An Empirical Study of Factors that Influence the Adoption of Cloud Computing Applications by Students in Saudi Arabian Universities

by

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Declaration

I certify that this thesis does not include any prior materials submitted for a degree or diploma in any university without acknowledgment; and to the best of the researcher knowledge and belief it does not include any prior material published or written by another individual with the exception of where due reference is used in the text.

Abdulwahab Ali Almazroi
August 25th, 2017

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Abstract

Cloud computing is an innovative technology that has revolutionized various areas such as education, healthcare, government, and commerce. The technology provides different solutions to organizations on demand in order to improve their performance and to lower hardware and software procurement and maintenance cost. There is a rich body of literature on its benefits for higher education institutions, however, studies that investigate the factors affecting cloud computing applications adoption by university students in developing countries especially Saudi Arabia are lacking. To fillthis gap, this study examines the factors that affect the adoption of cloud applications by Saudi Arabian university students. The researchadoptsTechnology Acceptance Model 3 (TAM3) as the basis for developing the study model. This study employs amixed method approach, which involves collecting and analyzing quantitative and qualitative data simultaneously. The proposed model is examined and validated using a questionnaire survey amongst university students at King Abdulaziz University and Taibah University in Saudi Arabia. Among 527 collected responses, 451 are valid for data analysis. In addition, 3 focus groups consisting of 14 students areconducted to validate the quantitative findings. Statistical Package for the Social Sciences (SPSS ver.22) and the Analysis of Moment Structures (AMOS ver. 19) software areutilized for questionnaire analysis. The findings show that both measurement and structural models demonstrate good fit to the data, and all constructs meet the criteria to achieve construct reliability and validity. In addition, the path estimates show that 9 out of the 17 proposed relationships aresignificant. The empirical results show that perceived ease of use hasa significant positive influence on perceived usefulness; perceived ease of use and perceived usefulness havea direct significant impact on behavioural intention; subjective norm has a direct positive influence on image; trust and job relevance have a significance positive impact on perceived usefulness; perceptions of external control, perceived enjoyment, and playfulness significantly predict perceived ease of use. On the other hand, subjective norm hasa non-significant effect on perceived usefulness, and behavioural intention; image has a non-significant effect on perceived usefulness; self-efficacy and anxiety have no influence on perceived ease of use; and trust has a non-significant influence on behavioural intention. The results further reveal that the

moderating factors in this study which are output quality and Internet experience have a non-significant effect on the hypothesized relationships in the proposed research model. Furthermore, these findings are supported by the findings of the focus groups. The results of this study will help decision makers in Saudi Arabian academic institutions to ensure successful adoption of cloud services among students. Likewise, the findings will help cloud applications providers better understandthe factors that influence the adoption of cloud applications by students, in order to develop cloud computing applications that would be easily adopted and used by students.

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List of Abbreviations

AGFI	Adjusted Goodness of Fit Index
AWS	Amazon Web Services
AMOS	Analysis of Moment Structures
ANX	Anxiety
API	Application Program Interface
A	Attitude
AVE	Average Variance Extracted
B	Behaviour
BI	Behavioural Intention
X^2	Chi-square
CSP	Cloud Service Provider
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CAGR	Compound Annual Growth Rate
CRC	Computing Resource Centre
CB-SEM	Covariance-Based Structural Equation Modelling
DBaaS	Database as a Service
DaaS	Data storage as a Service
DTPB	Decomposed Theory of Planned Behaviour
df	Degree of Freedom
DOI	Diffusion of Innovations
EC2	Elastic Compute
EFA	Exploratory Factor Analysis
GOF	Goodness of Fit
GFI	Goodness-Of-Fit Index
Google Docs	Google Documents
GSN	Government Secure Network
GSB	Government Service Bus
HaaS	Hardware as a Service
IPMaaS	Identity and Policy Management as a Service
IMG	Image
ICT	Information and Communication Technology

IS	Information System
IT	Information Technology
IaaS	Infrastructure as a Service
IBM	International Business Machines
IDC	International Data Corporation
IE	Internet Experience
REL	Job Relevance
KMO	Kaiser-Meyer-Olkin
KAU	King Abdulaziz University
D^2	Mahalanobis Distance
MBA	Master of Business Administration
MWaaS	Middleware as a Service
MI	Modification Indices
NIST	National Institute of Standards and Technology
NaaS	Network as a Service
X^2/df	Normed Chi-Square
NFI	Normed Fit Index
OpEx	Operating Expenses
OS	Operating System
OUT	Output Quality
PNFI	Parsimony Normed Fit Index
PLS-SEM	Partial least Squares Structural Equation Modelling
PBC	Perceived Behavioural Control
PEOU	Perceived Ease of Use
ENJ	Perceived Enjoyment
PU	Perceived Usefulness
PEC	Perceptions of External Control
PC	Personal Computer
PDA	Personal Digital Assistant
PaaS	Platform as a Service
PLAY	Playfulness
PCA	Principal Components Analysis
RNI	Relative Noncentrality Index

RMSEA	Root Mean Square Error of Approximation
RMR	Root Mean Square Residual
REST	Representational State Transfer
RES	Result Demonstrability
SAR	Saudi Arabian Riyal
S^2aaS	Sensing as a Service
SLA	Service Level Agreement
SE	Self-Efficacy
SOAP	Simple Object Access Protocol
S3	Simple Storage Service
SMB	Small and Medium Business
SME	Small and Medium Enterprise
SCT	Social Cognitive Theory
SaaS	Software as a Service
SMC	Squared Multiple Correlation
SPSS	Statistical Package for the Social Sciences
SEM	Structural Equation Modelling
SN	Subjective Norm
TU	Taibah University
TAM	Technology Acceptance Model
TAM2	Technology Acceptance Model 2
TAM3	Technology Acceptance Model 3
TOE	Technology-Organization-Environment Framework
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
TR	Trust
TLI	Tucker Lewis Index
UTAUT	Unified Theory of Acceptance and Use of Technology
UTAUT2	Unified Theory of Acceptance and Use of Technology 2
USA	United States of America
VIF	Variance Inflation Factor
VCL	Virtual Computing Lab
VPN	Virtual Private Network

Publications

1. Almazroi, A. A., Shen, H., Teoh, K. K., & Babar, M. A. (2016). *Cloud for e-Learning: Determinants of its adoption by university students in a developing country*. Paper presented at the 2016 IEEE 13th International Conference on e-Business Engineering (ICEBE), Macau, China.

2. Almazroi, A. A., Shen, H., Teoh, K. K., & Babar, M. A. (2017). Heads into the Clouds? An empirical study on the adoption of cloud computing services by developing country students. *Information Systems, Elsevier*. (Submitted).

Chapter 1: Introduction

1.1 Introduction

Internet is evolving rapidly, from a traditional medium of merely providing information to users, to an indispensable requirement for the users who want to store data, perform computing and even run software applications at any time from any part of the world. This is possible with the advent of technologies such as "Cloud Computing" which considered to be the fifth generation of computing after client-server computing, mainframe computing, personal computing and the web (Alzaid & Albazzaz, 2013; Khmelevsky & Voytenko, 2010; Rajan & Jairath, 2011). Cloud computing can be viewed as a technology that enables users to gain computing facilities such as data storage and software services via the Internet (AlCattan, 2014; Benton & Negm, 2010). Hence, cloud computing technology allows students to learn, collaborate, and share information online (Rao & Challa, 2013; Razak, 2009). The term, "Cloud Computing" is defined according to Mell and Grance (2011, p. 2) as a "model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction". They explained that it possess five fundamental characteristics (broad network access, on demand self-service, measured service, rapid elasticity, and resource pooling), three service models (Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS)), and four types of deployment models, which are public cloud, private cloud, community cloud, and hybrid cloud (Mell & Grance, 2011).

Contrary to traditional Information Technology (IT) where users can only use specific software on limited available devices, cloud computing allows users to efficiently, portably and securely use cloud applications without need of installing the software on their devices, and to access cloud applications anytime/anywhere and from any device. This will certainly reduce hardware and software procurement and maintenance cost (Chandra & Borah, 2012; Sen, 2013; Shawish & Salama, 2014).

Currently, cloud computing services are progressively being offered by well-established IT service providers such as Google, Amazon, Microsoft, Apple, Yahoo, and Salesforce.com (Höfer & Karagiannis, 2011; Velte, Velte, & Elsenpeter, 2010;

Writer, 2015). Cloud computing promises to deliver all IT services on-demand whereby enabling clients to only pay for the specific amount of resources they really use, or in other words, follow the pay-as-you-go pricing model (Benton & Negm, 2010; Sachdeva, Rana, Kapoor, & Shahid, 2011).

Cloud computing is considered as a promising technology to organizations that will improve their performance and overcome the excessive cost related to the IT resources. Many organizations around the world, including thosein the education field, have realized the advantages of cloud computing and consequently aspire to move all their services to cloud due to its numerous characteristics such as availability, scalability, agility, elasticity, and reliability for on demand services in order to make teaching, learning, and research easier. The fast growing interest and application of cloud computing specifically in education present an opportunity for both students and teachers to enhance their productivity (Badie, Hussin, & Dahlan, 2014; Gital & Zambuk, 2011; Tejal & Mathur, 2014). This is supported by various studies that present benefits associated with cloud services (N. Gupta & Thakur, 2014; Truong, Pham, Thoai, & Dustdar, 2012). The benefits include low barriers to entry, low costs, increased mobility and scalability, improving security, strong compliance, collaboration among users of cloud-based services, anywhere/anytime access to software, and cloud enabled processing power and storage on demand (S. C. Park & Ryoo, 2013; A. Verma & Kaushal, 2011). On the other hand, it was projected that the cloud computing market will accelerate from $40 billion (bn) in 2011 to $240 bn by 2020 (Mokhtar, Ali, Al-Sharafi, & Aborujilah, 2013). In United States of America (USA), the percentage of financial spending on cloud computing by higher education institutions is reported to increase from 15% in 2013 to 24% by 2016 (CDW, 2011).

Recently, organizations in the Middle East have started using cloud computing services as a means to achieve a high level of operational efficiency while providing cost effective outcomes. Saudi Arabia is among the first Arab countries that focus on using cloud computing due to its benefits and their extensive use of Information and Communication Technology (ICT) in various organizations (Alsanea & Wainwright, 2014; Ministry of Communications and Information Technology, 2014). The Government of Saudi Arabia jointly with United Arab Emirates are set to lead the adoption of cloud services in Middle East with an initial total expenditure of $280-

$324 million (Ministry of Communications and Information Technology, 2015). It was revealed that, in Saudi Arabia cloud services usage by organizations will rise with an increase in spending by 35% in 2016 as a result of benefits such as “operational efficiency” and “cost savings” (Ministry of Communications and Information Technology, 2014). However, many of these organizations are still at the beginning stage of using cloud computing particularly in education context (A. N. Tashkandi & I. M. Al-Jabri, 2015).

While the implementation of the cloud computing services in the education settings remains at the initial stage of development, existing research recognizes several advantages that can be gained by using cloud computing services in the education institutions. González-Martínez, Bote-Lorenzo, Gómez-Sánchez, and Cano-Parra (2015) further documented the benefits of cloud computing for educational institutions in terms of the flexible creation of learning environments; the availability of online applications to support education; computing-intensive support for learning, teaching, as well as evaluation; support for mobile learning; the scalability of learning systems and applications; and cost savings. Similarly, X. Tan and Kim (2011) demonstrated how cloud computing services such as Google Docs was used by a group of students pursuing Master of Business Administration (MBA) at a University in North Eastern of USAto carry out their projects. They reported that theywerehelpful to the students, who expressed they would be willing to adopt and use these technologies in the future.

In spite of all the realized and anticipated advantages of cloud computing, it is only recently that educational institutions started adopting the technology (Isaila, 2014). In addition, the adoption is usually partial and considered low when compared with other organizations (Okai, Uddin, Arshad, Alsaqour, & Shah, 2014). According to a survey of post-secondary institutions in USA, the institutions that implemented cloud computing do not go beyond 28% and additional 29% of the institutions only arranged for adopting the technology (CDW, 2011). Also, cloud computing usage in educational institutions accounted for only 4% of the total usage while other organizations accounted for the remaining 96% (Mokhtar et al., 2013). In order to deliver the maximum benefit of cloud computing services when implemented in educational settings, more research should be conducted to assess the factors that influence technology adoption by students.

Therefore, adopting cloud computing services represents an opportunity for higher education institutions in Saudi Arabia to transform their learning and teaching activities by using cloud computing services that provide a more competitive and robust environment (AlCattan, 2014; A. N. Tashkandi & I. M. Al-Jabri, 2015). Yet, studies in this area are inadequately presented in existing literature of cloud computing. Almost all current studies on the adoption and use of cloud computing in education have mainly focused on cloud computing security, pricing mechanisms, as well as implementation frameworks and not much has been done to address the adoption and use of the cloud computing by students (Alotaibi, 2014; A. N. Tashkandi & I. M. Al-Jabri, 2015). This argument is supported by Ibrahim, Salleh, and Misra (2015) who conducted a systematic literature review on the empirical studies of cloud computing in education and found that several universities were interested in using cloud computing in their education systems, but empirical studies focusing on identifying factors that affect the adoption of cloud computing by higher education institutions were lacking.

In addition, the current studies in higher education context mostly did not focus on examining the factors that affect students' adoption of cloud computing services but rather consider academic staff, IT personnel and other decision makers within the institution (H. S. Hashim, Hassan, & Hashim, 2015; Irshad & Johar, 2015; Sabi, Uzoka, Langmia, & Njeh, 2016; A. Tashkandi & I. M. Al-Jabri, 2015). Considering the limitations in the previous studies in examining the factors that affect cloud computing applications adoption by students, the aim of this research is to determine and investigate the factors that affect cloud computing applications adoption in the higher education institutions by students. It is expected that the perception and willingness of the students will determine the successful implementation and use of the technology (Behrend, Wiebe, London, & Johnson, 2011).

The adoption level of cloud computing in universities of developed countries is very high, and there are studies conducted in developed countries such as Australia and USA (Behrend et al., 2011; Ramachandran, Sivaprakasam, Thangamani, & Anand, 2014; Ratten, 2015a, 2015b), but in contrast the adoption level of cloud computing in universities of developing countries is very low and there is lack of studies conducted in developing countries such as Saudi Arabia (Sabi et al., 2016). Therefore, this study conducted in Saudi Arabia to fill this gap found in the literature. This research extends Technology Acceptance Model 3 (TAM3) to determine factors affecting the adoption of cloud computing applications by students in Saudi Arabian universities. This model will help university decision makers and cloud application providers better understand the factors that affect students' adoption of cloud computing applications in higher education institutions.

1.2 Problem Statement

The significance of cloud computing to organizations has been widely reported in today's competitive market place (Grossman, 2009). The realization of benefits that can be derived from implementing cloud services by organizations lead to their eagerness to adopt the technology. Higher education institutions are among the sectors that are in need of innovative technologies in order to advance the quality of teaching, learning, and research (Al-Zoube, Abou El-Seoud, & Wyne, 2010; Hazari & Schnorr, 1999; Laisheng & Zhengxia, 2011; Thomas, 2011). In this respect, educational institutions always look for novel technologies that will ease the teaching and learning process thereby enhancing student performance. Cloud computing is one of the latest trends in computing which is reported to have great impact on the quality of teaching and learning in educational settings (A. S. Hashim & Othman, 2014; Okai et al., 2014). The technology provides the students with flexibility, accessibility, and portability of educational materials anytime and anywhere (Guoli & Wanjun, 2010; Kalagiakos & Karampelas, 2011). Additionally, the technology offers the students an opportunity to use various Internet-based applications in an efficient, portable, and secured manner (Alshwaier, Youssef, & Emam, 2012; Kalagiakos & Karampelas, 2011).

