Saudi e-government (ACCE-GOV)

3.5 Summary

This chapter has highlighted theoretical frameworks used in different IS sectors. These take into account an understanding of factors that influence adoption of information technology and innovative new technologies. The literature review has shown that many researchers have had to combine several of the considered frameworks to examine the influential variables of the adoption of technologies. Understanding the issues in the adoption of cloud computing necessitates exploration of various aspects, such as the technological, organisational, environmental and social contexts. Also, this chapter has developed a framework for the adoption of cloud computing in Saudi e-government in order to identify the factors which most influence an organisation's decisions in the adoption of cloud computing. This research proposes a model for the Adoption of Cloud Computing in the Saudi E-Government systems (ACCE-GOV), that investigates the critical factors influencing the adoption of cloud computing in the Saudi government sector. The new theoretical framework is developed on the basis of four theoretical dimensions: (a) Technological context, (b) Organisational context, (c) Environmental context, and (d) Social context.

The proposed model includes the critical factors presented in the previous literature, as well as other factors that have not been investigated in this context in order to examine how these variables, influence the decision to adopt cloud computing in e-government system in Saudi Arabia. This framework is based on the Technology and Environment Organisation (TOE) model and integrates critical factors from the Diffusion of Innovations (DOI) theory. This has been examined experimentally for understanding the benefits of cloud computing adoption

Chapter 4: Research Methodology

4.1 Introduction

This chapter presents the methodology that has been used to carry out the research; and describes the process of selecting and implementing a suitable methodology that will fulfil the aims of the study. A research methodology is a comprehensive approach that addresses the problem of research from a theoretical basis and addresses the collection and analysis of data (Lincoln and Guba, 2000). In general, the purpose of the research methodology is to act as a framework to guide the researcher to achieve the objectives of the research. This study has a diverse methodological approach and used different methods for the collection, analysis and interpreting data. In addition, it strives to find the optimal method of answering the research questions and address the research topic in a sufficient manner (Creswell, 2014; Kim, 2003).

This chapter is divided into many sections as follows; research philosophy, research methods, the research population, sample size and sampling procedures, validity and reliability tests, data collection procedures, data analysis structure and ethical considerations. In research, an academic has many philosophical approaches and associated methods associated with social sciences and the IS area that have been established from which to select research approaches; such as positivism versus interpretivism, induction versus deduction, and quantitative method versus qualitative method. These presented in more detail in the following sections.

4.2 Research Philosophy

A philosophical framework is applied in a research paradigm to take into account the assumptions about the nature and the reality of the knowledge that is sought and acquired during the course of the study (Lincoln and Guba, 2000). This is explored in the next section. Creswell (2014) suggested that there are four types of research paradigms, including postpositivism, constructivism, transformative and pragmatism, as shown in Figure 4.1.

Postpositivism	Constructivism
• Determination • Reductionism • Empirical observation and measurement • Theory verification	• Understanding • Multiple participant meanings • Social and historical construction • Theory generation
Transformative	**Pragmatism**
• Political • Power and justice oriented • Collaborative • Change-oriented	• Consequences of actions • Problem-centered • Pluralistic • Real-world practice oriented

Figure 4.1: Research Philosophy (Paradigms) (Creswell, 2014)

4.2.1 Postpositivism

Positivism refers to a paradigm of how data are evaluated, and how theories and objective measurements are applied Positivism is regarded as to solve practical issues, investigate relationships of causal by applying statistical analysis (Kim, 2003). Therefore, the positivist paradigm has an objective and external perspective of social reality; while nonetheless being etic; i.e. acknowledging that the phenomenon is being studied, and data gathered, from the researcher's perspective (Kim, 2003). Accordingly, positivism looks to fathom useful key issues, investigates exact causal connections utilizing measurable analysis, and scans for law-like speculations (Crotty, 1998).

Therefore, the positivist approach can be understood as a methodology that applies logical strategies to cultural behaviour. Moreover, positivist research is characterised by empirical data and consistent thinking, with the supporting proofs introduced being undeniable and confirmed (Creswell, 2014). Therefore, there are some negative effects related to the positivist paradigm which make it unsuitable for exploratory research (Kim, 2003). However, both the positivist and the postpositivism was the approach that emphasised the importance of acknowledging the part played by the researcher's perspective.

Thus, in terms of its research philosophy, this study chiefly depends on a positivist methodology, with the application of some components from the interpretivist approach. Moreover,

this approach is used to explore the degree to which factors impact the adoption of cloud computing for an e-government system. As the empirical study used a sample that was representative of the population, and the data was subjected to rigorous testing; the study can be utilized in future studies in a similar setting, or different settings with the same conditions. As in many previous IS studies, most of the analysis followed the positivist methodology to achieve the research aims and objectives, and quantitative data was gathered via a survey of 887 participants from government organisations. This was done as exploratory research to limit the extent of the analysis. The analyst first brainstorms the hypotheses that arose from an initial exploration and afterwards defines these down to progressively explicit speculations that can be investigated. These are the reasons for selecting the positivist approach and methodology as the primary paradigm for this analysis.

4.2.2 Constructivism

Constructivism or social constructivism (which is associated with interpretivism) is an approach to qualitative research (Creswell, 2014). The constructive paradigm views the truth as subjective rather than objective (Goh, 2008). Social constructivists agree that researchers are looking to understand society and how people live and work. Subjective meanings from the subjects' experiences are developed, and the meanings are directed toward certain objects or things. Usually, the meanings are multiple and different which leads the researchers seek for the complexity of views instead of narrowing the meanings into a few ideas or categories. The goal of the research depends on the situation being studied. Usually, it involves interaction and discussion with other persons, and the questions often are broad and general. Therefore, the study takes into account the participants' constructs and the researcher can ask open-ended questions, so the participants can say more about their lives and perspectives to help the researcher understand them more fully. Often these subjective meanings are addressed socially and historically (Candy, 1991). Constructivist researchers, therefore, focus on the processes of interaction among individuals and the specific contexts of people living or working, in an effort to understand the cultural and historical situations of the participants (Creswell, 2014). Thus, constructivists do not believe that objective truth about such matters exists and they do not believe there is one correct interpretation for the research findings.

4.2.3 The Interpretivist Paradigm

The interpretivist paradigm is essential to sociological research and stresses the need to investigate the implications of natural or implanted in human behaviour. It complies with the standards of the hermeneutic circle, where synergistic significance is created through monotonous patterns of data understanding (Saunders, et al, 2009). It is a useful approach when trying to comprehend cultural issues and issues, and applies the standard of contextualization independently (Mora, et al., 2012). Contextualization suggests that each general public is novel and is created over time and that every general public should be comprehended and examined in that capacity.

The interpretivist paradigm considers an idea that is missing in the positivist paradigm, for example, the opportunity for decision and cognizance (Kim, 2003). For instance, individuals' view of reality must be comprehended utilizing a subjective methodology. The interpretivist paradigm looks to assemble data from individuals' attitudes, opinions, and people's experience. Nevertheless, significant social research analysis from this perspective requires validity and reliability, as well as speculation (Marcen et al., 2013). According to Kura (2012) It is considered a paradigm that is very often embraced for looking into themes relating to culture, language use and human association.

As the interpretivist design is identified with in-depth research and gives a detailed analysis of a subject, the research method most utilized in interpretivist research is the interview method (Lederman and Abell, 2014). This paradigm takes into account the advantages of this method when trying to understand human behaviour (Goh, 2008); and thus qualitative data were gathered via in-depth interviews to identify the influential factors in the adoption of cloud computing for the e-government system in the Saudi context. Thus, this study examines the points of view of staff working in some Saudi government organizations that are right now, or have been, definitely associated with e-government system implementation.

Qualitative data was obtained through eight semi-structured interviews with senior IT managers in government organisations. Those administrators and senior IT directors in various government organisations may have the opportunity to contact their top management to identify what affects the adoption and utilisation of e-government services and applications. However, these interviews are intended to be exploratory, as they try to provide knowledge

understanding of the real environment in which these decisions are made. This research was developing a comprehensive conceptual framework to investigate critical factors that affect the adoption of cloud computing on e-government system, which led to combining the two approaches that were the most appropriate design for this IS study. This strategy offers the opportunity to develop a comprehensive conceptual framework, as it generates a lot of data from participants about the proposed model as well as investigating and understanding their evaluation of cloud computing for e-government system.

4.2.4 Pragmatism

The pragmatist approach is another of the common research paradigms. The idea of this approach is to address problems facing people and figuring out what works. Howe, (1988) claims that a mixed method is appropriate in good research design. Using qualitative and quantitative methods is compatible and able to achieve the goals and objectives of the research questions. The key to the pragmatic method approach is a commitment to the end causes and action outcomes rather than focusing on the first causes of the problem (Cherryholmes, 1992). Moreover, Marshall and Rossman (2006) suggested that this approach emphasises understanding the problem is central as it leads to selecting the appropriate approaches and whether to apply inductive or deductive reasoning.

4.3 Research Methods

Research methods are the procedures and strategies of research that identify the phases of research, from the assumptions, through the data collection methods, the data analysis procedures, to the interpretation of research results. The research methods are outlined in detail in the next section which follows the three classifications of research design as shown in Figure 4.2.

Quantitative	Qualitative	Mixed Methods
• Experimental designs • Nonexperimental designs, such as surveys	• Narrative research • Phenomenology • Grounded theory • Ethnographies • Case study	• Convergent • Explanatory sequential • Exploratory sequential • Transformative, embedded, or multiphase

Figure 4.2: Alternative Research Design (Creswell, 2014)

The research was illustrating implementation of interview schedules to the major players, i.e. various decision makers in top government management and IT directors. The interviews attempt to understand the top government management's perspective on the adoption of e-government systems in Saudi Government organisations. Moreover, these interviews focused on understanding the factors that influence organisations to trust, adopt and utilise new technologies to e-government systems. This research was aimed at testing and improving the research model in the context of e-government in Saudi government organisations. The research empirically tested the proposed model by analysing the data collected from a limited sample. The study findings revealed that it had contributed to identifying the critical factors that influence the adoption of cloud computing in e-Government in Saudi government organisations. This study provides suitable insights into the motivations underlying the intention to the adoption of cloud computing in e-Government in the public sector in the Saudi Arabian context.

4.3.1 Quantitative Research Approach

Quantitative research is scientific in its methods and approach to thinking about the world. It uses deductive reasoning (testing theories and hypothesis) which means a logical process of developing a conceptual and theoretical structure to be then tested by the empirical study (Candy, 1991). Often quantitative researchers develop hypotheses and then test them empirically to see if they are accepted or rejected (Antwi and Hamza, 2015). Creswell, (2014) emphasised that using quantitative research allows the researcher to investigate a relationship between two or more variables in order to test objective theories. A variable (e.g. security, regulation, trust, attitude or awareness) is anything that can be measured by one of the types of scale in quantitative research, which can be nominal, ordinal, interval or ratio. The resulting data can then be analysed by using statistical procedures. There are independent and dependent variables whereby an independent variable can have an effect on the dependent one. According to Creswell (2014), two strategies of inquiry associated with quantitative research are experimental designs and non-experimental designs (such as surveys). The survey is a popular strategy which is usually used for exploratory and descriptive research and to answer the research questions: who, what, where, how much and how many (Saunders et al., 2009). Three different stages occur in a sample survey: sampling, designing questions and data collection (Kim, 2003).The survey can be conducted in three different ways including mail, telephone and personal interview although online surveys are more common nowadays.

4.3.2 Qualitative Research Approach

Qualitative research is a descriptive approach that allows the researchers to investigate and understand the meaning that groups or individuals give to a cultural or social problem (Creswell, 2014). "Qualitative research is based on interpretivism, the philosophical concept that there is not just one truth but multiple truths or realities" (Higgins and Green, 2008; p.134). It is a method of scientific inquiry for exploring people's experience in personal and social contexts, and to understand the factors that could affect these experiences (Kim, 2003). Often qualitative questions seek to explore and understand the meaning of the context and the questions start with words such as 'what' or 'how'. 'describe', 'explore' and 'discover' (Gelling, 2015). There are five strategies of inquiry associated with qualitative research identified by Creswell (2014) including narrative research, grounded theory, phenomenology, case study and ethnographies.

4.3.3 Mixed Method Research Approach

Mixed methods research is an approach that uses both quantitative and qualitative approaches in the same study. This is helpful in developing rich insights into several phenomena of interest that cannot be fully understood and explored using only one method (Candy, 1991). Creswell (2014) claimed that the mixed method approach could provide a better understanding of a research problem rather than using only one approach. Collecting, processing and analysing quantitative data and qualitative data can be carried out either at the same time (in parallel) or one after the other (sequentially) but, they cannot be combined. When using a mixed method approach in the same research inquiry, both quantitative and qualitative method can explain and analyse each other (Saunders, et al., 2009). Creswell (2003; p.15) states: "Quantitative research is explanatory and deductive with numerical data being collected to test a theory, whereas qualitative research is exploratory and inductive, with narrative data being collected to generate themes that may be used to develop a theory". Creswell (2014) identified six strategies of inquiry associated with mixed method research include convergent parallel, exploratory sequential, transformative, explanatory sequential, embedded and multiphase.

The analysis of the factors that affect adoption of cloud computing in e-government systems in government organizations was achieved by deciding what were the different

dimensional contexts and the technical, organisational, environmental and social factors. This research analysis considers various theories and models to examine the variables and verifies whether the hypotheses are supported or not; and this is presented and discussed in the quantitative research chapter. Furthermore, this analysis expects to be able to generalise the results of this exploration to the whole target population. The detail and depth of research data collected will throw further light on the research framework. In general, the Saudi government has implemented an e-government system with a lower level of quality than required, which suggested exploration of the strategy of adopting cloud computing as a way of improving the e-government system. To do this necessitated the use of a quantitative method to collect appropriate data for analysis.

4.3.3.1 Justification for using a quantitative and qualitative mixed approach.

Quantitative and qualitative research methods have weaknesses and strengths; and for this reason combining them in a mixed methods approach has become a favoured approach in a variety of research fields (Creswell, 2003). Based on the requirements of the study, researchers should select appropriate methods from these two approaches or combine them (Gelling, 2015). Furthermore, Goh (2008) confirms that the mixed approach would help both gain an in depth understanding of the research problem and allow for generalisation of study results. In this study, the mixed method was selected as the best approach to fulfil the research aims and to answer the research questions. This study uses the same mixed methods strategy as described by (Wolff et al, 1993) whereby both quantitative and qualitative methods were used to collect data. After the data had been analysed, the qualitative data was used to support and clarify the quantitative data. The TOE model is used as the base theoretical model to generate and evaluate quantitative data in order to produce a final model that best explains the predominant phenomena of the collected data.

This study also examines a set of hypotheses to understand the critical factors that influence the adoption of cloud computing in e-government systems. Therefore, a quantitative approach was chosen to be the primary approach for this study to examine and study the proposed research model. There is a gap in the literature in identifying the factors that influence and affect the acceptance and adoption of cloud computing in e-government systems in the public sector in the KSA from the perspective of IT employers and IT directors in government; therefore,

the current research attempts to understand and identify the factors that hinder or prompt adoption of cloud computing in e-government system in the KSA. The research is engaging in in-depth analysis of 'what' these factors are and 'how' they impact, from the viewpoints of IT employers and IT directors in government by conducting several interviews. Moreover, the e-government system in organisations in the KSA is still a relatively new phenomenon and becoming an area of research which has generated interest. Qualitative research is also the appropriate choice for this research since little is known about the phenomenon under study (Creswell, 2003). For the above reasons, quantitative and qualitative mixed method research with a positivist underlying position was chosen as most suitable for achieving the aims of this research.

In summary, the current research applies a mainly quantitative approach with a follow-up qualitative study using interviews with open-ended questions to gain a deeper understanding and to fill the gaps in the quantitative study. The employment of the amended TOE model helped determine the influencing factors of adoption of cloud computing in the e-government system in the KSA.

4.4 The research sample size

One of the essential phases in the research is to identify a representative sample size that may be considered as one of the main influences on the quality of the data collected. The research sample size means the number of target groups or individuals that participated and responded which achieves the level of requirement in the survey. According Hair et al. (2010, p.15) "there are no fixed rules for deciding the sample size, sample design, level of accuracy required, non-responses, factors, and sampling methods used". However, the number of participants needs to be high enough to achieve statistical significance (Sekaran and Bougie, 2010). The appropriate sample size should be around 100 responses so that factor analysis can proceed; and it is considered satisfactory when more than 300 responses are obtained (Kumar, 2010). The appropriate sample sizes for most studies are larger than 300 and less than 500 (Hair et al., 2010). The analysis used a structural equation modelling (SEM) technique; and the above discussion determined the sample size for SEM software; accordingly, this research found the optimal size of the sample should be above 500 to proceed with data analysis.

4.5 The research population

The selection of the research population is an important part of the research process. This is followed by the selection of a research plan and the study procedures for answering the research questions. This study is designed for exploring the perspective of the population of government employees from major government organizations. The participants were major IT employees and the IT directors of the Saudi government who were subsequently introduced to the study objectives and asked to share their views of the research being carried out.

4.6 Sample and Sampling Procedures

The evidence sample involved a standard number of respondents whose relevance was sustained throughout the research. The sample has consisted of respondents such as government experts distributed across various areas such as government executives, model stakeholders from other e-government platforms, policymakers (a range of organisations) and IT employees and the IT directors of Saudi government organisations. The sample size is one of the steps that should be taken into account by the researcher; and can become a major issue in the research. A researcher should be considered the optimum size, which is not too large or too small. Sampling is the process of selecting a section of the target population with a view to making that sample both statistically significant and representative

4.7 Sampling Procedure

The sampling procedure used purposive sampling to obtain the sample institutions for launching the research. Simple random sampling was used to select respondents from the institutions to avoid biased information. This was to ensure that all government respondents and policy makers in the roundup of the sampled government institutions were represented. There are two major categories of sampling: (1) probability sampling and (2) non-probability sampling.

(1) Probability sampling method in which the selection probability of population elements (single member of the population) is known, this method often depends on chance or random factors.

(2) Non-probability sampling where the selection probability of population elements is unknown (Saunders et al., 2009) Since the population elements (IT employees and the IT

directors of Saudi government) is known, the probability sampling method has been selected for this study. Therefore, the probability sampling method is reviewed and its four approaches discussed, in order to select the appropriate method. The four approaches of the probability sampling method are:

- **Simple random sampling** is one of probability sampling methods which gives each unit of the population an equal chance to be selected (Candy, 1991). For example, if the researcher needs to conduct a study for a certain company, all the employees' names must be taken and the sample is then selected randomly. This means each one of the employees gets an equal chance to be selected.
- **Stratified sampling** is probability sampling in which the populace initially should be divided into homogenous segments (strata) as indicated by a specific quality, such as age or gender. Afterward, from each section (strata), a basic irregular specimen can be chosen. The samples from each stratum are then joined to form the total study sample (Daniel, 2011). This approach utilizes the accessible data of the whole population (for example, complete population, nationalities; and so forth.) before choosing the sampling so as to make the sampling more accurate.

- **Systematic random sampling** is a variation of straightforward random sampling. The main component is chosen randomly from a list document; then every N^{th} element is selected from the sampling frame (Danish, 2006). It is a suitable method for drawing a random sample when the population sample components are arranged sequentially.
- **Cluster sampling** can be suitable when elements are not available. this approach is often used for large populations or different organisations over a wide geographic area (Gelling, 2015). It is a mixed aggregate of elements of this population, such that organisations could serve as clusters for sampling employees (Goh, 2008).

This research also used questionnaires in order to obtain the data necessary to answer the research questions and achieve the objectives of the study. IT employees and the IT directors of the Saudi government chosen for the research had to have experience that was almost 100% relevant for the study and in principle, they had to understand the questionnaires, fill them correctly as required and return them within the deadline. The questionnaires distributed yielded in-depth information concerning key factors such as their understanding of policies

regarding the implementation of new technologies. The target populations were then top management and IT employees who had a different levels of experience in IS sectors. As this study will apply random sampling, there should be a complete listing of the population from which the sample is to be drawn in order to prevent bias. Also, random sampling is appropriate for most of the mathematical theorems which justify the most frequently used statistical procedures. Therefore, we can claim that, as this probability sampling technique was used, each respondent of the target population has an equal chance of being selected and they are representative of the target population.

4.8 Research Instruments

The instruments used included questionnaires whose input is seen to be of great consequence to the study. It has also employed a semi-structured interview and the findings from these in association with the survey results are the most important inputs to the study.

4.9 Data Collection

Two main approaches have been identified for gathering information about a problem, situation, person or phenomenon (Kumar, 2010). These approaches to data collection are categorised as the collection of primary data, which refers to the data that is collected and analysed for the first time. Whereas secondary data is the data that has already been collected and analysed by somebody else (Kumar, 2010; Crotty, 1998). Several methods can be used for collecting primary data include observation, interview and questionnaire. Kumar, (2010) argued that choosing the method depends upon the purpose of the study and the availability of the sources. Secondary data refers to published or unpublished data such as government publications, journals, and newspapers, reports prepared by research scholars, governments, etc. (Kumar, 2010) whereas unpublished data refers to letters, diaries and unpublished biographies.

4.9.1 The Quantitative Method

This section discusses the quantitative method that involves the processes of developing the research plan and data collection. It also discussed the procedures of the pilot study phase and the validity and reliability of the measurement instrument, the sampling approach and the data collection phase.

4.9.1.1 Planning and Designing

Each research requires appropriate planning pre-data collection to ensure the quality of the data being collected. The choice of an appropriate method depends upon the purpose of the study and the availability of the sources. Due to a large population and sampling size, and time constraint, the questionnaire was chosen as the appropriate method to carry out this research. The planning and designing phase involved developing the questionnaire, conducting the pilot study, designing and choosing the sampling and obtaining ethical approval.

4.9.1.2 Quantitative Strategy: Using a Survey

Given the study problem, the approach considered most appropriate for collecting data to collect data is a questionnaire-based survey. This section explores the questionnaire development, pilot study procedure, the questionnaire protocol, questionnaire translation, and how data was to be analysed.

4.9.1.3 Questionnaire Development

The questionnaire has been developed based on previous studies and adopted in order to examine the proposed model in this study (Martins *et al.*, 2014; Oliveira *et al.*, 2014; Chang *et al.*, 2006; Liang *et al.*, 2017; Awa and Ojiabo, 2015; O. Ali *et al.*, 2018; Hana, 2013; Wahsh and Dhillon, 2015; Lin, 2014; Wahsh and Dhillon, 2015). It was designed to be easily understood by IT employees and the IT directors of the Saudi government. The questionnaire has been peer-reviewed by academic professors and researchers before the final version was released to the respondents. The questionnaire was also designed to include all the factors under investigation so as to achieve the aim of the study. This research used 5-point Likert scales (1= strongly disagree; 5 = strongly agree) or (1= never occur; 5= almost always occurs). The Likert scale is a type of rating scale that is based on the premise that each item has significance or weight that measures the respondent's attitude and opinions about a certain issue or subject (Saunders et al., 2009).

The questionnaire asked for information about the respondents and background demographic data; and the second section was designed to measure respondents' (IT employees and the IT directors of Saudi government) perceptions with reference to the independent variables (Technological context, organisational context, environmental context, and social context) A

covering letter was provided to the respondent at the start of the process to seek the participant's consent. Previous studies from the literature were used to obtain the 56 questions. A copy of the questionnaire is attached *(See Appendix B).*

Questionnaires were provided to the respondents had clear and brief instructions so that participants could easily understand what was required. The researcher has explained to participants the nature of the research study by using a consent form provided along with the questionnaire; and they were informed not to disclose their identities on the questionnaires so that they would remain anonymous. The researcher also explained to participants that their information would remain confidential. The researcher sent copies of the questionnaire to lead government organisations in Saudi Arabia in order to obtain the participants. The main instrument in this research was thus a web-based questionnaire with questions that mainly used a five-point Likert scale.

The advantages of using web-based questionnaires are that the researcher can cover a wide area quickly and cheaply, save the data directly in the database and avoid losing time or data and more easily avoid any errors. The questionnaire questions were divided into various sections regarding the research objectives and also obtained demographic data about the participants. There were 65 closed format questions included (*see Appendices B and C)* and the researcher was distributed 1000 questionnaires, out of which 887 responses were received.

4.9.1.4 Questionnaire

The self-completion questionnaire was distributed among the respondents to answer and complete the survey. This type of questionnaire can be distributed through online methods. The advantages of a self-completion questionnaire are that it is flexible to administer, cheaper, and easier for respondents. Moreover, it can be spread over a wider geographical area and a large population. It is also appropriate for measuring the relationship between variables and for statistical analysis. However, there are some disadvantages of the self-completion questionnaire. there is a lack of in-depth understanding of the phenomenon; and the representative sampling frame cannot be determined. This researcher used questionnaires only over the internet due to Saudi Arabia's lack of a postal code making questionnaires difficult to post. Online questionnaires were only distributed to respondents who were selected. However, Online questionnaires are restricted to online users which may result in the sample being

unrepresentative of the target population. However, given the nature of the target population for this study, this problem did not apply. Couper (2000) states that online questionnaires can be applied to large populations including those who are not in the target sample of organisations. Also, more explanations with graphics and high quality design can reduce the non-response rate. Finally, data can be collected and kept safely, and it is easy to analyse data. Thus, this study uses online questionnaires as the main method for collecting data.

4.9.1.5 Pilot study

A pilot study is recommended for researchers before starting the actual study. It is often conducted when there is a large population. According to Saunders, et al., (2009) the piloting procedure can any avoid errors, improve the questionnaire and ensure that it can be understood by the participants. Creswell (2003) believed that during a pilot study any mistakes that could occur may be detected, such as identifying missing or incorrect instructions, inconsistent wording, questions overlapping, spellings errors, and so on. The researcher can also predict the length of the survey. Dillman (2000), suggested a piloting technique developed into four steps. Firstly, colleagues can provide the initial comments to ensure and increase the questionnaire's efficiency. The second step is called cognitive pretesting and consists of observation and thought. Thirdly, the researcher conducts a small pilot study that emulates the main study. Dillman (2000), suggested that a pilot study should be conducted with around 10% of respondents from the whole sample of the main study to confirm that the questionnaire is able to measure the variable correlations and provide an indication of the response rate and length time. Finally, the questionnaire should be checked by someone regarding any inadvertent typographical errors.

After the questionnaire had been designed, the researcher conducted a pilot study with 38 participants. There were three main aims. Firstly, the researcher conducted a pilot study to develop the quality of questions through the comments received. The second aim was to identify the ability of the respondents to understand the questions and structures how to complete the questionnaire. Finally, the pilot study was conducted to determine the effectiveness of the techniques used.

4.9.1.6 Questionnaire Translation

As noted earlier, the sample population have Arabic as their mother tongue; accordingly, the questionnaire was written in the Arabic language. Gelling (2015) suggested that the survey instructions must be considered clear and comprehensive. The researcher thus took into account that the translation of the questionnaire needed to retain clarity and have no alteration of meaning.

The original questionnaire was developed in the English language *(see Appendix B)*, and it was then translated into Arabic *(see Appendix C).* This to ensure that all the respondents, who had Arabic as their mother tongue, could understand the questionnaire instructions and questions. The researcher collaborated with some experts in translation to make sure the translation was efficient; as, had there been misunderstandings due to inaccuracies in translation, this would have vastly affected the data collection process.

4.9.1.7 Survey Protocol

The researcher prepared and design questionnaires, then chose an appropriate website to upload it to the internet. The researcher has a trial run with some participants who provided some comments and were able to complete it without any issues. This study also established criteria for inclusion of the participants:

- The participants should have some IT experience and work in government departments.
- The questionnaire targeted both senior government management and senior managers in government organisations.
- The participants from IT administrations departments should have spent time working in the IT area.
- The questionnaire was distributed over the internet to a sample of 1000 respondents. The researcher received 887 completed responses, which formed the basis of the subsequent analysis.

4.9.2 The Qualitative Method

In this research, data collection was carried out in three main stages during this research. After the initial review of the literature was conducted, an exploratory study was carried out as a first stage towards achieving the objectives of this study. It was an exploratory study

conducted in the context of e-government in Saudi Arabia to identify the factors and challenges facing the development of services provided by the government.

In the exploratory phase of this research, an interpretive approach was adopted for collecting qualitative data, and semi-structured interviews were used. The purpose of this exploratory study was to explore key aspects and factors for evaluating the success of e-government systems. The study was conducted in the context of the Saudi government. To achieve the objective of this research, this study interviewed 8 Saudi government employees and IT directors to explore their perceptions of e-government systems and investigate the main factors that affect the success of e- government services. The interviewees in this study had diverse demographic backgrounds.

The results of the interviews contributed to the discovery of potential success factors for e-government systems; as well as setting up the initial framework for assessing the success of e-government. The objectives of this exploratory study were achieved, and resulted in the discovery of several issues related to factors affecting the success of e-government systems. The third phase is the development of the framework and validation of effectiveness through analysis of the results obtained from the stage of data collection and analysis of results.

4.9.2.1 The Interviews

This research designed a plan for conducting the interviews. The aim of interviews was to investigate the capacity of the e-government systems to be successfully implemented and perceptions of the Saudi government regarding adopting cloud computing in e-government systems. Moreover, the purpose of the interviews was to identify the perspectives of top management and IT administration around issues pertaining to e-government development and the adoption of cloud computing, taking into account the four dimensions, which were the technological, organisational, environmental and social contexts. According to Marshall and Rossman (2006), it may be important to select interviewees who have enough experience to understand the situation in detail and sometimes it may be useful to interview people who are considered influential. From 1 March to 30 May 2019, the interviews were conducted with the IT experts and managers at different managerial levels in Saudi government organisations. These resulted in the identification of various critical factors and having a deeper

understanding of issues pertaining to e-government development and why delays exist in adopting cloud computing for the existing e-government system in Saudi Arabia.

4.9.2.2 Selection of Interviewees and Government Organisations

This research has collected data from individuals in government organisations which have recently had e-government systems, so that the interviewees had appropriate knowledge and the ability to provide significant information regarding the current e-government systems and thus be able to properly respond to the interview questions. The eight government organisations were selected based on their skills and experiences with the e-government systems implemented and the value of e-government systems among Saudi government organisations. Moreover, these government organisations with comprehensive and interactive e-government systems could serve as guidance for other government organisations to develop and adopt cloud computing in their e-government systems.

4.9.2.3 Translation of the Interviews

The interviews questions were translated into the Arabic language in order to ensure better understanding with a high response rate and thus more accurate replies. This phase occurred after designing and preparing the interview questions in English. Respondents in the interview were selected IT managers or IT directors in government organisations. The translation process was to ensure the quality and efficiency of the interview. The next step integrated the comments of experts in linguistics and Arabic language specialists to ensure the quality and efficiency of the translating process. Finally, the comments allowed final adjustments before the pre-testing and piloting stage in Saudi Arabia.

4.9.2.4 Coding

Coding is about marking different sections of the data by using labels and proceeds towards the categorisation of data into themes (Holloway and Wheeler, 2010). The researcher reads through the transcript and identifies what they feel is important to both the researcher and the participant. During this initial coding, the researcher identifies words or phrases that the participant uses in order to discern important ideas that are found within the data (Holloway and Wheeler, 2010). The method adopted was manual coding.

4.10 Data Analysis

The major challenge facing data analysing is diversity in the statistical methods to present the data collected in appropriate ways. According to Hair et al., (2010) analysis of quantitative data has two basic steps: firstly, descriptive statistics from the sample data give a description of the essential features. Secondly, using data collected from a sample to identify inferential statistics to examine hypotheses. This would make inferences regarding the larger population to which these phases of statistical analysis have been applied to have an understanding of the data collected in this study.