However, the lack of cloud computing adoption in the Saudi higher education institutions has been emphasized by researchers (A. N. Tashkandi & I. M. Al-Jabri, 2015). Despite the fact that the academic institutions in Saudi Arabia appear to be well aware of the need for cloud computing services, students' readiness to adopt and use those cloud computing services remains a challenging task. It is acknowledged that most of the new technologies when introduced suffered from lack of adoption initially from the prospective users (Butler & Sellbom, 2002). Therefore, the success of such initiatives is dependent not only on the support of universities and cloud service providers, but also on students' willingness to adopt and use those cloud computing services (Ashtari & Eydgahi, 2015). Otherwise, a technology becomes worthless when it is developed and implemented, and users do not use it. Furthermore, to the best knowledge of the researcher, there is lack of studies that identify and investigate the determinants of cloud computing applications adoption by students of Saudi Arabian universities. Hence, an empirical study that focuses on identifying the factors influencing cloud computing applications adoption by students is required to help university decision makers and cloud service providers to comprehend the factors that influence students adoption of cloud applications, so that the level of cloud applications adoption can be increased.

Thus, this research aims to fill in the gap found in the literature by conducting an empirical assessment of factors that determine cloud computing applications adoption by university students in Saudi Arabia through a quantitative approach. In addition to that, the researcher employs a qualitative approach using focus group and open-ended question techniques to validate the quantitative results on one hand, and to discover factors that are not considered in the proposed model on other hand. This study extends TAM3 model to determine and explain the impacts of factors that influence the adoption of cloud computing applications by university students. The TAM3 model is selected as the base theoretical model for this research due to its comprehensiveness in comparison to other technology acceptance models. Basically, this study is among the few ones that extend TAM3 to develop a model for investigating cloud computing applications adoption by students in academic settings. This study will certainly add to the body of knowledge on cloud computing applications adoption by university students in developing countries especially in Saudi Arabia. To the best knowledge of the researcher, the present study is considered the first research that investigates the factors affecting cloud computing applications adoption by university students in Saudi Arabia, and the first research that extends TAM3 to explore the factors that determine the adoption of cloud computing applications by university students in developing countries. The outcome of this study will provide recommendations that will assist decision makers in Saudi universities, as well as cloud service providers to promote the adoption and use of cloud computing applications among university students.

1.3 Objectives of the Study

This research aims to discover and examine the factors that influence cloud computing applications adoption by university students in Saudi Arabia specifically with the following research objectives:

1. To review literature in order to identify the factors that influence university students' intention to adopt cloud computing applications.
2. To develop a cloud computing applications adoption model by extending TAM3, which will be used to study the factors affecting the adoption of cloud computing applications by Saudi university students.
3. To validate the proposed research model by empirically testing it on Saudi Arabia university students using a survey questionnaire.
4. To assess the impact of trust on the adoption of cloud computing applicationsby Saudi Arabian university students.
5. To assess the influence of moderating factors (Internet experience and output quality) on the hypothesized relationships in the proposed model.
6. To conduct focus groups with Saudi Arabian university students to validate the quantitative findings.
7. To identify and discover factors that are not covered in the proposed research model using an open-ended question method in both the questionnaire and focus groups from Saudi university students' perspective.
8. To provide essential recommendations for decision makers in universities and cloud applications providers to make the adoption of cloud applications more successful by students in Saudi Arabian universities.

1.4 Research Questions

The researcher attempts to answer the following research questions:

RQ1: *What is the influence of the TAM3 based factors on the adoption of cloud computing applications by Saudi Arabian university students?*

RQ2*: What is the influence of trust on the adoption of cloud computing applications by Saudi Arabian university students?*

RQ3: *What is the influence of the moderating factors (Internet experience and output quality) on the hypothesized relationships in the proposed model?*

RQ4: *What new factors that are not covered in the proposed research model can be identified using open-ended questions?*

1.5 Overview of Methodology

Numerous methodologies have been used in different studies in the Information Systems (IS) field and each illuminates different aspects of the whole situation under study. Therefore, an appropriate methodology needs to be chosen to provide a systematic procedure and to guide the researcher to fully achieve the research objectives (Creswell, 2009). In this research, a mixed-method approach has been adopted and applied in two continuous phases to investigate factors that influence cloud computing applications adoption by university students in Saudi Arabia. In the first phase, quantitative research is conducted to test the proposed model through using a survey questionnaire. In the second phase, qualitative research is conducted to validate the findings from the quantitative phase using focus groups technique. In addition, an open-ended question technique is employed in the questionnaire survey and focus groups to identify additional factors that are not covered in the proposed model. Hence, the study brings together both exploratory and empirical methods in order to achieve the study objectives.

The idea of combining quantitative and qualitative approaches in IS research is a promising method for combining their strengths and overcoming their single weaknesses (Creswell, 2009; Creswell & Clark, 2007; Johnson & Christensen, 2008). According to Venkatesh, Brown, and Bala (2013), the mixed methods approach provides three strengths for IS research. First, it provides the opportunity to address exploratory and confirmatory research questions concurrently. Second, it gives more powerful inferences than a single method research approach. Last, it helps attain a greater variety of different and/or complementary views.

1.6 Significance of the Study

This research is a pioneer study in the field of cloud computing applications adoption by university students in Saudi Arabia. It is also one of the few studies that attempt to present an understanding of factors that influence cloud computing applications adoption by students in the higher education settings in the developing countries. The direct beneficiaries of this research results will be the decision-makers in Saudi Arabia universities and those who are faced with the challenges related to making decisions on innovations adoption in general and cloud computing applications in particular. They could use findings from this study to design an effective strategic plan to encourage a successful and faster adoption of cloud services by students.

In addition, the findings of this study will significantly contribute to the development of cloud computing services. The identified factors when taking into consideration during development and implementation of cloud computing services by the cloud applications providers, will significantly influence the attitude and adoption rate of the technology by students. This will help promote the adoption of cloud computing applications in Saudi Arabian higher education institutions by students. In fact, researchers stress the importance of understanding the factors that affect the adoption of cloud computing applications by university students. Although there are many studies that investigated the factors affecting the adoption of cloud computing applications by students in developed countries, there is lack of studies that were conducted in the developing countries particularly in Saudi Arabia during the time of the present research. Therefore, the findings of this research can help fill this gap found in the literature, and act as a valuable resource for researchers who wish to use the findings of the study as a foundation for ongoing research. In addition, this study will increase the awareness of policy makers in Saudi Arabia universities by highlighting the significance of cloud computing and its benefits to students. The result of this study will also guide cloud services providers, and decision makers in the Saudi universities on how to tackle the factors that hinder students' adoption of cloud computing applications on one hand, and to increase its adoption by students, as well as facilitate the successful implementation of cloud computing applications in academic institutions on other hand.

1.7 Scope of the Study

The focal point of this research is investigating and examining the factors that can affect the adoption of cloud computing applications by higher education students in Saudi Arabia. The factors will first be identified and subsequently their effects and relationships will be investigated. The study extends TAM3 model to understand the important factors that influence students' intention to adopt cloud computing applications.

The validity and feasibility of the adapted TAM3 model will be evaluated in order to understand how well the proposed research model can predict the factors influencing university students in Saudi Arabia to adopt cloud computing applications. The factors that affect students' adoption of cloud applications will be assessed by collecting quantitative data using a questionnaire, and then the quantitative results will be validated using qualitative data collected through focus groups. Furthermore, an open-ended question technique will be employed in the questionnaire survey and focus groups to explore factors that are not covered in the proposed model.

1.8 Thesis Organization

This thesis is categorized into nine chapters described as follows. Chapter 1 introduces the study by presenting the problem statement and research objectives. Chapter 2 presents a comprehensive review of cloud computing. Chapter 3 discusses technology adoption theories and models. Chapter 4 presents the research model of this research. Chapter 5 discusses the research methodology applied in this study. Chapter 6 presents the quantitative data analysis and results. Chapter 7 presents the qualitative data analysis and results. Chapter 8 discusses the research findings. Chapter 9 presents the conclusions and contributions of the study.

Chapter 2: Overview of Cloud Computing

2.1 Introduction

This chapter presents a comprehensive review of cloud computing technology. It comprises history of cloud computingas well ascloud computing definition. The chapter also discusses the components of cloud computing, characteristics of cloud computing, the popular service models of cloud computing including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS), and the four deployment models including private cloud, community cloud, public cloud, as well as hybrid cloud. The chapter also highlights the benefits and challenges related to cloud computing adoption.In addition, the chapter presents the state of cloud computing in Saudi Arabia and discusses cloud computing in education environment. Finally, the chapter presents previous studies on cloud computing adoption.

2.2 History of Cloud Computing

Fundamentally, the notion of cloud computing has been in existence since 1950s, during mainframe computing age (Bhatiasevi & Naglis, 2015). In mainframe computing, multiple users access a central computer using terminals (Neto, 2014). At that time, the cost of purchasing and maintaining mainframe computers was very high, making it impractical for each user to own one. The storage and processing capacity of the mainframes was also too large for a typical user. As a result, the idea of shared access to the mainframe computers evolved (Almishal & Youssef, 2014; Neto, 2014). In 1960s, a computer scientist John McCarthy who is recognized as the founder of time-sharing concept proposed that, computing power and applications might in the future be delivered as a public utility like electricity and water. This idea plays a significant role in the formation of today's cloud computing (Foster, Zhao, Raicu, & Lu, 2008; Mohamed, 2009).

Another idea that contributed to the development of cloud computing is "Intergalactic Computer Network" proposed by Joseph Carl Robnett Licklider in early 1960's (Hauben & Hauben, 1998; Roberts, 1986). Intergalactic Computer Network is a networking concept whereby people will be globally interconnected in order to access programs and data from anywhere. This idea later transformed into ARPANET in the late 1960s, and finally in the 1970s it changed into today's Internet (Hauben & Hauben, 1998; Judy, 1995; Mohamed, 2009; Roberts, 1986). Similarly, in 1970s the concept of virtual machines was developed in which a virtualization software was used to run serveraloperating systems on a computer. The virtualization is an advancement of time-sharing in mainframe era, because it allows "multiple distinct computing environments to reside on one physical environment" (Neto, 2014). It was in the late 1970s that people started using the term "client-server" (Writer, 2015). Client-server represents a model where clients access applications and data from a computer called a server over a network. In client-server model, the client initiates the connection while the server replies by providing the requested data or access to the requested application (Dye, McDonald, & Rufi, 2008). Personal computers were also introduced in this era (Mowery & Simcoe, 2002). Furthermore, telecommunication companies were generally known to provide data connection service as a single dedicated point-to-point data connections, but in the 1990s they began to offer the service as Virtual Private Network (VPN) with similar quality of service cheaply (Neto, 2014). The design of VPN was to enable multiple users to share the same physical infrastructure (Alshaer, 2015; Neto, 2014).

The year 1999 marked the beginning of cloud services provisioningby companies such as Salesforce.com, Google, and Netflix. Salesforce.com was the first company that provided enterprise applications from its website (Marston, Li, Bandyopadhyay, Zhang, & Ghalsasi, 2011; Writer, 2015). Google launched a fledgling search services, while Netflix started its service of mailing Digital Video Disks(Writer, 2015). Later, Amazon developed Amazon Web Services (AWS) in 2002 and officially launched its commercial web service called Elastic Compute (EC2) in 2006 (Pallis, 2010; Writer, 2015). AWS provide customers with the ability to store their data and information, and also human intelligence services that enables users to perform tasks using Amazon Mechanical Turk (Mohamed, 2009; Writer, 2015). EC2 allows individual customers and companies to run their computer applications on rented computers (Mohamed, 2009). Subsequently, Amazon launched Amazon Simple Storage Service (S3) (Mohamed, 2009). S3 is one of the popular and pioneer online storage services that can be accessed through web services interfaces such as Simple Object Access Protocol (SOAP) and Representational State Transfer (REST) (Buyya, Yeo, Venugopal, Broberg, & Brandic, 2009). According to Mohamed

(2009), EC2/S3 is the first broadly accessible cloud infrastructure service. S3 is believed to provide high computing capacity faster and cheaper than a local server deployed in a company (Sommer, 2014).

The evolution of cloud computing can be viewed from the history of computing perspective, which is divided into 6 stages (Girdhar, 2010; Prasad, Naik, & Bapuji, 2013; Voas & Zhang, 2009). The revolution that started from mainframe computing until cloud computing is presented in Figure 2.1.

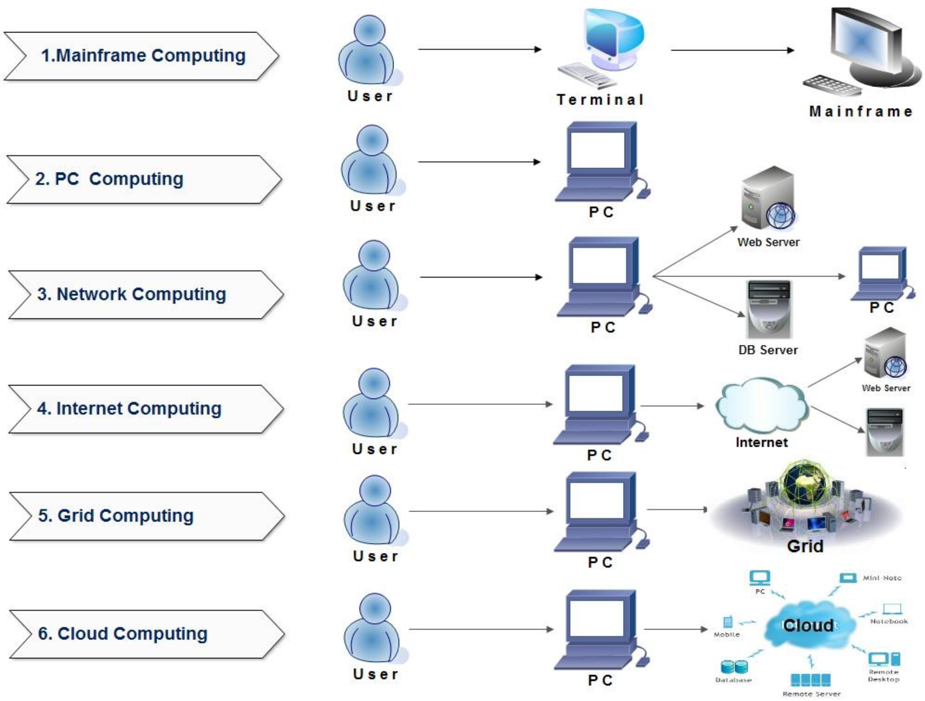


Figure 2-1 Six stages of computing paradigms (Prasad et al., 2013)

During phase 1, multiple users were allowed to access a powerful mainframe using “dummy” terminals thatwere slightly more than keyboards and monitors (Voas & Zhang, 2009). During phase 2, Personal Computers (PCs) became powerful enough to satisfy majority of a user’s need (Furht, 2010; R. P. Verma, Dutta, Chaulya, Singh, & Prasad, 2013). In phase 3, computers (PCs, servers, and laptops) were locally networked for improved performance by sharing resources (Girdhar, 2010; R. P. Verma et al., 2013; Voas & Zhang, 2009). Resources sharing were further improved in phase 4 by connecting multiple local networks to form a global network (Internet). This enabled running of various applications and accessing resources remotely (Furht, 2010). The concept of grid computing was introduced during phase 5 which utilized the idea of distributed computing to share computing power and storage (Girdhar, 2010; A. Singh & Hemalatha, 2012). Grid computing led to the emergence of cloud computing in phase 6, where computing resources are provided on demand to the users as a service over Internet (A. Singh & Hemalatha, 2012; R. P. Verma et al., 2013; Voas & Zhang, 2009).

2.3 Definition of Cloud Computing

Cloud computing is gaining more attention from individuals and researchers. This perhaps is one of the reasons why it is defined in many ways (L. Wang et al., 2008). Vaquero, Rodero-Merino, Caceres, and Lindner (2009, p. 51) reviewed more than 20 cloud definitions from various researchers and came up with a proposed definition as "a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of customized Service-Level Agreements (SLAs)". Cloud computing is also defined as "a type of parallel and distributed system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resource(s) based on service-level agreements established through negotiation between the service provider and consumers" (Buyya et al., 2009, p. 601).

Furthermore, National Institute of Standards and Technology (NIST) described cloud computing in a comprehensive, formal and standard way. It is defined as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell & Grance, 2011, p. 2). Thus, cloud computing can be defined as a model that provide computing resources as a service. The resources include applications, storage, networks, and other services (Mell & Grance, 2011; Zhu, 2010). As shown in Figure 2.2, the cloud computing model described by Mell and Grance (2011) comprises five fundamental characteristics, three service models, as well as four deployment models.

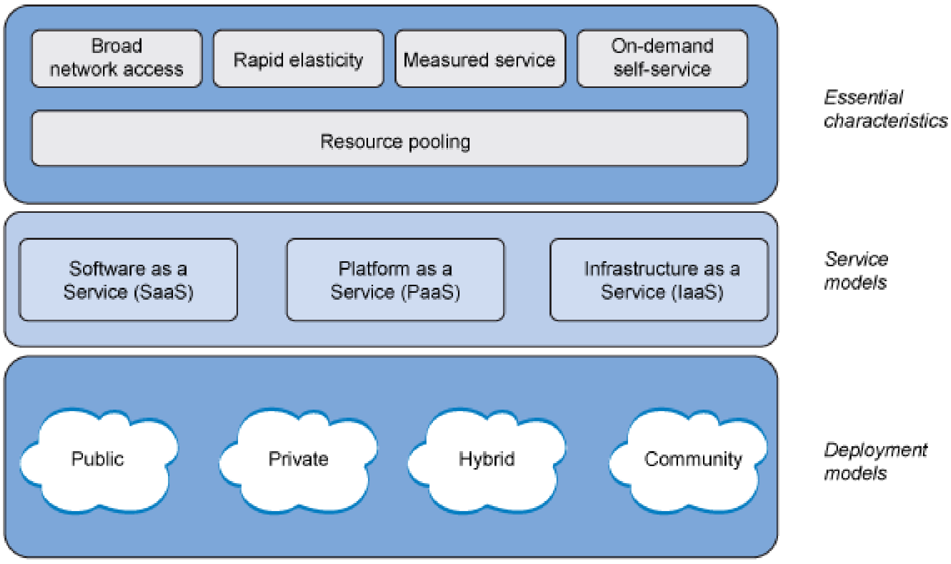


Figure 2-2 Pictorial representation of cloud computing model (Markey, 2013)

Moreover, there is misconception about the distinction between cloud computing and terms like cluster computing and grid computing. Cluster computing refers to “a type of parallel and distributed system, which consists of a collection of inter-connected stand-alone computers working together as a single integrated computing resource” (Buyya et al., 2009, p. 601). It is pertinent to note that cluster computing is generally a centralized setup with a focus on utilizing parallel processing power and load balancing in order to improve fault tolerance, performance, and availability of service (M. Baker, 2000; Buyya et al., 2009; Kaur & Rai, 2014).

Similarly, grid computing technology is a model that shares the resources of multiple computers in order to perform a task (S. M. Hashemi & Bardsiri, 2012). Buyya et al. (2009, p. 601) defined grid computing as “a type of parallel and distributed system that enables the sharing, selection, and aggregation of geographically distributed ‘autonomous’ resources dynamically at runtime depending on their availability, capability, performance, cost, and users’ quality-of-service requirements”. Table 2.1 comparescluster, grid and cloud systems based on their distinguishing features (Buyya et al., 2009).

Table 2-1Comparison of cluster, grid, and cloud systems based on their characteristics

Characteristics	Systems		
	Clusters	Grids	Clouds
Population	Commodity computers	High-end computers (servers, clusters)	Commodity computers and high-end servers and network attached storage
Size/scalability	100s	1000s	100s to 1000s
Node Operating System (OS)	One of the standard OSs (Linux, Windows)	Any standard OS (dominated by Unix)	A hypervisor (VM) on which multiple OSs run
Ownership	Single	Multiple	Single
Interconnection network/speed	Dedicated, high-end with low latency and high bandwidth	Mostly Internet with high latency and low bandwidth	Dedicated, high-end with low latency and high bandwidth
Security/privacy	Traditional login/password-based. Medium level of privacy – depends on user privileges.	Public/private key pair based authentication and mapping a user to an account. Limited support for privacy.	Each user/application is provided with a virtual machine. High security/privacy is guaranteed. Support for setting per-file access control list (ACL).
Discovery	Membership services	Centralised indexing and decentralised info services	Membership services
Service negotiation	Limited	Yes, SLA based	Yes, SLA based
User management	Centralised	Decentralised and also virtual organization (VO)-based	Centralised or can be delegated to third party
Resource management	Centralized	Distributed	Centralized/Distributed
Allocation/scheduling	Centralised	Decentralised	Both centralised/decentralised
Standards/inter-operability	Virtual Interface Architecture (VIA)-based	Some Open Grid Forum standards	Web Services (SOAP and REST)
Single system image	Yes	No	Yes, but optional
Capacity	Stable and guaranteed	Varies, but high	Provisioned on demand
Failure management (Self-healing)	Limited (often failed tasks/applications are restarted).	Limited (often failed tasks/applications are restarted).	Strong support for failover and content replication. VMs can be easily migrated from one node to other.
Pricing of services	Limited, not open market	Dominated by public good or privately assigned	Utility pricing, discounted for larger customers
Internet working	Multi-clustering within an Organization	Limited adoption, but being explored through research efforts such as Gridbus InterGrid	High potential, third party solution providers can loosely tie together services of different Clouds
Application drivers	Science, business, enterprise computing, data centers	Collaborative scientific and high throughput computing applications	Dynamically provisioned legacy and web applications, Content delivery

Characteristics	Systems		
	Clusters	Grids	Clouds
Potential for building 3rd party or value-added solutions	Limited due to rigid architecture	Limited due to strong orientation for scientific computing	High potential — can create new services by dynamically provisioning of compute, storage, and application services and offer as their own isolated or composite Cloud services to users

Source: Buyya et al. (2009, p. 603)

2.4 Components of Cloud Computing

Cloud computing technology consists of various components that play significant roles in delivering functional cloud computing services. These components are: clients, datacenters, and distributed servers as shown in Figure 2.3.

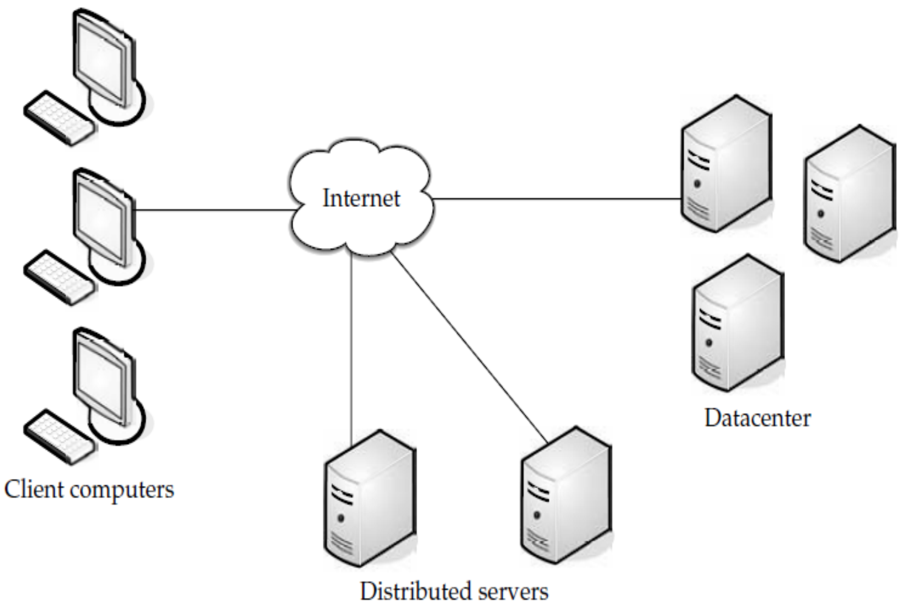


Figure 2-3 Components of cloud computing (Velte et al., 2010)

Clients are computers and mobile devices that are used by end users to access cloud computing services. Clients are further categorized into three, namely mobile, thin, and thick clients (Hung, Bui, Morales, Van Nguyen, & Huh, 2014; Velte et al., 2010). Mobile clients are mobile devices such as Personal Digital Assistants (PDAs) and smart phones. Thin clients represent computers that are used to display information only as they do not have hard drives and as such are not processing any information. Thin clients are being used nowadays because of their benefits which include low hardware and IT cost, increased security, and less noise and power consumption. Thick clients are ordinary computers like PC that use interfaces such as browser to connect to cloud services (Velte et al., 2010).

Datacenter is generally a facility or a room with group of servers that host the cloud service applications. The servers are either physical or virtual depending on the setup. Multiple virtual servers can be created on a single physical server using virtualization software (Tsai, Sun, & Balasooriya, 2010; Velte et al., 2010; Zhang, Cheng, & Boutaba, 2010).

Distributed servers are multiple servers dispersed over a wide geographic location (Velte et al., 2010; Vidyarthi, Sarker, Tripathi, & Yang, 2009). Although the servers are not in the same location but they appear to the consumers as if they are together. The function of these servers is to increase the reliability, efficiency, flexibility and scalability of the cloud services (Velte et al., 2010).

2.5 Characteristics of Cloud Computing

Understanding fundamental characteristics of the cloud computing technology is imperative because of its growing need by various organizations. Practically, there are five fundamental characteristics of cloud computing as suggested and defined by NIST which are: on-demand self-service, rapid elasticity, resource pooling, broad network access, as well as measured service (Mell & Grance, 2011). These characteristics are discussed in more details as follows.

On-demand self-service: computing resources such as applications and storage can be easily requested and acquired by a consumer alone without human interaction with the service provider. A consumer usually requests for a service when needed and as such the billing is on pay-for-what-you-use basis (Mell & Grance, 2011; A. Verma & Kaushal, 2011).

Broad network access: resources can be accessed at anytime from anywhere through Internet. A consumer can use any network enabled device like tablet, mobile phone, laptop, or PC to access the service (Mell & Grance, 2011; Pramod, Muppalla,

& Srinivasa, 2013; Sajid & Raza, 2013). This capability enables consumers to use the resources and services anywhere they go and at any time.

Resource pooling: the resources provided by cloud service providers are pooled so that it can be used by multiple consumers at the same time from anywhere using a multi-tenant model (A. Verma & Kaushal, 2011). Generally, consumers do not know the exact physical location of the resources and they have no control over the location, although they may know the address of the provider (Mell & Grance, 2011; Sajid & Raza, 2013).

Rapid elasticity: the cloud services are flexible and scalable. That is to say, the capacity of the delivered resources can be easily and quickly (mostly automatically) scaled up or down. In addition, aconsumer can simply add or remove resources in order to meet his/her need (Mell & Grance, 2011; Pramod et al., 2013; Sajid & Raza, 2013; A. Verma & Kaushal, 2011).

Measured service: the resources are monitored, controlled, and reported for proper optimization using metering, load balancing, and automated resource allocation (Mell & Grance, 2011; A. Verma & Kaushal, 2011). This capability ensures transparency and allows the consumers to pay for only the resources required. In this situation, the resources will not be wasted as in the case when the resources are provided and managed by a in-house server.

2.6 Service Models of Cloud Computing

Cloud computing has different service models that describe the type of services and capabilities that can be delivered by cloud service providers. The three popular models of cloud service are: Software as a Service (SaaS), Platform as a Service (PaaS), as well as Infrastructure as a Service (IaaS) (Dillon, Wu, & Chang, 2010; S. Hashemi, 2013; Mell & Grance, 2011; Sajid & Raza, 2013; A. Verma & Kaushal, 2011). Table 2.2 comparesthe models of SaaS, PaaS, and IaaS.

Table 2-2 Cloud service models

Classification	Service Type	Flexibility/ Generality	Difficulty Level	Scale and Example
IaaS	Basic computing, storage, network resources	High	Difficult	Large, Amazon EC2
PaaS	Application hosting environment	Middle	Middle	Middle, Google App Engine
SaaS	Application with specific function	Low	Easy	Small, Salesforce CRM

Source: Tian and Zhao (2015, p. 11)

Infrastructure as a Service (IaaS): in this model computing resources or hardware such as networks, servers for processing and storage are provided to the consumers to deploy and run software such asapplications and operating systems (A. Verma & Kaushal, 2011; Wiedemann & Strebel, 2011). This type of service is similar to having a server in form of virtual machine in a cloud (Milić, Simić, & Milutinović, 2014; Pramod et al., 2013). The consumers have no control over the cloud infrastructure but they can manage the deployed applications and other delivered resources (Mell & Grance, 2011). The function of IaaS is similar to data centers where the providers manage and control the data centers and consumers deploy and manage their applications (R. P. Verma et al., 2013). This capability allows individuals as well as organizations to hire these resources instead of spending money to buy and manage servers that deliver the resources (Sukumaran, 2011). IaaS is usually compared with hosting, but in IaaS users do not enter into long term deal with the providers and the resources are provisioned on demand (Bhardwaj, Jain, & Jain, 2010). Popular examples of IaaS are Amazon's S3 storage service, Rackspace Cloud Servers, OpenNebula, Joyent and Terremark (Dillon et al., 2010; Marston et al., 2011; A. Verma & Kaushal, 2011).

Platform as a Service (PaaS): is a model whereby Application Program Interfaces(APIs) or development environments are provided where consumers can build and deploy their applications on the cloud (Pramod et al., 2013; X. Tan & Kim, 2011; A. Verma & Kaushal, 2011). The consumers can manage their implemented applications and can change some of the hosting settings, but they have no control over the cloud infrastructure (Mell & Grance, 2011). Examples of PaaS include Google App Engine, Microsoft's Azure Services Platform, Amazon's Relational

Database Services, Amazon Web Services (AWS), Salesforce's Force.com, Rackspace Cloud Sites, and International Business Machines (IBM) Cloudburst (Dillon et al., 2010; P. Gupta, Seetharaman, & Raj, 2013). Different providers may use different programming languages to build the environment where consumers can deploy their applications (Androcec, 2013). For instance, Google AppEngine used Java and Python, and Windows Azure used .Net (Vecchiola, Chu, & Buyya, 2009). This is perhaps one of the challenges that consumers may face when switching from one provider to another (Androcec, 2013; Islam, Morshed, & Goswami, 2013).

Software as a Service (SaaS): this is the most commonly known cloud service model that allows consumers to use providers' software applications over the Internet (Pramod et al., 2013; R. P. Verma et al., 2013). SaaS applications can be accessed anytime from anywhere using thin client interfaces like a web browser or a programming interface (Mutiara, Refianti, & Witono, 2014). SaaS enables consumers to use various software when they require them without the need to buy and maintain such software or procure and maintain server (Ambrose & Chiravuri, 2010). Consumers in this case have no control over the cloud infrastructure and the application, but they may be allowed to configure and change basic user-specific settings (Mell & Grance, 2011). SaaS is similar to renting software for limited time rather than buying it, because the software will be provided on demand and the consumers will only pay for what they use (Ojala, 2013). Examples of this service are Google Docs, Salesforce CRM, and Trend Micro (V. Chang, Wills, & De Roure, 2010).