4.10.1 Quantitative Data Analysis

This research used quantitative methods to analyse the data collected from survey. The researcher used descriptive statistics such as frequency tables, percentages and bar charts to present the analysed data. This has allowed a meaningful description, through the distribution of the scores or measures, of the impact of social values on the e-government system to adopt cloud computing situations, with descriptive data being presented as well as frequency tables. In analysing the results of the questionnaire used in the study, we were using various methods to measure the reactions of the individuals, such as their satisfaction with the system's performance. Quantitative research methods were appropriate in this study for data collection and analysis. The aim was to understand the factors influencing the adoption of innovative technology from the point of view of the people involved and to gain an understanding of the obstacles facing the Saudi e-government system. This study used a content study to analyse the substantial body of data collected with the following procedure:

- Collation and reading of the collected data from quantitative methods.
- Definition of the collected data by a set of classification categories.
- Using collected data categorization.
- Implementing statistical treatment and quantification of the data.
- Using description scientific of the collected data.
- The interpretation of the results of the data.

For the quantitative data analysis, both descriptive and inferential statistics were derived to better understand and explore the crucial influential elements in e-government systems. Then,

there was evaluation of the model comprising the factors that influence adoption and utilization of cloud computing in e-government systems in the Saudi context. This was to provide recommendations and draw the attention of top management to some of the issues in the adoption of cloud computing.

4.10.1.1 Descriptive Statistics

Descriptive statistics provide an overview of the data so that it can be easily understood, and generating them is thus an essential initial phase of analysis in quantitative methods. According to Hair et al., (2010) data examination involves data screening, checking for any missing data; creating coding data and data cleaning. Descriptive statistics refer to the quantitative index that represented the data sample performance. Furthermore, prior to analysing the data researchers should test the normality of data and its completeness. Descriptive statistics can present a large amount of data in a simple way. They have some main indicators that involve frequency distribution, measures of central tendency (e.g. mean and median) and measures of dispersion (e.g. standard deviation and variance). The scores of individual respondents can be identified by the frequency distribution for each of the variables. A better understanding can be obtained by using a measure of central tendency which can summarize the characteristics of a variable in one statistical indicator (Hair et al., 2010). The advantage of descriptive statistics is that a large set of data can be simply described. Further, in descriptive statistics, the dispersion measure can be assessed by the variance and range of the standard deviation. According to Hair *et al.*, (2011) normality refers to the degree of distribution of the sample data with the assumption of corresponding to a normal distribution. Standard deviation refers to the normality of the variable data with normality being reached when the standard deviation is (S.D. <1). Skewness and kurtosis value measure the normality of data from a range of acceptable limits - 2.58 to + 2.58. Descriptive statistics have been considered able to identify whether the data is normally distributed or not. This research used the SPSS 20 program to present the results of descriptive statistics which are outlined in Chapter 5.

4.10.1.2 Assessing Normality

Normality assessment is considered as the first essential phase in analysing the collected data before embarking on the advanced analysis. The normality of data indicates the shape of data distribution for each variable and ensure correspondence with the normal data distribution

overall. Normality occurs when the variables or individual variable presents as a normal distribution shape. In fact, a large sample size plays a crucial role, especially as when using SEM, it not mandatory to conduct a normality test (Hair et al., 2010; Kline, 2005). This study identified the appropriate sample size as around 500 participants; this means normality assessment can be avoided but the normality of the data was ascertained to confirm the appropriateness of data analysis.

When descriptive statistics on data is required the normality of the collected data is assessed by means of skewness, and kurtosis tests which are widely applied to check the normality of data (Hair et al., 2010). Skewness in a normal distribution can be a measure of symmetry; and kurtosis tests the data to measure whether it is peaked or flat. Consequently, skewness and kurtosis values in the data normality were assessed and represented visually in a chart. Hair et al., (2010) recommend that the most appropriate skewness and kurtosis measurement values range from – 2.58 to + 2.58; however, George and Mallery, (2010) believe that appropriate skewness and kurtosis values range from – 2 to + 2. The descriptive statistics measurement techniques, including standard deviation, mean, skewness and kurtosis determine whether normal distribution of the data was achieved or not.

4.10.1.3 Structural Equation Modelling (SEM)

The structural equation model (SEM) is a powerful multivariate tool that allows the researcher to study the interrelationship between the latent and observed variables. SEM is very popular in behavioural, attitudinal, educational, psychological, and social research (Song and Lee, 2012). Latent variables (constructs) are those variables which cannot be directly observed or measured such as behaviour, attitude, intelligence etc. In establishing a model to reflect reality, assessing the interrelationships between latent and observed variables is necessary. Recent studies (Hooper *et al.*, 2008; Vaismoradi *et al.*, 2016) show that the most commonly reported fit indices were for the SEM program, which was one of the measures least affected by sample size.

This research has applied Structure Equation Modeling (SEM) procedures in order to examine the proposed conceptual model by AMOS 25 software. The first phase of analysis is the confirmatory factor analysis (CFA) in order to create a measurement model and to test its fit. SEM is the most useful statistical method serving this purpose. Observed variables refer

to variables that can be directly measured and observed, such as, height, weight, rate, etc. However, in some social science research, like medical, social and psychological studies, the researcher may encounter latent variables which cannot be directly observed by a single observed variable (Song *et al.*, 2012). The SEM has main components that are the structural model and the measurement model. The structural model identifies the relationship of the independent to dependent variables. The measurement model allows using several variables as indicators for a dependent variable or single independent variable (Hair et al., 2010). Also, SEM has two different techniques, namely Confirmatory Factor Analysis (CFA) and Exploratory Factor Analysis (EFA) that can be used for its running.

Exploratory Factor Analysis (EFA) refers to the factors that are determined from statistical results rather a theory. The structure of these factors can be determined by running the software and underlying pattern of the data. Therefore, EFA can be conducted when there are some factors, but it is not known which variables belong with which constructs. Applying EFA enables the researcher to determine how many factors are appropriate and which variables load on a particular factor. The factors that appear after the ultimate analysis can be named by the researcher. This emphasises that EFA where the relationships are created unlike in Confirmatory Factor Analysis (CFA) can create the relationships by the researcher (Hair et al., 2010).

- **Confirmatory Factor Analysis (CFA)** requires that before the results can be computed the researcher determines the existing number of factors and variables related to a particular construct. CFA allows the researcher to create the relationships as a collection of shapes and arrows representing relationships and the variables respectively (Hair et al., 2010). Moreover, CFA is used to identify if the assessment model fits the data collected by the researcher. CFA is a procedure to allows the researcher to investigate the validate or confirm a predefined relationship (Kline, 2005). In CFA the variables are loaded onto specific constructs to examine the theoretical pattern and identify that the factors can match reality in the theoretical specification (Hair et al., 2010). CFA allows the researcher to for decide whether the theory being studied is accepted or rejected.

For several reasons, this research has chosen to use the SEM statistical technique. Firstly, this research attempts to study the relationship between adopting cloud computing and the critical factors that influence e-government systems, and this cannot be measured directly by

encountering latent variables. Secondly, due to the strength of SEM, which considers the measurement error for each latent variable in the factor model that has been estimated to which can achieved fit model (Hooper *et al.*, 2008). Hence, SEM is the most useful statistical technique to serve these purposes. Accordingly, several factors have been determined in this study in order to investigate these factors based on the TOE models mentioned earlier in Chapter 3; thus, CFA is the suitable method for running SEM.

4.10.1.4 Evaluation of the SEM (Determining Model Fit)

This section explains how the model fits can be determined. McDonald and Ho (2002) stated that the model fits for the sample data can be properly determined through fit indices. These measures can provide an important indication of how the adopted theory data fits. In order to determine the model fits, the following are usually evaluated: Chi-Squared test, Comparative fit index (CFI), Root mean square error of approximation (RMSEA), P of Close Fit (PClos), and Standardised root mean square residual (SRMR)need to be computed (Hooper *et al.*, 2008). This evaluation showed evidence of the discriminant and convergent validity of the research instruments.

4.10.1.5 Chi-square (CMIN)

Chi-Square (CMIN) is used to evaluate the overall model fit. Providing an insignificant result at 0.05 means that the model fit is good (Barrett, 2007). Otherwise, the Chi-Square statistic reveals lack of fit or badness of fit measure (Kline, 2005). Also, a chi-square/degree of freedom (CMIN/DF) range between 1 and 5 is recommended (Gaskin and Lim, 2016). However, the Chi-Square statistic lacks power if used with small samples and may not discriminate between poor fitting models and good fitting models. Nevertheless, most research has used the Chi-Square test as a fit statistic (Barrett, 2007).

4.10.1.6 Comparative Fit Index (CFI)

The Comparative Fit Index (CFI) is a modified form of the measurement of the Normed Fit Index (NFI) that takes into account the sample size effectively. The CFI range value should be between 0.90 and 0.95 to indicate a good fit. Recent studies have shown that the CFI value should be greater than 0.90, which reveals that the model is not properly specified and unacceptable (Tabachnick and Fidell, 2007).

4.10.1.7 Standardised Root Mean Square Residual (SRMR)

SRMR is the "square root of the difference between the residuals of the sample covariance matrix and the hypothesised covariance model" (Hooper *et al.*, 2008, p.54). It has been recommended that this should be lower than 0.08 for a good model fit (Hu and Bentler, 1999). An SRMR of 0 is considered a perfect fit, however, it becomes lower when there is a high number of parameters in the model depending on sample size (Hooper *et al.*, 2008). Thus, the SRMR does not affect model complexity.

4.10.1.8 Root Mean Square Error of Approximation (RMSEA)

The RMSEA is the second measurement of statistic model fit and was first by Steiger and Lind (Hooper et al., 2008). Previous studies have shown different ranges of RMSEA values as an indication of model fit. RMSEA values above 0.10 are considered poor fit and RMSEA values in the range of 0.05 to 0.08 indicate fair fit. So, the values in the range of 0.08 to 0.10 are considered a medium fit. Finally, it is agreed that a well-fitting model has an RMSEA lower limit nearly at a value of 0. (Maccallum et al, 1996). The RMSEA has the great advantage of being able to calculate its value through a confidence interval. This allows for the null hypothesis to be tested by known distribution values of the statistic more precisely.

4.10.1.9 P of Close Fit (PCLOSE)

The measurement of the null hypothesis can use the P of Close Fit (PCLOSE) test, which can be a single test. This requires the RMSEA value should equal .05, which indicates a close model fit (Kenny, 2015). If PCLOSE isn't any greater than .05, this means RMSEA is bigger than .05, indicating the lack of an in-depth fit (Arbuckle, 2013). So, if *P* of Close is smaller than .05, this indicates that the model is less than close-fitting.

4.10.2 Qualitative Analysis

Based on the research aims and objectives, this research has considered various data collection techniques in order to enhance theory generation and to provide multiple perspectives on the research problem, emerging concepts and strong evidence of constructs. The researcher initially collected data from individual interviews with IT administrators in Saudi government organisations who were carefully screened to ensure they met the selection criteria. The following section discussed the approach to analysis of the qualitative phase of the research.

4.10.2.1 Thematic Data Analysis

Data analysis is the process of examining and categorizing data to achieve the research objectives addressed. The qualitative analytical process can be applied to various approaches of analysis, such as thematic analysis, grounded theory, analysis of content, and analysis of narrative (Crabtree and Miller, 1999; King, 2004). The qualitative research approaches can be analysed as thematic and content analysis (Vaismoradi *et al.*, 2016). Thematic analysis refers to "a strategy for recognizing, breaking down, and revealing examples (subjects) inside data. It significantly sorts out and depicts your data collection in (rich) detail" (Braun and Clarke, 2006). Key characteristics of the data are identified at the coding phase, which results in some of the themes being elicited.

Both thematic and content analyses are interpretive and represent the perspectives of the participants. However, some researchers believe that thematic analysis is the most commonly used and appropriate technique for analysis, as it requires a lower level of derivation and understanding (Vaismoradi et al., 2016). The researcher describes the findings by explaining the participants' responses. However, this thematic and content analysis has a lot of flexibility in interpreting. It allows collecting large data sets more easily. It is used as a method for getting information about practical importance from the results.

The current research uses a thematic analysis approach for analysis of the qualitative data obtained in the interviews. The data was broken down into specific topics reflecting the research objectives as well as other subjective themes that emerged in the light of statements and feelings identified in the interview transcripts. In this way, participants' points of view were identified, and the themes were able to be drawn out from the responses. These topics required a deep understanding and so a thorough comprehension of the data gathered was needed. This meant that it had to be dissected with the assistance of a conceptual framework which made analysis easier. Fereday and Muir-Cochrane (2006) believe that thematic analysis is one example of pattern recognition of the data, where themes can determine the classifications for analysis.

The thematic analysis model has a procedure that incorporates data in different stages as shown in Figure 4.1 (Roberts *et al.*, 2019). These six stages of the process of thematic analysis include data collection, coding, generating themes, reviewing and evaluating the themes,

defining and displaying themes, drawing conclusions and interpretation. The data collection is the initial phase and refers to having an overview of all the data collected through interviews. The purpose of this stage is to gather together all the primary data in order to achieve the analysis and the objectives of the research. During the phase of data filtering, the researcher emphasizes the significant data that is related to the objectives of the research or disposes of irrelevant collected data, to the degree that only the pertinent data for accomplishing the analysis objectives of the research remain and afterward, applicable data can be chosen and sorted out. Then, the researcher needs to select a coding system for the relevant data, which is usually in the form of phrases or sentences that describe their content. Generating the phrases that form the codes enables the researcher to identify patterns among them. and create themes. Generally, themes are broader than codes which can be combined to form a single theme. At the stage of reviewing and evaluating the themes, the researcher should make sure that all themes are useful and accurate representations of the data. Creating themes that do not really represent participants' perspectives or missing relevant themes contained in the data must be guarded against at this stage. For defining and displaying themes, the researcher should have compiled a final list of themes with each of them named and defined. Themes' names should be succinct and easily understood. Finally, drawing conclusions and interpretation refers to the analysis of the data which achieves the research aim and objectives and answers the research questions with accuracy and reliability.

Figure 4.3: Summary of the six phases of thematic analysis

4.10.2.2 Process of Interview Validation and Findings

Validation of the methodological process was achieved with the single technique of thematic analysis. The research aim has been achieved at this stage in that the investigation revealed the most significant factors influences the adoption of cloud computing in e-government systems in the Saudi government organisations. Therefore, the researcher considers it would be applicable to similar situations in which the study outcomes could be successfully achieved.

4.11 Quality Assurance of the Research

Quality assurance can be part of analysing data quality and provides confidence that quality requirements have been fulfilled. This section explores the most common test that is applied to ensure the validity and reliability of analysing data.

4.11.1 Reliability and Validity Analysis

The most important evaluation of studies is that they should have a good measure of reliability and validity (Collis and Hussey, 2009). Reliability is the degree of accuracy of the collected data; for instance, if the study was repeated, identical results would emerge. However, according to Singleton and Straits (2004) reliability also refers to the degree to which the variables, or indicators, are stable and consistent with what they are assumed to be measuring. Venkatesh (2003) measured the reliability of the TOE instrument several times during the development of the instrument and all of the reliability coefficients were approximately 0.70. In SPSS, the most popular test of reliability is Cronbach's coefficient alpha (Sekaran, U. and Bougie, 2010). Hair *et al.*, (2011) state that the value of Cronbach's alpha should be in the 0.7 range to be acceptable and to indicate adequate internal consistency. The reliability analysis result is discussed in detail in Chapter 5. However, the analysis results showed that all of the constructs had a high reliability value which achieved more than 0.7.

Validity is concerned with whether the researchers have studied what they intended to do and not something else (Neuman, 2003). Moreover, it refers to the extent to which the data collected truly measures what it is meant to measure (Field, 2005). According to Kripanont (2006), validity tests for the instruments include content validity and construct validity.

Firstly, content validity was achieved by employing the pre-testing technique to achieve content reliability and validity (Hair *et al.*, 2011). Secondly, the construct validity was examined and assessed through a series of processes by applying the exploratory (EFA) and confirmatory (CFA) techniques.

4.11.1.1 Reliability Analysis

The reliability of the data and findings is one of the main requirements for any research process. According to Nunan (1992), reliability refers to the degree to which there is consistency and replicability in the research. Nunan (1992) pointed out that the consistency of the data collection, analysis and interpretation are referred to as the internal reliability; while external reliability is a test by which researchers can obtain similar results to what has been found in the study. Reliability thus refers to the level to which data collection methods and analysis techniques were producing consistent findings (Saunders et al., 2009). In quantitative research, it is easy and straightforward to obtain similar results because the data are in numerical form. However, in qualitative research, similar results are difficult because the data are subjective and often in narrative form (Zohrabi, 2013). Lincoln and Guba (1985) stated that rather than attempting to achieve the same findings and results, it is better to think about the dependability and consistency of the qualitative data. Therefore, the main purpose of this is that the findings and results are consistent and dependable. Saunders et al., (2009) suggested that the dependability or trustworthiness of the results requires three techniques in order to be ensured:

4.11.1.1.1 The Cronbach's alpha

The Cronbach's alpha has become one of the most popular methods of providing a test for the form of reliability known as 'internal consistency' and is commonly used when measurements represent multiple questionnaire/test items (Saunders, 2009). Cronbach's alpha is the most frequently used test for measuring reliability in social and organisational science (Connelly, 2011). A set of items that are related as a group can be measured by the alpha coefficient (Bonett and Wright, 2014). The ranges of the alpha coefficient are between 0 to 1. The alpha value is greater than 0.70, but it is acceptable at 0.60 and considered reliable (Churchill, 1979). DeVellis (2003) claimed that although there are lower reliability coefficients in some studies, researchers still use this lower scale to indicate reliability.

4.11.1.1.2 Standardised factor loading

Factor loadings refer to correlation coefficients between latent common factors and observed variables that would be viewed as regression weights or standardized regression coefficients. The difficulty with unstandardized loadings is that they provide limited diagnostic information. Thus, the reliability and discriminant validity is useful and required to be calculated by examining standardized loadings. Hair et al., (2010) believed that the standardized factor loadings (regression weights) should be 0.5 as the minimum threshold.

4.11.1.1.3 Construct reliability

One of the convergent validities is constructed reliability. The estimated requirement should achieve .07 or above to indicate excellent reliability (Creswell, 2014). Furthermore, the minimum threshold for construct reliability considered as acceptable is 0.70. However, this rule does not apply to exploratory research. A construct refers to a measure of internal consistency in scale items, like Cronbach's alpha. Construct validity measures are used to investigate hypothetical constructs (Kline, 2005); thus, it should be taken into account for the assessment of item measures.

4.11.1.1.4 Average variance extracted (AVE)

Variance extracted from the item is the square of the standardized factor loading, and is conducted in order to show the latent factor which explains quantity variation in an item (Hair et al., 2010) .AVE is calculated due to the mean-variance extracted for the items loading on a construct (Fornell and Larcker, 1981). AVE values of 0.5 or higher are taken into account as adequate or good convergence.

4.11.1.2 Validity Analysis

The Validity tests measure both internal and external validity. Internal validity refers to the interpretability of research, and should focus on the factors that could directly affect the outcomes of the research; while external validity is concerned with the generalisation of the research results (Nunan, 1992). Burns (1999; p. 160) stresses that “validity is an essential criterion for evaluating the quality and acceptability of research”.

4.11.1.2.1 Content Validity

Content validity occurs when diverse elements, skills and behaviour are measured effectively and adequately (Burns, 1999). To achieve this, experts in the research field need to review the data and instruments. Based on the reviews, the questions which are deemed unclear and obscure could be revised, and the complex items reworded. In addition, some questions can be discarded, including the ineffective and non-functioning questions (Zohrabi, 2013). This study applied construct validity and content validity measurements to assess the instruments' validity.

4.11.1.2.2 Convergent validity

Convergent validity refers to "the extent to which indicators of a specific construct converge or share a high proportion of variance in common" (Hair et al., 2010; p. 689). In other words, it is the extent to which indicators of a particular construct converge or share to a great extent the proportion of variance. According to Hair et al., (2010) convergent validity implies that the indicators (items) of the construct have joined or provide a high degree of proportion of variance in different or in like manner. Therefore, a good convergent validity of the construct represents the measurement of the item that correlates closely with other measures for the construct (Hair et al., 2010). Anderson and Gerbing (1988) recommended three specially appointed tests to assess convergent validity, which Items achieving high AVE indicates that these items are illustrative of the latent content. The AVE should achieve 0.50 or higher to indicate excellent convergent validity (Creswell, 2014). This research considered convergent validity to measure factor loadings, which should have the values of critical ratios (C.R.) greater than 1.96.

4.11.1.2.3 Discriminant validity

Discriminant validity refers to "the extent to which a construct is truly distinct from other constructs" (Hair et al., 2010; p. 689). In other words, the degree to which a construct is distinct from two other different constructs. Accordingly, a high discriminant validity value indicates that a construct can be considered exclusive. Anderson and Gerbing (1988) recommended calculating the squared correlation estimates of any other two constructs (latent

variables) and comparing the AVE values of those two constructs. The AVE evaluations should be higher than the squared correlation between the two constructs, and demonstrates a high discriminant validity in the model (Kline, 2005). This research takes into account this test in its assessment of validity.

4.12 Ethical Considerations

One of the most important aspect of any research are the ethical considerations. Before undertaking any research activities, the protection of participants from any harmful consequences must be considered; this includes deciding how the issues of informed consent, data protection, safety, coercion, and the confidentiality of data are to be properly addressed. Also, it has addressed ethical considerations for the interviews (e.g. informing participants beforehand of how the information was going to be recorded, ensuring interviews took place at times and locations convenient to the participant, and so on. Also, mention how will maintain data security. This research (both survey questionnaires and semi-structured interviews) have followed the Sussex University Ethical Review Process with application number ER/NA424/1 and submitted the required documentation to the committee. A consent form accompanies a covering letter that informs the participant about the research objectives, and that their data will only be used for research purposes. In addition, the respondents are assured that their data are safe and private. Finally, participants have the opportunity to withdraw from participation in the questionnaire without restriction at any time.

4.13 Summary

This chapter has presented and discussed many aspects of the research methodology, including a number of methods and approaches that were established. The procedure and design of the research have been explained in more detail, including the quantitative and qualitative methods and includes a discussion of the processes of collecting and analysing empirical data and the sampling procedure from the target population, as well as procedures for data analysis and for testing validity and reliability. This chapter also highlights the ethical considerations of this research. This research developed a theoretical framework and used survey questionnaires and semi-structured interviews as instruments for collecting data.

In the following chapters, it was presented the description and analysis of the quantitative empirical data in further detail in chapter 5. Furthermore, in chapter 6 can be found the details and analyses of the qualitative empirical data. Finally, discussion and concluded the findings of this study results both (the quantitative and qualitative methods) in the final chapter.

Chapter 5: Quantitative Data Analysis

5.1 Introduction

This study obtains some of its primary data by using a quantitative method to investigate the effectiveness of adopting cloud computing for e-government systems. This chapter intends to discuss the data analysis of the quantitative stage of this research and provide an overview of the fieldwork carried out to collect data from IT employees and the IT directors of Saudi government organisations. As summarised in Chapter four, there are four types of research paradigm; but the postpositivism research paradigm is the most appropriate to achieve the main aim of this phase of the study on adoption of cloud computing in e-government systems. This chapter has included sections on the following: descriptive statistics for collecting data to ensure they were properly prepared for analysis; the means applied for confirmatory factor analysis for the constructs and the structural equation modeling (SEM) technique used to examine the hypotheses. Finally, the structural model fit method applied to confirm the proposed research framework by using AMOS 25 is described.

5.2 Conducting the Pilot Study

A pilot study was carried out on IT employees and the IT directors of the Saudi government departments in the public sector in order to ensure the validity and reliability of the instructions and the questions asked. The pilot study consisted of 44 questionnaires which were distributed to IT employees and the IT directors of the Saudi government who completed and assessed the draft of the questionnaire. These participants had experience in the IT sector or were government managers. The pilot study aimed to check the clarity of the items in the questionnaire and see if the instructions could be easily understood, also to identify the time needed to complete it. The pilot study confirmed the items and instructions were not difficult to understand and useful comments were obtained from the participants as a result of the pilot. Based on the result of the pilot study. There were no changes in the questionnaire.

5.3 Designing the Sampling Procedure

The target population selected for this study comprised IT employees and IT directors employed by the Saudi government between 1st March 2019 to 31st May 2019. According to a Ministry of General Authority for Statistics report, the total target population numbered in

excess of 10,000 IT employees and IT directors. There are several methods to calculate the sample size after determining the confidence level and margin of error. In this case, the sample size was calculated as 383 with a confidence level of 95 and a 5% margin of error (Saunders et al., 2009).

Sample Size = 384

Sample size for different size of population at a 95 % confidence level (assuming data are collected from all cases in the sample)				
Population	*Margin of error*			
	5%	3%	2%	1%
50	44	48	49	50
100	79	91	96	99
150	108	132	414	148
200	132	168	185	196
250	151	203	226	244
300	168	234	267	291
400	196	291	343	384
500	217	349	414	475
750	254	440	571	696
1000	278	516	706	906
2000	322	696	1091	1655
5000	357	879	1622	3288
10,000	370	964	1936	4899
100,000	383	1056	2345	8762
1,000,000	384	1066	2395	9513
10,000,000	384	1067	2400	9595

Table 5.1: Sample sizes for different sizes of population (Saunders et al., 2009)

Table 5.1 shows a simpler and more common way of determining the sample size. It presents the sample sizes for different sizes of the population at a 95% confidence level; which means that the researcher only needs to determine the confidence level and margin of error to select the appropriate sample size. Based on the available data for this study, the target sample size, therefore, will be 383 with a 95% confidence level and 5% margin of error.

5.4 Sampling Method Chosen

Since this phase of the study has used a quantitative approach, it was essential to concentrate on how the survey sample was to be selected. Selection of the sample for the quantitative phase was based on scientific methods to avoid bias and produce accurate results. This research had as its target population all the IT employees and the IT directors in Saudi government organisations. The sample was selected based on the distribution of the number of IT employees and the IT directors of the Saudi government in 2019 as described in the Ministry of the General Authority for Statistics report. Individuals in the sample were sent the link to a web-based questionnaire and completed responses were therefore saved directly into the database.

5.3.1 Data Screening

The purpose of data screening was to confirm that the collected data was clean before conducting the statistical analysis and contributed to the validity and reliability of data. This section discusses the missing data and normality test. These steps are required to justify the reliability of the data before moving on to the SEM analysis.

5.3.2 Missing Data

Missing data refers to the variables that do not contain valid values for analysis. Missing data may cause problems, which may not allow the analysis to run because the data obtained is not adequate. According to Hair et al. (2010) any individual case or observation that involves missing data under 10% can be generally ignored. As mentioned, more than 1000 questionnaires were distributed randomly among Saudi government organisations in different cities during a three month period, with a total of 887 (88.7%) of the questionnaires being returned. Of these, 838 questionnaires were used, as 49 questionnaires were considered unusable due to missing response items or participants choosing all the same answers, which implies that the data is inappropriate for the selected analysis technique.

5.3.3 Evaluating the Quality of Data: Assessing Outliers

Outliers indicate a set of values that differ significantly from the others that were observed, making them distinct from the rest (Rogelberg, 2004). Usually, outliers occur when errors are made in data entry, instructions are unclear or because there are problems with the

questionnaire. A single variable identifies as a univariate outlier, further, two or more variables mean a multivariate outlier that has a multiple score (Kline, 2005). According to Brown (2006) univariate outliers can occur when calculating the frequency distributions of z scores over 3.29 with $p < .001$, which means the data indicates that it has outliers. However, when this measure was calculated, fortunately no outliers were found, and the z value for all variables was less than 3.29. Moreover, the minimum standard deviation was 0.32, and the maximum standard deviation was 1.15. Therefore, there were no outliers observed in the dataset.

5.3.4 Normality Test

In multivariate analysis, the normality is an essential assumption which refers to the distribution of the data for a variable (Hair et al., 2010). It can be measured in two different ways: Skewness and Kurtosis. Data can be considered to be normal if: Skewness and Kurtosis are between -3 to +3. From Table 5.2 the result indicates that the normality of the data points is achieved, and the data is therefore normally distributed within range as Skewness was .084 and Kurtosis was .169.

Descriptive Statistics				
Items	**Mean**	**Std. Deviation**	**Skewness**	**Kurtosis**
	Statistic	**Statistic**	**Statistic**	**Statistic**
RA1	3.89	.927	-.767	.257
RA2	3.84	1.005	-.795	.208
RA3	3.95	.945	-.801	.394
RA4	4.07	.786	-.573	-.066
CM1	3.58	1.040	-.438	-.487
CM2	3.60	1.013	-.481	-.330
CM3	3.58	1.022	-.564	-.107
CM4	3.76	.992	-.659	.004
CO1	2.83	1.124	.088	-.989
CO2	2.62	1.029	.484	-.496
CO3	2.89	1.121	.184	-.868
CO4	2.70	1.082	.366	-.592
SQ1	3.82	.988	-1.017	.828
SQ2	3.95	.947	-.951	.735
SQ3	3.94	.977	-1.094	1.142
SQ4	3.93	.928	-1.002	1.232

SE1	3.16	1.161	-.174	-.931
SE2	3.17	1.118	-.090	-.817
SE3	3.00	1.140	.075	-.864
SE4	3.18	1.158	-.110	-.913
TM1	3.60	.930	-.663	.236
TM2	3.52	.988	-.514	-.074
TM3	3.75	.920	-.670	.279
TM4	3.58	.974	-.352	-.278
TR1	3.78	.976	-.770	.242
TR2	3.72	1.027	-.671	-.077
TR3	3.68	1.075	-.615	-.361
TR4	3.74	1.010	-.711	.021
RE1	3.63	.894	-.888	.878
RE2	3.54	.991	-.534	-.237
RE3	3.59	1.009	-.630	.143
RE4	3.59	.979	-.584	.040
CP1	3.56	.962	-.622	.135
CP2	3.64	1.012	-.581	-.126
CP3	3.68	1.016	-.585	-.127
TU1	3.74	.913	-.815	.641
TU2	3.77	.918	-.619	.205
TU3	3.71	.961	-.639	.194
TU4	3.74	.906	-.588	.272
TU5	3.75	.933	-.704	.340
AW1	3.61	.964	-.643	.161
AW2	3.68	1.001	-.560	-.201
AW3	3.72	1.053	-.639	-.214
AW4	3.49	1.000	-.470	-.160
AW5	3.64	1.002	-.643	.002
AT1	3.92	.980	-1.049	.921
AT2	3.44	1.198	-.321	-.974
AT3	3.28	1.231	-.164	-1.068
AT4	3.67	1.093	-.614	-.362
AC1	3.63	.952	-.403	-.268
AC2	3.49	1.064	-.357	-.471
AC3	3.45	1.153	-.506	-.504

AC4	3.75	.950	-.600	.093
AC5	3.44	.969	-.326	-.189
AC6	3.43	1.118	-.403	-.564

Table 5.2: Normality Test

5.3.5 Mean Distribution of the Variables

This section presents the mean distribution and standard deviation as well as the standard error of each variable used for this study. As shown in Table 5.3, the mean distribution of the majority of the variables is greater than 3, which may suggest that majority of the participants had a positive perception about the adoption of cloud computing.