Furthermore, there are other service models that are considered as special kinds of the presented three well known models (Sabahi, 2011a). They are: Data storage as a Service (DaaS) for delivery of storage, Hardware as a Service (HaaS) for delivery of hardware, Identity and Policy Management as a Service (IPMaaS) for managing the identity and control policy of the consumer, Network as a Service (NaaS) for delivery of virtualized network, Business Process as a Service (BPaaS) for delivery of business process outsourcing, Database as a Service (DBaaS) for database outsourcing, Sensing as a Service (S^2aaS) for delivery of sensing applications, Middleware as a Service (MWaaS) for outsourcing middleware solutions like application server, databases, and messaging. It can be noticed that, HaaS, DaaS, and NaaS are special type of IaaS (Dillon et al., 2010; IBM Global Technology Services, 2012; Lehner & Sattler, 2010; Moscato, Aversa, Di Martino, Fortis, & Munteanu, 2011; Sheng, Tang, Xiao, & Xue, 2013; R. P. Verma et al., 2013).

The cloud service models are provided by cloud service providers, which are vendors who lease cloud services to customers on demand (Almishal & Youssef, 2014). Table 2.3 compares different cloud service providers.

Table 2-3 Comparison among different cloud providers

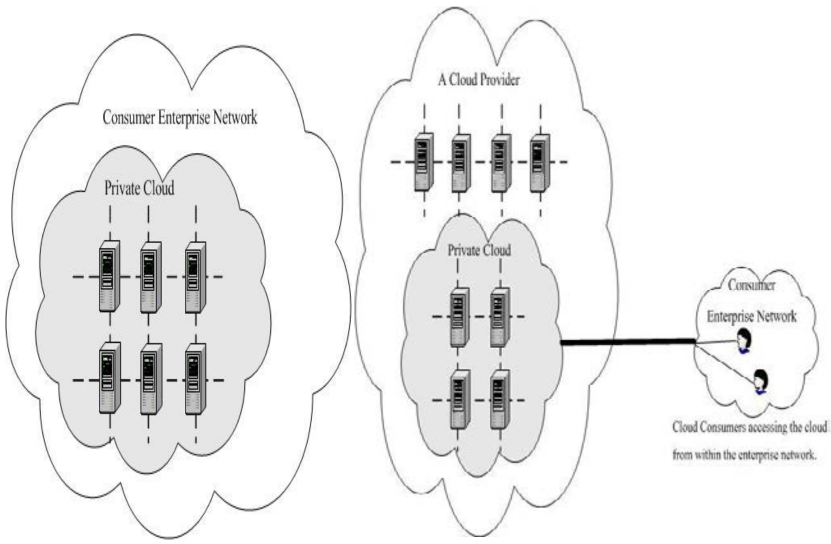
Criteria	Cloud Service Providers						
	Amazon	*Google*	*Microsoft*	*HP*	*AT&T*	*Salesforce*	*Rackspace*
Types of cloud services provided	Iaas, Paas, Storge, Database	Iaas,Paas, Storge, mobile, database, Big Data	Iaas, paas, mobile, Media, Database, Big Data	Iaas, Paas, Storage, Database, DNS	Iaas, Paas, Storage, Network	Saas, Paas, Storage, business application	Iaas,Paas, Storage, Database, big Data, Network
Key features	A various cloud services	Including big data and mobile development platform	Including media and mobile development.	Including storage and cloud load balancer, Openstack software	Proving a private network for enterprise	Focusing on sales and CRM application	Provide about 11 different CC products, Openstack software.
Average Monthly price	66$	42.2$	65.7$	87.60$	121$	195$	116$
Payment Plan	Pay per use, monthly	Pay per use	Pay per use, yearly, Monthly	Pay per use	Pay per use	Pay per use,Monthly	Pay per use
Number of OS Supported	9	2	6	4	2	3	4
Service Age	5+ years	1-2 years	1-2 years	1-2 years	4-5 years	4-5 years	5+ years
Easy to use	Good	Good	Good	Medium	Medium	Good	Good
Security level	High	High	High	medium	High	High	High
Security Certification	yes	yes	yes	no	yes	yes	yes
Integration Standard	Proprietary	Proprietary	hyperV	openstack	VMware	VMware	openstack
Availability as SLA	99.95%	99.95%	99.95%	99.95%	99.9%	99.9%	100.00%
API support	yes	yes	yes	yes	no	yes	yes
Number of Data Centers	8	11	8	3	26	6	9

Source: Almishal and Youssef (2014, pp. 50-51)

2.7 Deployment Models of Cloud Computing

Cloud computing presents four different types of environments where consumers can choose to deploy their applications (Brohi & Bamiah, 2011; F. Liu et al., 2011). The four cloud deployment models are: private cloud, public cloud, community cloud, as well as hybrid cloud (S. Hashemi, 2013; F. Liu et al., 2011; Mell & Grance, 2011; Sajid & Raza, 2013; A. Verma & Kaushal, 2011). Organizations may decide to use one or a combination of these models based on their needs (Skiba, 2011).

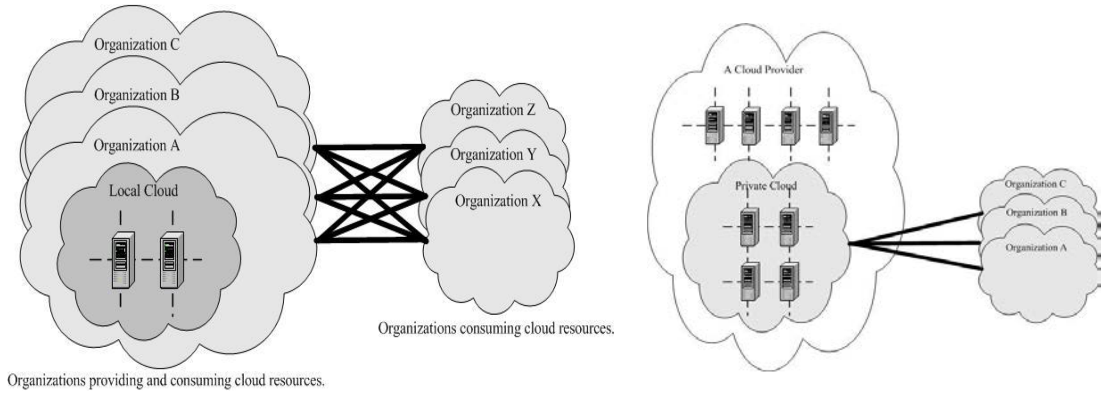
Private cloud: in this model the cloud services are provisioned exclusively for only one organization (Sajid & Raza, 2013). The organization can possess, manage, operate, and host the cloud infrastructure; or it can be managed and hosted by a third party (Dillon et al., 2010). The consumers of the services provided in this model comprises various individuals and departments of the organizations (Mell & Grance, 2011). Organizations generally prefer this model when they want to for example utilize their available resources, reduce the cost of data transfer, have total control, and improve the confidentiality and security of their data (Dillon et al., 2010; A. Verma & Kaushal, 2011). Private clouds include Eucalyptus and OpenNebula (Peng et al., 2009; Srirama, Batrashev, & Vainikko, 2010). Figure 2.4 illustrates the private cloud.



(a) On-site (b) Out-sourced

Figure 2.4 Private cloud (F. Liu et al., 2011)

Community cloud: the cloud services provided in this model are offered to a group of organizations or consumers known as a community as shown in Figure 2.5 (Mell & Grance, 2011). Various organizations that form the community cloud share common concerns like mission, policy, compliance considerations, and security requirements (Dillon et al., 2010; Mell & Grance, 2011; Sajid & Raza, 2013; A. Verma & Kaushal, 2011). The management and hosting of the cloud infrastructure can be handled by one or more members of the community, a third-party, orboth of them (Mell & Grance, 2011). Various community clouds exist, for instanceHealthcare Community Cloud Service™ and the Media Cloud (Carpathia, 2015; Henneberger & Luhn, 2010).



(a) On-site (b) Out-sourced

Figure 2-5 Community cloud (F. Liu et al., 2011)

Public cloud: this is a deployed model whereby the services are offered to general public (Sajid & Raza, 2013). The cloud infrastructure is managed and hosted by the cloud service providers who are business, academic or government organizations, or combination of them (Mell & Grance, 2011). The cloud services may be free to the general public or leased and charged based on pay-as-you-go system (Sabahi, 2011b). The consumers share the cloud infrastructure, which makes the cost of the cloud services low since it will be distributed among the consumers (Alsufyani, Safdari, & Chang, 2015; Marston et al., 2011). On the other hand, sharing of the infrastructure poses a security and privacy threat (F. Liu et al., 2011). Amazon EC2, S3 and Google AppEngine are among the popular public cloud services (Dillon et al., 2010; Ren, Wang, & Wang, 2012). The public cloud is shown in Figure 2.6.

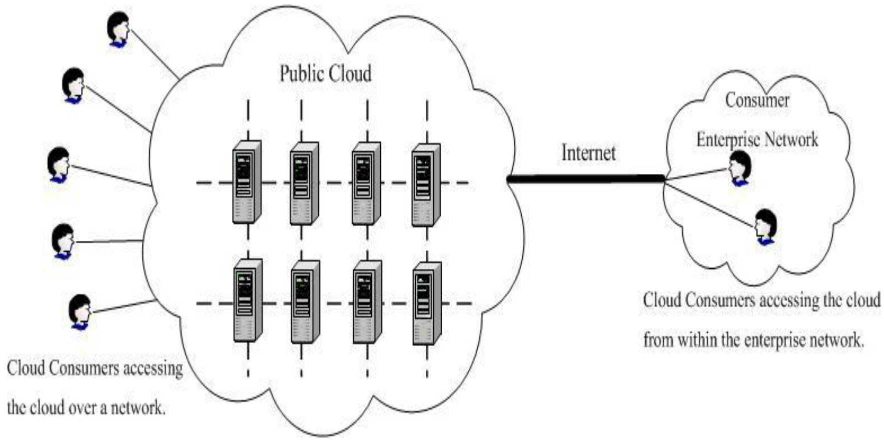


Figure 2-6 Public cloud (F. Liu et al., 2011)

Hybrid cloud: a model is called hybrid when it provides cloud services by combining two or more separate cloud models (private, community, or public) (Sajid & Raza, 2013). The models are bound together using standardized technologies that allow application and data portability, such as "cloud bursting for load balancing between clouds" (Mell & Grance, 2011, p. 3). Organizations can use the hybrid cloud model when they want to gain the benefits of more than one model simultaneously (Rani & Ranjan, 2014; Zhang et al., 2010). For instance, an organization may host an application with their confidential data on private cloud and link the application with other software in a public cloud. In this case the organization will benefit from the security of the private cloud (A. Verma & Kaushal, 2011). The hybrid cloud is illustrated in Figure 2.7.

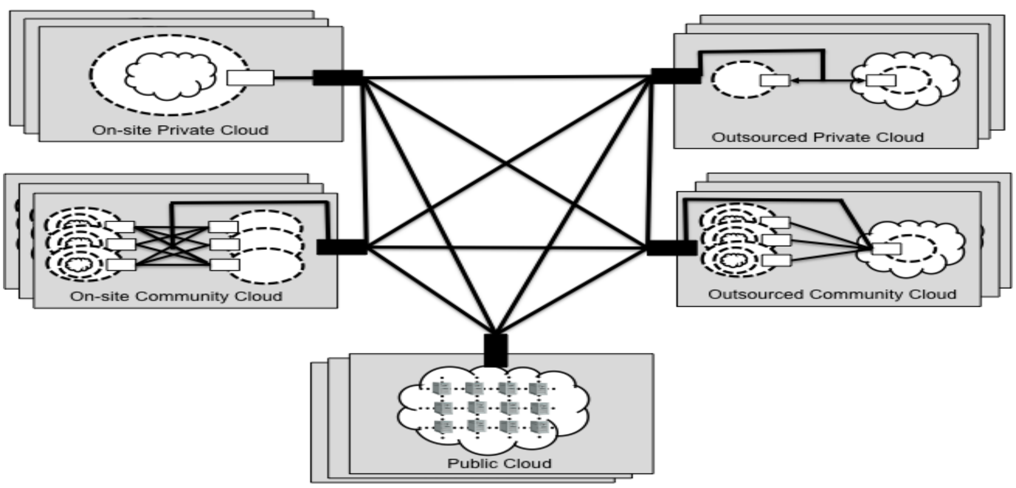


Figure 2-7 Hybrid cloud (F. Liu et al., 2011)

The cloud deployment models are compared in Table 2.4 based on their scope, ownership, management, security level, and location.

Table 2-4 Cloud deployment models

Deployment model	Scope of services	Owned by	Managed by	Security level	Location
Public	general public and large industry groups	Cloud Service Provider (CSP)	Cloud Service Provider (CSP)	Low	off premise
Private	single organization	single organization	single organization or CSP	High	off or on premise
Community	organizations that share the same mission, policy and security requirements	several organizations	several organizations or CSP	High	off or on premise
Hybrid	organizations and public	organizations and CSP	organizations and CSP	Medium	off and on premise

Source: Almishal and Youssef (2014, pp. 46-47)

2.8 Benefits of Cloud Computing

Cloud computing offers tremendous benefits to individuals, organizations as well as educational institutions. It provides efficient services and infrastructures without the need to acquire the required IT infrastructure (González-Martínez et al., 2015; Milić et al., 2014). Although choice of deployment model determines the benefits that can be realized, the technology is becoming increasingly popular because many organizations and education institutions are moving to it due to the realized benefits. Some of the widely reported benefits are presented as follows:

Cost saving: cloud computing is a cost-effective computing technology (El-Seoud, El-Sofany, Taj-Eddin, Nosseir, & El-Khouly, 2013; Ghazizadeh, 2012). This is the main advantage of cloud computing technology (Gens, 2009). It was reported that, USA based higher education institutions saved 21% after migrating their applications to cloud (Cisco, 2012). Cloud computing reduces and in most cases eliminates hardware and software procurement, implementation, and maintenance costs; and technical support provided by institutions (AlCattan, 2014; IBM Global Technology Services, 2012). It reduces cost related to IT operation by centralizing software, operating systems, hardware, and applications; and by sharing of equipment and solutions (Cisco, 2012; El-Seoud et al., 2013; IBM Global Technology Services, 2012; Karim & Goodwin, 2013). The pay-per-use billing system lowers service cost since customers only pay for the services used (AlCattan, 2014; Ghazizadeh, 2012; Mokhtar et al., 2013; Odeh, Warwick, & Cadenas Medina, 2014; Soni & Gupta, 2013). Academic institutions waste resources due to underutilization of infrastructure during off-peak academic period, hence deploying cloud computing will improve resource utilization since the resources will be consumed only on demand (Boss, Malladi, Quan, Legregni, & Hall, 2007; Cisco, 2012; IBM Global Technology Services, 2012). The capital expenditures (CapEx) are eliminated since capital assets like storage and processing cycles are virtualized and converted into operating expenses (OpEx). Thus, the number of IT staff required is reduced and coupled with the pay-per-use capability, so the OpEx will be decreased (Cisco, n.d.; El-Seoud et al., 2013; IBM Global Technology Services, 2012; Powell, 2009; Sukumaran, 2011).

Efficiency: cloud computing guarantees instant software update to keep up with the current technologies (AlCattan, 2014; Isaila, 2014; Karim & Goodwin, 2013; Soni & Gupta, 2013), improves performance (Alshwaier et al., 2012; Ghazizadeh, 2012; Isaila, 2014), and increases IT agility (Cisco, 2012; Mokhtar et al., 2013). Cloud computing allows infrastructure, services, and applications to be obtained, provisioned, and deployed rapidly (Cisco, 2012, 2013). Implementation becomes easier since there is no need for hardware purchase, software licencing, and implementation of services (Cisco, n.d.). In addition, cloud computing makes it possible to launch Web 2.0 applications quickly and scale up applications when needed, and increase responsiveness through real time workload balancing (Boss et al., 2007). Moreover, it saves IT management time thereby increasing the productivity of the IT personnel (Brohi & Bamiah, 2011; Ogunde & Mehnen, 2013).