Factors	**Descriptive Statistics**		
	Items	**Mean**	**Std. Deviation**
Relative Advantage (RA)	"Adoption of cloud computing in our organisation will enable us to reduce the operating costs."	3.89	.927
	"Adoption of cloud computing will improve the performance of our organization."	3.84	1.005
	"The use of cloud computing in our organisation will help us to accomplish tasks more quickly.	3.95	.945
	Adoption of cloud computing will improve our online services delivery."	4.07	.786
Compatibility (CM)	"Adopting of cloud computing can be easily integrated into existing IT infrastructure."	3.58	1.040
	"Adopting of cloud computing is compatible with the systems that are already in use.	3.60	1.013
	Adopting of cloud computing is compatible with all aspects of our organisation's existing format, interface, and other structural data."	3.58	1.022
	"Adopting of cloud computing fits well with our online services provided."	3.76	.992
Complexity (CO)	"With the adoption of cloud computing, there will be some complexity of maintaining cloud computing platform."	2.83	1.124

	"With the adoption of cloud computing, it will be more difficult to develop new solutions / extend the existing functionality of the system."	2.62	1.029
	"With the adoption of cloud computing, more time is required by IT staff to perform their normal duties."	2.89	1.121
	"Learning to operate in the cloud computing environment is complex for employees."	2.70	1.082
Service Quality (SQ)	"The adoption of cloud computing will provide a high service quality with high efficiency."	3.82	.988
	"The adoption of cloud computing will deliver better online services."	3.95	.947
	"The adoption of cloud computing will provide sufficient backup service."	3.94	.977
	"The adoption of cloud computing meet user expectations with respect to response time, flexibility and ease of use."	3.93	.928
Security (SE)	"The security systems built into cloud computing are insufficient to protect our organizational data."	3.16	1.161
	"The traditional servers are more secure than cloud computing technology."	3.17	1.118
	"In the cloud computing environment, the confidentiality and security are poor."	3.00	1.140
	"Cloud computing service providers do not manage security controls adequately for a comprehensive system's defence."	3.18	1.158
Top Management Support (TM)	"The organization's top management provides strong leadership and engages in the process when it comes to the adoption of cloud computing."	3.60	.930
	"The organisation's management is willing to take risks (e.g. financial) involved in the adoption of cloud computing."	3.52	.988
	"Top management encourages using new emerging technology to provide e-services."	3.75	.920
	"Top management has allocated adequate financial and other resources for intention to the adoption of cloud computing."	3.58	.974

Technology Readiness (TR)	"The adoption of cloud computing will be compatible with existing hardware and software in the organisation."	3.78	.976
	"The IT technical support in the organisation has the capacity and appropriate skills to deal with the adoption of cloud computing."	3.72	1.027
	"The Internet speed of the organisation is sufficient to adopt cloud computing."	3.68	1.075
	"The technology infrastructure of our organisation is available to support cloud computing."	3.74	1.010
Regulations (RE)	"The laws and regulations in our organisation allow the adoption of new technologies."	3.63	.894
	The law and regulations in our organisation are flexible to be amended according to the emerging needs.	3.54	.991
	"The law and regulations in our organisation comply with the current cloud computing regulations."	3.59	1.009
	"The laws and regulations in our organisations support cloud computing initiatives and implementation."	3.59	.979
Competitive pressure (CP)	"Some of the organisation competitors have already started using cloud computing."	3.56	.962
	"Our organisation has experienced pressure from the competitors to adopt cloud computing."	3.64	1.012
	"Our organisation believes that adopting cloud computing will strengthen our competitiveness and improve online services offer."	3.68	1.016
Trust (TU)	"I am confident that cloud computing has legal and technological structures to adequately protect me from problems at technological level."	3.74	.913
	"I have a trust in cloud computing providers to store our sensitive information appropriately and securely."	3.77	.918
	"The cloud computing has enough safeguards to make us feel comfortable using it."	3.71	.961

	"I am confident that Our organisation's information in the cloud will not be used by a third party without our consent."	3.74	.906
	"The digital storage in cloud computing is a reliable and secure environment."	3.75	.933
Awareness (AW)	"Our organisation is fully aware of the benefits of cloud computing."	3.61	.964
	"Our organisation is familiar with the cloud computing that allows us to deliver online services based on the Internet."	3.68	1.001
	"Our organisation has a good perception of the effectiveness of cloud computing."	3.72	1.053
	"Our IT department is aware about cloud computing, but the top management does not have intention to adopt it."	3.49	1.000
	"Our organisation is aware of the disadvantages and challenges of cloud computing."	3.64	1.002
Attitude (AT)	"Adoption of cloud computing is a beneficial for our organisation."	3.92	.980
	"Adoption of cloud computing is challenging from technical perspective."	3.44	1.198
	"Adoption of cloud computing will require more effort from each employee."	3.28	1.231
	"Adoption of cloud computing will create better work dynamic in our organisation."	3.67	1.093
Adoption of cloud computing (AC)	"I have a favourable attitude toward cloud computing implementation, and I am willing to try cloud computing out shortly."	3.63	.952
	"It is likely that our organisation will take steps to adopt cloud technology in the future."	3.49	1.064
	"I strongly recommend our organisations to adopt cloud computing technology."	3.45	1.153
	"I believe that adopting cloud computing services will give us more advantages."	3.75	.950

	"Our organisation has potential adoption of cloud computing but decided not to pursue by top management at the present time"	3.44	.969
	"Our organisation completed an adoption plan but has a lack of a financial resource."	3.43	1.118

Table 5.3: Mean Distribution of The Variables

5.5 Descriptive Statistics

Descriptive statistics can be used to present and describe a range of phenomena expressed as variables or combinations of variables (Tabachnick and Fidell; 2007). Therefore, they can describe data assessments by using tables, charts and graphs to summarised percentage, mean, mode, frequency and standard deviation. Moreover, the result of this study has used descriptive statistics to present and describe the data collected in terms of the adoption of cloud computing in e-government systems and demographic profiles.

Before the advanced analysis is addressed, the next few sections (e.g. gender, IT experience, education, and age, type of organisation, type of cloud adoption) focus on the demographic characteristics of the study sample to investigate whether any of these variables had a critical impact on the adoption of new technology, specifically the adoption of cloud computing in e-government systems in Saudi government organisations.

5.5.1 Demographic profile

The demographic section of the questionnaire asked respondents to identify their gender. The survey results showed that 614 respondents (73.3%) were male and 224 (26.7%) were female, as shown in Table 5.4. These results were predictable due to the nature of Saudi society, which was discussed in Chapter 2.

Gender	Frequency	Percent
Male	614	73.3
Female	224	26.7
Total	838	100

Table 5.4: Gender of Respondent

The findings indicated that 16.2% of respondents were between 18 to 30 years old; 38.9% were between the ages of 31 and 45; 37.1% were aged between 46 and 60 years old; but only 7.8% were over 60. The total average age of the Saudi population is under 24 years, the median age being 25 years old, and over 65s forming 3% of the population (The World Fact Book, 2018). This spread of ages is reflected in the result of this study. Breakdown of age is shown in Table 5.5.

Ages	Frequency	Percent
18-30	136	16.2
31-45	326	38.9
46-60	311	37.1
Over 60	65	7.8
Total	838	100

Table 5.5: Age of Respondents

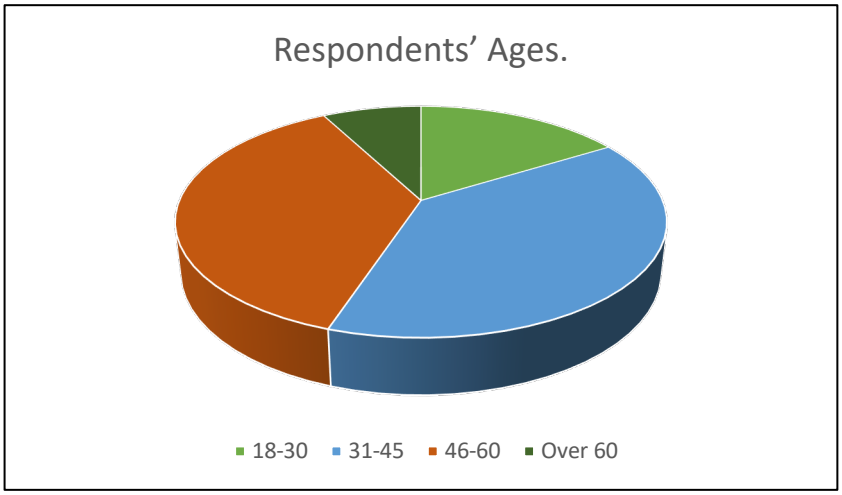

Figure 5.1: Age of Respondents

The respondents' level of education is shown in Figure 5.4; and the largest number: 71.4% (598) had a Bachelor degree. The next largest group: 22.9% (192) had a Masters degree, and only 16 respondents (1.9%) had PhDs. There were 27 respondents (3.2%) with pre- Diploma degrees and only 5 respondents (0.6%) with an education level of secondary school or less (see Table: 6.3). This reflects the general population, as the literature review showed that the

majority of Saudi citizens are well educated. This finding shows that around 96% of the respondents have postgraduate or graduate levels of education (see Table 5.6).

Education level	Frequency	Percent
Secondary school or less	5	0.6
Diploma	27	3.2
Bachelor degree	598	71.4
Master degree	192	22.9
Doctorate degree	16	1.9
Total	838	100

Table 5.6: Respondents' Levels of Education.

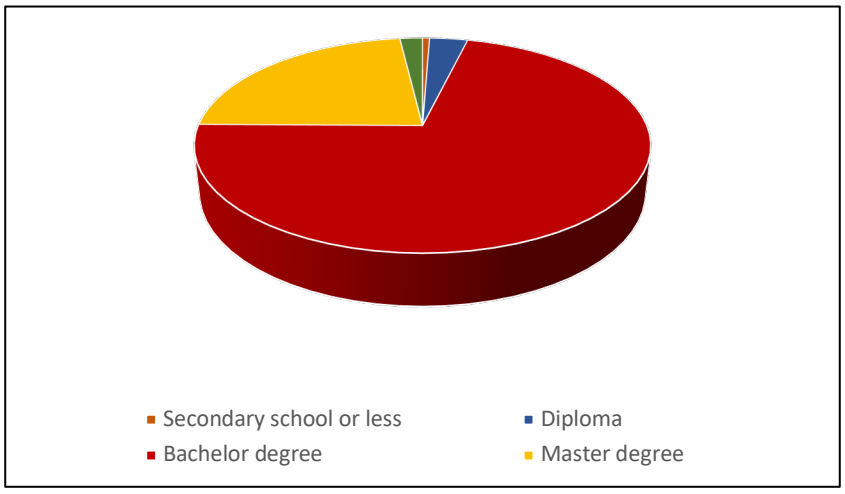

Figure 5.2: Respondents' levels of education

The frequencies of organisational sector data in Figure 5.5 reveal that a majority of respondents (20.9%) worked in financial organisations (n =175). Respondents working in the education sector (n=127) comprised 15.2 % of the respondents. Security and military organisations respondents (n=166) also had significant representation (19.8%). 15.4% worked in communication and information technology organisations (n = 129); and the smallest group (11.7%) worked in labour sector organisations (n=98). The figures are shown in Table 5.7.

Organisations	Frequency	Percent
Education Sector	127	15.2
Health Sector	143	17.1
Security and Military Sector	166	19.8
Financial Sector	175	20.9
The Communication and Information Technology Sector	129	15.4
Labour Sector	98	11.7
Total	838	100

Table 5.7: Respondents' Organisational Sector

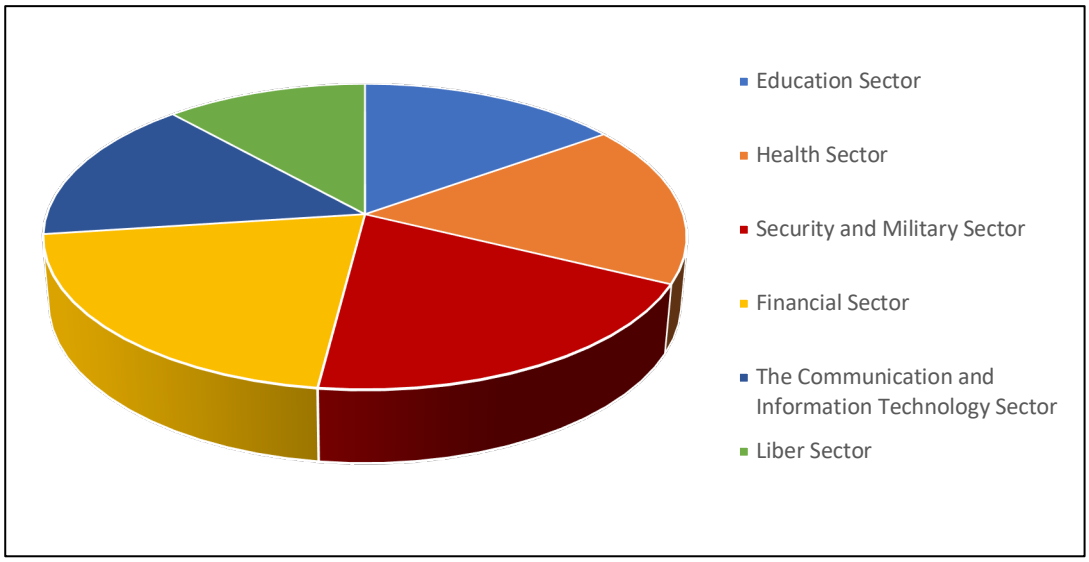

Figure 5.3: Respondents' Organisational Sector

Respondents working in organisations with less than 50 employees (n=196) represented 23.4% of respondents, while those working in organisations with (51-249) employees (n=480) represented the largest group (57.3%); and 9.7% of respondents were working in organisations with 250 – 499 employees (n=81). Respondents working in organisations with less than (500 - 999) employees (n=64) represented 7.6%, while those in organisations employing more than 1000 employees (n=17) represented 1.9% of the respondents. Figures are shown in Table 5.8.

Number of employees	Frequency	Percent
Less than 50	196	23.4
51 - 249	480	57.3
250- 499	81	9.7
500 -999	64	7.6
More than 1000	17	2.0
Total	838	100

Table 5.8: Number of Employees in the Organisation

In relation to job title, directors of governmental organizations (n=9) were least represented (1.1%), while IT directors (n=36) represented 4.3% of respondents. IT staff (n=763) were the largest group (91.1%) and those working in other organisations (n=30) represented 3.6% of respondents. Figures are shown in Table 5.9.

Position title	Frequency	Percent
Director of the government organization	9	1.1
IT Director	36	4.3
IT staff	763	91.1
Others	30	3.6
Total	838	100

Table 5.9: Respondents' Job Title in the Organisations

Data about years of experience in the IT sector demonstrate that 3.3% of respondents claimed that they had less than one year of IT experience, and 16.5% of respondents had IT experience of between one to three years. 52.4% (439) of respondents claimed they had IT experience of less than ten years; whereas 27.8% of respondents had over ten years of IT experience (see Table: 5.10). Moreover, these findings indicated that over 70% of respondents have IT experience of more than three years. Participants working in the larger organisations tended to have high levels of IT experience.

Years of IT experience	Frequency	Percent
Less 1 year	28	3.3
Less 3 years	138	16.5

Less 10 years	439	52.4
More than 10 years	233	27.8
Total	838	100

Table 5.10: Respondents' Years of Experience

The survey questions also asked about the adoption of cloud computing and thus whether the respondent had dealt with cloud computing, as well as the type of cloud computing. 14.7% (129) of respondents had worked with cloud computing and 85.3% of respondents (709) claimed they had not (see Table 5.8).

Of the 14.7% (129) working with cloud computing, those working with public cloud computing constituted 12.9% of respondents (133) and those working with private cloud computing (16) represented1.8% of respondents (see Table: 5.11). These findings indicate that there is a higher adoption rate of public cloud computing than private or other types of cloud computing. This pattern of high levels of adoption of public cloud computing might be due to the number of participants working in large organisations, as discussed earlier.

Cloud computing adoption	**Frequency**	**Percent**
Yes	129	15.4
No	709	84.6
Total	838	100

Table 5.11: Cloud Computing Adoption

Adoption of Cloud computing	**Frequency**	**Percent**
Public cloud	113	13.5
Private cloud	16	1.9
Total	129	15.4
Non adoption	709	84.6
Total	**838**	**100**

Table 5.12: Type of Cloud Computing Adoption

5.6 Data Analysis and Confirmatory Factor Analysis (CFA)

This section presented the fitness test of the Confirmatory Factor Analysis (CFA) model and identifies convergent and discriminant validity. Further, it ensured the reliability of the model before and after constraints. There was some assessment before proceeding with data analysis and testing the hypotheses, to ensure that the result for the measurement of the model revealed evidence of unidimensionality, discriminant and convergent validity and reliability. The Statistical Packages for the Social Sciences (SPSS) version 24 was used for the consistency reliability analysis, while the CFA utilized the Analysis of Moment Structure (AMOS) software version 25 to examine the fitness of the model, as discussed in Chapter 4.

5.6.1 Confirmatory Factor Analysis (CFA)

One of the theoretical patterns of the variables loading test is Confirmatory Factor Analysis (CFA), which is conducted in order to identify the relation between the actual data and the theoretical specification of the factors. The researcher can determine factors by selecting the appropriate theory being examined before obtaining any results. CFA allows the researcher to decide whether to accept or reject the theory (Hair et al., 2010).

When researchers apply a CFA, it should first measure unidimensionality before assessing the reliability and discriminant and convergent validity (Awang *et al.*, 2015). Before modeling the interrelationship in SEM, it is necessary to perform CFA for all latent constructs. Unidimensionality is an indicator of the latent construct loading for the assessment items; which should achieve 0.60 and above (Hu, 1999; Awang *et al.*, 2015).

The CFA results revealed 13 latent constructs as shown in Figure 5.6 including Relative Advantage (RA), Compatibility (CM), Complexity (CO), Service Quality (SQ), Security (SE), Top Management Support (TM), Technology Readiness (TR), Regulation (RE), Competitive pressure (CP), Trust (TU), Awareness (AW), Attitude (AT), Adoption of cloud computing (AC). There were 12 constructs including 55 items to examine the perceived effectiveness of adopting cloud computing on e-government system. CFA presented the latent variables and the items in Table 5.13 showed the results when CFA was applied for each construct related with other items.

Constructs	Factor loading Range		Factor loading Range Minimum	Code for Items
	Minimum			
Relative Advantage (RA)	0.44	0.44	4	RA1, RA2 .RA3, RA4
Compatibility (CM)	0.65	0.65	4	CM1, CM2, CM3, CM4
Complexity (CO)	0.60	0.60	4	CO1, CO2, CO3, CO4
Service Quality (SQ)	0.69	0.69	4	SQ1, SQ2, SQ3, SQ4
Security (SE)	0.72	0.72	4	SE1, SE2, SE3, SE4
Top Management Support (TM)	0.55	0.55	4	TM1, TM2, TM3, TM4
Technology Readiness (TR)	0.55	0.55	4	TR1, TR2, TR3, TR4
Regulation (RE)	0.61	0.61	4	RE1, RE2, RE3, RE4
Competitive pressure (CP)	0.68	0.68	3	CP1, CP2, CP3
Trust (TU)	0.64	0.64	5	TU1, TU2, TU3, TU4, TU5
Awareness (AW)	0.41	0.41	5	AW1, AW2, AW3, AW4, AW5
Attitude (AT)	0.50	0.50	4	AT, AT2, AT3, AT4
Adoption of cloud computing (AC)	0.56	0.56	6	AC1, AC2, AC3AC4, AC5, AC6

Table 5.13: Constructs and Associated Items

Most of the factors loading on individual items in Figure 5.6 obtained a value of 0.60. However, other factors loading on individual items scored below 0.60, which indicated they should be removed from the model before the next stage of analysis. Awang et al., (2015) believe that: “in order to ensure unidimensionality of a measurement model, any item with a low factor loading less than 0.60 should be deleted”.

Standardized factor loadings, as called in AMOS, or standardized regression weights refer to the relationship between indicators and individual latent variables. The standardised estimates parameters range between -1.0 and +1.0. According to Hair et al. (2010) there should be a minimum common threshold of 0.5 for estimates of all factor loading. The standardised loading estimates for all factors are shown in Table 5.13.

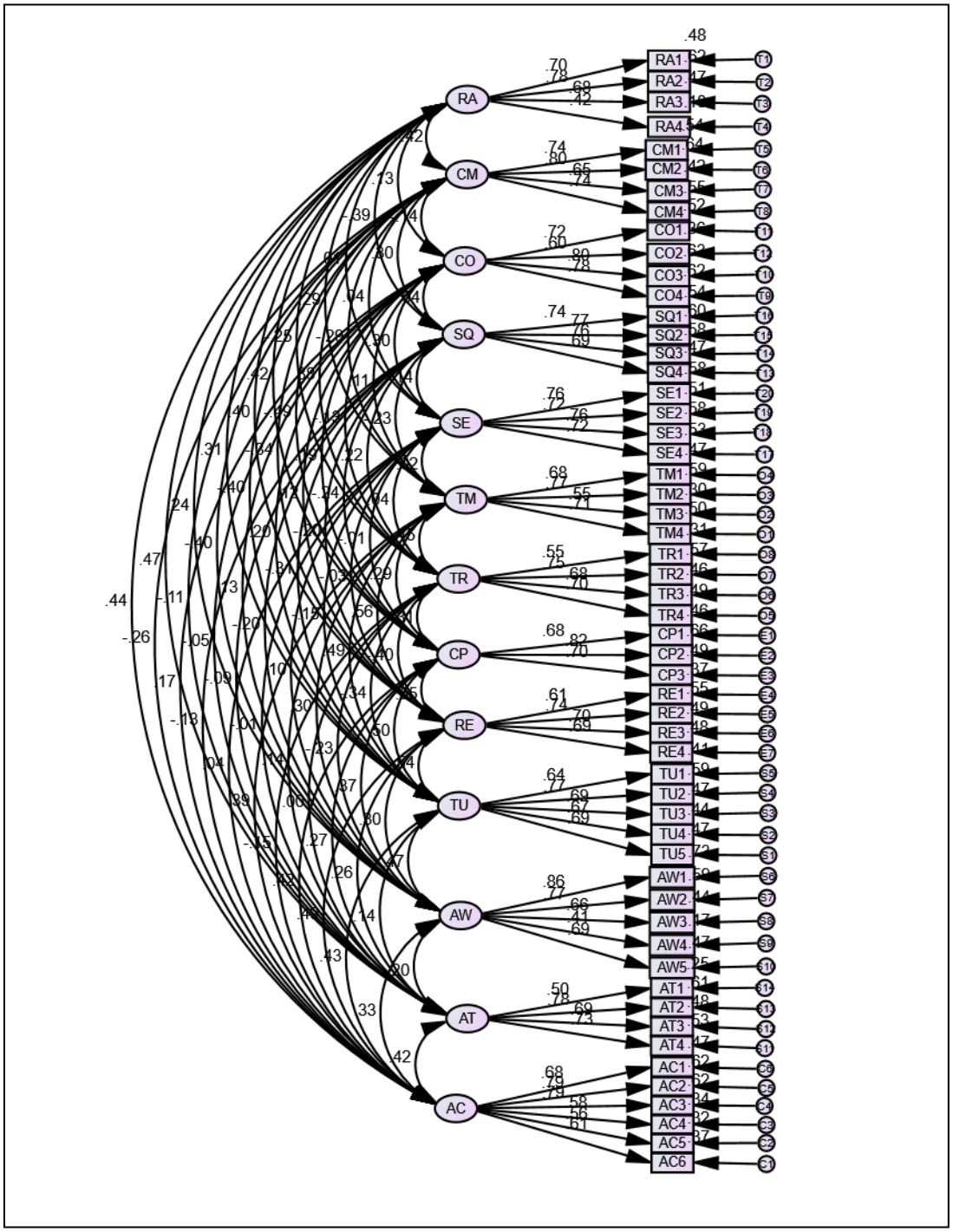

Figure 5.4: Confirmatory Factor Analysis (CFA) for all constructs

Therefore, as shown above in Figure 5.4, the loading estimates statistically confirm that the measurement model has a high loadings rate.

5.7 Model Validity Measures

RMSEA measurement is appropriate to assess the discrepancy per degree of freedom (Steiger, 2002). According to Anderson and Gerbing (1992) model validity is recommended to measure the overall model fit, including construct validity, convergent validity, and discriminant validity. However, model fit indices can be measured only by construct validity. In addition, it is not necessary to achieve validity for both convergent and discriminant validity (Jaccard et al., 1990) recommended obtaining a model fit, should involve CFI, TLI and the GFI. At this stage, construct validity still not be achieved to improve the reliability and accuracy of the model fit.

This study has achieved a chi-squared ($\chi 2$) value, which is equal to 1476.5 with 824 degrees of freedom with less than 0.001 of the value of the probability. However, both the value of Chi-square $\chi 2$ and the p-value, which is more sensitive to sample size impact model fit. While this study has met the ratio value. it achieved a value of CMIN/DF equal to 1798.5. Moreover, the next section reveals a good overall model fit based on the measurement of model fit indices. There were several indices and standards implemented to assess the model fit (Hu and Bentler, 1999). These assessments are shown in Table 5.14 as follows:

Indices and standards	**Result**
Goodness-of-Fit Index (GFI) Normed Fit Index (NFI)	≥ 0.90
Adjusted Goodness-of-Fit Index (AGFI)	≥ 0.80
Index of Fit (IFI) Tucker–Lewis index (TLI) Equivalent to the non-normed fit index	≥ 0.95
Comparative Fit Index (CFI)	≥ 0.90
Root Mean Square Error of Approximation (RMSEA)	< than 0.08 for a good fit < than 0.05 for an excellent fit

Table 5.14: Indices and Standards Assessment of Model Fit

5.7.1 Convergent Validity

In the convergent validity measurement, the model fit should be excellent, and the value of AVE must be over 0.5 (Hair et al., 2010). The AVE indicates whether answers to question-statements were sufficiently related to the latent variables. Awang *et al.* (2015) and Gaskin and Lim (2016) suggested that the categories of acceptable model fit were as follows: the value of CMIN/DF should be between 1 and 5, with the value of CFI ≥ 0.90, the value of RMSEA ≤ 0.06, and the value of SRMR ≤ 0.08.

The results of the model fit measures of this study have been achieved as CMIN/DF = 2.050, CFI = 0.918, SRMR = 0.100, RMSEA = 0.043 and P Close = 1.000. However, the model isn't fit at this stage because of the measures have not yet met the requirement of model fit as indicated in Table 5.15. Based on the CFA results and AVE for all constructs results the model isn't appropriate for further analysis due to the minimum required level not being achieved. thus, the model fit needs more improvement to achieve the specified level.

Measure	**Chi-square (CMIN) / Degrees of freedom (DF)**	**Comparative fit index (CFI)**	**Standardised root mean square residual (SRMR)**	**Root mean square error of approximation (RMSEA)**	**P of Close Fit (PClos)**
Estimate	2.050	0.918	0.043	0.035	1.000
Threshold	Between 1 and 5	>0.95	<0.08	<0.06	>0.05
Interpretation	Good fit	Accepta-ble	Good fit	Good fit	Good fit

Table 5.15: Model Fit Measures with All Constructs

The table above shows the results for all constructs before constraints. The CFA results confirm that the model should achieve the minimum requirement to be acceptable for further analysis, as discussed early. So, the following section presents the standard minimum for re-liability and validity.

5.7.2 Discriminant Validity

Discriminant validity refers to the extent of the distinction between a construct and other constructs. Hair et al. (2010) suggest associating the squared correlation estimates value with (AVE) values for any two constructs. Moreover, the AVE value should be higher than the squared correlation estimates. This study revealed no concerns regarding discriminant validity, as presented in Table 5.16. The researcher used the cross-loadings matrix and Fornell-Larker criterion (Hair et al., 2011). Moreover, the CFA measurement for the model presented an acceptable achievement of both convergent and discriminant validity.

	RA	CM	CO	SQ	SE	TM	TR	RE	AC	CP	TU	AW	AT
RA	**0.661**												
CM	-0.424	**0.735**											
CO	0.130	-0.144	**0.729**										
SQ	-0.386	0.298	0.042	**0.740**									
SE	0.008	0.042	-0.298	-0.144	**0.741**								
TM	0.291	-0.291	0.113	-0.231	-0.018	**0.681**							
TR	-0.246	0.384	-0.125	-0.218	0.043	-0.451	**0.676**						
RE	0.400	-0.341	0.116	-0.196	-0.026	0.562	-0.404	**0.687**					
AC	0.438	-0.256	0.172	-0.127	0.043	0.388	-0.146	0.494	**0.675**				
CP	0.424	-0.495	0.189	-0.237	-0.007	0.294	-0.311	0.547	0.424	**0.733**			
TU	0.310	-0.397	0.199	-0.306	-0.147	0.492	-0.338	0.540	0.431	0.499	**0.691**		
AW	0.244	-0.401	0.126	-0.200	0.096	0.298	-0.232	0.298	0.330	0.366	0.469	**0.694**	
AT	0.474	-0.109	0.054	-0.088	-0.014	0.139	0.003	0.258	0.420	0.270	0.144	0.203	**0.684**

Table 5.16: Construct Correlation Matrix (Standardized)

Furthermore, the table above showed that the CFA confirms discriminant validity, as constructs in the model, is highly correlated to the adoption of cloud computing for e-government system. In this study, the construct correlation matrix showed other related values less than the diagonal values in which the constructs show acceptable discriminant validity. The results of the square root of AVE value for all latent constructs were greater than the correlation between these constructs, as shown in Table 5.16. Thus, the findings revealed the discriminant validity of the latent constructs in this study.

5.7.3 Reliability and Construct Validity

The Composite Reliability (CR) and Cronbach's alpha were applied to measure reliability and construct validity and confirm the data reliability prior to making any advanced analysis. According to Hair *et al.*, (2011) reliability is "an assessment of the degree of consistency between multiple measurements of a variable". Reliability refers to results that have achieved dependability and consistency. In this context, consistent results can be predicted to give the reliability of any survey instrument. An assessment for consistency refers to the extent of measurements for the same point on two different scales (Hair *et al.*, 2011); in other words, the responses of a particular instrument should have the same answer over time, otherwise they are not considered reliable. This study measured reliability by calculating Cronbach's alpha, which should be over 0.70. Churchill (1979) claims that "coefficient alpha absolutely should be the first measure one calculates to assess the quality of the instrument". Additionally, there was another measurement for reliability applied in this study called composite reliability (CR). The CR should over 0.70 which is considered as acceptable composite reliability.

Table 5.17 presents reliability and construct validity. Chin et al. (2003) suggested comparing the CR and Cronbach's alpha, as CR is more accurate, due to the loadings or errors of the items being the same. CR and Cronbach's Alpha tests should achieve a standard lowest threshold of 0.60 and 0.70 respectively. Furthermore, the average variance extracted (AVE) is used to identify variation in the latent variables by random measurement error. Therefore, the AVE estimates of average should be ranged at 0.5 or higher. The result of the AVE in this study achieved from 0.5 to 0.77, which exceeds the recommended lowest requirements as shown in Table 5.16. One of the other recommended criteria measurements for discriminant validity is the Maximum Shared Squared Variance (MSV) which must achieve less than the AVE result (Hair *et al.*, 2011). The MSV results indicated in Table 5.17 showed the measurement model is valid. The following formula was used for the calculation of Average Variance Extracted

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

- *Li* refers to the standardised factor loading.
- *i* refers to the number of items.