Sharing: skills, practices, applications, infrastructure, and teaching content can be shared to avoid duplication, thereby harmonizing resources and promoting new ways of accessibility to education (AlCattan, 2014; IBM Global Technology Services, 2012). Likewise, sharing of cost between the cloud service users improves infrastructure utilization (Jadeja & Modi, 2012). The cost is further reduced as a result of sharing the infrastructure (Armbrust et al., 2009).

Reliability: this is the ability of the cloud to function as expected, involving guaranteeing high quality of service, high transmission rate, minimum error rate, and faster recovery from error (Alkhater, Walters, & Wills, 2014). Cloud infrastructureis more reliable than on-premise infrastructure(El-Seoud et al., 2013).

Portability: cloud computing services can be accessed using any computing devices like PC, laptop, tablet, smart phone, and any other internet-enabled mobile devices (AlCattan, 2014; Ghazizadeh, 2012). It eliminates document format incompatibility because documents are accessed from cloud (Ghazizadeh, 2012). Portability involves moving data from one cloud application to another within different cloud environments with little cost and disruption (F. Liu et al., 2011).

Flexibility (elasticity): cloud computing uses various technologies like virtualization and modularity of component parts that promote flexibility (Alshwaier et al., 2012; IBM Global Technology Services, 2012; A. Singh & Hemalatha, 2012), and capability of responding to changes quickly (X. Tan & Kim, 2011). Cloud computing enhances mobility by permitting access to services and resources from any location. Flexibility of learning and teaching content gives easy access to courses and content at any time, any place, allows students to learn outside school, outside school calendar,and enables ongoing learning (IBM Global Technology Services, 2012).

Scalability: cloud computing enables hardware and software expansion as the needs arise and when user load decreases, the resources shrink (Akin, Matthew, & Y., 2014; Cisco, n.d.; Powell, 2009; A. Singh & Hemalatha, 2012). Therefore, when clients, orders, and traffic grow, the cloud system will be ready to sustain the new demand (Mansuri, Verma, & Laxkar, 2014). Administrators can utilize parallel remote application server capability to add new servers and provide applications or services to new users in a very short period of time (Aerohive Networks, 2015; Bonuccelli, 2014). In educational settings, the demand for resources usually increases during peak period like enrolment, assignment submission deadlines, and publishing of results; therefore, at this period the resources will increase to accommodate the large number of users at that particular time (González-Martínez et al., 2015).

Security: cloud computing providers implement appropriate security policies and use latest threat intelligence to ensure that customers’ data is protected (Alshwaier et al., 2012; Cisco, 2013). The data and other contents stored in the cloud are usually accessed after authentication, so it is not easily accessible (Staines, 2013).

Backup and recovery: cloud provides backup and recovery services so that customers can easily backup and recover their data anytime in case of disaster or failure (Okai et al., 2014). One of the major benefits of cloud backup and recovery is improving data protection. Since customers' data is managed by cloud service provider and the data is available and reliable especially if proper measures are taken; therefore, data can be easily and quickly recovered. Usually, contents are automatically saved and remain in cloud, so they can be easily and quickly restored (Mansuri et al., 2014; Sajid & Raza, 2013).

Green technology: in cloud computing, resources are virtualized which increases energy and resource efficiencies (Alsanea & Barth, 2014; Ghazizadeh, 2012; Jose & Kumar, 2015; S. Kumar & Murthy, 2013). Virtualizing the infrastructure protects the environment since the number of physical equipment is reduced which in turn means low cooling, space requirement, and energy consumption (Ghazizadeh, 2012; Odeh et al., 2014; A. Singh & Hemalatha, 2012). Using cloud computing reduces electronic waste and emission of hazardous substances as a result of widespread use of computer systems (Almishal & Youssef, 2014).

Availability and accessibility: cloud computing allows infrastructure, services, applications, tools and resources to be accessed anytime from anywhere using any device (AlCattan, 2014; A. S. Hashim & Othman, 2014; Mansuri et al., 2014; Mircea & Andreescu, 2011; Mokhtar et al., 2013). Generally, cloud-based resources and services are accessed via Internet, so they can be accessed on-campus or off-campus which increases their availability (Mansuri et al., 2014; Sukumaran, 2011; X. Tan & Kim, 2011). Hence, students can easily access recourses such as files, assignments, and lecture notes (Mansuri et al., 2014).

Reduce processing and tasks time: since content is online the teacher does not need to spend time and resources while collecting, processing, sharing, printing or copying large files or documents (A. S. Hashim & Othman, 2014; Mansuri et al., 2014). The students can also access their courses, resources, assignments, and other stuffs online (Mansuri et al., 2014).

Facilitate task and data management: cloud computing allows permission and roles to be defined for each user to ensure that each department or employee in an institution perform their duly assigned duty to avoid role conflict (A. S. Hashim &

Othman, 2014). It allows the IT departments to focus on innovation rather than implementation and maintenance (Erkoç & Kert, 2011; A. Singh & Hemalatha, 2012). Cloud computing also allows easy scheduling, reservations, and management of computing resources that can be used by students or teachers (González-Martínez et al., 2015).

Enhance distance and mobile learning: students can use their mobile devices to access courses and resources online either in their campus or off-campus (Ghazizadeh, 2012; González-Martínez et al., 2015; Mokhtar et al., 2013). This increases the productivity of organizational staff, educators, and students, and improve quality of education; since users can work or learn anytime from anywhere (Aerohive Networks, 2015; Bonuccelli, 2014). Some of the learning services supported by the cloud include receiving context-based e-Learning content in real time and live video streaming (González-Martínez et al., 2015). Mobile learning by using cloud services improves students engagement, resources availability, and simplification of teaching and learning processes (Crucial Cloud Hosting, 2014).

Simplification and standardization: there is no need to carry devices like thumb drives or Compact Discs (CDs)anymore, so there is no need to worry about losing or damaging the device, or content getting corrupted (Staines, 2013). In cloud computing data centres and facilities are consolidated and at the same time standardized practices and security compliance are improved, making management easier (Cisco, 2012; Soni & Gupta, 2013).

Innovation: cloud computing promotes and speeds up innovation by making resources available and by providing services quickly to innovators so that they can fully focus on the innovation (Boss et al., 2007; Sukumaran, 2011). Using cloud computing enables institutions to explore research opportunities and get latest technological innovations by sharing cloud resources with various universities (Bonuccelli, 2014; Cisco, 2012). This can be achieved when educators, students, and administrators are given the required applications and the freedom required to do their work (Cisco, 2012).

Access to top-end IT capabilities: cloud computing enables access to sophisticated hardware, software, and IT personnel that an institution cannot afford (Cisco, n.d.; Powell, 2009).

Effectiveness: cloud computing offers effective computation by centralizing storage, memory processing and bandwidth (Soni & Gupta, 2013). Cloud computing leads to productive and effective learning for students, and it also encourages pooling and implementation of good management practices (IBM Global Technology Services, 2012).

Collaboration: cloud computing enhances learning by using cloud based collaborative technologies such as Google Docs which allow multiple users to work on one document and share ideas (Mansuri et al., 2014; Suwantarathip & Wichadee, 2014). In a collaborative setting, groups can be created to work on projects, assignments, collaborative writing, and peer editing in the cloud (Firth & Mesureur, 2010; Staines, 2013). Collaborative learning is regarded as one of the factors that significantly contribute to students' learning since it promotes active learning by allowing a group of students and teachers to socially interact for sharing of information, knowledge, and experience (Ishtaiwa & Aburezeq, 2015; Suwantarathip & Wichadee, 2014). Services like Cisco Tele Presence and Cisco WebEx can be used to extend rich interactive learning environments to anyone, and anywhere (Cisco, 2013).

2.9 Challenges of Cloud Computing Adoption

There are many challenges associated with cloud computing adoption. According to a survey conducted by International Data Corporation (IDC), the top three most reported challenges of cloud services are security, availability, and performance (Gens, 2009). Researchers also have highlighted other challenges that may affect an organization's decision makers to adopt cloud computing. The widely reported challenges are described in the subsections below.

2.9.1 Security and Confidentiality

This is one of the highly reported and fundamental issues that prevent customers from adopting cloud technology (Alshamaila, Papagiannidis, & Li, 2013; Coursaris, van Osch, & Sung, 2013; E. Park & Kim, 2014; A. Verma & Kaushal, 2011). Customers' data and applications are vulnerable to various security threats like data loss, and unauthorized access as a result of lack of control over cloud data and infrastructure(Pramod et al., 2013). Even though cloud providers typically give an assurance to customers that they use experts to manage their data centres, customers are still worried about who will monitor and manage their data (Almabhouh, 2015; Jlelaty & Monzer, 2012). Customers are anxious of the fact that their data is under the control of the cloud providers which may not protect their confidential data. Therefore, to ensure confidentiality of data the following techniques should be applied in order to overcome the security and privacy challenges (Alshwaier et al., 2012; Masud & Huang, 2012; Mircea & Andreescu, 2011; Okai et al., 2014).

- **Encryption**: it is the main method used to protect data during transfer and storage in the cloud. It ensures authenticity and integrity of the data and prevents improper disclosure of confidential data (Alharthi, Yahya, Walters, & Wills, 2015; Islam et al., 2013; R. Kumar, Kant, & Sharma, 2015; Laisheng & Zhengxia, 2011; Okai et al., 2014). Organizations usually prefer handling the encryption themselves in order to enhance the confidentiality of their data (Pramod et al., 2013).

- **Digital signature**: by using an electronic signature, the identity of the user can be authenticated, which requires appropriate login to get access to the data (Okai et al., 2014).

- **Identification and authentication**: access to the cloud services should be controlled such that only validated user should be granted. Different accounts for faculty members, students, and staff should be created and validated using username and passwords (Alharthi et al., 2015). The verification process should be implemented so that a customer's data will not be compromised (A. Verma & Kaushal, 2011).

- **Authorisation**: each user should access the content based on their privilege using priorities, permissions, and ownerships. This ensures "referential integrity is maintained" (Alshwaier et al., 2012; A. Verma & Kaushal, 2011, p. 450).

- **Integrity and confidentiality**: sensitive and confidential data like students' results should be protected using techniques such as encryption (Alharthi et al., 2015; Zissis & Lekkas, 2012). This will ensure the reliability of the data (Okai et al., 2014). This involves imposing Atomicity, Consistency, Isolation, and Durability properties on the cloud delivery models (A. Verma & Kaushal, 2011).

- **Non-repudiation**: this ensures that all the parts of electronic transactions are not denied (Zissis & Lekkas, 2012). Timestamp and digital signature can be used for this purpose (Alharthi et al., 2015). Digital receipt can be used to confirm the sending and receiving of data (A. Verma & Kaushal, 2011).

- **Direct contact with the service provider**: the institution should create a direct contact with the cloud provider to reduce the chance of data compromise by a third party (Okai et al., 2014).

- **Gradual sequence of migration**: the process of moving to cloud should be in stages starting with applications of insignificant risks (Okai et al., 2014). This will ensure that the institution is satisfied with the provider before migrating sensitive and confidential data (Okai et al., 2014).

- **Investigating the vendor**: this involves checking the security measures to ensure that they are in line with those defined by bodies like NIST and Cloud Security Alliance (Okai et al., 2014).

- **Data splitting**: this involves using more than one cloud provider to store data or for different purposes. For instance, students' grades can be stored in cloud A and alumni information in cloud B. Email service is outsourced to Google and file storage service is outsourced to Amazon. This will improve confidentiality, availability, and integrity of the data; improve performance; avoid vendor lock-in; and reduce risk of data loss and downtime (Okai et al., 2014).

2.9.2 Availability

Availability is regarded as the second most significant issue that affects cloud computing adoption (Gens, 2009). It is determined by factors such as reliability, latency, and performance. Although availability issueis common with cloud, most cloud infrastructureis built to provide high availability (Ogunde & Mehnen, 2013). Ensuring the availability of a cloud service or resource implies that customer's request is granted instantly and the requested service is delivered immediately.

Steady and good quality Internet connection will eliminate service outage, which increases availability and accessibility of the services (Karim & Goodwin, 2013). The provider should guarantee high service availability to customers (Almabhouh, 2015). The availability of cloud services is guaranteed in SLA documents. Hence, availability is among the most significant issues to be considered when choosing between the cloud service types and delivery models (A. Verma & Kaushal, 2011).

2.9.3 Performance

Performance is considered as a third most significant issue that affects cloud computing adoption (Gens, 2009). It is usually determined by capabilities of the applications running on the cloud (Sajid & Raza, 2013). The performance of cloud system may be affected by the distance between the cloud and the customer as a result of delay (Kim, Kim, Lee, & Lee, 2009). Internet is the medium through which cloud services are delivered, so the performance of the cloud services depends on the Internet (Alsufyani et al., 2015; S. Kumar & Murthy, 2013). The cloud data has to pass through different shared routes, hops and packets during the transmission process, where the data may be lost or corrupted. Thus, the procedure could be negatively affected by data transmission challenges like delay and jitter which will consequently result in poor performance (Alsufyani et al., 2015). The reliability of Internet itself may as well affect the performance (Alsufyani et al., 2015; Cisco, n.d.; Kihara & Gichoya, 2014; S. Kumar & Murthy, 2013). Slow Internet connection can significantly affect the cloud service performance. Hence, a fast Internet connection is required for efficient service delivery (Jlelaty & Monzer, 2012). Organizations experience poor performance when cloud applications become unresponsive which may happen due to communication delay. The performance becomes worse if multiple users are simultaneously using data-intensive services on a low bandwidth network. The consequence of poor performance is loss of customers which may result in reduction in revenues (Almabhouh, 2015; Sajid & Raza, 2013). Therefore, the provider should guarantee performance especially for a task that requires extensive computing power, and availability for timely delivery of resources and research result (Gital & Zambuk, 2011; Sukumaran, 2011).

2.9.4 Costing Model

Cloud computing can reduce the infrastructure cost, but when network resources such as data usage and bandwidth are highly used it will increase the data communication cost (Dillon et al., 2010). The cost of computing resources will be higher if more resources are used for data exchange between providers and organizations. For instance, a customer who is using hybrid cloud where the organizational data is distributed across different clouds will consume more computing resources than a private based or a public based customer. Therefore, the saved infrastructure cost will now be spent on the communication and data transfer (Harfoushi et al., 2014). The pricing models include pay-as-you-go and subscription pricing. The costing model of a provider and the resulted trade-offs should be analysed prior to deployment (Pramod et al., 2013). In this case the benefits should be weighed against the cost in order to maximize the benefits over the cost by considering the desired level of security (Harfoushi et al., 2014). For organizations of a limited budget, pay-as-you-go plan should be used, while subscription pricing is the best when there are long term and well defined requirements. On the other hand, using hybrid cloud would result in better return on investment (Harfoushi et al., 2014; Pramod et al., 2013).

2.9.5 Service Level Agreement

SLA is a contract between cloud service provider and customer, which specifies what services the provider will offer (Garg & Stiller, 2015; Prabowo, Janssen, & Barjis, 2012). SLAs are used by providers to guarantee efficient delivery of cloud services and resources. This involves: ensuring the quality, availability, reliability, and performance of the services (Dillon et al., 2010; Harfoushi et al., 2014; Pramod et al., 2013). SLA is regarded as one of the crucial considerations when choosing the right deployment model. Customers usually negotiate SLAs with the providers to make sure service delivery feature meets their expectations (Pramod et al., 2013). Some of the concerns related to SLA are interpretation of the conditions, omission of some customers’ requirements, and the criteria for assessing the terms in the agreement (Harfoushi et al., 2014).

2.9.6 Vendor Lock-in

Cloud service providers have distinct ways of interaction between customers and the cloud (Pramod et al., 2013). They have no standard format for storing data which hampers customer's migration from one provider to another or in-house data centre for resources optimization (Akin et al., 2014; Alshwaier et al., 2012). Lock-in prevents customers from moving from one cloud provider to another or on-premise data centre (González-Martínez et al., 2015; Li & Chang, 2012). When institutions are locked in to a particular provider, switching to another is difficult and attracts high cost (Ogunde & Mehnen, 2013). Cloud service providers develop different APIs, whichcomplicates integration of cloud services with organizations' legacy systems. This results in interoperability issues which can be resolved using standardization (Armbrust et al., 2010; Ogunde & Mehnen, 2013). Vendor lock-in can lead to risks such as price increase and non-reliability, because the customers are locked-in to a particular provider. Therefore, the customers have to stay with the provider, even though they are displeased with the service provided (Lewis, 2013).

2.9.7 Compliance and Physical Location

Compliance is one of the determinants of cloud computing adoption, because customers may not know the location of their data or may not have control over the location,creating legal issues with regulatory and privacy laws (Ogunde & Mehnen, 2013). For instance, many European Union countries and USA do not allow certain type of data to be moved out of their countries. Likewise, customers who have their cloud data stored in USA have to comply with rules concerning storage and disclosure of data (Jlelaty & Monzer, 2012; Kim et al., 2009; Ogunde & Mehnen, 2013). Legal issues can bind institutions into unsatisfactory conditions which may result in legal disputes due to laws of the location where data is situated. For instance, Lakehead University in Canada is facing legal challenges with the faculty union as a result of adopting Google public cloud. The union complains that Google does not protect their privacy and academic freedom since Google is a United States (US) company and they are required to give their data to US government when required based on their law (Okai et al., 2014). In addition, organisations that are required to comply with regulatory compliance measures like Health Insurance Portability and Accountability Act, Payment Card Industry Data Security Standard, or Sarbanes-Oxley Act may be reluctant to adopt cloud computing (Aerohive Networks, 2015).

2.9.8 IT Department’s Stand and Changes

The change from traditional ways of computing to cloud computing becomes an issue because the IT personnel will be worried of losing their jobs since adopting cloud computing will require them to change the way they operate. But cloud computing will increase the performance of the IT personnel, since they will now focus on new innovations rather than managing IT infrastructure (Jlelaty & Monzer, 2012). Outsourcing IT operations from a cloud computing provider may result in reduction or elimination of IT personnel’s routine support activities (Benlian & Hess, 2011).

2.10 State of Cloud Computing in Saudi Arabia

The growing number of companies that embrace cloud computing services in Saudi Arabia provide an evidence of increasing interest and spending in ICT market, particularly cloud computing in Saudi Arabia (Shetty, 2015). Saudi Arabia is one of the Arab countries that utilize ICT to a great extent in their organizations, and now Saudi Arabia is one of the leading cloud computing adopters in the Arab world (Alsanea & Wainwright, 2014; Ministry of Communications and Information Technology, 2014). However, cloud computing technology provides Saudi organizations and institutions with opportunities to use state-of-the-art technologies with minimal budget (A. Tashkandi & I. M. Al-Jabri, 2015). Although findings from Alharbi (2012) revealed positive attitude of users toward accepting cloud computing in Saudi Arabian organizations, the technology is still not widely used in Saudi Arabia, perhaps as a result of issues such as security fears, and shortage of qualified IT skills (Alkhater, Chang, Wills, & Walters, 2015; Alkhater, Wills, & Walters, 2014; IDC, 2014). The government of Saudi Arabia in partnership with United Arab Emirates are set to lead the adoption of cloud services in Middle East with an initial total expenditure of $280 - $324 million (Ministry of Communications and Information Technology, 2015). According to IDC, the Saudi cloud market is expected to increase in 2015 by 53.8% from 2014 and the market is anticipated to reach $77.5 million in the same year (Shetty, 2015). IDC also predicts that public, private, and virtual private clouds market in Saudi Arabia will increase at a Compound Annual Growth Rate (CAGR) of 40.37%, 40.7%, and 67.7% respectively by 2018 (Shetty, 2015).

Meanwhile, the Saudi Arabian cloud market is improving significantly, as a result local cloud providers and telecom operators are substantially investing in developing various cloud solutions (IDC, 2014). The sales of IT services in Saudi Arabia rose from Saudi Arabian Riyal (SAR) 5.6 bn in 2014 to SAR 6.1bn in 2015 (A. N. Tashkandi & I. M. Al-Jabri, 2015). Despite the issues associated with cloud computing such as security, privacy, connectivity, and usability, Saudi Chief Information Officers are developing cloud computing strategies due to cost-reduction, risk management, and commercial expectations benefits (IDC, 2014).

However, the customers in Saudi Arabia prefer local providers who they will be interacting with most of the time (IDC, 2014). One of the local cloud services providers in Saudi Arabia is Elm (AlBar & Hoque, 2015). Elm is a joint-stock company owned by the Public Investment Fund. The company develops"secure e-Services and high-profile government support projects that fully meet client expectations" (Elm, n.d.-a). The company's cloud service called Elm Cloud provides cloud-based project management services to both government and private sectors (Elm, n.d.-b). Other cloud service providers in Saudi Arabia include Mobily which provides VMware-based services (Arab Brains, 2013; Saudi Telecom Market, 2015a); AWAL which partners with IT companies such as HP, IBM, Cisco, Dell, and Huawei to deliver cloud services (A. N. Tashkandi & I. M. Al-Jabri, 2015); and Saudi Telecom Company which partners with Oracle to provide PaaS and SaaS (Saudi Telecom Market, 2015b). The cloud computing customers in Saudi Arabia include Zamil Industrial Investment which uses Office 365 from Microsoft, Al-Hammadi Hospitals which uses private health cloud from Cisco and Wipro; Saudi Ministry of Health which uses public health solution from IBM, and Jubail Energy Services Company which uses HANA Enterprise Cloud (A. N. Tashkandi & I. M. Al-Jabri, 2015).

Meanwhile, the Saudi government is investing extensively on e-Government solutions to improve services in public sectors. The Saudi national e-Government action plan has different initiatives that include developing cloud computing delivery model for government agencies (A. N. Tashkandi & I. M. Al-Jabri, 2015). The e-Government planis to have different products and services as part of the cloud computing initiative. The following are some of the services available in the initiative: Government Secure Network (GSN) which is part of IaaS; Government Service Bus (GSB), and National Contact Center (Amer) which are part of PaaS; and E-Correspondence which is part of SaaS (e-Government Program, n.d.). In this regard, a Saudi Arabian e-Government program (YESSER) organized the first G-cloud computing forum which was attended by various international cloud computing experts. The aim of the forum was to share ideas and opinions of IT professional from various government agencies in order to identify best e-Government practices (e-Government Program, 2012).

On the other hand, Saudi Arabian universities still lag behind other organizations in terms of cloud computing adoption (A. Tashkandi & I. M. Al-Jabri, 2015). A study of proposed plan to use cloud computing in Saudi Arabian higher education was conducted in King Saud University (Alhazzani, 2014). Questionnaires were administered to 200 members of the university in order to identify the advantages and disadvantages of cloud computing in education and to assess the level of cloud computing usage by teaching staff. The findings showed that nearly all the respondents (96.7%) agreed that using cloud computing in education was an important step towards improving Saudi Arabian higher education system.

Another study of cloud computing in Saudi Arabian higher education was conducted by A. Tashkandi and I. M. Al-Jabri (2015) who considered institutional, technological, and environmental factors. The study considered the adoption at institutional level rather than individual level. Despite various Saudi government initiatives on ICT, this study revealed that there was no pressure from government towards adoption of cloud computing by higher education institutions. In addition, Internet performance and trust were identified as some of the respondents' major concerns that affect the adoption of cloud computing in Saudi Arabian higher education institutions (A. Tashkandi & I. M. Al-Jabri, 2015). However, Alhammadi, Stanier, and Eardley (2015) recognized security, government and top management support, organizational readiness, firm status, and compatibility as factors that influence cloud computing adoption in technologically developing countries like Saudi Arabia.

2.11 Cloud Computing in Education Environment

While the implementation of the cloud computing in the education settings remains at the initial stage of development, existing research recognizes several advantages can be gained by using cloud computing in education. According to Britland (2013), the future of technology in education would be about anywhere access to resources for learning and collaboration. This suggested cloud computing as the future of technology in education. He further projected that “in the future, teaching and learning is going to be social” (Britland, 2013). The students can use cloud services to aid independent learning, which enable them to study in their own way from anywhere (Benson & Morgan, 2013; Britland, 2013). The collaboration can be achieved using shared applications such as Google Apps and Office 365 which allow students and teachers to work on same documents from anywhere in the world (Aaron & Roche, 2011; Britland, 2013; Murray, 2011). With cloud computing, teachers and students can be connected with each other within and outside their campuses, and classrooms can be everywhere since educational resources will be available around the clock.

Moreover, education institutions are facing challenges such as limited resources (human/finance), growing IT/information demands, and lack of ICT facilities needed to support teaching, learning, research, and developmental activities (Bonuccelli, 2014; Erkoç & Kert, 2011; Mircea & Andreescu, 2011; Okai et al., 2014; Sultan, 2010). Cloud computing addresses the problems above by providing services, resources, and IT infrastructures so that institutions can focus on teaching and research rather than on IT configuration and management (Ercan, 2010; Mircea & Andreescu, 2011). Cloud computing has the potential to reduce IT cost by virtualizing resourcessuch asprocessing cycles and disk storage into an available and inexpensive operating expense (Cisco, n.d.; Sultan, 2010).

Generally, there are various implementation of educational cloud services, for example, North Carolina State University implemented Virtual Computing Lab (VCL), which is a platform that pools together IT resources such as servers, storage, and software of several sites that can be accessed from anywhere. The aim of this project was to improve rate of use of IT resources, reduce the maintenance cost of the infrastructure, and provide access to optimize resources to everyone. The VCL is accessible to approximately 250,000 pupils and students, by pooling about 2,000 physical servers, supporting nearly 5,000 virtual servers, and more than 800 software images. The benefits are: up to 75% savings on license cost, 150% increase in the ratio of number of students/license, enhanced flexibility, better rate of use of servers, lowered investment in desktops, reduced IT support team to two people. All students regardless of their distance to the school have access to the same learning resources (videos, 3D animations) as their counterparts in more funded schools from anywhere (IBM Global Technology Services, 2012).

Likewise, University of Rhode Island’s College of Pharmacy developed a collaborative portal, which is linked to social networking tools. The portal was created to make resources (human, financial) identification faster, interact with researchers, and provide automatic recommendation services. The complete system consists of a central database, a collaborative portal, and social networking and content analysis tools. For each project, a profile and webpage will be created for meeting and collaboration between researchers with matching profiles and skills. The system systematically searches for relevant information related to researchers, projects, theses, and available funds from the central database and suggests potential contacts and collaboration. The analysis and social networking tools identify resources and opportunities like skills and publications. Finally, an optimization software tool suggests how the resources (students, professors, and grants) should be allocated and creates an association between the resources (IBM Global Technology Services, 2012).

2.12 Previous Studies on Cloud Computing Adoption

This section presents previous studies on cloud computing services adoption. There are plenty of studies that identify and investigate factors affecting cloud computing services adoption. Some of the studies focused on adoption by organizations (Al-Jabri, 2014; Alshamaileh, 2013; Borgman, Bahli, Heier, & Schewski, 2013; Low, Chen, & Wu, 2011; Opala & Rahman, 2013), while others examine the adoption by individual users (Alotaibi, 2014; Burda & Teuteberg, 2014; Cao, Bi, & Wang, 2013; Coursaris et al., 2013; Li & Chang, 2012). The growing interest of cloud computing services adoption by organizations and individuals is due to the benefits that can be realized (Behrend et al., 2011; S. Kumar & Murthy, 2013; Militaru, Niculescu, & Teaha, 2013). However, studies that focused on identifying factors affecting adoption of cloud computing applications by university students are lacking (Arpaci, 2016; H. S. Hashim et al., 2015; C.-S. Wang & Huang, 2015).

The adoption of cloud computing applications can be promoted if factors that affect the adoption are identified and examined. There are many different theories and models that researchers use or extend to study technology adoption by organizations and end users. The popular ones include Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), Theory of Planned Behaviour (TPB), Diffusion of Innovations (DOI) Theory, and Technology-Organization-Environment (TOE) Framework (Al-Jabri, 2014; Alharbi, 2012; Cao et al., 2013; Coursaris et al., 2013; Li & Chang, 2012). Table 2.5 illustrates previous studies on cloud computing services adoption conducted in the context of organization, education and end users. There are many different factors which influence the adoption of cloud computing technology. For instance, from the organizational perspective, Opala and Rahman (2013) investigated the impact of security, cost effectiveness, and IT compliance on managers' decision to adopt cloud computing services inUS companies. The study participants were 282 Chief Information Officers, operational managers, and other IT directors and managers responsible for technology acquisition. The results showed that management's perception of cost effectiveness is more significantly associated with their decision to adopt cloud computing than security. The reason for this significant association is due to the awareness of cost savings resulted from cloud adoption.

Similarly, P. Gupta et al. (2013) identified five factors that influenced cloud usage by Small and Medium Enterprises (SMEs) or Small and Medium Businesses (SMBs). The factors were ease of use and convenience, security and privacy, cost reduction, reliability, and sharing and collaboration. A survey questionnaire was administered to about 1100 SMEs/SMBs in various countries within the Asia Pacific region. A total of 211 valid responses were used for analysis. It was found that cost reduction was a predictor of ease of use, sharing and collaboration, and usage and adoption of cloud computing; ease of use was a predictor of sharing and collaboration, and usage and adoption of cloud computing; reliability was a predictor of cost reduction and ease of use; and security and privacy predict ease of use, reliability, sharing and collaboration, and usage and adoption of cloud computing.

Moreover, from the end users' perspective, Coursaris et al. (2013) investigated the effect of user characteristics on individual's behavioural intention to adopt and use cloud computing technology. They proposed a model which incorporated technological, demographic, lifestyle, and contextual factors and validated it on non-cloud application note-taking users in USA. Out of the 1721 recruited respondents, only 402 met the selection criteria as such they were selected. It was found that innovation attributes (relative advantage, compatibility, observability, and triability) had significantly influence on individuals' intention to use the innovation. Also, the intention to adopt the cloud application was found to be influenced by risk, contrary to complexity which had no influence on the intention. The contextual factors (social influence, past experience, and knowledge) were found to have significant impact on some of the innovation attributes. Specifically, social influence had significant relationship with all the innovation attributes except perceived risk. Similarly, past experience was found to have significant impact on three attributes of innovation which were observability, triability and perceived risk. Finally, knowledge had significant influence on compatibility, triability, perceived risk and complexity. Furthermore, three lifestyle clusters were identified in this study, which are: traditionalists, hedonic yuppies, and intelligent businessmen. The cluster analysis showed that compatibility and relative advantage affected all the three clusters. Perceived risk affected only traditionalist and hedonic yuppies. Finally, observability and triability affected hedonic yuppies cluster alone.

In order to encourage the use of cloud services in educational institutions for effective teaching and learning, Behrend et al. (2011) conducted a study using TAM3 to identify the factors that influence cloud computing adoption by higher education students in some colleges in the South-eastern USA. The study used Virtual Computing Lab (VCL 2007) as the cloud platform. From 760 responses collected in the study,it was found that background features like the students' capability to travel to the campus had impacted the perception of usefulness of the technology, whereas first-hand experiences with the system and instructor support specified the ease of using cloud computing. Also the results showed that the influence of perceived ease of use on the adoption was stronger than that of the perceived usefulness. This implied that students may admit the usefulness of the technology, but if using the technology was difficult they may lack the motivation to use it.