Constructs	Cronbach (above 0.7)	CR	AVE	MSV	Convergent validity CR > AVE AVE > 0.50	Discriminant validity MSV < AVE
RA	.742	0.749	*0.437*	0.225	*No*	Yes
CM	.820	0.824	0.540	0.245	Yes	Yes
CO	.817	0.818	0.532	0.089	Yes	Yes
SQ	.828	0.829	0.548	0.149	Yes	Yes
SE	.829	0.830	0.549	0.089	Yes	Yes
TM	.769	0.774	*0.464*	0.316	*No*	Yes
TR	.762	0.768	*0.456*	0.204	*No*	Yes
RE	.779	0.781	*0.472*	0.316	*No*	Yes
AC	.830	0.832	*0.456*	0.244	*No*	Yes
CP	769	0.776	0.537	0.299	Yes	Yes
TU	.818	0.820	*0.477*	0.292	*No*	Yes
AW	.804	0.816	*0.481*	0.220	*No*	Yes
AT	.769	0.774	*0.468*	0.225	*No*	Yes

Table 5.17: Reliability and Construct Validity

The results for convergent and discriminant validity and reliability revealed that the convergent validity not met the requirement level, as shown in the tables above. However, there was adequate evidence that the CR and Cronbach's alpha had exceeded the minimum required level of 0.60, approving the model reliability. The average variance extracted (AVE) did not achieve the minimum requirement, which need some improvement by co-varying error terms or either deleting the affected factor loadings or running the model one at a time until obtaining a new measurement model that fits.

5.8 Confirmatory Factor Analysis (CFA) after Constraints

By deleting the redundant items or those with low factor loading and the covarying error terms, the poor fit initial model shown in Figure 5.4 has been transformed into a good fit

model, as shown in Figure 5.5, which presents the CFA model after the constraints. At this stage, the model fit failed to meet the required level. Thus, modifications to the Modification Indices (MI) were made. Several items were deleted one at a time, which should achieve some modifications, due to co-varying the error terms and achieving the minimum required level of fitness index including modifications.

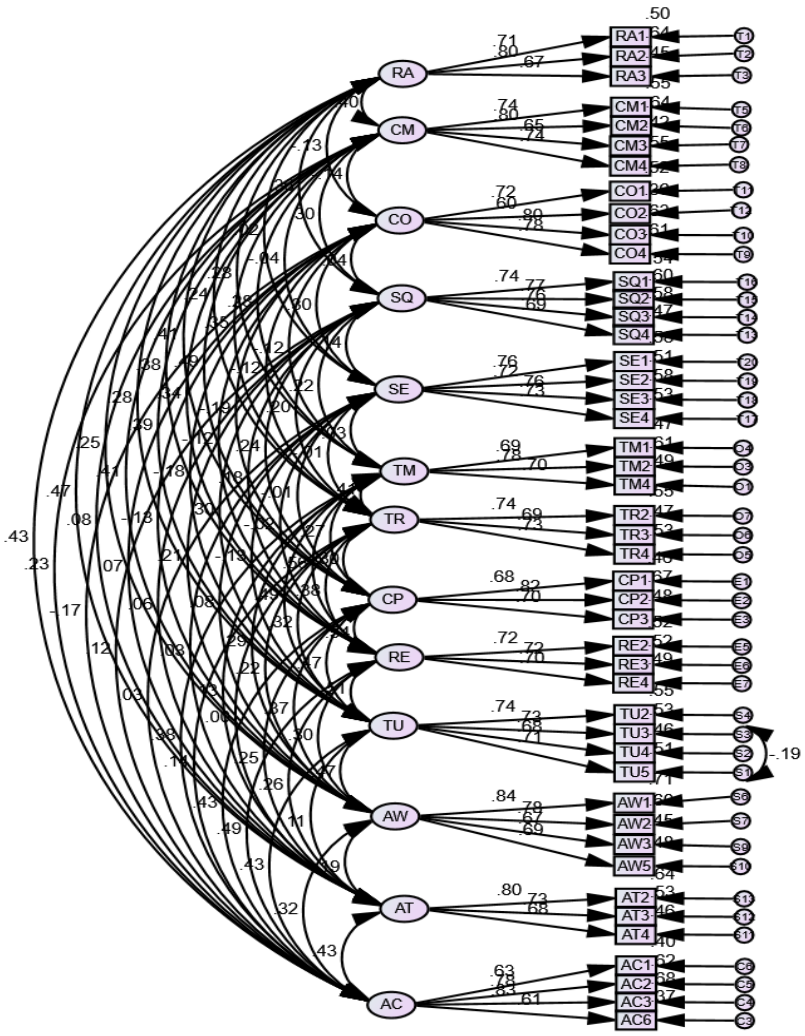

Figure 5.5: Confirmatory Factor Analysis (CFA) for all constructs after constraints

In addition, a modification indices assessment was made to identify how each item was associated with other constructs. Moreover, TU5 was indicated as being connected to other constructs with a high residual variance. The construct validity and improvements to the model fit should not be affected by removing the item with the lowest value.

5.8.1 Convergent Validity

As discussed early, the model fit should obtain appropriate fit to achieve convergent validity. The AVE must be over 0.50. Furthermore, if a study that has collected data exceeding 250 responses, the chi-square requires to be lower than 3 to revealed model fit (Hair et al., 2010). This study has collected data from 838 participants with the chi-square value 1. 758. All measures the model fit, including CFI = 0.953, SRMR = 0.036, RMSEA = 0.030. and AVE has achieved the standard a value lower than 0.50; thus, attaining the required level of the model fit. Table 5.18 shows these results with the required level of model fit.

Measure	Chi-square (CMIN) / Degrees of freedom (DF)	Comparative fit index (CFI)	Standardised root mean square residual (SRMR)	Root mean square error of approximation (RMSEA)	P of Close Fit (PClos)
Estimate	1.758	0.953	0.036	0.030	1.000
Threshold	Between 1 and 5	>0.95	<0.08	<0.06	>0.05
Interpretation	Good fit	Good fit	Good fit	Good fit	Good fit

Table 5.18: Model Fit Indices

The above table presents the results of the model fit measures for the adoption of cloud computing for e-government in Saudi organisations and has achieved the minimum requirement. as mentioned earlier, to assess the model fit, that initially found chi-square (x^2) and normed chi-square tests did not take into account adequate evidence of model fit. This study thus achieved three to four fit indices of good fit for all assessments of the model fit.

5.8.2 Discriminant Validity

As stated earlier, three criteria determine discriminant validity, namely: Maximum Shared Squared Variance (MSV), the Fornell-Larcker test, and Average Shared Squared Variance (ASV) (Hair et al., 2010). The AVE of the constructs achieved a value greater than the value of correlation estimates, as presented in Table 5.19. This study compares the value of the absolute correlation through the constructs and the square root of the AVE by a construct. However, the model fit is not considered as discriminant validity if the correlations are lower than the square root of the AVE by a construct (Fornell and Larcker, 1981). Furthermore, the

square roots of the AVEs *"diagonal cells"* show a score higher than the correlations between constructs which refer to discriminant validity.

	RA	CM	CO	SQ	SE	TM	TR	RE	AC	CP	TU	AW	AT
RA	**0.728**												
CM	-0.401	**0.735**											
CO	0.129	-0.144	**0.729**										
SQ	-0.359	0.298	0.042	**0.740**									
SE	0.021	0.042	-0.298	-0.144	**0.741**								
TM	0.277	-0.278	0.124	-0.221	-0.029	**0.724**							
TR	-0.237	0.353	0.129	0.200	0.014	-0.413	**0.719**						
RE	0.379	-0.339	0.121	-0.182	-0.016	0.557	-0.384	**0.714**					
AC	0.427	-0.231	0.166	-0.117	0.033	0.382	-0.143	0.490	**0.718**				
CP	0.410	-0.494	0.189	-0.237	-0.007	0.271	-0.296	0.544	0.430	**0.733**			
TU	0.281	-0.388	0.184	-0.297	-0.129	0.486	-0.321	0.507	0.434	0.468	**0.715**		
AW	0.250	-0.406	0.134	-0.208	0.085	0.294	-0.222	0.296	0.317	0.374	0.473	**0.748**	
AT	0.473	-0.082	-0.069	-0.064	0.028	0.131	0.001	0.256	0.426	0.251	0.114	0.189	**0.737**

Table 5.19: Discriminant Validity

As clearly shown in Table 5.19 above, the model fit measures of the adoption of cloud computing for e-government in Saudi organisations by comparing the squared estimates of correlation for two latent variables with the values of AVE. The results of this study revealed the square roots of the AVEs "diagonal cells" show a score higher than the correlations between constructs which means there are no issues with discriminant validity (see Table 5.18). Therefore, these results indicate that the CFA model measurement was acceptable in convergent and discriminant validity.

5.8.3 Reliability and Construct Validity

The reliability and constructs validity of this study was tested by applying CR and Cronbach's alpha test. Both CR and Cronbach's alpha have achieved the minimum requirement threshold of 0.60 and 0.70. The convergent and discriminant validity and reliability results indicate that both the convergent and discriminant validity outcomes have met the required level, as shown in Table 5.20. This means that the model indicates the acceptability contrast and ensures that all items are free from any errors (Hair et al., 2010).

Constructs	Cronbach (above 0.7)	CR	AVE	MSV
RA	.769	.770	0.530	0.224
CM	.820	.824	0.540	0.244
CO	.809	.812	0.523	0.089
SQ	.82	.829	0.549	0.129
SE	.829	.821	0.549	0.089
TM	.765	.777	0.525	0.310
TR	.761	.762	0.517	0.170
RE	.757	.757	0.510	0.310
AC	.801	.807	0.515	0.241
CP	.769	.776	0.537	0.296
TU	. 796	.807	0.511	0.257
AW	.831	.835	0.560	0.224
AT	.775	.781	0.544	0.224

Table 5.20: Reliability and Construct Validity

Based on the above, the results of the analysis, clearly show that all the items listed in Table 5.20 on each construct of the model fit measures of the adoption of cloud computing for e-government systems in Saudi organisations model has achieved the minimum requirement of reliability and has enough measurement properties. Overall, assessment of the measurement model revealed that Composite Reliability (CR) and Cronbach's alpha were over .70, and Average Variance Extracted (AVE) achieved the minimum requirement level of .50.

Moreover, the Maximum Shared Squared Variance (MSV) is less than the results of AVE, which also implies that the measurement model is valid. Moreover, the results for unidimensionality, convergent validity, discriminant validity and reliability demonstrate solid evidence of the reliability and validity of the model, such that it can proceed with further analysis.

In results of validity and reliability for both the convergent and discriminant measures, as shown in Table 5.21 below, have met the required level. All the factors in the model fit measures of the adoption of cloud computing for e-government in Saudi organisations had significant loadings greater than 0.60 on their respective constructs.

Constructs	Items code	Items	Factor loading
Relative Advantage (RA)	**RA1**	"Adoption of cloud computing in our organisation will enable us to reduce the operating costs."	**.71**
	RA2	"Adoption of cloud computing will improve the performance of our organization."	**.80**
	RA3	"The use of cloud computing in our organisation will help us to accomplish tasks more quickly.	**.67**
Compatibility (CM)	**CM1**	Adoption of cloud computing will improve our online services delivery."	**.74**
	CM2	"Adopting of cloud computing can be easily integrated into existing IT infrastructure."	**.80**
	CM3	"Adopting of cloud computing is compatible with the systems that are already in use.	**.65**
	CM4	Adopting of cloud computing is compatible with all aspects of our organisation's existing format, interface, and other structural data."	**.74**
Complexity (CO)	**CO1**	"Adopting of cloud computing fits well with our online services provided."	**.72**
	CO2	"With the adoption of cloud computing, there will be some complexity of maintaining cloud computing platform."	**.60**
	CO3	"With the adoption of cloud computing, it will be more difficult to develop new solutions / extend the existing functionality of the system."	**.80**
	CO4	"With the adoption of cloud computing, more time is required by IT staff to perform their normal duties."	**.76**
Service Quality (SQ)	**SQ1**	"Learning to operate in the cloud computing environment is complex for employees."	**.74**
	SQ2	"The adoption of cloud computing will provide a high service quality with high efficiency."	**.77**
	SQ3	"The adoption of cloud computing will deliver better online services."	**.76**
	SQ4	"The adoption of cloud computing will provide sufficient backup service."	**.69**
Security (SE)	**SE1**	"The adoption of cloud computing meet user expectations with respect to response time, flexibility and ease of use."	**.76**
	SE2	"The security systems built into cloud computing are insufficient to protect our organizational data."	**.72**

	SE3	"The traditional servers are more secure than cloud computing technology."	**.76**
	SE4	"In the cloud computing environment, the confidentiality and security are poor."	**.73**
Top Management Support (TM)	**TM1**	"Cloud computing service providers do not manage security controls adequately for a comprehensive system's defence."	**.69**
	TM2	"The organization's top management provides strong leadership and engages in the process when it comes to the adoption of cloud computing."	**.78**
	TM4	"The organisation's management is willing to take risks (e.g. financial) involved in the adoption of cloud computing."	**.70**
Technology Readiness (TR)	**TR2**	"Top management encourages using new emerging technology to provide e-services."	**.74**
	TR3	"Top management has allocated adequate financial and other resources for intention to the adoption of cloud computing."	**.69**
	TR4	"The adoption of cloud computing will be compatible with existing hardware and software in the organisation."	**.73**
Regulation (RE)	**RE2**	"The IT technical support in the organisation has the capacity and appropriate skills to deal with the adoption of cloud computing."	**.72**
	RE3	"The Internet speed of the organisation is sufficient to adopt cloud computing."	**.72**
	RE4	"The technology infrastructure of our organisation is available to support cloud computing."	**.70**
Competitive pressure (CP)	**CP1**	"The laws and regulations in our organisation allow the adoption of new technologies."	**.68**
	CP2	The law and regulations in our organisation are flexible to be amended according to the emerging needs.	**.82**
	CP3	"The law and regulations in our organisation comply with the current cloud computing regulations."	**.70**
Trust (TU)	**TU2**	"The laws and regulations in our organisations support cloud computing initiatives and implementation."	**.74**
	TU3	"Some of the organisation competitors have already started using cloud computing."	**.73**
	TU4	"Our organisation has experienced pressure from the competitors to adopt cloud computing."	**.68**
	TU5	"Our organisation believes that adopting cloud computing will strengthen our competitiveness and improve online services offer."	**.71**

Awareness (AW)	**AW1**	"I am confident that cloud computing has legal and technological structures to adequately protect me from problems at technological level."	**.84**
	AW2	"I have a trust in cloud computing providers to store our sensitive information appropriately and securely."	**.78**
	AW3	"The cloud computing has enough safeguards to make us feel comfortable using it."	**.67**
	AW5	"I am confident that Our organisation's information in the cloud will not be used by a third party without our consent."	**.69**
Attitude (AT)	**AT2**	"The digital storage in cloud computing is a reliable and secure environment."	**.80**
	AT3	"Our organisation is fully aware of the benefits of cloud computing."	**.73**
	AT4	"Our organisation is familiar with the cloud computing that allows us to deliver online services based on the Internet."	**.68**
Adoption of cloud computing (AC)	**AC1**	"Our organisation has a good perception of the effectiveness of cloud computing."	**.64**
	AC2	"Our IT department is aware about cloud computing, but the top management does not have intention to adopt it."	**.78**
	AC3	"Our organisation is aware of the disadvantages and challenges of cloud computing."	**.83**
	AC6	"Adoption of cloud computing is a beneficial for our organisation."	**.61**

Table 5.21: Factor Loading for All Construct

5.8.4 Construct Reliability (Composite)

Both Construct reliability and Cronbach's alpha are similarly applied to make sure that all variables are internally consistent according to Cronbach's alpha. As revealed in Table 5.21, the reliability of the study constructs is indicated as between 0.75 and 0.80. Therefore, the study constructs exceed the commonly accepted estimate of 0.70 in internal consistency. The composite reliabilities are shown in Table 5.22 below for all constructs model estimation. All construct values for the composite reliability of the measurement model achieved over 0.7. At this stage, the researcher was able to apply the formulation of the final structural/path model. This study used the formula below to calculate composite reliability (Raykov, 1997).

$$CR = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + (\sum \epsilon_i)}$$

- λ (lambda) means the standardized factor loading for item (i).
- ε means the respective error variance for item (i).
- The error variance (*εi*) is estimated based on the value of the standardized loading (λ):

$$\epsilon_i = 1 - \lambda_i^2$$

Construct		Standardized factor loading	Error Variance	Construct reliability
Relative Advantage (RA)	RA1 ← RA	.708	0.548	.770
	RA2 ← RA	.797	0.365	
	RA3 ← RA	.672	0.499	
Sum		2.177	1.412	
Sum square		4.739		
Compatibility (CM)	CM1← CM	.739	0.454	0.824
	CM2 ← CM	.80	0.360	
	CM3 ← CM	.648	0.580	
	CM4 ← CM	.744	0.446	
Sum		2.931	1.84	
Sum square		8.590		
Complexity (CO)	CO1← CO	.673	0.547	0.812
	CO2 ← CO	.601	0.639	
	CO3 ← CO	.831	0.309	
	CO4 ← CO	.764	0.416	
Sum		2.869	1.911	
Sum square		8.231		
Service Quality (SQ)	SQ1← SQ	.735	0.459	0.829
	SQ2 ← SQ	.775	0.4	
	SQ3 ← SQ	.761	0.421	
	SQ4 ← SQ	.686	0.529	
Sum		2.969	1.801	
Sum square		8.814		
Security (SE)	SE1 ← SE	.744	0.447	0.817

	SE2 ← SE	.712	0.493	
	SE3 ← SE	.747	0.441	
	SE4 ← SE	.703	0.506	
Sum		2.906	1.887	
Sum square		8.444		
Top Management Support (TM)	TM1 ← TM	.685	0.531	. 0.777
	TM2 ← TM	.784	0.385	
	TM4 ← TM	.728	0.47	
Sum		2.196	1.574	
Sum square		4.826		
Technology Readiness (TR)	TR2 ← TR	.740	0.452	0.762
	TR3 ← TR	.688	0.527	
	TR4 ← TR	.728	0.470	
Sum		2.156	1.449	
Sum square		4.648		
Competitive pressure (CP)	CP1 ← CP	.678	0.540	0.776
	CP2 ← CP	.817	0.333	
	CP3 ← CP	.696	0.516	
Sum		2.191	1.389	
Sum square		4.800		
Regulation (RE)	RE2 ← RE	.723	0.477	0.757
	RE3 ← RE	.722	0.479	
	RE4 ← RE	.697	0.514	
Sum		2.142	1.47	
Sum square		4.588		
Trust (TU)	TU2 ← TU	.741	0.451	0.807
	TU3← TU	.726	0.473	
	TU4 ← TU	.678	0.540	
	TU5 ← TU	.712	0.493	
Sum		2.857	1.957	
Sum square		8.162		
Awareness (AW)	AW1 ← AW	.845	0.286	0.835
	AW2 ← AW	.776	0.398	
	AW3 ← AW	.668	0.554	
	AW5 ← AW	.692	0.521	
Sum		2.981	1.759	

Sum square		8.886		
Attitude (AT)	AT2 ← AT	.800	0.360	0.781
	AT3 ← AT	.726	0.473	
	AT4 ← AT	.681	0.536	
Sum		2.207	1.369	
Sum square		4.870		
Adoption of cloud computing (AC)	AC1 ← AC	.631	0.602	0.807
	AC2 ← AC	.825	0.319	
	AC3 ← AC	.784	0.385	
	AC6 ← AC	.606	0.633	
Sum		2.846	1.939	
Sum square		8.099		

Table 5.22: Composite Reliabilities of The Measurement Model

5.9 Structural Model Assessment

The research hypotheses were examined by the structural modelling tests that identify the relationships in the model were empirically examined as follows:

5.15.1 Procedure and assessment criteria

When all assessment of the measurement model had been successful; the structural model was assessed to explore the relationships between the constructs of the hypothesized theoretical model. There is a difference between the structural model and the measurement model. The measurement model emphasises assessment which indicates the relationships between constructs, and the structural model has measured variables to show the significance of the relationships between constructs. The significance of the hypothesized relationships between the constructs has been designed using causal arrows, as presented in the TOE conceptual model. Figure 5.7 shows the full proposed structural model, incorporating the factor structures and the hypothesized relationships. In general, the aim of testing hypotheses is to determine how predictors (independent variables) provide an explanation of the dependent variables (Hair et al., 2006). Generally, the model specified Relative Advantage (RA), Compatibility (CM), Complexity (CO), Service Quality (SQ), Security (SE), Top Management Support (TM), Technology Readiness (TR), Regulation (RE), Competitive pressure (CP), Trust (TU), Awareness (AW), and Attitude (AT), as exogenous (independent) constructs, Adoption of

cloud computing (AC) was specified as the endogenous (dependent) construct, as shown in Figure 5.7.

The assessment procedure for the structural model utilizes assessments such as model fit indices and the standardized path coefficients. These assessments have explored which hypothesised relationships are supported or unsupported. The criteria for the model fit indices adopted in this section were similar to those in the previous section (see Section 5.4.2). To confirm which the hypothesized relationships have been supported. the requirements of standardized path coefficients must be significant at the $p < 0.05$ level and greater than 0.30 to be considered meaningful (Byrne, 2001). The structural model assessment results are presented in the next section.

5.10 Structural model results.

Table 5.17, summarized the Fit Indices, as discussed earlier, while the structural model was shown in Figure 5.7. Overall, there showed a good level of model fit: ($\chi^2 = 1.756$, $df = 910$, GFI = 0.923, CFI = 0.953, SRMR = 0.036, and RMSEA = 0.030). Furthermore, the results of AVE for all constructs, provided in Table 5.17, indicate the standard achieved the minimum required level of 0.50. All standardised loading estimates (λ) for items exceeded 0.5. There are no negative the error variances achieved, so there are related positive variances.

As a result of the assessment of the structural model, the developed conceptual model was mostly supported by the data; 10 out of the 12 relationships were supported. However, for greater improvement and enhancement, the model was refined in order to identify the final model that best fitted and explained the research data.

5.10.1 Statistical Analysis and Hypotheses Testing

The descriptive analysis results of the data collected were discussed in the previous section (5.3) regarding the adoption of cloud computing in e-government systems in government organisations. The results indicate the influence of critical factors on the adoption of cloud computing. This section attempts to interpret the analysis of the data in detail by identifying the relationships between critical factors influencing the adoption of cloud computing in e-government organisations, and whether the hypotheses are supported or unsupported.

5.10.1.1 Relative Advantage

The relative advantage of cloud computing for Saudi e-government was measured by a total of 4 items. The first CFA showed that the range model fit was acceptable. Different criteria were used to determine model fit. The findings were all items with loadings of over 0.5, except RA4 which had less than 0.5. The second analysis removed RA4 and running CFA showed the model had good fit. As discussed earlier, the confirmatory factor analysis for the relative advantage construct is shown in Figure 5.3 that looked at the overall model fit, and the results are presented in Table 5.23. The researcher found that RA has a significant positive effect on the adoption of cloud computing for e-government systems. There is a moderately positive correlation between RA and AC. Table 5.23 shows that all obtained values including critical ratio for each item was (>=1.96), values of standardized regression weight were (>0.50) and squared multiple correlations were over (0.30). Standardized regression weights less than (0.50) and squared multiple correlations less than (0.30) were well within the range which indicated that the model was fit and acceptable ($\beta = .218$, $p<0.006$). This is related to hypothesis H1 which was stated as following:

H1: Perceived relative advantages have a direct and positive influence on the intention to adopt cloud computing for e-government systems. Moderately Supported.

Structural Relation			Regression Weight	Standard Error (S.E.)	Critical ratio (C.R.)	P value
AC	**←**	**RA**	**.218**	**.079**	**2.763**	**.006****

Table 5.23: Analysis of Hypothesis Path for Relative Advantage

5.10.1.2 Compatibility

The compatibility of the cloud with Saudi e-government was measured by a total of 4 items. The first CFA was run to check if the results reflected a good model fit by using different criteria to determine the level of model fit. The descriptive analysis results can be interpreted as indicating that the CM factor had an insignificant effect on adopting the cloud computing for e-government systems. As shown in Table 5.24, the relationship between the CM factor and the adoption of cloud computing for e-government was assessed statistically and it was

found that there was an insignificant correlation between CM and AC (β = .065, p<0.293). Table 5.24 shows that all obtained values including critical ratio for each item was not higher than or equal to1.96, the values of standardized regression weight was (>0.50) and squared multiple correlations were over (0.30). However, the result of the descriptive analysis showed that there was no indication of any level of influence on adopting cloud computing in e-government systems. This result is due to the government sector having a high level of support from the top government. This reflects on IT departments that should have an appropriate IT infrastructure to meet the requirements for government transactions. Thus, the descriptive analysis findings for this factor and the correlation result showed that the hypothesized positive relationship was not supported (H2).

H2: Higher Compatibility positively influences the intention to adopt cloud computing for e-government systems. Rejected

Structural Relation			Regression Weight	Standard Error (S.E.)	Critical ratio (C.R.)	P value
AC	**←**	**CM**	**.065**	**.062**	**1.051**	**.293**

Table 5.24: Analysis of Hypothesis Path for Compatibility

5.10.1.3 Complexity

The complexity of adopting of cloud computing for Saudi e-government system was measured with a total of 4 items. The first CFA showed that the range model fit was good. Moreover, there were different criteria used to identify the level of model fit. The result of analysis demonstrated that loadings for all items were over 0.5, and it was a good model fit. Moreover, the confirmatory factor analysis for the complexity construct showed that items loadings were higher than 0.5. which means including all of the items in analysis. The results presented in Table 5.25 show there was positive correlation between CO and AC. The descriptive analysis result revealed that there was a moderate relationship and a positive influences correlation CO and AC (β = .159, p<0.009). Table 5.25 shows that all obtained values including critical ratio for each item was (>=1.96), values of standardized regression weight was (>0.50) and squared multiple correlations were over (0.30). Standardized regression weights less than (0.50) and squared multiple correlations less than (0.30) were well within the range which indicated that

the model was fit and acceptable. Thus, the descriptive analysis findings for this factor and the correlation result indicated that there was support for the hypothesized positive relationship which was stated as follows:

H2: less Complexity negatively influences the intention to adopt cloud computing for e-government systems. Moderately Supported

Structural Relation			Regression Weight	Standard Error (S.E.)	Critical ratio (C.R.)	P value
AC	**←**	**CO**	**.159**	**.061**	**2.610**	**.009****

Table 5.25: Analysis of Hypothesis Path for Complexity

5.10.1.4 Service Quality

The service quality generated by the adopting of cloud computing in Saudi e-government was measured with a total of 4 items. The first CFA indicated that the range model fit was acceptable. Moreover, there were different criteria used to determine the level model fit. Moreover, the result of analysis showed loadings for all items were over 0.5. and it was a good enough model fit to include all items. The results are shown in Table 5.26, The path from SQ to AC is a weak positive influence (β=.112, $p<0.040$). Table 5.26 shows that all obtained values including critical ratio for each item was (>=1.96), values of standardized regression weight were (>0.50) and squared multiple correlations were over (0.30). Standardized regression weights less than (0.50) and squared multiple correlations less than (0.30) were well within the range which indicated that the model was fit and acceptable. This indicates Saudi government organisations believe adopting cloud computing improves service quality in e-government system. The service quality of e-government system should be taken into account by government organisations that need to improve the IT infrastructure efficiently and effectively in order to meet the needs of government organisations. Thus, the descriptive analysis findings of the service quality factor and the correlation result indicated that the positive relationship hypothesized was supported. This is relating to the hypothesis which was stated as follows:

H4: There is a positive relationship (direct correlation) between the high services quality and the intention to adopt cloud computing for e-government systems. Weakly Supported

Structural Relation			Regression Weight	Standard Error (S.E.)	Critical ratio (C.R.)	P value
AC	**←**	**SQ**	**.112**	**.055**	**2.056**	**.040***

Table 5.26: Analysis of Hypothesis Path for Service Quality

5.10.1.5 Security

The descriptive analysis shows security was influential factor. A total of 4 items were developed to measure how secure cloud computing was perceived to be for Saudi e-government systems. The analysis result of loadings for all items was over 0.5. which means a good model fit. The descriptive analysis including all of the items had loadings of over 0.5, which indicated an acceptable model fit. Furthermore, results presented in Table 5.27 showed that the statistical assessment revealed a positive influence and statistically significant relationship between *SE* and *AC*, (β=.101, $p<0.016$). Table 5.27 shows that all obtained values including critical ratio for each item was (>=1.96), values of standardized regression weight were (>0.50) and squared multiple correlations were over (0.30). Standardized regression weights less than (0.50) and squared multiple correlations less than (0.30) were well within the range which indicated that the model was fit and acceptable. This means that security has a positive relationship with the adopting of cloud computing in e-government systems. Thus, the descriptive analysis findings for security and the correlation result indicated that there was the hypothesized positive relationship was supported. This is relating to the hypothesis which stated as follows:

H5: High level of security (data protection) positively influences the intention to adopt cloud computing for e-government systems. Moderately Supported.

Structural Relation			Regression Weight	Standard Error (S.E.)	Critical ratio (C.R.)	P value
AC	**←**	**SE**	**.101**	**.042**	**2.410**	**.016***

Table 5.27: Analysis of Hypothesis Path for Security

5.10.1.6 Top management support

A total of 4 items were developed to measure the influence of top management support on the adoption of cloud computing in e-government systems. A CFA was conducted to evaluate the loading of the items in the construct; and the first run of the CFA analysis showed the model fit was acceptable. Moreover, different criteria were used to determine the level of data fits of the proposed models. The items load of TM1 was 0.68, TM2 was .077, TM3 was 0.55, TM4 was 0.71. However, the standardized residual covariance and modification indices obtained a good model fit. It was decided to remove TM3, as shown in Figure 5.5, and the second analysis showed the model fit was acceptable. Furthermore, the confirmatory factor analysis demonstrated a good model fit in regard to the influence of tope management support on adopting cloud computing for e-government systems. Based on running the analysis a second time around, as presented in Table 5.28, the researcher found a positive influence and statistically significant relationship between TM and AC, (β=.181, $p<0.015$). Table 5.28 shows that all obtained values including the critical ratio for each item was (>=1.96), values of standardized regression weight were (>0.50) and squared multiple correlations were over (0.30). Standardized regression weights less than (0.50) and squared multiple correlations less than (0.30) were well within the range which indicated that the model was fit and acceptable. This means that TM has a positive correlation with adoption of cloud computing in e-Government and this supports the hypothesized relationship H6.

H6: Top management support influences positively the intention to adopt cloud computing for e-government systems. Moderately Supported

Structural Relation			Regression Weight	Standard Error (S.E.)	Critical ratio (C.R.)	P value
AC	**←**	**TM**	**.181**	**.074**	**2.439**	**.015***

Table 5.27: Analysis of Hypothesis Path for Top Management Support

5.10.1.7 Technology Readiness

In order to measure the influence of technology readiness on adopting cloud computing for e-government systems, a total of 4 items were developed. The first CFA was run to evaluate whether all items present acceptable model fit; and the results showed that the construct load was satisfactory. Different criteria were used to identify the data fits of the proposed model. The item load of TR1 was 0.55, TR2 was .075, TR3 was 0.68 and TR4 was 0.70. Moreover, the model fit showed a slight improvement after the second analysis was run. The item loadings were higher than 0.5 and CR was over 1.96. Moreover, other criteria were used to identify whether any items needed removing to develop the model fit. However, when item TR1 was removed and the second CFA analysis was run it achieved a good model fit. The results are presented in Table 5.29. The researcher found a positive significant relationship between TR and AC, (β=.131, $p<0.023$). Table 5.29 shows that all obtained values including critical ratio for each item was (>=1.96), values of standardized regression weight were (>0.50) and squared multiple correlations were over (0.30). Standardized regression weights less than (0.50) and squared multiple correlations less than (0.30) were well within the range, which indicated that the model was fit and acceptable. This means that TM has a positive correlation with adoption of cloud computing in e-government system and supports the hypothesized relationship H7.

H7: Technology readiness influences the intention to adopt cloud computing for e-government systems. Moderately Supported

Structural Relation			Regression Weight	Standard Error (S.E.)	Critical ratio (C.R.)	P value
AC	**←**	**TR**	**.131**	**.058**	**2.271**	**.023***

Table 5.28: Analysis of Hypothesis Path for Technology Readiness

5.10.1.8 Competitive pressure

The influence of competitive pressure on adoption of cloud computing in e-government system was measured by three items. The first CFA identified whether all items load satisfactorily to evaluate the competitive pressure construct. The second running of CFA found that all items in the competitive pressure construct were acceptable. Moreover, the analysis result confirmed the model fit met the requirements of model fit indices which showed at acceptable levels. Table 5.30 shows that all obtained values including critical ratio for each item was (>=1.96), values of standardized regression weight were (>0.50) and squared multiple correlations were over (0.30). Standardized regression weights less than (0.50) and squared multiple correlations less than (0.30) were well within the range, which indicated that the model was fit and acceptable. Based on the result of CFA, the researcher included all three items in the competitive pressure construct. Furthermore, the second running of CFA showed that all items of the competitive pressure construct were acceptable, associated and a good model fit, as shown by the results presented in Table 5.30. Based on the above result, the researcher found that there is a positive significant relationship between CP and AC, (β=.114, $p<0.030$), as stated in the hypothesized relationship H8. This means that TM has a positive correlation with the adopting of cloud computing for e-government and supports the hypothesized relationship H8.

H8: Existence of a competitive pressure influences positively the intention to adopt cloud computing for e-government systems. Moderately Supported

Structural Relation			Regression Weight	Standard Error (S.E.)	Critical ratio (C.R.)	P value
AC	**←**	**CP**	**.114**	**.053**	**2.168**	**.030***

Table 5.29: Analysis of Hypothesis Path for Competitive Pressure

5.10.1.9 Regulation

Four items were identified to measure the relationship between regulation and the adoption of cloud computing for e-government systems. The CFA was applied to identify whether all items loaded were adequate to evaluate the regulation construct. Moreover, the first running

of CFA found all items were loaded satisfactorily and that revealed the range model fit was acceptable. Different criteria were used to improve model fit. Furthermore, the item RE1 was removed and the second analysis achieved a good model fit. Table 5.31 shows that all obtained values including critical ratio for each item was (>=1.96), values of standardized regression weight were (>0.50) and squared multiple correlations were over (0.30). Standardized regression weights less than (0.50) and squared multiple correlations less than (0.30) were well within the range, which indicated that the model was fit and acceptable. Thus, the researcher found that based on above analysis, there was a positive correlated significant relationship as the obtained critical ratio between RE and AC was (β=.247, p<0.004), This means that TM has a positive correlation with adoption of cloud computing in e-government and supports the hypothesized relationship H9. Hence, regulation is confirmed as highly significant and this hypothesis is strongly supported.

H9*: *A less stringent regulatory environment will have a positive influence to adopt cloud computing for e-government systems. Strongly supported

Structural Relation			Regression Weight	Standard Error (S.E.)	Critical ratio (C.R.)	P value
AC	**←**	**RE**	**.247**	**.086**	**2.883**	**.004****

Table 5.30: Analysis of Hypothesis Path for Regulation

5.10.1.10 Trust

Five items were developed to measure the influence of trust on the adoption of cloud computing for e-government systems. While the first CFA was conducted to measure the trust construct, the five items were loaded adequately, and the model fit was acceptable but could be improved. As the result for standardized regression weights was less than (0.50) and the squared multiple correlations was less than (0.30), various other estimates needed to be observed. The researcher decided to modify the covariance between some error terms (S3, S5) which were over 0.5. Moreover, the second running of CFA showed improved estimates of model fit; suggesting that no items in the trust construct needed further modification. The results presented in Table 5.32, reveal that trust positively influences adoption, as the critical ratio obtained between TU and AC was (β=.291, p<0.001). The strong positive relationship

shows this factor has a significant effect on the adoption of cloud computing for e-government systems which was stated in the hypothesized relationship H10 as follows:

H10: High level of trust in cloud computing positively influences the intention to adopt cloud computing for e-government systems. Strongly supported

Structural Relation			Regression Weight	Standard Error (S.E.)	Critical ratio (C.R.)	P value
AC	**←**	**TU**	**.291**	**.076**	**3.849**	**.001*** **

Table 5.31: Analysis of Hypothesis Path for Trust

5.10.1.11 Awareness

To measure the influence of awareness on the adoption of cloud computing in e-government, five items were developed. When CFA was applied, all five items loaded adequately to assess the awareness construct. Moreover, the first analysis revealed the model fit was acceptable. All loadings were higher than 0.5 and all CR were over 1.96. Furthermore, modification indices were assessed to identify if any items should be removed. Item AW4 was removed and the second analysis was run to achieve a better model fit. The results presented in Table 5.33 demonstrate there was an insignificant relationship between AW and AC as (β=0.53, p<0.380), Table 5.33 shows that all obtained values including critical ratio for each item was (>=1.96), values of standardized regression weight were (>0.50) and squared multiple correlations were over (0.30). Standardized regression weights less than (0.50) and squared multiple correlations less than (0.30) were well within the range which indicated that the model was fit and acceptable. This means that although awareness was believed to have a positive correlation with the adoption of cloud computing for e-government systems. however, the hypothesized relationship H11 was unsupported which was expressed as follows:

H11: High level of awareness positively influences the intention to adopt cloud computing for e-government systems. Rejected

Structural Relation			Regression Weight	Standard Error (S.E.)	Critical ratio (C.R.)	P value
AC	←	AW	.053	.060	0.878	.380

Table 5.32: Analysis of Hypothesis Path for Awareness

5.10.1.12 Attitude

Attitude was measured with four items, for which all item loadings were higher than 0.5 and all critical ratios were over 1.96. The CFA was conducted to get model fit and to see if removing any of the items would improve it. Moreover, the modification indices indicated removing item AT1; and the second analysis was run and obtained a good model fit. Based on analysis, as presented in Table 5.34, attitude has a positive influence on the adoption of cloud computing in e-government systems and there is a significant correlated relationship, as shown by the CR obtained between AT and AC (β=.244, $p<0.001$). Table 5.34 shows that all obtained values including critical ratio for each item was (>=1.96), values of standardized regression weight were (>0.50) and squared multiple correlations were over (0.30). Standardized regression weights less than (0.50) and squared multiple correlations less than (0.30) were well within the range which indicated that the model was fit and acceptable. this means the trust construct has a significant effect on the adoption of cloud computing in e-government systems, as stated in the following hypothesized relationship H12.

H12: Positive attitude on cloud computing positively influences the intention to adopt cloud computing for e-government systems. Strongly supported

Structural Relation			Regression Weight	Standard Error (S.E.)	Critical ratio (C.R.)	P value
AC	←	AT	.244	.048	5.118	.001***

Table 5.33: Analysis of Hypothesis Path for Attitude

5.11 Proposed Modified Framework (ACCE-GVE)

Based on the data analysis that confirmed the hypotheses, the framework was modified. The results presented are arranged in order of hypothesis. According to the findings shown in Table 5.34, 10 out of 12 path coefficients (hypotheses) were statistically significant. The path loadings and P values and Critical Ratios (C.R.), and Standard Error values in the structural model are displayed in Table 5.35 below:

Structural Relation			Regression Weight	Standard Error (S.E.)	Critical ratio (C.R.)	P value
AC	←	RA	.218	.079	2.763	0.006**
AC	←	CM	.065	.062	1.051	0.293
AC	←	CO	.159	.061	2.610	0.009**
AC	←	SQ	.112	.055	2.056	0.040*
AC	←	SE	.101	.042	2.410	0.016*
AC	←	TM	.181	.074	2.439	0.015*
AC	←	TR	.131	.058	2.271	0.023*
AC	←	CP	.114	.053	2.168	0.030*
AC	←	RE	.247	.086	2.883	0.004**
AC	←	TU	.291	.076	3.849	0.001***
AC	←	AW	.053	.060	0.878	0.380
AC	←	AT	.244	.048	5.118	0.001***

Table 5.34: Path loadings and critical ratios within constructs in the structural model

*Note: (***=significance at the 0.001 level, **=significance at the 0.01 level and *=significance at the 0.05 level)*

Overall, as shown above in Table 5.34, the empirical data demonstrated that all the independent variables have a significant influence on the adoption of cloud computing for e-government systems except two: Compatibility (CM (P=0.293) and awareness (P=0.380), as shown in Table 5.34. Further, the hypothesis H2, "Higher Compatibility positively influences the intention to adopt cloud computing for e-government systems". with a value of (P=0.293) was rejected, which means that compatibility of the IT infrastructure with cloud computing did not significantly affect decisions to adopt cloud computing for Saudi e-government. The

hypothesis H11 “High level of awareness positively influences the intention to adopt cloud computing for e-government systems” had a value of (P=0.380) and was also rejected; which means awareness about cloud computing did not have any significant effect on top government decisions to adopt cloud computing for e-government systems. This result due to the level of experiences of IT administrations in the IS sector as found in the descriptive data that over 70% of IT employees have IT experience over three years. So, IT employees have the ability to work in a cloud computing environment and IT infrastructure has suitable for the adoption.

It was observed that different government organisations have different degrees of concern toward cloud computing adoption. Therefore, the result of empirical data has unique value and contributes to an understanding of the critical factors from the government organisations’ perspective. Thus, this study fills a gap in the literature and provides a deeper understanding of the adoption of cloud computing in e-government systems. The critical findings relate to the factors that influence government organisations to adopt cloud computing for the e-government system. Additionally, these results indicate that there are obvious differences from other studies; which may be due to differences in organisational environments and target populations between countries. The researcher found that the empirical data findings based on the structural equation model and hypotheses analysis confirmed that most of the hypothesized relationships were supported. Table 5.35 shows which hypotheses were supported or rejected.

H	**Hypothesis Statement**	**Decision**
H1	*Perceived relative advantages have a direct and positive influence on the intention to adopt cloud computing for e-government systems.*	Supported
H2	*Higher Compatibility positively influences the intention to adopt cloud computing for* e-government system*s.*	*Rejected*
H3	*Higher Complexity negatively influences the intention to adopt cloud computing for e-government systems.*	Supported
H4	*There is a positive relationship (direct correlation) between the high services quality and the intention to adopt cloud computing for e-government systems*	Supported
H5	*High level of security (data protection) positively influences the intention to adopt cloud computing for e-government systems.*	Supported

H6	*Top management support influences positively the intention to adopt cloud computing on* e-government systems.	Supported
H7	*Technology readiness influences the intention to adopt cloud computing on* e-government systems.	Supported
H8	*Existence of a competitive pressure influences positively the intention to adopt cloud computing on* e-government systems	Supported
H9	*A less stringent regulatory environment will have a positive influence on the adoption of cloud services.*	Supported
H10	*High level of trust in cloud computing positively influences the intention to adopt cloud computing for e-government systems*	Supported
H11	*High level of awareness positively influences the intention to adopt cloud computing for e-government systems*	Rejected
H12	Positive attitude on *cloud computing positively influences the intention to adopt cloud computing for e-government systems*	Supported

Table 5.35: Results of the Hypothesis direct effect relationship

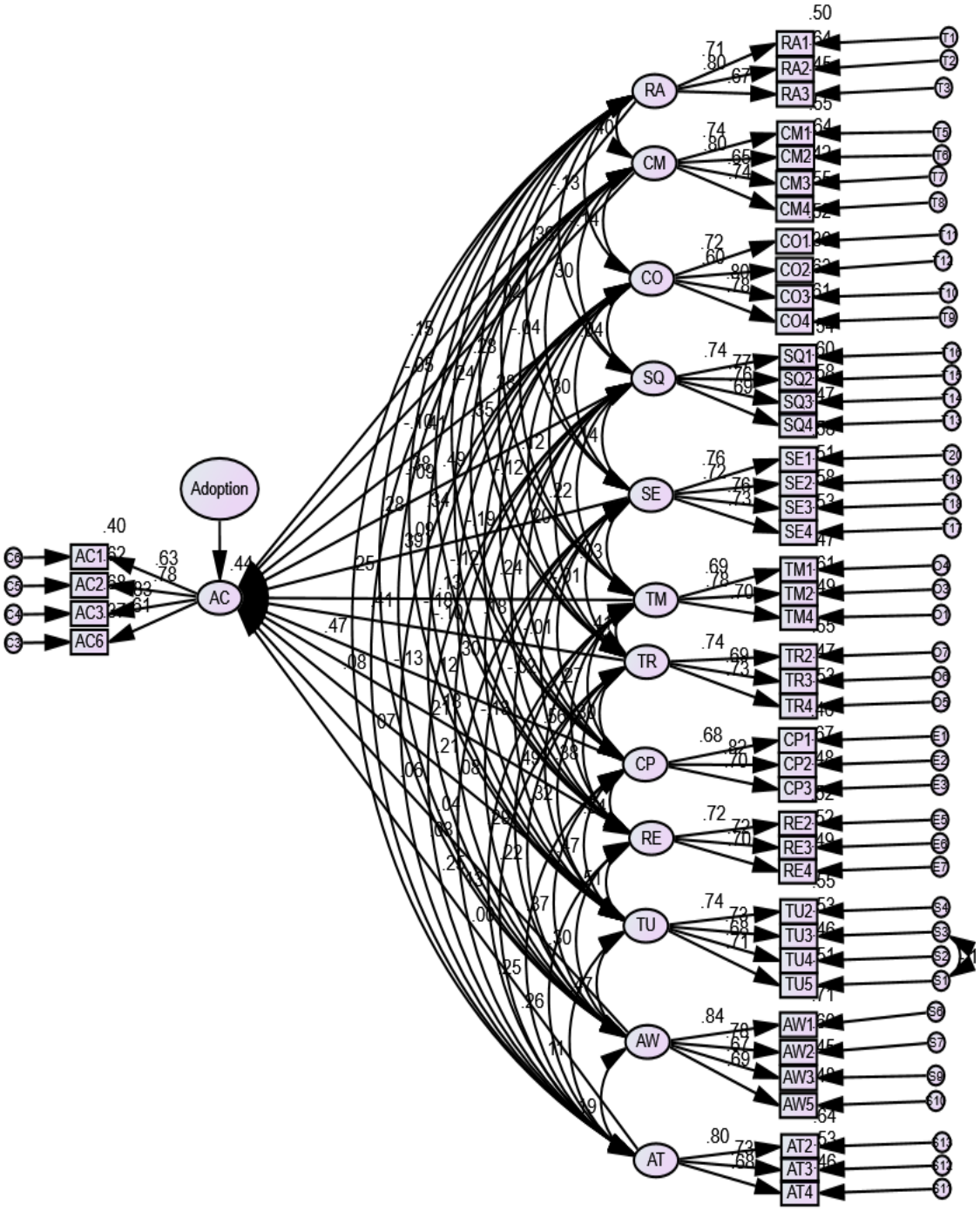

Figure 5.6: The Measurement Structural Model

5.12 Summary

This chapter discussed the advanced quantitative analysis method by which used SEM to evaluate the proposed framework ACC-GE. The researcher used two software analysis programs?], namely, SPSS 24 and AMOS 25 to run the advanced data analysis. SPSS 24 was utilized for descriptive analysis. The descriptive analysis was investigated, and the data examined for normality, kurtosis and skewness, standard deviation and mean to identifying the normality of the data before moving to an advanced quantitative analysis. Moreover, for statistical analysis the researcher utilized SEM using AMOS 25 before proceeding to advance statistical analysis. The model fit measurement applied CFA to measure all constructs of the proposed framework. Reliability and validity measurements were then conducted, including those for construct reliability, convergent validity and discriminant validity. Finally, the path analysis was evaluated through a structural model fit requirement. Based on the literature, this study proposed the framework, ACCE-GVE, which included 12 constructs and 12 hypothesised relationships. The results of the empirical data analyses showed that 10 hypotheses out of 12 were significant relationships and positive influences, while, two of these hypotheses did not meet with the established criteria of this analysis. The next chapter illustrates the qualitative data analysis in more detail.

Chapter 6: Qualitative Analysis

6.1 Introduction

Qualitative interviews come in different types, namely, structured, semi-structured and unstructured (Rossman, 2017). Yin (2013) noted that there were different interview styles, such as open-ended, focused and structured. Unstructured interviews usually have open-ended questions, which allow the researcher to get more detailed information about interviewees' opinions and experiences as well as events and situations. Focused interviews, which are also called semi-structured, allow researchers to ask questions in a targeted manner. In this study, this interview technique is used, for the purpose of gaining a deeper understanding by asking some open questions in a structured way.

For this phase of the research, thematic analysis tools were involved in data analysis, as discussed in Chapter 4. Data was collected through interviews and the data analysed according to specific themes that related specifically to the research context. Thematically analysing the interviewees' answers allowed the researcher to identify patterns in their perspectives and to arrange the interview transcripts into these themes. The purpose of identifying these themes is to understand more deeply the data collected by the interviews, which can also be framed with the help of the conceptual framework.

The interview process and analysis are presented in this chapter by the following sections. The first section gives an overview about how the interviewees feel about the adoption of cloud computing for e-government systems being implemented in their government organisations. Then, their ideas about how the adoption of cloud computing would impact on their organisations are explored. Finally, questions related to factors in the proposed framework namely, relative advantage, compatibility, complexity, service quality, security, top management support, technologies readiness, competitive pressure, regulation, trust, awareness and attitude were asked and explored. This research has followed the Sussex University Ethical Review Process with application number ER/NA424/1, which was submitted with the required documentation to the committee for approval. The interview was composed of eleven main questions (see Appendix C).

6.2 Interview Data Analysis

The interviews were conducted face-to-face with participants individually, through contacting each person by phone and arranging a meeting to take place in their organisational office at their convenience. The researcher provided an overview of the research to the interviewees and the interview procedure and the research questions that would be explored were explained. The researcher also indicated what information was needed. Also, prior to the interviews; the interviewees were provided with a letter of consent to sign. The letter of consent outlined an overview of the research and stated the purpose of the interviews. It also informed the interviewees that their information would be anonymous and their names and details would remain confidential and not be disclosed. They were informed that the interview would be audio-recorded, and the recording would be stopped at any time if they requested it.

Eight Ministries were selected in which to conduct interviews with IT managers working at various levels, in order to understand what challenges and advantages they perceived might result from the adoption of cloud computing in e-government systems as implemented in Saudi government organisations (see Table 6.1).

Government organisations	Position of Interviewee	Sector type	Interviewee codes
Ministry of Education	IT Senior Manager (Noor program)	Education	(MOE)
Ministry of Health	IT manager (Sehha program)	Health	(MOH)
Ministry of Justice	IT manager (E-service Gate)	Civil Service	(MOJ)
Ministry of Interior	IT Administrator (Abshir program)	Interior affairs	(MOI)

Communications and Information Technology Commission	IT Administrator	ICTC	(ICTC)
Ministry of Finance (MOF)	IT Director	Finance	(MOF)
Ministry of Commerce and Industry	IT manager	Finance	(MOCI)
Yesser E-Government program	IT manager	Government online program	(YEG)

Table 6.1: Interviewee Codes for IT Ministry Employees

In the interview, four sections addressed the development of e-government systems in the Saudi government, as presented in the following sections. The first section (6.3) focuses on the current situation for Saudi e-government systems. The second section (6.4) explores the benefits and challenges of adopting cloud computing for e-government by government organizations in Saudi Arabia. The third section (6.5) addresses the technological, the organisational, the environmental and the social aspects of motivations for adoption. Finally, the results are discussed in section 6.6, the perceptions of managers and expert IT employees of the influence of factors that encourage or delay adopting cloud computing are identified; and their expectations of procedures to be adopted in the near future are outlined.

6.3 The current situation e-government system

There was indication from some of the participants that their organisation was at the stage of considering cloud computing, including making the relevant exploratory tests; however, they had not started using the cloud for government purposes. A participant voiced the idea that there may be adoption of cloud computing:

"We have a current plan to turn to cloud computing, but not in the near future. Therefore, we suffer from the extra cost for maintenance and continuous development. Thus, adoption is one of the proposed solutions." (**MOI**)

Another participant said:

"*Yes, cloud computing has been implemented. But not fully, as it has only been applied to a part of the organization's internal services system. We are attempting to provide cloud computing as an authorized provider of government organizations."* (**ICTC**)

The Saudi government organisations' initiative has a vision about developing e-government as shown in the following statement:

"The Saudi ministries' experience in adopting IT technologies has not reached the level that the leadership wishes to achieve in the Saudi government's Vision 2030." (**MOE**)

The participants agreed that the top management in government organisations are still considering whether to adopt cloud computing, as seen in the following statement:

"We are currently discussing the adoption of cloud computing for the purpose of efficiency and cost reduction of IT hardware in our organisation." (**MOCI**)

Another interviewee responded:

"We haven't yet, but there is an idea to adopt cloud computing for one of our e-services in the near future. We will explore the challenges until we are more confident about the adoption of cloud computing." (**MOJ**)

In the statements above the interviewees are saying that government organisations have the intention to adopt cloud computing for e-services in the future. There is also evidence that generally there was an understanding of the environment of cloud computing. Some of the participants, however, gave responses that showed that adopting cloud computing for e-services was not a top priority. In response to the question about whether they currently have issues and challenges facing their current online system one of them said the following:

"One of the most important challenges facing us in the current systems' security and protection systems is that many government agencies suffer from the proliferation of cyber attacks." (**ICTC**)

Another responded:

"*To avoid the impact of problems in IT infrastructure, we certainly need to make a lot of effort. Also in terms of the satisfaction with the services provided to citizens and increasing reliance on them, as the population of the Kingdom is about 30 million citizens and residents,*

and electronic operations to be conducted during each month do not exceed 500 thousand per month, this raises the question about satisfaction with the services provided." (**YEG**)

However, those responsible for government IT, had more to say about the current relation with IS policy in the country. One of the respondents said the following:

"We must understand that most government organisations have some policies and laws which make it difficult for them to successfully implement IT easily, especially e-government." (**MOI**)

Another asserted that:

"*Government agencies have a lack of IT experts, and it requires a high cost to provide them."* (**MOH**)

Some of the government have long experiences of the IT sector which make them able to overcome the IT infrastructure challenges. One of IT manager said:

"The experiences of our employees have achieved qualified education in the IT sector that has reduced IT issues and provide an efficiency e-government system." (**ICTC**)

an e-government system might affect by the large size of the government sector as the key player to establish the e-government system. The size of organisations could be encouraged by adopting cloud computing in the e-government system. One of IT manager comment that:

"As we have the largest ministry with employees and users. We are currently facing many IT issues such as the capacity access, Workload and security attacks which reflects on the quality of e-government system. So, adopting cloud computing in our e-government system might one of these solutions". (**HOI**)

The participants also focused on evaluating issues and challenges faced by the current online system that had to meet all the requirements of improving service levels, increasing the quality of services and reducing the amount spent. If government organisations are to adopt cloud computing and reap the benefits, they need to be able to learn from the experience of other government establishments. Some interviewees believed that the systems in government organisations suffered from a lack of IT infrastructure, security concerns and the existence of some regulations and policies that prevented decisions from being made without the approval of top decision makers. This reflects negatively on the IT department and restricts the

development of e-government systems due to their not being able to connect other government branches with the main data centre. Consequently, it requires a great effort and adopting the best technologies that provide solutions to government organizations who wish to increase government organisations' adoption of e-government. Moreover, cloud computing needs a suitable IT infrastructure if it is to provide a suitable business environment in the systems located in government organizations.

6.4 The issues and challenges facing current online systems

The findings of this study showed that adoption of cloud computing yields many tangible benefits if government organisations could be encouraged to adopt it for e-government. These benefits include reducing the costs of improving ICT, increasing the level of productivity, and using a system that is available anywhere at any time. One of the IT managers stated that:

"It is better to pay for using the service instead of building and developing a complete ICT infrastructure at high cost and continuous development." (**MOJ**)

Moreover, one of the participants said that the adoption of cloud computing gave them solutions for improving the quality of their services:

"Recently, many services have been built using cloud computing. These services provide integrated solutions for different organisations. Amazon and Google provide a hardware-based service, making using this platform a comprehensive management system that minimises cost and increases the quality of performance." (**ICTC**)

The participants in the interview clearly knew the advantages of adopting cloud computing and understood how would enable the IT infrastructure of government organisations to be more efficient and productive, and lead to reducing the costs of ICT. However, The IT managers also agreed that their organisations' mission should focus on their efforts and budgets rather than on what could be outsourced. These benefits have been discussed in detail in Chapter 2. Cloud computing was nevertheless seen as one solution to these issues, as one interviewee pointed out:

"Developing services means adopting the best technology that provides easy interaction and high satisfaction to users by delivering our services with a high quality, such as cloud computing." (**MOH**)

Another respondent said the following:

"We spend a lot on IT infrastructure, which is one of the high priority tasks in our IT department organization. I would definitely adopt cloud technology if it could reduce our investment cost in the IT infrastructure." (**ICTC**)

Furthermore, the IT administrators in the government organisations believed that adopting cloud computing would dramatically improve the ICT of organisations. One of the IT specialists' participants mentioned that:

"The benefits of cloud computing encourage us to adopt it. A high security service is available. Also, it reduces the operating load we have in IT, and there is an increase in backups for the system, which facilitates rapid development and the provision of new services to the organization." (**MOF**)

Another IT manager added that:

"The adoption of cloud computing in e-government will enable us to reduce the cost of ICT. So, providing this as evidence to the top management ensures they will pay attention to adopt cloud computing." (**MOE**)

As observed in the responses above, these findings show that the IT administrators in the government organisations understood the benefits of cloud computing and agreed that this would encourage its adoption for e-government in Saudi government organisations. Furthermore, some interviewees believed their government organisations suffered from an increase in government branches, which reflected on the IT expansion in the data centre. This incurred a high cost towards improving IT infrastructures, ongoing maintenance and IT experts to solve any problems. Cloud computing helps reduce the cost of these requirements; as the cloud service provider provides continuous maintenance and reduces the cost of ICT by connecting to the system from anywhere.

6.5 Motivations for organisations to adopt cloud computing for e-government

Government organisations empowered to implement e-government have an excellent opportunity to adopt cloud computing for their e-government system. The organisations' services considered as satisfactory by the top government management can also be considered ready to adopt cloud computing. Moreover, the top management of the e-government system takes

into account establishing an appropriate environment by providing an ICT infrastructure for the government organisations to start introducing cloud computing for e-government.

Previous research found that there are many reasons behind the delay in adopting cloud computing for e-government in Saudi Arabia. These include factors related to the technological, organisational, environmental and social contexts. These delays mean that the government puts pressure on its organisations to figure out the main factors that may influence the decision to adopt cloud computing for e-government.

This section will highlight the participants' responses that address the main research question: Why are Saudi government organisations still not adopting cloud computing for their e-government system?

6.5.1 Technical context

This section presents the participants' responses about critical factors that influence the adoption of cloud computing in e-services in the technical context, namely: relative advantage, compatibility, complexity, service quality and security, from the perspectives of IT managers of government organizations.

6.5.1.1 Relative Advantage (RA)

The findings of this study showed that IT administrators in Saudi government organisations have understood the reasons for adopting cloud computing in order to have an effective e-government system. The majority of participants believed that adopting cloud computing for e-government in their organisations would be beneficial in comparison to the existing traditional ways of conducting government transactions, and adoption would make sense for IT administrations in terms of relative advantage. However, one participant stated:

"Unfortunately, we believe that it is not the right time to determine the appropriate cloud computing services for current systems, because e-government systems are still incomplete." (**MOI**)

Some participants acknowledged the importance of adoption of cloud computing for e-government, and understood the benefits of cloud computing for developing their systems. One of these participants noted:

"The rate of user satisfaction for the services provided did not meet our objectives, and this is due to the lack of overall quality. So, cloud computing will increase the opportunities to develop our systems and improve the provision of services to users." (**MOI**)

Some interviewees pointed out that the advantages of adopting cloud computing for e-government systems had to include satisfying the requirements of security, cost efficiency and quality of performance.

"The Ministry has made a decision that data security cannot be given to another party. We will not adopt this technology unless we are absolutely sure that data protection will be completely safe." (**MOE**)

These above responses show that IT departments in government organisations understand the benefits associated with the adoption of cloud computing for their e-government systems, and believe that it could contribute to increased efficiency in terms of time and effort and helping the government to improve online services. Moreover, participants stated that it was the most appropriate way to address any shortcomings of the e-government system associated with reducing spending cost in order to ensure their success in the provision of services. Thus, IT specialists believed that expanding rapidly in cloud computing had many advantages such as the variety of cloud settings, storage, software access from anywhere and continuous maintenance. These features will assist in finding solutions to IT infrastructure issues; and IT specialists believed that these factors would encourage the adoption of cloud computing in their government organisations.

6.5.1.2 Compatibility (CM)

Compatibility was considered as one of the factors to be addressed in this research. The findings show that some IT managers believe that the standard of their IT infrastructure needs to be compatible with any new technologies to be adopted. However, IT managers are looking for any alternative technical solutions that reduce spending on ICT. This can be seen from one of participants who concluded:

"There are no problems by which the compatibility of the current system requires development to comply with computing systems but reducing spending is the most important issue." (**MOF**)

Some the participants agreed that adopting cloud computing might reduce government spending cost on ICT even if it was not compatible. The findings showed that most of the participants clarified that they would adopt cloud computing by developing and deploying their technologically driven projects. One of the participants mentioned that:

"In my point of view, compatibility with the Ministry's systems should not influence the adoption of cloud computing, in particular, we have the capacity in financial and human resources." (**MOJ**)

Moreover, another IT manager added that:

"When an organisation begins to use cloud computing, it no longer needs complex plans to address any errors or crises that may harm their business areas. Cloud computing providers take care of most problems and resolve them quickly." (**YEG**)

In the above response, it can be observed that the IT administrations focused on the environmental compatibility of cloud computing need to primarily consider issues of reducing cost. One of the IT directors said:

"Government agencies have a lack of IT experts, and it is very expensive to provide them, which makes it more difficult to deal with the compatibility of operating systems required to immigrate to cloud computing" (**MOH**)

The interview responses identified that the transfer from proprietary systems to other systems in different open environments such as cloud computing environments should not be affected by environmental compatibility to e-government IT infrastructures. This study revealed that the compatibility of ICT in of some government organisations will enable these systems to adopt cloud computing for e-government. In particular, the e-government system in Saudi Arabia will require considerably more investment to develop applications compatible with cloud computing. Thus, it is notable that most of the interviewees agreed that the compatibility of the organisation system such as software and hardware may not affect the adoption of cloud computing if IT employees had more knowledge about how to deal with new technology and could overcome any obstacles by restructuring the system, and making other improvements. The IT managers agreed that it was imperative for government organisations and the service provider to have a set of compatible standards for both systems.