Table 2-5 Summary of the previous studies on cloud computing services adoption

Author(s)	Country	Subject/ Sample Size	Context	Theory Used	Factors Examined
Ratten (2016)	Australia	Managers /142	Organization	Social Cognitive Theory (SCT)	Personal attitude, perceived behavioural control, risk, innovativeness, and creativity.
Arpaci (2016)	Turkey	Students/262	Education	TAM	Perceived ease of use, perceived ubiquity, perceived security, perceived privacy, perceived usefulness, trust, subjective norm, attitude, and intention to use.
Hew and Kadir (2016)	Malaysia	Teachers/ 1064	Education	Self Determination Theory, and Channel Expansion Theory	Perceived relatedness, perceived autonomy, perceived competency, school support, perceived media richness, interactivity, content design, attitude toward knowledge sharing, trust in website, specialization, teaching experience, education level, and behavioural intention.
Alhammadi et al. (2015)	Saudi Arabia	Computing professionals/ 81	Organization	DOI and TOE	Technology readiness, security concerns, technology barriers, organizational readiness, firm size, firm status, industry sector, top management support, competitive pressure, external support, government support, relative advantage, compatibility, and complexity.
S.-T. Park, Park, Seo, and Li (2015)	China and Korea	College students and employees/ 337	End-user	-	Information leakage risk, fault recovery risk, compliance risk, service interruption risk, and trust.
Ratten (2015a)	USA and Turkey	Students/249	End-user	SCT and TAM	Perceived usefulness, perceived ease of use, innovation self-efficacy, ethical awareness, performance expectancy, privacy, and behavioural intention.
A. Tashkandi and I. M. Al-Jabri (2015)	Saudi Arabia	IT decision makers/31	Education	TOE	Relative advantage, compatibility, privacy concerns, complexity, vendor lock-in, top management support, regulatory policies, government pressure, and peer pressure.

Author(s)	Country	Subject/ Sample Size	Context	Theory Used	Factors Examined
Abu-Shanab and Qasem (2014)	-	Individuals/ 120	End-user	-	Information security, information privacy, online experience, brand reputation, trust in brand, brand equity, and intention to use.
Burda and Teuteberg (2014)	German	Students and staff/229	End-user	TAM	Perceived usefulness, perceived ease of use, risk, trust, satisfaction, reputation, familiarity, and intention to use.
Al-Jabri (2014)	Saudi Arabia	IT managers, IT consultants, and IT professionals/ 106	Organization	TOE	Relative advantage, complexity, compatibility, top management support, organizational readiness, competitive pressure, and business partner pressure.
Alotaibi (2014)	Saudi Arabia	IT professionals and end users/ 770	End-user	TAM	Perceived usefulness, perceived ease of use, trust, anxiety, perceived risk, attitude, behavioural intention, and actual use.
Nguyen, Nguyen, Pham, and Misra (2014)	Vietnam	Users and potential users of cloud based e-Learning systems/282	Education	Unified Theory of Acceptance and Use of Technology 2 (UTAUT2)	Performance expectancy, effort expectancy, social influence, facilitating conditions, price value, hedonic motivation, habit, innovativeness, behavioural intention, and technology usage.
Opala and Rahman (2013)	USA	Chief information officers, operational managers, and other IT directors and managers/282	Organization	-	Cloud security, cost effectiveness, and IT compliance.
Alshamaileh (2013)	England	SMEs adopters and non-adopters of cloud computing services / 184	Organization	TOE	Technological (relative advantage, uncertainty, compatibility, complexity, and trialability), organizational (size, top management support, innovativeness, and prior IT experience), and environmental (competitive pressure, industry, market scope, supplier efforts and external computing support)

Author(s)	Country	Subject/ Sample Size	Context	Theory Used	Factors Examined
Trenz, Huntgeburth, and Veit (2013)	German	Students /143	End-user	Principal-Agency Theory	Trust, peer adoption, switching costs, information privacy concerns, information security concerns, availability concerns, perceived uncertainty, and satisfaction.
P. Gupta et al. (2013)	Various countries in Asia Pacific region	SMEs/211	Organization	-	Cost reduction, ease of use and convenience, reliability, sharing and collaboration, and security and privacy.
Borgman et al. (2013)	-	IT executives and decision makers/669	Organization	TOE	Relative advantage, technology compatibility, technology complexity, firm size, top management support, IT expertise of business users, competition intensity, and regulatory environment.
Coursaris et al. (2013)	USA	Non-cloud application note-taking users /402	End-user	DOI	Relative advantage, complexity, compatibility, observability, triability, risk, social influence, past experience, and knowledge.
Cao et al. (2013)	China	College students, faculty members, and other people/225	End-user	UTAUT	Perceived risk, perceived cost, personal innovativeness, performance expectancy, effort expectancy, social influence, facilitating conditions, adoption intention, and adoption behaviour.
Shin (2013)	Korea	Users/ 93	End-user	TAM	Perceived usefulness, perceived ease of use, perceived availability, perceived security, perceived reliability, perceived access, subjective norm, behavioural intention, and usage behaviour.
M. Tan and Lin (2012)	Singapore	Chief Executive Officers, Chief Information Officers, and IT managers / 43	Organization	TOE and DOI	Complexity, compatibility, relative advantage, demonstrable results, technology-sensing sensing capability, technology – response capability, and perceived industry pressure.

Author(s)	Country	Subject/ Sample Size	Context	Theory Used	Factors Examined
Alharbi (2012)	Saudi Arabia	Employees of an IT organizations/ 171	Organization	TAM	Perceived usefulness, perceived ease of use, attitude, gender, age, education level, job domain, nationality, and behavioural intention to use.
Li and Chang (2012)	Taiwan	Students/222	End-user	TAM, TPB, computer learning theories, and social and economic exchange theories	Security concerns, privacy concerns, vendor lock-in, skills transfer, perceived risks, vendor reputation, perceived usefulness, subjective norm, perceived ease of use, attitude, perceived behavioural control, and behavioural intention.
Behrend et al. (2011)	USA	Student /760	Education	Technology Acceptance Model 3 (TAM3)	Access to software, ease of travel to campus, personal innovativeness, technology anxiety, instructor support, reliability, usefulness, ease of use, intentions for future use, future usefulness, and actual usage.
Low et al. (2011)	Taiwan	IT staff and managers/111	Organization	TOE	Relative advantage, compatibility, complexity, top management support, firm size, trading partner pressure, competitive pressure, and technology readiness.

Cloud computing services adoption studies were extensively reviewed and a number of gaps were observed from the review, as presented in Table 2.5. First, most of the cloud computing services adoption studies conducted in both developed and developing countries including Saudi Arabia focused on organizations and end users. Second, there were few studies in the context of higher education. Last, studies identifying the factors that affect cloud computing applications adoption by university students in Saudi Arabia are generally lacking. In fact, this is supported by Alsaeed and Saleh (2015) who identified around 40 exploratory studies on the adoption of cloud computing from Google Scholar, Elsevier Science direct, Springer Link and IEEE published between 2009 and 2014. Therefore, this study aims at filling these gaps by identifying and assessing factors affecting cloud computing applications adoption by higher education students in Saudi Arabia.

2.13 Chapter Summary

This chapter presented a history of cloud computing, definition of cloud computing from prominent scholars, and a comparison among cloud, cluster, and grid computing technoligies. The three components of cloud computing which are clients, datacenters, and distributed servers were also presented,followed by the fundamental characteristics of the cloud computing which are: on-demand self-service, rapid elasticity, resource pooling, broad network access, and measured service. The three popular cloud service models (IaaS, PaaS, and SaaS) were also discussed in detail, followed by the cloud deployment models. Next, the benefits offered by cloud computing to individuals, organizations and educational institutions were highlighted. They include cost saving;sharing of resources and collaboration; increased efficiency, reliability, portability, flexibility, scalability, availability and accessibility; backup and recovery; task and data management; enhanced distance and mobile learning; and promotion of innovation. Moreover, the challenges that affect the adoption of cloud computing were also discussed. Then, the chapter discussedthe state of cloud computing in Saudi Arabia, and cloud computing in the education environment. Finally, the chapter presented previous studies on cloud computing services adoption.

Chapter 3: Technology Acceptance Theories and Models

3.1 Introduction

This chapter presents a comprehensive review of the most recognized technology adoption theories and models that are used to study the human behaviour towards acceptance of a new technology. The models are examined in order to identify their strengths and weaknesses, which in turn helps us to select the best model that would appropriately answer our research questions. Finally, the chapter presents justification of the selected research model of this study which is TAM3.

3.2 Overview of Technology Adoption Models

IS researchers deal with different theories and models that can be used to study human behaviour towards acceptance and use of technologies. The models identify and explain factors that influence users to either accept or reject a technology. These models, which emerged from different fields such as sociology, psychology, and IT have been in existence for decades. Researchers from different disciplines continue to validate and extend the models in order to fit into various situations and contexts. The models are: Theory of Reasoned Action (TRA), Diffusion of Innovations (DOI) Theory, Technology Acceptance Model (TAM), and Theory of Planned Behaviour (TPB). These theories and models are explained in detail in the following subsections.

3.2.1 Diffusion of Innovations (DOI) Theory

DOI theory is among the early acceptance theories that explain how innovations in the form of new ideas or technologies spread through society. Everett M. Rogers developed DOI theory in 1962. Rogers (1983, p.11) defined innovation as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption”.The adoption of an innovation is seen by Rogers (1983) from the point of view of diffusion. Rogers (1983, p. 5) viewed diffusion as “the process by which an innovation is communicated through certain channels over time among the members of a social system”.

Based on the Rogers's theory, the rate of adopting innovations is generally influenced by five attributes which are: relative advantage, compatibility, complexity, triability, and observability (Rogers, 1983). Relative advantage refers to "the degree to which an innovation is perceived as better than the idea it supersedes" (Rogers, 1983, p. 15). Complexity refers to "the degree to which an innovation is perceived as difficult to understand and use" (Rogers, 1983, p. 15). Compatibility is defined as "the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters" (Rogers, 1983, p. 15). Triability is "the degree to which an innovation may be experimented with on a limited basis" (Rogers, 1983, p. 15). Observability is "the degree to which the results of an innovation are visible to others" (Rogers, 1983, p. 16).

Since its conception, the model has been verified and extended by several researchers (Moore & Benbasat, 1991; Zmud, 1982). For instance, Moore and Benbasat (1991) developed a questionnaire to assess perception of users on adopting IT innovation. They adapted and extended DOI theory by adding image, voluntariness, ease of use, as well they split observability into visibility and result demonstrability. Image was considered as part of relative advantage by researchers including Rogers, but the effect of image was realized to be different from relative advantage (Al Qirim, 2006; Moore & Benbasat, 1991). Hence, it was separated from relative advantage. Observability was found to be complex and measured two different dimensions when it was critically examined. Therefore, it was divided into visibility and result demonstrability (Moore & Benbasat, 1991). Voluntariness was added because behaviour in organizations is to some extent affected by voluntariness based on experience and common sense; also some studies assume the adopters of innovation are voluntary adopters "because adoption is not strictly mandatory" (Moore & Benbasat, 1991). Similarly, the inclusion of ease of use construct was to validate its scale to ensure that is suitable to measure all perceived characteristics of innovating.

DOI has some limitations as suggested by Clarke (1999) which include: not strong enough to predict outcomes and help improve rate of innovation adoption. It also lacks good explanatory power. Most of its elements are specific to the culture of the environment where it was formulated. Innovation characteristics and how they change over time were not given adequate consideration (Nutley, Davies, & Walter, 2002).

3.2.2 Theory of Reasoned Action (TRA)

TRA was developed by Fishbein and Ajzen (1975), and it was built from social psychology field. The theory was created as a result of dissatisfaction with attitude-behaviour relationship which mostly show "weak correlations between attitude measures and performance of volitional behaviours" (Hale, Householder, & Greene, 2002, p. 259). The model considers general behaviour, so it can be widely applied to explain individual's behaviour in any discipline (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The model posits behavioural intention to perform a behaviour as the main predictor of volitional or individual's behaviour. Individual influence and normative influence formed the behavioural intention as presented in Figure 3.1.

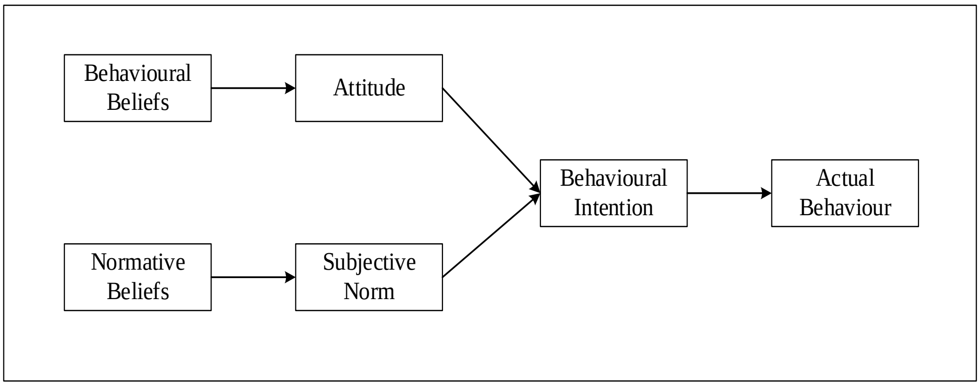


Figure 3-1 Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975)

The individual influence on intention is represented as the attitude towards performing the behaviour. While the normative influence corresponds to subjective norm. Therefore, the behaviour of an individual (B) is predicted by behavioural intention (BI) that is determined by subjective norm (SN) and attitude (A) toward the behaviour. TRA can be represented mathematically as follows:

$BI = (A_B)W_1 + (SN)W_2$

The behavioural intention is a function of attitudinal and normative factors with weights. The weight is an importance, which a person attributes to a particular opinion. Fishbein and Ajzen (1975, p. 288) viewed behavioural intention as "a person's subjective probability that he will perform some behaviour".Attitude toward the behaviour is referred to as "the degree to which a person has a favourable or unfavourable evaluation of the behaviour in question" (Ajzen & Madden, 1986, p.

454). Davis, Bagozzi, and Warshaw (1989) described attitude as a product of salient beliefs about outcomes of performing a behaviour and evaluation of the outcomes. Belief is the “individual’s subjective probability that performing the target behaviour will result in consequence” (Davis et al., 1989, p. 984), while the evaluation of the outcome is “an implicit evaluative response” to the consequence (Fishbein & Ajzen, 1975, p. 29).

Subjective norm is referred to “person’s perception that most people who are important to him think he should or should not perform the behaviour in question” (Fishbein & Ajzen, 1975, p. 302). A subjective norm is a “function of a normative belief and motivation to comply with the normative belief” (Hale et al., 2002, p. 261). Normative beliefs is the perceived expectations of a particular individual or group that will accept or reject performing behaviour (Ajzen & Madden, 1986). Thus, thinking of other people like family and friends will contribute to the formation of individual’s behaviour.

Ajzen, Timko, and White (1982) studied the moderating effect of self-monitoring on attitude-behaviour relation using TRA. The study was conducted during 1980 presidential election to investigate two behavioural areas (voting in the election and smoking marijuana). Data were collected from 155 University of Massachusetts undergraduate students taking psychology courses at three time periods. Questionnaires containing several attitude scales and personality measures were distributed to the students three weeks before the election. Beliefs and attitudes related to the two behaviours were evaluated after two weeks. Finally, the participants were asked to report their behaviours via telephone two weeks after the election. The sample was divided at the median into high self-monitoring and low self-monitoring subsamples. The analysis was carried out on the total sample as well as the two subsamples. The findings suggest that the correlation between attitude and behaviour was stronger for low self-monitors. Similarly, a stronger correlation was observed between intentions and behaviour for low self-monitors.