6.5.1.3 Complexity (CO)

Many interviewees considered complexity of new technologies as an issue that may prevent the adoption of these technologies, especially in regard to cloud computing. The findings revealed that complexity in the environment of cloud computing may discourage its adoption by government organisations. This was especially so when IT employees were not familiar with cloud computing. Therefore, professional training was seen as one of the essential ways to overcome the issue of complexity. As one senior manager commented:

"The complexity is due to the lack of expertise in managing the system through computing." (**MOI**)

Another IT manager added:

"From my point of view, the more complex cloud computing is, the more likely it will positively influence the top management organization decision to adopt cloud computing". (**ICTC**)

One of the IT managers stated that:

"The complexity of suppliers' conditions and their failure to reach the required level as a service provider - that represents our problems with adoption of cloud computing." (**MOCI**)

Moreover, another IT manager said:

"Any technology that is too complex to deal with makes us not consider it, which means it will not contribute to the development of our IT infrastructure and any difficulty with accessing online services." (**MOE**)

Thus, it was observed that all the interviewees believed that the cloud computing environment should not be too complicated if it was to be adopted. Also, the findings of this study show that most IT departments in these organisations do not provide their IT employees with any training courses training on how to deal with these technologies. This factor should be considered seriously by the IT administrations to improve the acceleration of the process of adoption. The IT managers agreed that their departments could adopt any technology and overcome any complex issues that face IT employees by providing intensive training and workshops. The providers of cloud computing should also consider being more user-friendly if they wish to encourage government organisations to adopt cloud computing services.

6.5.1.4 Service Quality (SQ)

Service Quality is considered one an important factor in terms of adopting cloud computing for e-government systems. Likewise, IT administrators knew that cloud computing in e-government might be better equipped to deal with service quality. The interviews indicated that participants believed it was important to improve service quality in their organisations' e-government systems, and that adopting cloud computing might be a way of addressing this. Many IT administrators admitted that it was difficult to provide high service quality with the current systems. An IT manager gave reasons for this:

"The current situation of the e-government system does not reach the required standard for service quality, which puts us in IT under pressure to identify an appropriate approach for reforming government services which might well be the adoption of the cloud computing for our e-government systems." (**MOF**)

The IT sector has developed a plan to help organisations acquire expertise in providing a high quality of service by using advanced technologies. However, this issue still difficult to resolve as service quality needs a more comprehensive set of standards. One IT manager stated:

"With regard to quality services offered by IT cloud experts, employees in our IT department lack knowledge about evaluating the service quality by comparing it with other technologies. So, top leaders believe that the current ways of using IT experts will increase the service quality of e-government. However, the problem is not with a lack of employee knowledge or with using IT experts but with the level of the IT infrastructure. Thus, we can solve this by the adoption of cloud computing, and we can get great quality services to deliver to our citizens online." (**MOH**)

The findings from interview data in terms of service quality showed the importance of realizing that the service quality provided by cloud computing in an e-government system could be one of the solutions for replacing the current traditional system with modern technology. One of the IT directors commented that:

"The rate of user satisfaction for the services provided did not meet our objectives, and we believe that this is due to the lack of overall quality in IT infrastructure. So, these issues

encourage us to increase the opportunities to develop our systems and improve the provision of services through cloud computing." (**MOI**)

Based on the participants' responses above, most of the participants agreed that the problem associated with the adoption of cloud computing was due to the service quality on both sides; namely, in the current cloud service provider and in the IT departments in organisations. The IT department believes that the current level of the IT infrastructure is not able to adopt cloud computing, due to the majority of government organisations sharing the same services and technology and being in the early stages of e-government. Thus, organisations that need to adopt cloud computing require an understanding of service quality and the need to improve the technical issues. The cloud service provider should clarify the quality standards of service that can be provided are compatible with e-government systems. Hence, both sides need to apply certain standards in service quality agreements. The IT administrators should consider service quality as a high priority to encourage the adoption of cloud computing.

6.5.1.5 Security (SE)

Findings showed that security concerns in terms of adopting cloud computing technology have high priority in most government organisations and may prevent adoption. These organisations have difficult challenges in addressing concerns about security that make them hesitate in transferring their e-government systems to cloud computing environments. The government organisations always give the highest priority to avoiding breaches of security. One IT administrator emphasised this stating:

"In fact, risking the organization's data being exposed to another party is unacceptable to us, as our sensitive data are confidential and should not be disclosed." (**ICTC**)

Interviewees stressed that considering security issues was essential in adopting a new technology. According to one of these participants, security was the technical issue that needed to be of central concern in adoption. One IT manager commented:

"We, as IT management, are keen to protect data even if they are saved outside of our organisation. We have some solutions to maintain our safety and protect our privacy. However, the important goal is that the cloud service provider must be a government organisation because we would not deal with a private provider in this case." (**MOI**)

Another IT manager reported that:

"There are not enough clear standards to protect any system in the event of a serious security breach of data to adopt cloud services from a local cloud provider." (**MOJ**)

Interviewees emphasised that security is considered one of the crucial factors among technical issues that can affect adoption of cloud computing. This makes it the highest priority concern that must be treated carefully by IT departments. One of the participants clarified that, saying:

"Security is one of the important obstacles in adopting any technology, whereby there is a concern in allowing any unauthorised party to modify information, whether in storage, processing or transmission of data. In addition, guarantees provided by the service provider are needed to detect and respond to threats to the organisations' data." (**MOH**)

As observed in the above responses, security concerns are taken into account in Saudi government organisations for a range of reasons related to regulations and having to deal with sensitive data, which is not usually allowed to be managed by a third party that may have direct contact with it. In the Saudi context, the IT departments that have dealings with a cloud computing provider as the third party that has access to government organisations systems have to be authorised by royal decision, owing to the seriousness of the decision. Many IT government organisations have technical initiatives that have been delayed or cancelled for these reasons. To conclude, the findings show that IT managers believed that security was a very high priority in decisions concerning the adoption of cloud computing because of the sensitive nature of the data, and because it allowed control of the government's systems by a third party. Therefore, the IT departments need to consider this issue seriously and implement any necessary technical solutions.

6.5.2 Organisational Context

In the organizational context, the structure of the organisation plays a significant role in the adoption of cloud computing. The IT departments that an in cooperation with an organisation's decision-making may positively affect the adoption of cloud computing which is less likely under a very complicated management system. This section discusses critical organisational factors that influence the adoption of cloud computing for e-services; such as top

management and technology readiness from the perspectives of IT managers of government organizations.

6.5.2.1 Top management supporting

Generally, the IT managers believed that decision-making was an issue that could delay adopting cloud computing by their insistence on certain standards for service agreements and costs with the cloud providers. The IT departments in government organisations are concerned about the decisions of top management in terms of requiring an agreement that governs the relationship with the cloud service providers. As one of the IT managers stated:

"We believe that there are difficulties in adopting new technologies if the top management of the organization does not recognise the benefits of the agreement for adopting new technologies, but the top management of our organization understands the necessity for making improvements to online services with little risk in the agreement." (**ICTC**)

However, the top management of organisations is considered to be one of the features that would accelerate and facilitate IT departments in deciding to adopt cloud computing by providing a significant role to achieving the organisations' goals. An IT manager stated that:

"For sure, the adoption of cloud computing should take into account how it can manage and reduce the cost of ICT. So, if this were the case, this would gain the full support of top management, who, would then have a good intention to adopt cloud computing." (**MOE**)

The findings showed that top management support results in providing the required budget needed to adopt new technologies and deal with technical issues. One of the IT managers explained:

"There are some obstacles to adopting modern technologies from some of the top leadership, but the majority of top management will give a high level of support and have the required power and influence to successfully adopt new technologies." (**MOF**)

Another IT interviewee explained that:

"We understand that the quality of our e-government system is not every citizen's dream, but, with support of the top leadership, we may still make that dream come true." (**MOCI**)

The adoption of e-government initiatives cannot succeed without full support from top management. One of the IT managers explained:

"There are some top managers who have not fully supported the IT department to improve the IT software and hardware in the public sector. This is due to the large gap between the IT director and the top management and the governor which can impeded achieving any effective development." (**MOE**)

Others agreed that the cost of adopting cloud computing would influence the decision-making process.

"In fact, the top management has refused to adopt new technologies such as cloud computing because of the high cost." (**MOI**)

Another IT manager also stated that:

"*Not all leaders want to apply new technology in the period of their leadership because they are worried about failure of the systems. In addition, each one has their own individual vision of what they want to achieve*." (**MOI**)

Another IT manager added that:

"T*he IT department has a desire to develop IT, but the instability in management and continuous change inhibits adopting it*." (**MOCI**)

And another interviewee remarked that:

"*There is a lack of a readiness at the service provider level, especially in Saudi Arabia. We think this gave us the negative perception that prevents adoption*." (**MOJ**)

According to the above findings, top management support is seen as an important factor that there is real hope that adoption of cloud computing for e-government might affect the development of the whole organisation. The IT departments have suffered from a lack of top management support that may delay adopting this technology. Moreover, there may not be enough support for providing training and technical workshops. The top management has authority to make the important decisions, and is very strict about any decisions which might result in transferring government systems to a third party. Thus, the Saudi political context may influence many technical initiatives because it is a long process to convince them to

accept new technologies. The IT government organisations are not allowed to make quick decisions about technical matters, due to the gap between the top ruling authority and the IT departments. The IT administrations should consider that this factor is important in adoption of cloud computing in government organizations.

6.5.2.2 Technology Readiness

This study found that IT infrastructure readiness could be vital to enabling the adoption of cloud computing. Therefore, government organisations need a suitable IT infrastructure to adopt cloud computing technology. Most of the interviewees agreed that technology readiness is a crucial factor, such that government organisations who have an excellent IT infrastructure should have a high level of adoption. The IT administrators emphasised that technology readiness should be given important consideration in the process of adopting cloud computing. One IT manager stated that:

"There is a gap in the existing technologies of the organization and the technologies required to adopt cloud computing." (**MOI**)

Another IT manager said:

"As an education ministry, there are a large number of users using the services provided to them over the Internet. This requires that we have adequate IT readiness. So, we need to have compatible technologies with the current services to ensure the quality of service delivery. Therefore, we have considered adopting cloud computing in our organisation." (**MOE**)

Top management in government organisations attempts to figure out any outsourcing to reduce the costs of the substantial IT infrastructure that occurs in adopting cloud computing. Through adopting cloud computing, government organisations will be able to concentrate on the core business, and not need more equipment and facilities.

"Unfortunately, there are many government online services which have not received financial support to reduce the cost of improving IT infrastructure, but the adoption of modern technologies like cloud computing would assist us to focus on our duties." (**MOH**)

One IT manager agreed with that, saying:

"The IT department has a desire to develop IT, but the instability in management and continuous change inhibits adopting it." (**MOE**)

The top management in government are pushing IT administrations to try to avoid spending huge sums of money on ICT. The IT departments desire to adopt cloud computing that would significantly reduce ICT costs. One of the IT managers stated that:

"To avoid the impact of problems in IT infrastructure, we certainly need to make a lot of effort. In terms of the satisfaction with the services provided to citizens and increasing reliance on them, as the population of the Kingdom is about 30 million citizens and residents, and electronic operations to be conducted during each month do not exceed 500 thousand per month, this raises the question about satisfaction with the services provided." **(YEG)**

In summary, as observed from the above responses, government organisations with poor IT infrastructure readiness need to pay huge sums of money to build data centres. However, the government organisations that decide to adopt cloud computing are not required to continuously monitor all their ICT infrastructures such as networking equipment, and security software. These services will be the responsibility of the service provider. Thus, government organisations lacking IT infrastructure readiness may have problems with maintenance, security, licensing and training. For this reason, adopting cloud computing is a possible solution as responsibility for these issues will devolve onto the service provider.

6.5.3 Environmental context

The current research investigates social factors that could impact comprehensively on adopting cloud computing for e-government by Saudi government organisations. The environmental context data was collected from the perspective of senior IT managers. The interview questions investigated how senior IT managers perceived the influence of critical environmental factors, namely, regulation and competitive pressure.

6.5.3.1 Regulation

Based on the findings of this study, government organisations have considered having strong regulations and laws which can hinder or delay the process of adopting cloud computing. There were suggestions that these regulations should clearly address the relationships among all participating parties (organisations and cloud providers) before adoption. One IT administrator said that:

"There are some regulations that do not correspond to the current state of the rapid development of information technology." (**MOF**)

In addition, the IT managers believed that regulations and laws are very important, and clear regulation would make it easier for government organisations to prevent conflicts with the cloud provider. Moreover, these would allow government organisations to preserve rights and understand the responsibilities on both sides (organisations and cloud providers). One of the IT managers said that:

"Updating of the regulations by new leadership shows inconsistent decisions for our plan to improve IT hardware. This affects making decisions in support of new information technologies; which is caused by some leaders seeking success for themselves." (**MOH**)

Furthermore, one interviewee believed that:

"Recently, our organisation has sought to develop regulations and laws through seminars and workshops in order to create regulations that are compatible with the development of technology, and that complies with organisational goals." (**HOE**)

One IT manager stated that:

"Certainly, the Ministry's policies play an active role in achieving our goals through the adoption of new technologies; by providing the required financial support." (**YEG**)

One IT manager added that:

"Unfortunately, the IT department has no fixed regulations and laws that support adopting cloud computing." (**ICTC**)

Another senior manager stated that:

"The rapid turnover of leaders and the inconsistencies in the regulations and decisions affects confidence in the development of IT in the organisations." (**MOH**)

In addition, the IT managers agreed that the existence of a regulatory system often means that making decisions can be a lengthy procedure. One of the IT managers said:

"It is not easy for top management in the Ministry of the Interior to amend the regulations of the organisation that were issued by the Council of Ministers. Until we get approval by the Council it makes adoption of cloud computing decisions sensitive." (**MOI**)

Overall, although the IT administrators acknowledged the significance of regulations for adoption; they felt that there was more concern about this factor due to the misunderstanding of the policies and regulations provided by the providers of cloud computing. In brief, this factor was seen as a very significant influence on government organisations moving towards the adoption of cloud computing. Many of the interviewees believed that there was a gap in the policies and regulations provided by the providers and organisations. This creates issues and problems that can arise between both parties (organisations and cloud providers). Thus, the appropriate regulations should be issued by the top government to facilitate the process the adopting. Likewise, regulations should be agreed on with the cloud providers to ensure compatibility.

6.5.3.2 Competitive pressure

The findings showed that IT departments in government organisations have significant pressure from top management which is pushing them towards providing online services at a high level of quality. Therefore, IT departments attempt to have the appropriate ICT infrastructure increase effectiveness and efficiency in their e-government systems. One IT manager stated that:

"Because Saudi Arabia is still at an early stage, it is difficult to compete with other organisations. The reason is the lack of intention of top leaders towards the application of the latest technologies because of concerns about cost and lack of experience in using them." (**MOE**)

The government organisations attempt to make their e-government systems equal in ranking to those of the developed countries. These rankings encourage government organisations to develop and adopt new technologies to provide online services in appropriate ways. One IT manager asserted that:

"The lack of top management support in the IT sector is one of the difficulties that would push any e-government system out of the competition in the global rankings." (**MOH**)

Furthermore, an IT manager acknowledged that:

"The pressure on the IT department from the development of other organisations to provide distinctive services puts our leadership under pressure in regards to the implementation of the latest technologies, such as cloud computing." (**MOI**)

As the Saudi government has established a new vision called 'Vision 2030', that means pressure is being put on the IT departments in government organisations by the ruling authority to prepare the appropriate ICT infrastructure to meet the targets. In view of this, adopting cloud computing tools are vital for developing e-government systems. In the words of one IT participant:

"The government is promoting the use of ICTs within organisations; there is a new vision for the Saudi government called Vision 2030. Therefore, there is pressure from the government on organisations to achieve this, and this requires the development of information technology in order to provide better electronic services and digital transformation of the organisation." (**MOI**)

Overall, IT government organisations have existing pressures that might drive them towards adopting cloud computing. In the Saudi context, there are significant pressures on IT departments in government organisations to achieve the new vision of the government. Thus, the pressures would only come from the ruling authority to force them to provide the appropriate ICT infrastructure, which is an influence on government organisations that should be considered in adopting cloud computing.

6.5.4 The Social Context

The current research explores social factors that could influence the adoption of cloud computing for e-government in the Saudi context. The data collected was about how critical factors in this context (trust, awareness and attitude) influence the adoption of cloud computing for e-government from the perspective of senior IT managers.

6.5.4.1 Trust

The findings of this study showed the importance of trust in influencing government organizations to adopt cloud computing in online services; regardless of whether this trust was in relation to the technology or to organizational issues. One IT manager said the following:

"If we explore the concept of trust in technologies seriously, we find it affects many aspects of our decisions. We know that any decision by the top management is on the basis that the technology is trustworthy for our systems - such as the adoption of cloud computing." (**YEG**)

Top management in a government organisation believe that trust is important for making decisions, and should exist between the stakeholders and the provider. It is a very crucial factor, as one of the IT managers stated:

"*We believe that the top leaders desire an improvement in the quality of cloud computing services by local cloud providers so that they can be sure this technology is trustworthy. This will be the beginning of adoption, which may lead to increased trust and implementation in the e-government system*." (**MOI**)

Adopting cloud computing benefits might encourage government organisations to trust this technology. A number of the participants expressed the idea that familiarity was an important aspect of trust. In response to the question about whether participants trusted cloud computing, one said the following:

"I*n my IT experience, adopting cloud computing has many benefits that can enhance trust in this technology. The adoption of cloud computing will play a major role in reducing the costs of improving IT infrastructure and increasing our productivity*." (**ICTC**)

One IT manager stated that:

"*Trust in new technologies is a concern for the ruling power, but there is a particularly negative attitude towards embracing cloud computing at the moment, as there is no local cloud provider*." (**MOE**)

Interviewees in the financial sector agreed that this factor has a high priority, and technology should be more trustworthy. IT departments in financial organisations paid extra attention to trust because of the nature of their working environments, and their need to trust their cloud providers. An IT manager emphasised that concerning the data security of customers and financial transitions:

"*There is a lack of trust due to poor efficiency in the quality of services provided by cloud service providers*." (**MOCI**)

Some IT managers believed that many government organisations try to avoid approaching any new technologies, especially, if any financial transactions were involved. One of the interviewees stated that:

"*We believe that if government details or financial transactions are in the trust of the third party, that should be a government local cloud provider. At this time, we do not have a clear idea about the local cloud providers, and this will affect the degree of trust in adopting cloud computing*." (**MOE**)

One of the participants made the following statement:

"*Our top management cannot believe that other parties would be allowed to manage data centres and IT services and systems without trusting them, as we are a reliable government that has sensitive data*." (**MOJ**)

Overall, trust emerges as a crucial factor in the adoption of cloud computing for e-government in Saudi organisations. The impact of a lack of trust in adopting cloud computing for e-government is due to the low level of trust between the government organisations and cloud computing providers. Therefore, top management that has sensitive data cannot trust a global third party to manage data centres, lack of local cloud computing providers. These were essential elements that were clearly evident from the participants' responses; therefore, trust should be considered a very important factor by IT managers wanting to improve the e-government systems in government organisations.

6.5.4.2 Awareness

Awareness is another factor identified as important in the adoption of cloud computing for e-government in Saudi Arabia, as it is related to realising the future benefits of e-government. The cloud computing providers play an important role in introducing the concept of cloud computing to the top management of the organisations and their IT departments as part of the effort to raise awareness and to create a positive image about the adoption of cloud computing for e-government. As one of the IT managers stated:

"The organisation's awareness about the available services in cloud computing provided by global suppliers has a positive influence on adopting cloud computing, especially in e-government systems." (**MOJ**)

Moreover, interviewees believed that IT staff needed knowledge about cloud computing through the provision of training programs and dealings with global IT companies regarding awareness of the technology. One of the IT senior managers added that:

"Awareness is an important factor in how new technologies are handled, but there many ways to increase the level of awareness of cloud computing through visits to providers, training, attending IT conferences and awareness through education about new and important technologies in the organisations as part of increasing our knowledge." (**MOE**)

The top management in the government try to encourage the IT departments to explore new technologies such as cloud computing and establish whether to have seminars, conferences and workshops with cloud computing providers about the potential services that could improve e-government by adopting cloud computing. According to one member of the IT teams:

"Moreover, one of our duties is to provide national workshops to solve technical limitations. These may include addressing any lack of awareness about the positive aspects of cloud computing and the services and competencies that it provides." (**MOE**)

Many participants agreed that top management in the government and the IT departments have a high level of awareness regarding the merits of cloud computing and how to ensure its acceptability during the adoption process. An expert interviewee indicated that:

"From my point of view, there is awareness about the benefits of technologies such as cloud computing in our organizations. So, this gives us a great opportunity to save the time when deciding whether to adopt cloud computing for e-government." (**MOF**)

One of the participants also indicated that:

"Adoption of cloud computing will reduce all expenses and concerns associated with problems in the IT infrastructure." (**MOJ**)

The responses of participants revealed that IT managers are already fully aware of the benefits of adopting cloud computing. Most of the IT admissions departments in the government organizations have knowledge about global cloud computing providers and understand the advantage of adopting cloud computing. There was an understanding of the benefits of the cloud through attending many IT conferences, and workshops about the benefit of cloud computing. IT departments have an awareness of the advantage of cloud computing to offer services at a very low cost in comparison to a private data centre, moreover, that it eases the burden on organisations and is a readymade product.

6.5.4.3 Attitude

Based on findings of this study, the attitude of government organisations is considered to be one of high significance in the adoption of cloud computing. A negative attitude towards cloud computing would impact negatively on its adoption. Indeed, the interviewees believed that a positive attitude would encourage IT departments to use cloud computing. Moreover, one of IT participants stated:

"As an IT manager, I believe that there is a positive attitude towards cloud computing that can help us to adopt cloud computing for our e-services."

The positive attitude towards the advantages of cloud computing technology leads to leadership satisfaction with solutions provided for infrastructure problems, which would obtain a higher efficiency through the ability to increase capacity and the ease and availability of access to data centres from anywhere. One of the IT managers explained that:

"Of course, we have a great attitude about the adoption of cloud computing. Therefore, it is necessary to develop the IT hardware, as we have infrastructure problems regarding the limitations on updating our data centres in our government organisations and developing the IT sector in those organisations. We wish to adopt this technology in the near future." (**MOE**)

Another IT manager also stated that:

"The attitude of the Ministry is positive, due to the response of service suppliers regarding the policies of the Ministry and cloud computing services." (**MOI**)

In addition, the findings show that most of IT staff in government organisations are familiar with the advantages of cloud computing. These advantages could help to overcome IT infrastructural issues which result in government organisations still dealing with a lot of information that has to be processed manually. An IT specialist claimed that:

"We hope that the advantages of cloud computing are made clear by suppliers as this strengthens the attitude of enterprises in government to improve IT infrastructure such that it allows for the adoption of cloud computing." (**MOH**)

Another IT manager added that:

"At the moment, we are in the process of looking for a provider that meets the requirements of the Ministry and provides cloud computing services as a global provider." (**MOF**)

Moreover, an IT manager stated that:

"Yes, we have an idea in regard to the adoption of cloud computing, and this will be based on lengthy procedures designed by the top management and IT department." (**MOI**)

In light of the improvement of technologies, the interviewees appeared familiar with new technology, particularly cloud computing. The majority of participants believed that there should be major upgrades to e-government systems with new technology, particularly cloud computing. Interviewees' answers revealed a positive attitude regarding the advantages of adopting cloud computing. These take into account that the cloud has the advantage of efficiently transmitting a huge volume of data which can be distributed over the internet between government organizations. Collaboration with the service provider can be carried out to manage and maintain e-government with effective management practices and reduce the effort. Moreover, IT departments in an organisation need to consider attitude as a key factor in the adoption of cloud computing.

6.6 Exploring other factors that influence the motivations for Adopting Cloud Computing

In addition to the ideas that were revealed about the relationship of the factors considered in this study, there were a number of different themes that emerged from the analysis of the interview data. These themes give further insight into the opinions about the adoption of cloud computing in e-government and possible reasons for lack of adoption. In this study, the factors investigated were classified into four contexts, the organisational and technological, environmental and social contexts.

The aim of this section is to discuss factors not contained in the research model that interviewees believed would be identified as critical factors in the adoption of cloud computing for e-government systems. These factors were discussed during the interviews and can be considered as new themes; and the responses below illustrate new factors identified by the IT managers that were interviewed. For example, one of the IT managers stressed that:

"The local service provider costs more than the limit of our IT improvement budget. So, if we keep our data centre as it is, we could continue to improve our IT infrastructure". (**MOJ**)

Another IT manager added that:

"At present, there is a discussion by the top management and IT department to explore the total cost of the adoption of cloud computing and comparing that with the cost of our improvements to a data centre by determining standards that are consistent with the policies of the organisations." (**MOI**)

There is a vision for the Ministry in line with the spirit of the government's Vision 2030, in which digital transformation is required for all transactions but currently there are problems with internet providers. As cloud computing is based on the internet, the lack of local Internet providers with the ability to successfully provide large bandwidths with high speeds delays the adoption of cloud computing. As one IT manager's response shows:

"We believe that adopting cloud computing is one of the current solutions for ICT infrastructure issues, but there are some motivational issues that deter government organisations from adopting this technology. One of these issues is the lack of ICT providers. Consequently, we are not ready to adopt cloud computing." (**YEG**)

Another IT manager stated that:

"We understand that the local Internet providers do not obtain a high level of satisfaction from our customers, due to the lack of ICT infrastructure. So, with support from the top leadership, we need a huge effort to make this dream come true." (**MOI**)

One of the interviewees highlighted that:

"In the past, there was no provider we could trust, but now we have only Digital City to set up a joint local Internet provider. So, we are still at an early stage of Internet provider experience". (**MOE**)

Another IT manager added:

"The government in Saudi Arabia has an interest in providing services in the best way possible. For example, there are more than half a million transactions done every month. Therefore, solutions must be found for the problems faced by government organisations to

increase internet providers, and rely on electronic services rather than traditional methods." (**MOF**)

In conclusion, the findings from the interviews highlighted the issues from the IT administration's perspective. IT administrators considered which external factors influenced the adoption of cloud computing in their experience. In the end, most concluded that if the cost of adopting cloud computing via a global cloud provider went over the IT budget, it was not possible to adopt in the near future. Furthermore, the cloud computing services that IT depends on by using the internet provided would have to work continuously in a reasonable range. Generally, the IT administrators suggested that there was poor service from the current internet providers. In addition, IT administration in Saudi government organisations should be taking these valuable details into consideration and attempting to move toward cloud computing in the near future.

6.7 Summary

This chapter presented the analysis of qualitative data from interviews conducted with the IT administrators. They discussed the factors that impact on government organisations adoption of cloud computing in the four dimensions identified in the initial conceptual framework and discussed in Chapter 3. Based on the data analysed, the findings of this study showed that these factors should be considered seriously by IT administration toward adopting cloud computing for Saudi e-government in the future.

In addition, the findings showed that in the technological context key factors such as relative advantage, complexity, security and service quality should be taken into consideration as having significant influence to encourage the move to cloud computing. Furthermore, the findings in the organisational context show that top management support, and technology readiness are considered extremely important and to significantly influence adoption of cloud computing for e-government. Additionally, the results for the environmental context demonstrate that regulations and competitive pressures were thought to have a significant impact on the decisions of top government management to adopt cloud computing for e-government. Moreover, with reference to the social context, trust and attitude were factors that were given high priority by the interviewees; and believed to have significant impact on the decision of top government management to adopt cloud computing for e-government. In contrast, the interviewees' responses regarding compatibility, and awareness showed that both factors were not considered significant influences on decisions to adopt cloud computing for e-government.

In the next chapter, both the quantitative and the qualitative research findings of this study are discussed in detail. The final conceptual framework will be provided in the light of the results of the research.

Chapter 7: Discussion and Conclusion

7.1 Introduction

This chapter gives a brief overview of the research, presents the research aims and identifies the research contributions to filling the knowledge gap in the field. Moreover, the research question has the main objective to examine the influence of factors on the adoption of cloud computing in e-government in Saudi context. Consequently, there were specific objectives:

- *To examine the existing issues of e-government systems in terms of efficiency, quality of online services and to review the current prototype framework of e-government systems.*
- *To identify the challenges and benefits of cloud computing in implementing e-government systems effectively from a review of the literature.*
- *To examine and explore the critical factors of adopting cloud computing in e-government systems from the perspectives of senior management in government organisations. (Through interviews)*
- *To investigate from the perspectives of senior management in government organisations and IT managers the critical factors that affect adopting cloud computing for e-government systems in the public sector. (Through questionnaires)*
- *To develop and evaluate an appropriate conceptual framework that can be utilised to investigate and implement the adoption of cloud computing for e-government in developing countries.*

To achieve the aim and objectives of this research; there was a main research question with five sub- questions, as stated below:

To what extent will the critical factors affecting government confidence in the Saudi government sector influence the adoption of cloud computing for e-government systems?

- *What are the existing issues of e-government systems in terms of efficiency and the quality of online services?*
- *What are the major challenges and benefits of cloud computing in implementing e-government system effectively in government organisations in the public sector?*

- *What are the factors that prevent the Saudi government from adopting cloud computing for e-government systems in government organisations in the public sector?*
- *According to senior IT managers, which factors influence government organisations to adopt cloud computing for e-government systems, and to what extent?*
- *What is an appropriate conceptual framework that can be utilised in developing countries and be applicable to the Saudi government in adopting cloud computing for e-government systems?*

This research was based on the premise that the investigation should focus on factors that might influence the adoption of cloud computing for e-government systems, such as regulations, security, trust, awareness, and top management support. The idea was to consider each of these factors to gain the full picture. This idea lead to developing a conceptual framework on which the research design of the study was based. The research design and the methodology that was developed were comprehensive. These factors as critical influences were applied in the research design to reveal the reasons why the Saudi government is reluctant to adopt cloud computing for e-government systems.

7.2 Discussion of the Research Objectives and Hypotheses

Generally, this research has achieved its objectives. The result of the data analysis for both the quantitative and qualitative stages revealed the factors that influence the adoption of cloud computing for e-government systems. They also indicated that the e-government system is still playing an important role in the government's provision, by adding value and offering an optimal environment for a wide range of online services; and allowing government organisations to manage their services and systems effectively. The lack of government organisations' satisfaction and the citizens negative attitude towards e-government means that government organisations are seeking to adopt new technologies with the aim of improving the way in which e-government systems are provided.

This research offered a more comprehensive view of the interplay between the intentions of government organisations and the adoption of cloud computing to gain a better understanding; and shows that consideration of one factor in isolation would not serve to better understand the situation. Moreover, this more detailed consideration of relationship between the

critical factors and adoption of the cloud has been justified by limitations in the literature. The results indicate, within the study context, that Saudi government organisations are becoming more open to adopting cloud computing for e-government.

The research model was based on the TOE model, which investigates the factors that influence government organisations to adopt cloud computing for e-government systems. The model hypothesised that relative advantage, compatibility, service quality, security and privacy, complexity, top management support, technology readiness, regulations, competitive pressure, trust, awareness and attitude are influential factors. Thus, 12 critical factors were identified of which 10 were found were found to have a statistically significant relationship to adoption of cloud computing for e-government. These factors and indicators were also tested and validated. The results for these factors, which were explained in detail in Chapter 3, are summarised as follow:

7.2.1 Relative Advantage

From the results reported in Chapter 5, it is evident that the first hypothesis (H1): Perceived relative advantages have a direct and positive influence on the intention to adopt cloud computing for e-government systems, was supported. Relative advantage means the degree of benefit accruing to an organisation when they decide to adopt new technologies. The research measured this factor by using four items, as discussed in Chapter 5. Therefore, relative advantages have a significant effect on adopting cloud computing for e-government systems. Some studies (Oliveira et al., 2014; Waller and Genius, 2015) revealed that relative advantages are a direct predictor of technology adoption. Moreover, the findings of this study agreed with other studies (Gangwar et al., 2015; Lang et al., 2018; Martins et al., 2016) who investigated the impact of relative advantage on adopting cloud computing for e-government systems, and found a significant correlation. These results could be explained by this study's findings that, in the Saudi context, e-government systems are not reaching a high level of quality. Findings from the survey were supported by the results of the interviews.. As the one of IT administrators noted: "*The rate of user satisfaction for the services provided did not meet our objectives, and this is due to the lack of overall quality. So, the advantages of cloud computing will increase the opportunities to develop our systems and improve the provision of services to users."* Furthermore, the relative advantages of cloud computing were shown to

positively affect IT administrators' desire for its adoption.The results suggest that government organisations need to give relative adavantages serious consideration in their discussions on whether to adopt cloud computing.

7.2.2 Compatibility (CM)

In this research, compatibility refers to "the degree to which an innovation is perceived as consistent with the existing values, past experiences and the needs of potential adopters" Rogers (1995). Hypothesis (H2): *Higher Compatibility positively influences the intention to adopt cloud computing for e-government systems* was found to be not supported. Compatibility is therefore not considered to be a significant influence on the adoption of cloud computing for e-government in this context. The findings of this study conflict with previous studies that found the compatibility of the IT infrastructure in systems impacted directly on the adoption of new technologies in many organisations (Lemay *et al.*, 2018; Chen *et al.*, 2017). However, other studies (Oliveira *et al.*, 2014; Wahsh and Dhillon, 2015; Awa and Ojiabo, 2015; Ahmadi *et al.*, 2017) had similar results to those of the current study; in that compatibility of IT infrastructure was found not to be significant in affecting adoption. This study revealed that government organisations already expect to have an IT infrastructure that facilitates e-government and is ready to adopt any new technologies. The results of the survey were supported by data from the interviews. When the relationship between compatibility and the adoption of cloud computing for e-government was assessed statistically, an insignificant correlation was unexpectedly found. This result confirmed that the government perceived the compatibility of the system as a requirement for adopting any new technologies, suggesting that the organization systems already have a high level of ability to adapt to new technologies. One of the IT administrators clarified that: *"In my point of view, compatibility with the Ministry's systems should not influence the adoption of cloud computing, in particular, we have the capacity in financial and human resources"*. Thus, IT managers of e-government systems believed that compatibility of systems did not affect the adoption of cloud computing.

7.2.3 Complexity (CO)

The study outcome supports the proposed hypothesis (H3): *Higher Complexity negatively influences the intention to adopt cloud computing for e-government systems,* and confirms that complexity is the most salient predictor that determines the adoption of cloud computing. This

result of this study is consistent with previous studies in the literature of technology adoption (AlBar and Hoque, 2017; Senyo *et al.*, 2016; Hsu *et al.*, 2014) that found complexity significantly predicted the adoption of cloud computing for e-government systems. Although, the relationship in the current study was considered moderate, the result of the correlation coefficient showed a strong negative correlation between complexity and adoption of cloud computing for e-government system. In this study, both the quantitative and qualitative data suggest that the government should consider the complexity of the cloud computing environment as one of the critical factors that influence the adoption of cloud computing. As one of the IT administrators stated: "*Any technology that is too complex to deal with makes us not consider it, which means it will not contribute to the development of our IT infrastructure and any difficulty with accessing online services."*. This analysis indicates that complexity has a moderate correlation with the adoption of cloud computing. Thus, IT administrators in government organisation should consider this factor as one of influences on the adopting of cloud computing.

7.2.4 Service Quality (SQ)

This study demonstrates that service quality in e-government organisations is influential when considering the adoption of cloud computing for e-government system. Generally, the findings support the proposed hypothesis (H4): *High service quality has a positive influence on the intention to adopt cloud computing for e-government systems.* Service quality was shown to have a strong positive effect on the adoption of cloud computing. This finding of this study was consistent with others (Jain and Aggarwal, 2018; Santa *et al.*, 2018) which were conducted on the adoption of cloud computing related to IS; and which demonstrated that perceived service quality is a significant positive determinant of the adoption of new technologies. For example, Gasova and Stofkova (2017) found that service quality service has a strong positive impact on transferring to new technologies. Therefore, this quantitative result is supported by the qualitative results about the impact of service quality. As one IT manager put it: *"The rate of user satisfaction for the services provided did not meet our objectives, and we believe that this is due to the lack of overall quality in IT infrastructure. So, the issues encourage us to increase the opportunities to develop our systems and improve the provision of services by cloud computing."*. Service quality (which is the result of comparing the system quality and level of satisfaction with the service) was regarded as a single factor that influences

the adoption of cloud computing for e-government. Therefore, based on the statistical results, this hypothesis is significantly supported, and consideration of service quality would assist in decision-making about the use of cloud computing for e-government by Saudi government organisations.

7.2.5 Security (SE)

Security is identified in this study as a technical challenge of high concern, and is a serious issue for the adoption of cloud computing in e-government. In this study, the survey results supported the proposed hypothesis (H5): A *High level of security (data protection) positively influences the intention to adopt cloud computing for e-government systems.* Government organisations are afraid that cloud computing is not secure enough to protect their private information. Many government organisations have to take into account that sensitive data can be exposed once transferred into a third party. The qualitative result supported that, as one participant noted: *"We, as IT managers, are keen to protect data even if they are saved outside of our organisations. We have some solutions to maintain our safety and protect our privacy. However, the important goal is the cloud service provider must be a government organisation because we would not deal with a private provider in this case."*. This study's findings indicate, from the statistical assessment, that there is a positive and statistically significant relationship between security and the adoption of cloud computing. Security considered one of the most influential factors that impact the adoption of cloud computing for e-government. Likewise, some previous studies (Wong and Jackson, 2018; AlBar and Hoque, 2017) found that security in the adoption of cloud computing seems to be a significant challenge for government organisations. Thus, the Saudi government needs to have a very clear understanding of the data protection protocols used by cloud computing providers in order to increase the adoption level of its e-government systems.

7.2.6 Top Management Support (TM)

The quantitative data analysis found that top management support is statistically significant and has a positive influence on government organisations' adoption of cloud computing for e-government systems. The hypothesized relationship (H6): *Top management support influences positively the intention to adopt cloud computing on e-government systems,* was supported. Moreover, the findings of this study showed that IT administrators believe that it is

very important to have effective support from the top management in government organisations to facilitate the adoption process. It has been observed that top management support in government organisations helps the IT administration in organisations and positively influences the adoption of cloud computing. This research found that there is a positive and statistically significant relationship between top management support and the adoption of cloud computing. These findings reflect those of previous studies (AlBar and Hoque, 2017; Lal and Bharadwaj, 2016; Martins *et al.*, 2016) that identified top management support as a key motivating factor. Findings from the survey were supported by the qualitative data, as one participant remarked: *"We believe that there are difficulties in adopting new technologies if the top management of the organization does not recognise the benefits of the agreement for adopting new technologies, but the top management of our organization understands the necessity for making improvements to online services with little risk in the agreement."*. Furthermore, it was also noted that interview participants in technical positions agreed that support from top government leaders increased the adoption of cloud computing. Thus, IT administrators in government organisations should consider this factor as one of the influences on the adopting of cloud computing for e- government systems.

7.2.7 Technology Readiness (TR)

This study emphasised evaluation of the current ICT infrastructure in government organizations to enable the adoption of cloud computing. This research proposed hypothesis (H7): *Technology readiness influences the intention to adopt cloud computing on e-government systems*, which was supported. The ICT infrastructure in organizations is an essential part of the government system that enables cooperation and facilitates the delivery of online services. Moreover, some government organisations still lack an adequate IT infrastructure; and need to invest in new equipment and upgrade the existing infrastructure before adopting cloud computing for e-government systems. These findings are reflected in the literature (Martins *et al.*, 2016; Camargo and Wang, 2015; Gebba and Zakaria, 2015). These authors agreed that many organisations lack a properly networked ICT infrastructure in e-government systems to allow adoption and diffusion of any new technologies. The results demonstrated that there is a positive significant relationship between technology readiness in government organisations and adopting cloud computing. The qualitative data analysis supported this with one interviewee commenting: *"Unfortunately, there are many government online services which have not*

received financial support to reduce the cost of improving IT infrastructure, but the adoption of modern technologies like cloud computing would assist us to focus on our duties.". Thus, government organisations should consider a high priority within IT administration to develop the ICT infrastructure in order to facilitate the adoption of cloud computing for e-government.

7.2.8 Regulation (RE)

The findings showed that concerns about regulations concerns factor are a statistically significant influence on the adoption of cloud computing, as discussed in Chapter 5. This research proposed a hypothesis (H8): *A less stringent regulatory environment will have a positive influence on the adoption of cloud services, and this was supported.* The findings from the study revealed that the regulation of government organizations is very significant, and organisations have concerns about their role in adopting cloud computing. Moreover, many organisations have policies, regulations, and standards which constrain preparation for the adoption process. The top managers agreed that regulation was a very important factor which negatively influences the adoption of cloud computing, but IT administration understood the importance of regulation and do not necessarily consider it a barrier. The existence and effectiveness of regulations will give government organisations more confidence in the adoption of cloud computing. Based on quantitative analysis, the researcher found that there was a positively correlated significant relationship between regulations and adopting cloud computing. These findings echo those of other researchers (Cao *et al.*, 2014., Almarabeh *et al.*, 2016; Martins *et al.*, 2016) who investigated IT administration concerns about regulations as a potential of difficulty in adopting cloud computing. The qualitative results also support the quantitative findings. As one IT administrator stated: *"Unfortunately, the IT department has no fixed regulations and laws that support adopting cloud computing."*. Thus, IT administrators in government organisations should consider the nature of the regulations as one of influences on the adoption of cloud computing for e-government systems.

7.2.9 Competitive pressure (CP)

The findings showed that competitive pressure has a significant and positive influence on the adoption of cloud computing. This study proposed hypothesis (H9): *The Existence of a competitive pressure influences positively the intention to adopt cloud computing for e-government systems*." The main pressures on organisations came from leaders in top management.

These organisations considered pressures from a high level as possibly motivating the adoption of new technologies such as cloud computing. Pressure from above (Top IT Managers) may result in the implementation of a more efficient IT infrastructure for e-government, with the adoption of cloud computing seen as a solution to improving e-government services. Moreover, the Saudi government has promised *(Vision 2030 is a very powerful pressure as it is internationally as well as nationally publicized)* to transfer from traditional transactions to electronic ones, which puts government organisations under a lot of pressure. The survey findings statistically showed that IT administration in government organisations consider competitive pressure as a key factor in adopting cloud computing. Some previous studies found similar results (Verma *et al.*, 2018; Andergassen *et al.*, 2017) when they examined competitive pressure as one of the significant factors that influence organisations to adopt cloud computing. The qualitative data also supported this result, as one of the interviewees stated: *"The pressure on the IT department from the development of other organisations to provide distinctive services puts our leadership under pressure in regard to the implementation of the latest technologies, such as cloud computing."*. Thus, the government organisations are concerned about pressure to improve the quality of e-government which, may increase the likelihood of adopting cloud computing for e-government in the future.

7.2.10 Trust (TU)

The result of data analysis showed that the trust in cloud computing is considered significant by Saudi IT organisations; which suggests that one of the critical factors in determining adoption is trust. The findings from this study supported the proposed hypothesis (H10): *High level of trust in cloud computing positively influences the intention to adopt cloud computing for e-government systems*. This study indicated that, in the provision of cloud computing, trust should exist on both sides, in terms of the cloud providers and organisations. The Saudi government has strict guidelines concerning the issue of trust when their organisations' data is to be managed by a third party who would then have control over their IT services. There are some IT managers who still insist on dealing only with government authorities as service providers of cloud computing. Furthermore, this finding reflects findings in other studies (El Haloui and Kriouile, 2017; Agag and El-Masry, 2016) that identified trust as a key motivation in the adoption of cloud computing. This result agreed with findings from the interviews; namely, that trust is a crucial factor when government organisations deal with service

providers of cloud computing. This means government organisations support the adoption of cloud computing, as one IT administrator commented: *"We believe that the top leaders desire an improvement in the quality of cloud computing services by local cloud providers so that they can be sure this technology is trustworthy. This will be the beginning of adoption, which may lead to increased trust and implementation in the e-government system."*. In the Saudi e-government context, where the systems have not reached a high enough level of quality, government organisations simply do not trust that adoption of new innovations would bring success. Thus, IT administrators in government organisations should consider trust as one of the influential factors that needs to be addressed in order to enhance the adoption of cloud computing.

7.2.11 Awareness (AW)

The survey findings revealed no significant correlation between the awareness of the government organisations and the adoption of cloud computing in e-government. This finding thus rejects the proposed hypothesis (H11): *High level of awareness positively influences the intention to adopt cloud computing for e-government systems.* This study found that the Saudi government was already aware of the benefits of adopting cloud computing in e-government. IT management and leaders in top management have to be aware of both positive and negative aspect of any new technology adopted for government organisation systems. For example, there would need to be an awareness about aspects of the cloud such as cost, cloud policies, and what it would be authorised to do before any adoption took place. There were many previous studies that agreed with these findings (Chen *et al.*, 2017; Lopes, 2017., Lang *et al.*, 2018) and which identified that organisations that have enough information are thus not concerned about awareness for the adoption of any new technologies in the public sector, such as cloud computing. The qualitative results also indicated that awareness does not affect the adoption of technology; as one IT manager stated: "From my point of view, there is awareness about the benefits of technologies such as cloud computing in our organizations…". Awareness about the advantages and problems of cloud computing is clearly important for any organisation wishing to adopt it. This study has confirmed that awareness is not an influential factor for the adoption of cloud computing for e-government in the Saudi context, due to the presence of an already high level of awareness. However, as this awareness needs to be maintained it should not be overlooked as a factor in improving e-government.

7.2.12 Attitude (AT)

The findings of the survey data analysis found that attitude is a critical influence on Saudi government organisations regarding the adoption of cloud computing. The hypothesis (H12) proposed that *Positive attitude on cloud computing positively influences the intention to adopt cloud computing for e-government systems.* This study found that attitude toward the adoption of cloud computing in e-government has a strongly significant positive effect on the government organizations' intention to adopt it. The finding is consistent with many previous studies in the literature on the adoption of new technology (Verma *et al.*, 2018; Howard *et al.*, 2017); which showed that the attitude toward the adoption of cloud computing has a strong significant influence on government organizations' decisions. Also, organisational leaders' attitudes towards the new technology have been shown to be a very strong predictor of adoption. Furthermore, the interviews revealed that individuals in the organisation with an advanced level of experience of Internet technologies also rated attitude as an important factor for adoption, as shown by this IT administrator's remark. *"As an IT manager, I believe that there is a positive attitude towards cloud computing that can help us to adopt cloud computing for our e-services."*. Therefore, as participants knowledge about cloud computing that there is the attitude towards cloud computing is informed by an awareness of its functionality, advantages and possible pitfalls, so that, in this context, the attitude has subsumed awareness as an influential factor on the adoption of cloud computing for e-government system. Thus, the findings imply that government organizations are most likely to adopt cloud computing if they have favourable attitudes towards the benefits of cloud computing. Government organisations should therefore consider attitude as a high level of priority in the adoption of cloud computing for e-government systems given that this factor has a strong positive significant relationship correlated to adoption.

7.3 Research Adoption Model

This research investigated critical influences on the adoption of cloud computing for e-government in Saudi organisations. To this end, an integrated research model based on the TOE model combined with DOI was developed and validated. The proposed model (ACCE-GOV) extended the TOE by including extra variables that made it more appropriate for investigating the adoption of cloud computing by Saudi organisations for their e-government

systems. This study applied the Cronbach alpha test to measure reliability, which achieved a value of more than 0.6 which indicates this model has a great reliability coefficient. The factor analysis used the correlation matrix between factor loading and variables to confirm the construct validity of the data.

These results showed that the adoption of cloud computing for e-government is strongly predicted by the attitude towards cloud computing, that makes this factor the most significant in the ACCE-GOV model. The second most influential predictor of adoption of cloud computing for e-government was revealed as trust in cloud computing services. This can be explained by the Saudi government's determination to only entrust sensitive data to third parties that they totally trust. Government organisations might be encouraged to adopt technologies for e-government systems if they can be convinced to have confidence in the cloud computing provider. Thus, by applying the ACCE-GOV model, which was developed with the Saudi context in mind, this study has revealed the most significant variables in the adoption of cloud computing for the e-government system.

In contrast, compatibility was hypothesised to correlate with the adoption of cloud computing. This study applied multiple regression examinations and found that compatibility had no significant impact on the adoption of cloud computing. Moreover, in this study the analysis revealed that awareness was also not positively correlated with adopting cloud computing. The compatibility and awareness factors were revealed to not be significant in the ACCE-GOV model and it was decided that they should consequently be removed. However, they should not be overlooked as important for the improvement of e-government systems. The significant relationships are represented line arrow unlike the insignificant relationships are represented as Intermittent arrow as well as asterisks (*) that indicate the level of the significance. The revised research model is presented in Figure 7.1.

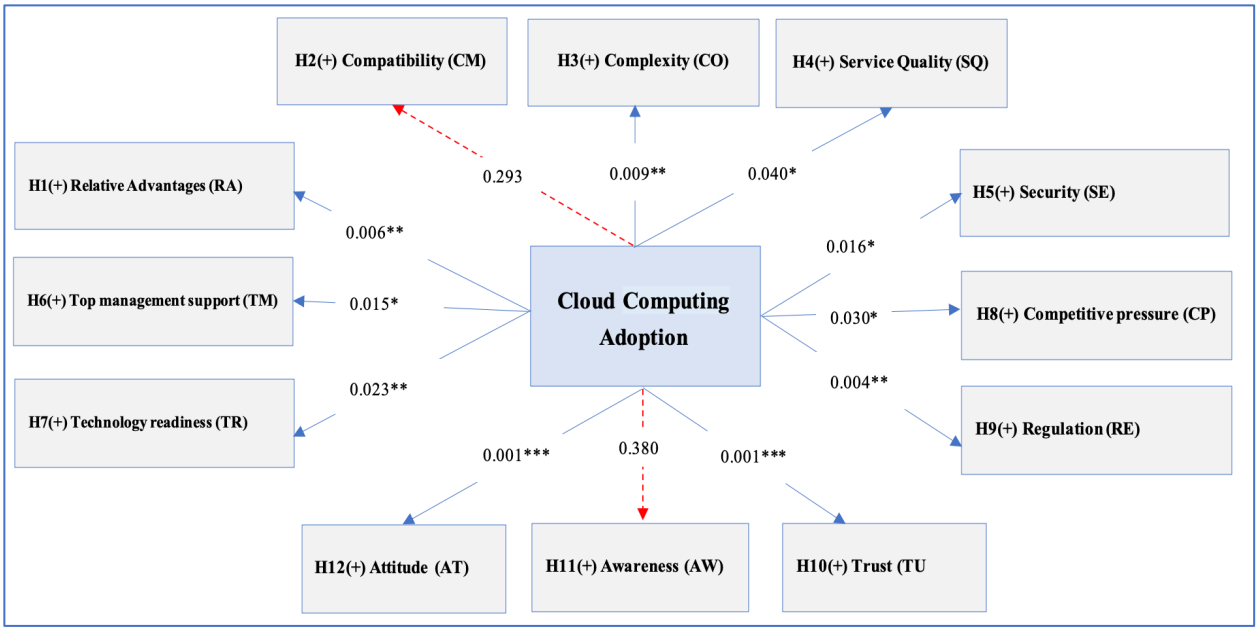

Figure 7.1: The Revised Structural Model

significant effect	→
no significant effect	⇢

7.4 Recommendations for adoption of cloud computing for e-government systems

The study conducted has led to some results that could be taken into consideration by government organisations who intend to adopt technological innovations. This research had proposed a model that can help to make decisions about introducing technological innovations, like the cloud, into government systems. The following recommendations are provided based on the insights gained from this study into the main factors that influence the adoption of cloud computing for Saudi e-government. Given the heavy investment in ICT, policymakers are keen to find creative strategies that may be enhanced by consideration of the recommendations before implementing any services in the future:

1. **Flexibility in IT infrastructure**

Government organisations should take into consideration that cloud computing is ideal for government organisations with growing or fluctuating bandwidth demands. Many organizations need an easy way to store data; and this can be done on the cloud's remote servers. This is especially flexible to manage storage capacity which changes rapidly. This flexibility makes cloud computing suitable for a growing online service and can give organisations using it an advantage as back up storage. This feature will develop e-government through the adoption of cloud computing. Moreover, decision-makers can more easily create a strategic action plan for the future of e-government system and use the advantages of cloud computing to support the Saudi government's vision of modernising and improving its provision of information and services to its citizens.

2. **Automatic software updates and disaster recovery**

Government organizations should consider investing in appropriate technologies that have reliable recovery and avoid any damage in data storage. Adoption of the cloud for e-government can take into account cloud-based backup and recovery solutions. Moreover, cloud computing providers can provide regular software and security updates that allow government organisations to not worry about wasting time maintaining the system. Most IT departments in organisations focus on developing the quality of their services, to attain the high level of satisfaction in e-government required by the Saudi government. This feature of automatic software update and disaster recovery may encourage government organisations to seek more suitable solutions for updating their systems. In terms of challenges facing the implementation and improvement of e-government system; government organisations need to consider the IT infrastructural issues related to the adoption of cloud computing in e-government system.

3. **Reducing cost of improvement**

In this research, the results show that government organizations are still incurring high costs in improving their IT infrastructure. Therefore, one of the benefits of cloud computing is that it can reduce the high cost of IT hardware. Organizations simply pay as they use it. In addition, setup is easy and management can be more effective. The organisations that take a first step towards adopting the cloud can access and share systems anytime and from anywhere. Also, the government organizations can be in collaboration and connected with each

other in one platform based on cloud computing. This may encourage top management in government organizations to consider the advantages of this feature.

4. More mobility with reliability

Saudi e-government is still in the early stages, that means the government needs to increase the number of employees and customer service centres that are either on the premises or in remote locations; and which could be easily accessed by all organisations through the use of cloud services. All government organisations need more connectivity for their internet services. Therefore, with reliable cloud computing, organizations can always get instantly updated about the changes without any effect to their system. The Saudi government can improve e-government systems by formulating appropriate policies and strategies about the development of e-government. Furthermore, the results of this study are useful as a way to attract support for e-government system initiatives. The revised research framework proposed has been shown fully capable of providing an efficient and reliable way to assess the adoption of cloud computing for e-government, especially in the Saudi context.

7.5 Research Contribution

This research has made an important contribution to knowledge by integrating a new theoretical framework for identifying the critical factors in the adoption of cloud computing for e-government. The framework consists of four main dimensions to evaluate the adoption of cloud computing for e-government, namely: the technological context organisational context, environmental context and social context. This is a novel contribution to the theoretical perspectives on e-government development. In the framework, each dimension has a set of critical factors to evaluate the adoption of cloud computing in e-government. These could provide recommendations to top management in government organisations for increasing the quality of e-government services. This research contributes to the field of the adoption of cloud computing for e-government research from both top management and IT administration perspectives. These contributions were discussed in chapter 1 as follow:

7.5.1 The Various Dimensions of the Theoretical Framework of the research

This research has made a significant contribution to developing a research framework for evaluating the adoption of cloud computing for e-government. The theoretical model of this research is based on the TOE model combined with DOI model that categorised into four main dimensions: (a) technological context, (b) organisational context, (c) environmental context, and extended dimension (d) social context; which found that attitude and trust have a strong positive influence toward the adoption of cloud computing for e-government systems. Each of these dimensions comprises significant critical factors identified in the conducted study, which evaluate the adoption of cloud computing for e-government systems (see Chapter Four for details). This, model can be used to research innovative technology adoption to improve e-government systems in developing countries.

7.5.2 The Research used Mixed Methods

This research further contributes to the literature on the mixed methods (quantitative and qualitative) approach and the research methodology that can be employed to assess the adoption of cloud computing for e-government. The research demonstrates how this methodology fulfils the exploratory and confirmatory research objectives, provides insight into research procedures and the formulation of research questions as well as data collection and analysis for both quantitative and qualitative data. This research will be an appropriate example of the applicability of a mixed-methods approach to investigating the adoption of cloud computing for e-government to obtain a comprehensive evaluation and understanding of the issue. The current research is the first thesis that examines four critical contexts (technological, organisational, environmental and social) that influence the adoption of cloud computing for e-government by applying a mixed method (quantitative and qualitative) approach.

7.5.3 The Framework Generalization [ACCE-GOV] as an Appropriate Framework for Developing Countries

This research can contribute the revised framework to allow researchers and governments in developing countries to identify the most important barriers in the transition to a reliance on cloud computing for e-government systems. This can be by applying the factors identified in the framework that highlight the main organisational requirements needed to successfully adopt the cloud for e-government. The research is arguably the first investigation to use this

comprehensive evaluating framework to examine the adoption of cloud computing for e-government systems; specifically, in the context of a developing country. As a result, governments in the Middle East, especially those in the Arabian Gulf, which have similarity in the economy, culture, policies and government regulations. Therefore, these governments would be able to take the required action in any initiative involving consideration of adopting cloud computing for e-government to evaluate the likely outcome and determine whether there are any impediments to successful adoption. Therefore, the framework would be an appropriate framework to assist the adoption of cloud computing for e-government in other developing countries.

7.5.4 Examination of Various Perspectives

This research contributes to literature on the adoption of cloud computing by investigating and examining critical factors that influence the adoption of cloud computing for e-government in the Saudi context. There are a limited number of previous studies that focus in the public sector: (Huang, 2018; Fleming *et al.*, 2017; Kao *et al.*, 2015; More and Kanungo, 2017; Almarabeh *et al.*, 2016). Therefore, this research provides a significant contribution to examine the perspectives of top government management and the IT administration of government organisations in investigating the relevant critical factors that impact the adoption cloud computing for e-government If applied, the findings can be expected to assist in addressing improvements needed for the IT infrastructure for government organisations' services, especially e-government. Based on that, the results of the research accepted by the Saudi e-government program ***"Yesser".*** For this, there is a cooperative between the researcher and Yesser an e-government program to take into account the research results and recommendations and plan to provide more research.

7.5.5 A basis for future academic studies

This study takes into account previous theories in its exploration of the adoption of cloud computing by organisations for e-government, and its findings can be built on by future studies. This study incorporates four dimensions to develop a research model to assess the determinants of the adoption of cloud computing for e-government system: (a) technological context, (b) organisational context, (c) environmental context, and (d) social context. This was done by extending the TOE model, and the two factors (attitude and trust), which were found to have the most statistically significant impact, were both in the added dimension (d). This

demonstrates the value of adding this dimension. Furthermore, understanding the influences on the adoption of cloud computing for e-government system took a holistic approach to empirically validate the characteristics of adoption. There were important insights regarding the adoption of cloud computing in e-government system in developing countries specifically in the Saudi e-government context. In this regard, the proposed conceptual research model will be appropriate for any governments that have the intention to improve the quality of e-government with innovations such as the cloud.

The aforementioned contributions of this research outline how important insights have been provided regarding the adoption of cloud computing for e-government system in developing countries, specifically in the Saudi e-government context.

7.6 Practical Implications for Decision Makers in E-government system

The features of cloud computing have been prompting many governments to move to cloud-based services. Therefore, the findings of this empirical study may contribute to understanding of the mechanism of adoption of cloud computing for e-government systems. The findings will help top management in government organizations develop more appropriate and effective strategies that encourage adoption of cloud computing for e-government.

Firstly, top management in government organizations could concentrate their efforts on enriching provision by implementing improvement in technical infrastructures. This study provides an integrated framework that provides explanations for the reasons why e-government systems have a lack of IT infrastructures that allow the adoption of cloud computing platforms. This empirical study has been conducted to identify the critical factors that influence adoption of cloud computing for e-government, to evaluate them and develop a comprehensive research framework. Thus, government organisations should have appropriate e-government services and consider the adoption of cloud computing platforms; for this there has to top management support to implement effective IT infrastructure in the e-government system.

Secondly, this study provides empirical evidence of how different theories can be integrated to provide a more appropriate conceptual model. The theoretical concept of this research was based on the TOE model and DOI theory to enrich the research model, the technology acceptance literature, there were a few examples of models being integrated. This

integrated model offers insights into the adoption of technologies by highlighting the differential effects of the variables that may prove useful to top managers of organisations considering adoption. The general implications emerging from the study highlight the potential difficulties as well as the advantages that could arise from cooperation between Saudi government organisations and cloud computing providers to ensure the efficiency of e-government, Thus, making full use of this research may assist any future decisions about such cooperative ventures.

Thirdly, this research has illustrated how the attitudes of top managers and Saudi government policy and regulations are enormously influential in adopting innovations such as the cloud to improve e-government. Top managers need to consider the importance of creating a supportive organizational environment by providing clear and effective regulations to support the development of e-government; and the leaders of government organisations need to understand and overcome any barriers to investment IT technologies that would enhance their systems. The impact of stringent and complex regulations has been shown by this study to delay providing better solutions (such as the cloud) for issues such as disaster recovery and flexible and easy-to-access data with ever-increasing volume. Top management leaders may be motivated by these findings to look at solving these difficulties and reducing the concerns of many Saudi government organisations about the increased capacity of e-government systems in the future.

Fourthly, one important practical implication of the results of this research is that top managers and IT departments should consider that the quality of e-government services would be retained and that the security of sensitive data would be highly assured during and after any transfer to the cloud. Thus, the investment in new technologies that will increase the effectiveness of the e-government systems has the attention of top managers who wish to overcome the IT infrastructure issues of government systems.

7.7 Research limitations

The findings of this research have provided an appropriate understanding of the adoption of cloud computing in e-government; however, several limitations have been identified in this research. This affords scope for further research, in the light of the research limitations explained below:

- **Limitation in the research scope**

This research was focused on the perspective of government organisations. Interviews were conducted with a limited number of participants (eight top managers and IT administrators from eight government ministries). Therefore, the other branches of the government administration (*e.g. The Ministry of Sports, the Ministry of Culture and Information and the Ministry of Housing*) and cloud computing providers were out of the scope of this research. This limitation suggests that these organisations could be investigated, and their members questioned in order to extend the knowledge gained from this research.

- **Some of the potential interviewees refused to participate**

The researcher experienced some difficulty when attempting to conduct interviews with IT staff to invite and record their participation. This was imposed by top management in government during the research that made it difficult to collect further data. There were even doubts about the possibility of applying of research model in the Saudi e-government context. Therefore, the supervision team at the University of Sussex provided a supporting letter to the researcher in the hope that this would open doors. However, most of the Saudi government organisations were not convinced enough to allow participation in the research due to the introduction of stricter regulations in organisations, not allowing non-workers to enter the most sensitive government organisations, as some organisations were having a lot of problems with its IT systems.

Furthermore, during the interviews, some of the participants hesitated or were reluctant to discuss some questions, due to concerns about criticising the government's role in the improvement of e-government systems. In this case, the researcher (interviewer) immediately asked the question in a different way to obtain the required information. Nevertheless, this caused difficulty in acquiring all the relevant data from government employees. There is still a lack of transparency in many government organisations which is essential if these challenges are to be properly explored. Thus, not being able to access government data represents one of limitations of this research.

- **Time taken to analyse interviews**

Despite the significant contribution of this study to the adoption of cloud computing in e-government research, the answers to interview questions were all in Arabic; as this was the

mother tongue of all the interviewees. However, the research needed to be written up in English as the thesis was submitted to the University of Sussex. Much care was taken in order to avoid missing any data or misrepresenting the participants' meanings and a substantial amount of time was needed during the process of translation. In spite of these precautions, translation, however accurate, may not always fully convey what an interviewee intends; especially when the languages come from two very dissimilar cultures

- **Limitations of time and resource constraints**

Finally, this research had limitations of time and resource constraints. This Ph.D research had to be completed within a reasonable timeframe. Moreover, communication procedures with government organizations in order to set up the interviews were extremely lengthy. In the future, if there more time to allocate for empirical work, that would be a great opportunity to conduct the research with a wider scope.

7.8 Conclusion and Further Research

The adoption of cloud computing in e-government is considered a critical phenomenon in the field of technology adoption that still requires further study. Therefore, this research assists as the first step towards further research into the adoption of cloud computing for e-government systems. Thus, highlighting the limitations and concerns of this research, has revealed areas of interest that are opportunities for future studies. These are as follows:

- Further research needs to be done using the ACCE-GOV model, possibly using a larger number of government organisations or in a different context. This can be carried out to evaluate the model's validity and provide a deeper understanding of the relationships among the factors. This would strengthen knowledge about what influences adoption of cloud computing for e-government system and could be useful to the relevant government agencies for creating a structured plan on how to encourage and motivate the adoption of cloud computing.

- The adoption of cloud computing for e-government still faces many problems; as was identified through a set of interviews with a limited sample of IT managers in Saudi government organisations. It would be appropriate to carry out interviews with a wider sample of top management in government organisations. Alternatively, a focus group consisting of IT experts from a wide range of government organisations could be set up to discuss the question of what influences the adoption of cloud technology for e-government. In the future, both

qualitative and quantitative data collection could be done on a wider scale to allow further and more detailed exploration of the adoption of cloud computing for e-government systems.

- Finally, future research could address specific aspects of the adoption of cloud computing for e-government, such as software development models and waterfall and process structure models to identify important influential factors and barriers to adoption that it can be generalised more broadly.

The research aimed to examine the critical factors that influence the adoption of cloud computing in e-government. The chapter discussed the finding of this research conducted with top management and IT experts in e-government in Saudi government organisations. The revised research model identified based on a result of data analysis about the adoption of cloud computing for e-government systems. The results from the interview data analysis supported the findings from the questionnaire data analysis. New factors were explored, that could be appropriate to explore further in future research; which will increase the understanding of adoption and provide a holistic view of Saudi e-government from government organisations' perspectives.

This research identified critical factors in technological, environmental, organisational, and social context that were drivers in influencing the adoption of cloud computing for Saudi e-government. This study was carried out with the aim of providing a comparison of the results of both qualitative and quantitative data analysis about Saudi government organisations' perspectives on using new innovations (the cloud) to develop e-government systems. This research and its findings provide insights into an important issue that impaction the efficiency and success of any future decision to adopt cloud computing for Saudi e-government systems. As a result, this research proposes a research model to ensure the most efficient and reliable transformation to cloud computing for e-government system.

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Appendix A: Ethics Application Approval

Sciences & Technology C-REC
crecscitec@admin.susx.ac.uk

Certificate of Approval	
Reference Number	ER/NA424/1
Title Of Project	Design a comprehensive model to investigate the factors affecting the adoption of cloud computing in government organizations
Principal Investigator (PI):	Natalia Beloff
Student	Naif Al Mudawi
Collaborators	
Duration Of Approval	4 months approx
Expected Start Date	01-Mar-2019
Date Of Approval	04-Mar-2019
Approval Expiry Date	30-Jun-2019
Approved By	Karen Long
Name of Authorised Signatory	Karen Long
Date	04-Mar-2019

*NB. If the actual project start date is delayed beyond 12 months of the expected start date, this Certificate of Approval will lapse and the project will need to be reviewed again to take account of changed circumstances such as legislation, sponsor requirements and University procedures.

Please note and follow the requirements for approved submissions:

Amendments to protocol

* Any changes or amendments to approved protocols must be submitted to the C-REC for authorisation prior to implementation.

Feedback regarding the status and conduct of approved projects

* Any incidents with ethical implications that occur during the implementation of the project must be reported immediately to the Chair of the C-REC.

Feedback regarding any adverse(1) and unexpected events(2)

* Any adverse (undesirable and unintended) and unexpected events that occur during the implementation of the project must be reported to the Chair of the Science and Technology C-REC. In the event of a serious adverse event, research must be stopped immediately and the Chair alerted within 24 hours of the occurrence.

Monitoring of Approved studies

The University may undertake periodic monitoring of approved studies. Researchers will be requested to report on the outcomes of research activity in relation to approvals that were granted (full applications and amendments).

Research Standards

Failure to conduct University research in alignment with the Code of Practice for Research may be investigated under the Procedure for the Investigation of Allegations of Misconduct in Research or other appropriate internal mechanisms (3). Any queries can be addressed to the Research Governance Office: rgoffice@sussex.ac.uk

(1) An "adverse event" is one that occurs during the course of a research protocol that either causes physical or psychological harm, or increases the risk of physical or psychological harm, or results in a loss of privacy and/or confidentiality to research participant or others.

(2) An "unexpected event" is an occurrence or situation during the course of a research project that was a) harmful to a participant taking part in the research, or b) increased the probability of harm to participants taking part in the research.

(3) http://www.sussex.ac.uk/staff/research/rqi/policy/research-policy

Appendix B: Data collection documents for the questionnaire (English versions)

Part I: Organisations Details

Q1. Please indicate your gender?

- Male
- Female
- prefer not to say

Q2. What is your age?

- 18 - 30
- 31 - 45
- 46 - 60
- Over 60

Q3. What is your education level?

- Secondary school or less
- Diploma
- Bachelor degree
- Master degree
- Doctorate degree

Q4. Your organisations (Education, Health, Liber, Financial, Other Please specify .....)

Q5. What is the number of employees in your organisation? …….

Q6: What is your job title in the organisations?

- Director of the governmental organization
- IT Director
- IT staff
- Other, please specify .....

Q7: Years' experience:

- Less 1 year
- Less 3 years
- Less 10 years
- More than 10 years

Q8. Does your organisation adopt cloud computing?

- Yes
- No

Q9. What types of cloud computing does your organisations use?

- Public cloud
- Private cloud
- Hybrid cloud
- N/A

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

Survey 1: Technological context **From your experience in IT field, please choose the most appropriate answer on the right against each of the following questions regarding cloud computing that best indicates your opinion.**						
Sr	**Q1. Relative Advantages (RA)**	**Strongly Disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly Agree (5)**
1	**Adoption of cloud computing in our organisation will enable us to reduce the operating costs.**					
2	**Adoption of cloud computing will improve the performance of our organization.**					
3	**The use of cloud computing in our organisation will help us to accomplish tasks more quickly.**					
4	**Adoption of cloud computing will improve our online services delivery.**					
Sr	**Q2. Compatibility (CM)**	**Strongly Disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly Agree (5)**
1	**Adopting of cloud computing can be easily integrated into existing IT infrastructure.**					
2	**Adopting of cloud computing is compatible with the systems that are already in use.**					
3	**Adopting of cloud computing is compatible with all aspects of our organisation's existing format, interface, and other structural data.**					
4	**Adopting of cloud computing fits well with our online services provided.**					
Sr	**Q3. Complexity (CO)**	**Strongly Disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly Agree (5)**
1	**With the adoption of cloud computing, there will be some complexity of maintaining cloud computing platform.**					
2	**With the adoption of cloud computing, it will be more difficult to develop new solutions / extend the existing functionality of the system.**					
3	**With the adoption of cloud computing, more time is required by IT staff to perform their normal duties.**					

4	Learning to operate in the cloud computing environment is complex for employees.					
Sr	Q4. Services Quality (SQ)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1	The adoption of cloud computing will provide a high service quality with high efficiency.					
2	The adoption of cloud computing will deliver better online services.					
3	The adoption of cloud computing will provide sufficient backup service.					
4	The adoption of cloud computing meet user expectations with respect to response time, flexibility and ease of use.					
Sr	Q5. Security (SE)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1	The security systems built into cloud computing are insufficient to protect our organizational data.					
2	The traditional servers are more secure than cloud computing technology.					
3	In the cloud computing environment, the confidentiality and security are poor.					
4	Cloud computing service providers do not manage security controls adequately for a comprehensive system's defence.					

Survey 2: Organisational context

From your experience in IT field, please choose the most appropriate answer on the right against each of the following questions regarding cloud computing that best indicates your opinion.

Sr	Q1. Top Management Support (TM)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1	The organization's top management provides strong leadership and engages in the process when it comes to the adoption of cloud computing.					
2	The organisation's management is willing to take risks (e.g. financial) involved in the adoption of cloud computing.					

3	Top management encourages using new emerging technology to provide e-services.					
4	Top management has allocated adequate financial and other resources for intention to the adoption of cloud computing.					
Sr	Q2. Technology Readiness (TR)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1	The adoption of cloud computing will be compatible with existing hardware and software in the organisation.					
2	The IT technical support in the organisation has the capacity and appropriate skills to deal with the adoption of cloud computing.					
3	The Internet speed of the organisation is sufficient to adopt cloud computing.					
4	The technology infrastructure of our organisation is available to support cloud computing.					

Survey 3: Environmental context From your experience in IT field, please choose the most appropriate answer on the right against each of the following questions regarding cloud computing that best indicates your opinion.						
Sr	Q1. Regulatory (RE)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1	The laws and regulations in our organisation allow the adoption of new technologies.					
2	The law and regulations in our organisation are flexible to be amended according to the emerging needs.					
3	The law and regulations in our organisation comply with the current cloud computing regulations.					
4	The laws and regulations in our organisations support cloud computing initiatives and implementation.					
Sr	Q2. Competitive pressure (CP)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)

1	Some of the organisation competitors have already started using cloud computing.					
2	Our organisation has experienced pressure from the competitors to adopt cloud computing.					
3	Our organisation believes that adopting cloud computing will strengthen our competitiveness and improve online services offer.					

Survey 4: Social context

From your experience in IT field, please choose the most appropriate answer on the right against each of the following questions regarding cloud computing that best indicates your opinion.

Sr	Q1. Trust (TR)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1	I am confident that cloud computing has legal and technological structures to adequately protect me from problems at technological level.					
2	I have a trust in cloud computing providers to store our sensitive information appropriately and securely.					
3	The cloud computing has enough safeguards to make us feel comfortable using it.					
4	I am confident that Our organisation's information in the cloud will not be used by a third party without our consent.					
5	The digital storage in cloud computing is a reliable and secure environment.					
Sr	**Q2. Awareness (AW)**	**Strongly Disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly Agree (5)**
1	Our organisation is fully aware of the benefits of cloud computing.					
2	Our organisation is familiar with the cloud computing that allows us to deliver online services based on the Internet.					
3	Our organisation has a good perception of the effectiveness of cloud computing.					

4	Our IT department is aware about cloud computing, but the top management does not have intention to adopt it.					
5	Our organisation is aware of the disadvantages and challenges of cloud computing.					
Sr	Q3. Attitude toward Cloud computing	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1	Adoption of cloud computing is a beneficial for our organisation.					
2	Adoption of cloud computing is challenging from technical perspective.					
3	Adoption of cloud computing will require more effort from each employee.					
4	Adoption of cloud computing will create better work dynamic in our organisation.					

Survey 5: Adoption Intention Cloud Computing

From your experience in IT field, please choose the most appropriate answer on the right against each of the following questions regarding cloud computing that best indicates your opinion.

Sr	Q1. Adoption Intention (AI)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1	I have a favourable attitude toward cloud computing implementation and I am willing to try cloud computing out shortly.					
2	It is likely that our organisation will take steps to adopt cloud technology in the future.					
3	I strongly recommend our organisations to adopt cloud computing technology.					
4	I believe that adopting cloud computing services will give us more advantages.					
5	Our organisation has potential adoption of cloud computing but decided not to pursue by top management at the present time					
6	Our organisation completed an adoption plan but has a lack of a financial resource.					

Appendix C: Data collection documents for questionnaire (Arabic versions)

السلام عليكم ورحمة الله وبركاته **وبعد**

عزيزي المشارك،

انا الطالب نايف ال مداوي، بمرحلة الدكتوراه بجامعة ساسيكس بالمملكة المتحدة، قسم المعلوماتية تحت إشراف الدكتورة ناتاليا بيلوف. أدعوك للمشارك في الإجابة على أسئلة الاستبيان لهذه الدراسة والتي تركز على تحديد العوامل ومدي تأثيرها على تطبيق الحوسبة السحابية للمنظمات الحكومية بالمملكة العربية السعودية، تحت عنوان "تصميم نموذج شامل لدراسة العوامل المؤثر على اعتماد الحوسبة السحابية في المنظمات الحكومية"

قبل الإجابة على أسئلة الاستبيان نرجو منك قراءه بعض التفاصيل:

الغرض الرئيسي من هذه الدراسة هو تحسين الخدمات الإلكترونية المقدمة للمواطنين والشركات والمنظمات الحكومية عبر الإنترنت ومعرفة مدي رغبة الجهات الحكومية في تطبيق الحوسبة السحابية (**Cloud computing**) .

ومن الأمثلة على الخدمات الحكومية المقدمة للمواطنين عبر الانترنت ما يلي:

- ابشر التي تقدمها وزاره الداخلية مما يتيح لك تجديد جوازات السفر، والتقدم بطلب للحصول على بطاقة الهوية الوطنية أو رخصه القيادة.
- الموقع الالكتروني لوزارة التجارة والذي يسمح للمواطنين بإصدار السجلات التجارية وغيرها من الخدمات عبر الإنترنت.
- برنامج جداره الذي تقدمة وزارة الخدمة المدنية بطلب الحصول على وظائف تعليميه حكومية

تستغرق الإجابة على هذا الاستبيان حوالي ٢٠ دقيقة والذي يتكون من جزأين رئيسيين: الأول معلومات عامة. الجزء الثاني أسئلة حول العوامل المؤثرة على تطبيق الحوسبة السحابية. مشاركتك تعتبر تطوعية مما يعني انه لديك الحق في التوقف عن اكمال الاستبيان في أي وقت، أرجو منك الاحتفاظ برقم الاستبيان الخاص بك. جميع البيانات والمعلومات التي سيتم جمعها سوف يتم حفظها بسرية تامة .وسوف يتم إخفاء وترميز أي معلومات يمكن من خلالها تحديد هوية المشارك للحفاظ على خصوصية المشاركين . سوف يتم تحليل نتائج هذه الدراسة وإستخدامها لأغراض البحث فقط .إذا أردت مناقشة نتائج هذه الدراسة، لا تتردد في التواصل معي .

ملاحظة: تمت الموافقة على هذه الدراسة من قبل لجنة أخلاقيات البحث العلمي (crecscitec@sussex.ac.uk). الرقم المرجعي للمشروع هو (**ER/NA424/1**) .إذا كنت ترغب في حذف المشاركه و البيانات الخاصة بك من هذا البحث ، يرجى إرسال طلب إلى الباحث عبر الايميل التالي (na424@sussex.ac.uk).

معلومات الاتصال بالباحث:
البريد الالكتروني: **na424@ Sussex.ac.uk**
هاتف: 7378747414 (**00**44)

إذا كان لديك اي استفسار بشأن الدراسة، يمكنك الاتصال بالمشرف أولجنه الأخلاقيات (C-REC):

مشرف البحث الدكتورة / ناتاليا بيلوف
البريد الالكتروني: N.Beloff@sussex.ac.uk
تلفون: 1273 678919 (**0044**)
قسم المعلوماتية،
جامعه ساسكس
برايتون
BN1 9**QJ**

لجنه الأخلاقيات (C-REC): crecscitec@sussex.ac.uk

لك خالص الشكر والتقدير،

? أرغب بالمشاركة.

? لا أرغب بالمشاركة.

الجزء الأول: التفاصيل العامة للمنظمة

السؤال الأول: العمر: (.....)

السؤال الثاني: الجنس؟

- ذكر
- انثى

السؤال الثالث: ما هو المستوى التعليمي لديك؟

- ثانويه او اقل
- دبلوم
- بكالوريوس
- ماجستير
- دكتوراه

السؤال الرابع: ما هو مجال المنظمات التي تعمل بها؟

(.....)

السؤال الخامس: كم عدد الموظفين بمنظمتك؟

(.....)

السؤال السادس: المسمى الوظيفي الذي تعمل به في المنظمة ؟

- مدير المنظمة الحكومية
- مدير إدارة تقنيه المعلومات
- موظف في قسم تقنيه المعلومات
- الأخرى، يرجى تحديد.....)

السؤال السابع: عدد سنوات خبرتك في مجال تقنية المعلومات؟

(.....)

السؤال الثامن: هل تعتمد منظمتك على تقنيه الحوسبة السحابية؟

- نعم
- لا

السؤال التاسع: ما هو نوع الحوسبة السحابية التي تستخدمها منظمتك؟

- سحابه عامه
- سحابه خاصه
- سحابه هجينة
- N/A

.الجزء الثاني: العوامل المؤثرة على تطبيق الحوسبة السحابية

من خلال تجربتك حدد مستوى موافقتك على العبارات التالية؟						
م	**أ- مميزات تطبيق الحوسبة السحابية .**	لا أوافق بشده ١	لا أوافق ٢	محايده ٣	أوافق ٤	أوافق بشده ٥
١	تطبيق الحوسبة السحابية في المنظمة سوف يقلل من تكاليف التشغيل.					
٢	تطبيق الحوسبة السحابية سوف يساعد على تحسين أداء المنظمة.					
٣	تطبيق الحوسبة السحابية في المنظمة سوف يساعد على إنجازالمهام بشكل أسرع.					
٤	تطبيق الحوسبة السحابية سوف يساعد على تحسين الخدمات الإلكترونية عبرالإنترنت.					
م	**ب- من خلال خبرتك الي أي مستوى يتوافق تطبيق الحوسبة السحابية مع منظمتك.**	لا أوافق بشده ١	لا أوافق ٢	محايده ٣	أوافق ٤	أوافق بشده ٥
١	تطبيق الحوسبة السحابية تتلائم مع البنية التحتية الحالية لتقنية المعلومات.					
٢	تطبيق الحوسبة السحابية متوافق مع النظام المستخدم حالياً في المنظمة.					
٣	تطبيق الحوسبة السحابية متوافق مع جميع البرامج، وواجهات المستخدم لنظام الحالي.					
٤	تطبيق الحوسبة السحابية متوافقة مع تقديم الخدمات الإلكترونية عبرالإنترنت.					
م	**ج- من خلال خبرتك مامدى مستوى التعقيد في حالة تطبيق الحوسبة السحابية مع منظمتك.**	لا أوافق بشده ١	لا أوافق ٢	محايده ٣	أوافق ٤	أوافق بشده ٥
١	يوجد بعض الصعوبات والتعقيدات في التعامل مع خدمات الحوسبة السحابية .					
٢	من الصعب إيجاد حلول جديدة أو تطويرفي الخدمات الإلكترونية الحالية عند تطبيق الحوسبة السحابية.					
٣	يحتاج موظفين تقنية المعلومات إلى مزيد من الوقت لأداء المهام عند تطبيق الحوسبة السحابية.					
٤	العمل في بيئة الحوسبة السحابية أمر معقد للموظفين.					
م	**د- من خلال خبرتك إلي أي مدى تطبيق الحوسبه السحابيه يساعد علي تحسين جودة الخدمات بمنظمتك.**	لا أوافق بشده ١	لا أوافق ٢	محايده ٣	أوافق ٤	أوافق بشده ٥
١	تطبيق الحوسبة السحابية سوف يقوم بتحسين جوده الخدمات الإلكترونية بصورعالية.					
٢	تطبيق الحوسبة السحابية سوف يساعد على سهولة الوصول إلى الخدمات الإلكترونية بشكل أفضل.					
٣	تطبيق الحوسبة السحابية سوف يساعد على توفير نسخ إحتياطية بصوره كافيه لنظام.					
٤	تطبيق الحوسبة السحابية يُمكن النظام ليصبح اكثرالاستجابة ومرونة.					

م	هـ - من خلال خبرتك إلى أي مستوى تكون الحماية في تطبيق الحوسبة السحابية بمنظمتك.	لا أوافق بشده ١	لا أوافق ٢	محايده ٣	أوافق ٤	أوافق بشده ٥
١	نظام الحماية بالحوسبة السحابية غير كافي لحماية بيانات النظام.					
٢	السيرفر المستخدم بالمنظمة أكثر أماناً من استخدام الحوسبة السحابية.					
٣	سرية بيانات ومعلومات المنظمة لدى الحوسبة السحابية تعتبر ضعيفه.					
٤	مزودي خدمات الحوسبة السحابية لا يقوموا بتوفير نظام حماية كافٍ للنظام.					

من خلال خبرتك حدد مستوى موافقتك على العبارات التالية؟						
	أ -من خلال خبرتك إلى أي مستوى يكون دعم الإدارة العليا في تطبيق الحوسبة السحابية بمنظمتك.	لا أوافق بشده ١	لا أوافق ٢	محايده ٣	أوافق ٤	أوافق بشده ٥
١	الإدارة العليا للمنظمة توفر الدعم الكافي لتطبيق الحوسبة السحابية.					
٢	الإدارة العليا للمنظمة على إستعداد تحمل كافة المخاطر المختلفة (مثل المالية) من أجل تطبيق الحوسبة السحابية.					
٣	تقومالإدارة العليا بتحفيز المنظمة لتطبيق تقنيات جديدة مما يساعد على توفير الخدمات الإلكترونية بصورة افضل.					
٤	الإدارة العليا للمنظمة خصصت دعم مالي كافي لتطبيق الحوسبة السحابية.					
م	**ب -من خلال خبرتك الي أي مستوى يكون الاستعداد التقني بمنظمتك مع تطبيق الحوسبة السحابية.**	لا أوافق بشده ١	لا أوافق ٢	محايده ٣	أوافق ٤	أوافق بشده ٥
١	تطبيق الحوسبة السحابية سوف يكون متوافقًا مع الأجهزة والبرامج المستخدمة حالياً بالمنظمة.					
٢	الدعم التقني لتقنية المعلومات بالمنظمة لديه القدرة والمهارات الكافية للتعامل مع الحوسبة السحابية.					
٣	سرعه الإنترنت في المنظمة كافٍ لتطبيق الحوسبة السحابية.					
٤	البنية التحتية لتقنية المعلومات (مثل أنظمة التشغيل والكيابل وغيرها) بالمنظمة ملائمة لتطبيق الحوسبة السحابية.					

من خلال خبرتك حدد مستوى موافقتك على العبارات التالية؟						
م	**أ -من خلال خبرتك الي أي مستوى تتوافق اللوائح والقوانين بمنظمتك مع تطبيق الحوسبة السحابية.**	لا أوافق بشده ١	لا أوافق ٢	محايده ٣	أوافق ٤	أوافق بشده ٥
١	اللوائح المعمول بها بالمنظمة تسمح بتطبيق تقنيات جديدة.					
٢	اللوائح في المنظمة مرنه حيث يتم تعديلها وفقاً لإحتياجات ومتطلبات المنظمة .					
٣	القوانين واللوائح في منظمة متوافقة للوائح الحوسبة السحابية الحالية.					

٤	اللوائح في منظمة تدعم أي مبادرات يمكن يطلقها مزودى الحوسبة السحابية.					
م	**ب- من خلال خبرتك الي أي مستوى يكون الضغط التنافسي من اجل تطبيق الحوسبة السحابية بمنظمتك.**	لا أوافق بشده ١	لا أوافق ٢	محايده ٣	أوافق ٤	أوافق بشده ٥
١	سارعت بعض المنظمات الحكومية الأخرى بتطبيق الحوسبة السحابية.					
٢	يوجد تنافس من قبل بعض المنظمات الحكومية والخاصه بتبني تقنيات جديده.					
٣	تطبيق الحوسبة السحابية سيعزز قدرتها التنافسية ويحسن تقديم الخدمات الإلكترونية عبرالإنترنت.					

من خلال خبرتك حدد مستوى موافقتك على العبارات التالية؟

م	**أ -من خلال خبرتك إلى أي مستوى تكون الثقة في منظمتك من أجل تطبيق الحوسبة السحابية.**	لا أوافق بشده ١	لا أوافق ٢	محايده ٣	أوافق ٤	أوافق بشده ٥
١	نحن على ثقة بأن الحوسبة السحابية لديها لوائح قانونية و وقدرة تقنيه لحماية نظام المنظمة بشكل كافٍ من المشاكل التقنية.					
٢	المنظمة لديها الثقة التامه بمزودي الحوسبة السحابية لحفظ معلومات المنظمة بشكل ملائم وأمن.					
٣	مزودي الحوسبة السحابية لديهم ضمانات كافية لتفادي المشاكل التقنية ما يجعل المنظمة تشعر بأمان نحو تطبيق الحوسبة السحابية.					
٤	المنظمة على يقين بأن البيانات والمعلومات التى سوف يتم حفظها بسرية تامه بالحوسبة السحابية ولن يتم إستخدمها بأي شكل من الاشكال من غيرموافقة المنظمة.					
٥	حفظ المعلومات والبيانات بالحوسبة السحابية يعد آمن ومضمون.					
م	**ب -من خلال خبرتك إلى أي مستوى يكون الوعي في تطبيق الحوسبة السحابية بمنظمتك.**	لا أوافق بشده ١	لا أوافق ٢	محايده ٣	أوافق ٤	أوافق بشده ٥
١	١-المنظمة على درايه تامه بمميزات الحوسبة السحابية.					
٢	لدى المنظمة الوعي الكافي بأن الحوسبة السحابية ذات اعتماد كلي على الإنترنت.					
٣	المنظمة تمتلك وعياً كافي لفعالية تطبيق الحوسبة السحابية.					
٤	إدارة تقنية المعلومات لديها معرفة بالحوسبة السحابية ولكن الإدارة العليا ليس لديها الرغبة في تطبيقها.					
٥	المنظمة تدرك عيوب وتحديات الحوسبة السحابية.					
م	**ج- من خلال خبرتك إلى أي مستوى يكون موقف منظمتك إتجاه تطبيق الجوسبة السحابية.**	لا أوافق بشده ١	لا أوافق ٢	محايده ٣	أوافق ٤	أوافق بشده ٥

١	نحن على يقين بأن تطبيق الحوسبة السحابية سوف يعطي منفعة كبيره للمنظمة.					
٢	المنظمة سوف تواجه بعض الصعوبات والتحديات التقنية عند تطبيق الحوسبة السحابية					
٣	تطبيق الحوسبة السحابية يتطلب جهد أكبر من موظفي المنظمة.					
٤	تطبيق الحوسبة السحابية سوف يخلق بيئة عمل أفضل بالمنظمة.					

من خلال تجربتك حدد مستوى موافقتك على العبارات التالية؟

	أ- من خلال خبرتك ما مدى إمكانية تطبيق الحوسبة السحابية بمنظمتك.	لا أوافق بشده ١	لا أوافق ٢	محايده ٣	أوافق ٤	أوافق بشده ٥
	المنظمة لديها موقفاً إيجابيا اتجاه تطبيق الحوسبة السحابية.					
	يوجد هناك خطه لتطبيق الحوسبة السحابية بالمنظمة في المستقبل القريب.					
	المنظمة على استعداد في البدء لتطبيق الحوسبة السحابية.					
	تطبيق خدمات الحوسبة السحابية سوف يعطي مزايا أكثر للمنظمة.					
	يوجد للمنظمة النية نحو تطبيق الحوسبة السحابية ولكن الإدارة العليا مانعت بتطبيقها في الوقت الحالي.					
	المنظمة قامت بعمل الخطة وإنهاء الإجراءات اللازمة لتطبيق الحوسبة السحابية ولكن تفتقر إلى الدعم المالي.					

Appendix D: IT managers' Interview Questions (Arabic Language)

السؤال١: هل سبق تم تطبيق الحوسبة السحابية على الخدمات الحكومية الإلكترونية في منظمتكم؟ لماذا؟

السؤال ٢: من خلال خبرتك، ماهي المشكلات والتحديات التي تواجهكم في تطبيق النظام الحالي لمنظمتكم؟

(على سبيل المثال، التكلفة، الخدمات عبر الإنترنت، الأمان، الجودة**)**

السؤال ٣: ما مدى معرفتكم بالخدمات المقدمة من خلال الحوسبة السحابية؟

السؤال ٤: من وجهة نظرك ماهي الأسباب في عدم تطبيق الحوسبة السحابية، بشكل عام؟

السؤال ٥: ما هي العوامل التي قد توثر على منظمتكم في حالة تطبيق الحوسبة السحابية؟

السؤال ٦: ما هي الفوائد التي تعتقد أن التقنيات الجديدة مثل الحوسبة السحابية يمكن أن تجلبها إلى منظمة؟

السؤال ٧: ما هي العوامل التقنية التي تعتقد أنها يمكن أن تؤثر على تطبيق الحوسبة السحابية لدي منظمتك؟

على سبيل المثال، مزايا الحوسبة والتوافق والتعقيد والأمان) لماذا؟**)**

السؤال ٨: ما هي العوامل التنظيمية التي تعتقد أنها يمكن أن تؤثر على تطبيق الحوسبة السحابية لدى منظمتك؟

على سبيل المثال، حجم المنظمة، دعم الإدارة العليا، جاهزية التقنية) لماذا**)**

السؤال ٩: ما هي العوامل البيئية التي تعتقد أنها يمكن أن تؤثر على تطبيق الحوسبة السحابية في منظمتك؟

على سبيل المثال، الضغط التنافسي والتنظيمي) لماذا؟**)**

السؤال ١٠: ما هي العوامل الاجتماعية التي تعتقد أنها قد تؤثر على تطبيق الحوسبة السحابية في منظمتك؟

على سبيل المثال، الثقة والوعي والموقف اتجاه التقنيات الجديدة) لماذا؟**)**

السؤال ١١: هل أنتم على استعداد لتطبيق الحوسبة السحابية في المستقبل؟

السؤال١٢: من خلال تجربتك هل ممكن أان تشرح لنا ماهي الخطة التي يمكن من خلالها تطبيق الحوسبة السحابية في منظمتكم؟

السؤال ١٣: هل لديك أي شيء يمكن أن تضيفه؟

شاكر ومقدر لكم حسن تعاونكم،،،،

Appendix E: Senior IT managers' Interview Questions (English Language)

Q1: Have adoption of cloud computing on e-government system been implemented in your sector? Why?

Q2: From your experience, could you please tell me about *the issues and challenges* you face in your current online system in term of (e.g. cost, online services, security, quality)?

Q3: To what extent do you think your organisation is *aware* of cloud computing?

Q4: Could you please tell me about the *reasons that prevent* you to adopt cloud computing, if any?

Q5: What *factors* you think from your experience represent challenges in adopt could computing?

Q6: What *challenges and benefits* think new technologies such as Cloud computing can bring in organisations?

Q8: What *technological factors* do you think may impact the adoption of cloud computing in your organisation? (e.g. Relative advantage, compatibility, complexity, and security) Why?

Q9: What *organisational factors* do you think may impact the adoption of cloud computing in your organisation? (e.g. organisation size, top management support, technologies readiness) Why?

Q10: What *environmental factors* do you think may impact the adoption of cloud computing in your organisation? (e.g. competitive pressure and regulatory) Why?

Q11: Are you willing to adopt cloud computing in *the future*?

Q11b: Can you gave the highlight adoption of cloud computing in your organisations?

Appendix F: The measurement model