However, Davis et al. (1989) expressed that TRA is a model that describe human behaviour generally, so it does not specify beliefs that would be appropriate in specific behaviour. Also, behaviour was determined by intention alone due to the expectation that social behaviour of human is under volitional control, so the model will not be suitable to situations with absence of absolute control over the behaviour

(Ajzen, 1991, 2002). TRA is also criticized for explaining medium percentage of variance in intention (40% to 50%) and behaviour (19% to 38%) (Holdershaw & Gendall, 2008). TRA has been assessed and extended in various studies (Vallerand, Deshaies, Cuerrier, Pelletier, & Mongeau, 1992), leading to two popular acceptance theories which are Technology Acceptance Model (TAM) and Theory of Planned Behaviour (TPB) (Ajzen, 1985; Davis et al., 1989).

3.2.3 Theory of Planned Behaviour (TPB)

The TPB was proposed to solve the limitations of TRA, particularly to address the issue of dealing with human behaviour under incomplete volition control (Ajzen, 1991). Ajzen (1985) proposed TPB as an extension of TRA with one additional antecedent of behavioural intention and behaviour called Perceived Behavioural Control (PBC). As postulated in TRA, the main predictor of behaviour in TPB is intention (Ajzen, 1991).

The general assumption about intention is that, it will capture the motivational factors that determine the behaviour. In this case, the behavioural intention can only lead to behavioural expression if an individual is free to decide on performing the behaviour under volitional control. In some situations, the behaviours may depend on non-motivational factors such as time, money, and skills. These factors “represent people’s actual control over the behaviour” which leads to the suggestion that behaviour is predicted by “motivation (intention) and ability (behavioural control)” (Ajzen, 1991).

TPB theorized that attitude toward a behaviour, perceived behavioural control, and subjective norm jointly influence individual’s behavioural intention that leads to the actual behaviour. Attitude and subjective norm with their antecedents are described as in the TRA section. PBC is hypothesized to directly influence behaviour or indirect through behavioural intention as shown in Figure 3.2.

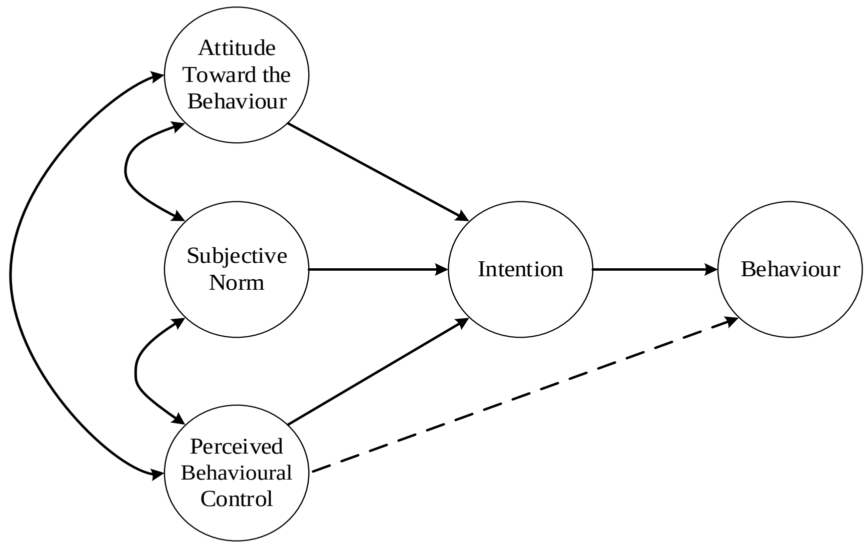


Figure 3-2 Theory of Planned Behaviour (TPB) (Ajzen, 1991)

According to Ajzen (1991), PBC can be defined as the perception of individual about how easy or difficult to perform a particular behaviour. Perceived behavioural control is consistent with Bandura's 1977 perceived self-efficacy. Perceived self-efficacy is a concept that "is concerned with judgments of how well one can execute courses of action required to deal with prospective situations" (Bandura, 1982, p. 122).

S. Taylor and P. A. Todd (1995) examined TPB and compared the result with TAM and Decomposed Theory of Planned Behaviour (DTPB). A total of 786 completed questionnaires were returned from the participants who were business school students using a Computing Resource Centre (CRC). The centre provided specialized computing and printing services, and technical support to students. The students were both undergraduate (582) and MBA (204) students. The questionnaire measured intention to use CRC which was voluntary, so the sample consisted of 58% CRC users and 42% non-users. Data were collected initially for the beliefs, determinants of intention, and intention of respondents to use CRC. Later, the behaviour data were collected. The percentage of variance explained for behavioural intention was slightly higher in TPB (57%) than TAM (52%). On the other hand, TPB explained attitude with a lower percentage (58%) than TAM (73%). Overall, the model did not provide better explanation of behaviour (34%) over TAM which was also 34%. This implied that addition of perceived behavioural control did not improve the explanatory power of the TPB model compared with TAM.

However, TPB was criticized for combining belief structures (attitudinal beliefs, normative beliefs, and control beliefs) into uni-dimensional constructs which may not be consistently related to the corresponding constructs they determine (S. Taylor & P. A. Todd, 1995). They also expressed that the operationalization of TPB becomes difficult due to the belief structures particularly attitudinal beliefs being “idiosyncratic to the empirical setting”.

3.2.4 Technology Acceptance Model (TAM)

TAM is among the most prominent and frequently applied IS acceptance theories developed by Davis (1986). The model was adapted from TRA. The model recognized and suggested behavioural intention as the antecedent of actual use similar to TRA. However, contrary to TRA, attitude toward using a system and perceived usefulness determine the behavioural intention. In addition, subjective norm in TAM is not included as determinant of behavioural intention because it is considered as “one of the least understood aspect of TRA” (Davis et al., 1989), while perceived ease of use and perceived usefulness were introduced as determinants of attitude as presented in Figure 3.3.

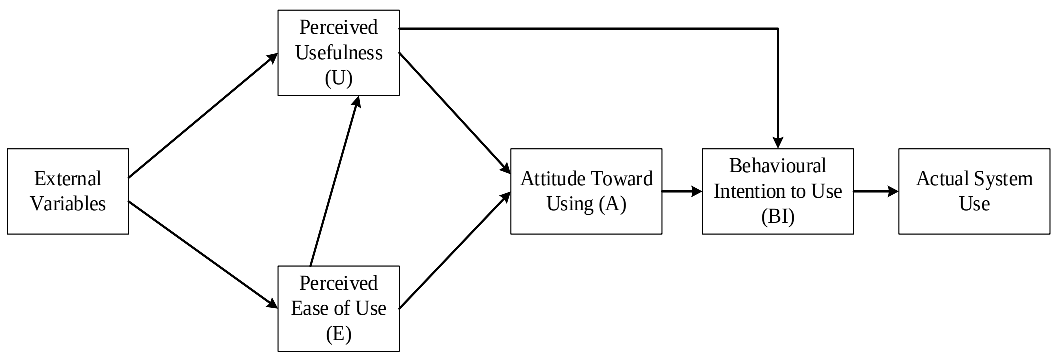


Figure 3-3 Technology Acceptance Model (TAM) (Davis et al., 1989)

Attitude toward using a system or technology is “the degree of evaluative effect that an individual associates with using the target system in his or her job” (Davis, 1993, p. 476). Perceived usefulness refers to “the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989, p. 320), while perceived ease of use is “the degree to which a person believes that using a particular system would be free of effort” (Davis, 1989, p. 320).

Furthermore, perceived usefulness and perceived ease of use are directly influenced by design features, which are external variables. These variables represent demographic characteristics, nature of the behaviour, characteristics of referents, and other salient features of the system (Davis, 1986). The external variables have indirect impact on intention to use via perceived usefulness and perceived ease of use. Also, perceived usefulness was theorized to be determined by perceived ease of use. This was based on the notion that asystem that is easier to use will be more useful (Davis, 1989; Venkatesh & Davis, 2000). In subsequent versions of TAM, attitude is omitted because of the partial mediation impact of attitude on relationship between beliefs and intention, weak direct connection between perceived usefulness and attitude, and a significant direct effect of perceived usefulness on intention (Venkatesh, 2000).

An empirical study was conducted by Davis et al. (1989) to evaluate both TRA and TAM. A total of 107 University of Michigan students participated in the study. The students were introduced to word processor application (Write One) at the beginning of semester, and a questionnaire with both TRA and TAM variables was administered to them. At the end of the semester, another questionnaire was administered with self-reported usage. The findings showed that, TRA explained 32%and 26% of the variance in behavioural intention in the first and the second study respectively, whereas TAM explained 47% and 51% of the variance in behavioural intention in the first and second study correspondingly. The variance of attitude explained for TRA was 7% and 30% in the first and the second study respectively, while TAM explained 37% and 36% of the variance in the first and the second study correspondingly. This implied that TAM had more explanatory power than its predecessor (TRA). In general, perceived usefulness and perceived ease of use both had a significanteffect on behavioural intention. Perceived usefulness contributed more to the realization ofindividual’s intention (Davis et al., 1989).

Despite the fact that TAM has been extensively used in various technology acceptance studies, it has some limitations. TAM is usually criticized for using self-reported use data for measuring system use instead of using real data. Using self-reported usage may affect the causal relationship between the dependent and independent variables (Chuttur, 2009; Y. Lee, Kozar, & Larsen, 2003). Another limitation is that TAM does not consider the “influence of social and personal control factors on behaviour" (S. Taylor & P. A. Todd, 1995, p. 149). Other weaknesses of TAM include: critical gaps in the framework (related to intention-behaviour relationship in which behaviour is considered as a terminal goal); lack of a sound theory and method for identifying the determinants of PU and PEOU; ignoring the three aspects of decision making (group, social, and cultural); reliance on simple concepts of affect or emotions; and over dependence on a purely deterministic framework without considering self-regulation processes (Bagozzi, 2007; Chuttur, 2009). Another limitation is its inability to classify mandatory and voluntary situations (Y. Lee et al., 2003).

3.2.5 Technology Acceptance Model 2 (TAM2)

Venkatesh and Davis (2000) developed an extension of TAM called TAM2. The model identified and added antecedents of perceived usefulness based on social influence and cognitive instrumental processes as shown in Figure 3.4. This was perhaps in response to some of the limitations of TAM including the nonexistence of a sound theory and approach to identifying the predictors of perceived ease of use and perceived usefulness (Bagozzi, 2007). Social influence processes include subjective norm, voluntariness, and image (Venkatesh & Davis, 2000). Subjective norm was adapted from TRA and included in TAM2 as a social influence process that directly influences perceived usefulness and intention. This direct influence of subjective norm on behavioural intention is based on the assumption that a behaviour can be performed by an individual if he/she believes that those who are important to him/her thinks that the behaviour should be performed, even though he/she may not be favourable toward the behaviour (Venkatesh & Davis, 2000). The impact of subjective norm on behavioural intention was analysed in some studies depending on the respondent's mandatory or voluntary usage. For instance, in a study conducted by Hartwick and Barki (1994) the respondents were categorized into two groups of mandatory and voluntary users. The researchers revealed a significant impact of subjective norm on behavioural intention only in mandatory settings. As a result, TAM2 posits voluntariness as a moderating variable that moderates the effect of subjective norm on intention (Venkatesh & Davis, 2000). Voluntariness is viewed as "the extent to which potential adopters perceive the adoption decision to be non-mandated" (Agarwal & Prasad, 1997, p. 564).

Furthermore, TAM2 hypothesizes that subjective norm influences intention indirectly through perceived usefulness. This relationship is called Internalization (Venkatesh & Davis, 2000). According to Venkatesh and Davis (2000, p. 189) internalization is “the process by which, when one perceives that an important referent thinks one should use a system, one incorporates the referent’s belief into one’s own belief structure”. Based on this assumption, it is expected that individuals may form an intention to use a system when they believe that a system is useful on the basis of suggestion by a superior or co-worker. TAM2 further theorizes an indirect impact of subjective norm on intention through perceived usefulness regardless of the context being voluntary or mandatory (Venkatesh & Davis, 2000). Finally, TAM2 theorizes that subjective norm will have a positive impact on image, which is defined as “the degree to which use of an innovation is perceived to enhance one’s image or status in one’s social system” Moore and Benbasat (1991, p. 195). In detail, TAM2 suggests that subjective norm will have a positive influence on image because, “if important members of a person’s social group at work believe that he or she should perform a behaviour”, then his or her status within the group will rise after performing the behaviour (Venkatesh & Davis, 2000). TAM2 hypothesizes that image will positively impact perceived usefulness. Image will influence perceived usefulness if image enhancement leads to perception of improvement in job performance when the system is used. In addition, experience was added in TAM2 as moderator of subjective norm-perceived usefulness and subjective norm-intention relationships (Venkatesh & Davis, 2000). This is to measure the effect of experience on the social influence processes. Building on prior research, TAM2 suggests that the influence of subjective norm on behavioural intention for mandatory usage settings will be stronger before implementation and at early usage, but will become weaker as experience with the system increases. Likewise, the influence of subjective norm on perceived usefulness is expected to be weaker as experience increases for both mandatory and voluntary settings (Venkatesh & Davis, 2000).

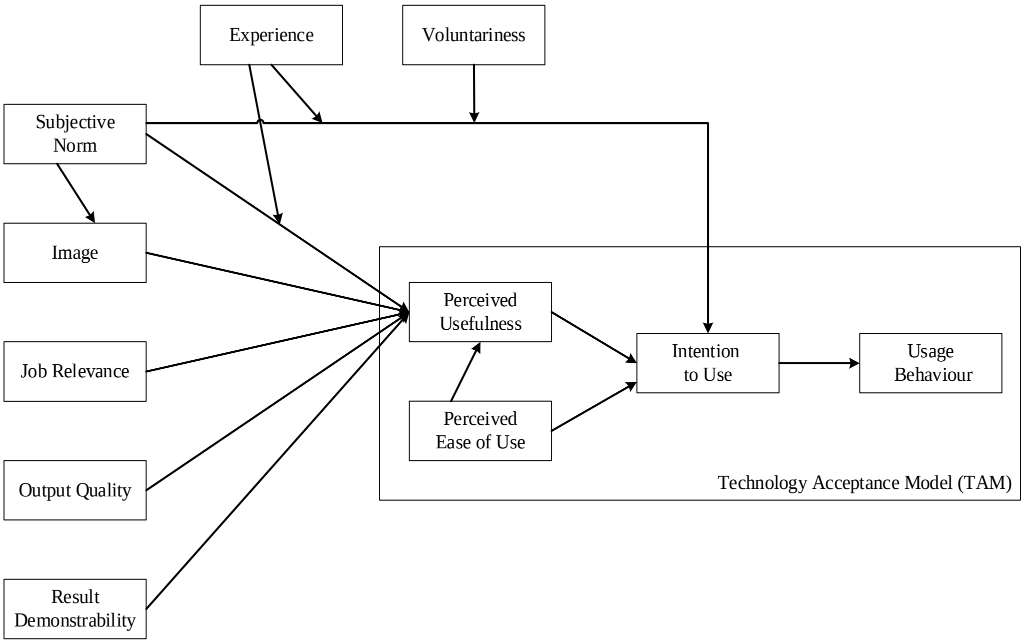


Figure 3-4 Technology Acceptance Model 2 (TAM2) (Venkatesh & Davis, 2000)

Moreover, TAM2 hypothesizes four cognitive instrumental predictors of perceived usefulness, which are: job relevance, output quality, result demonstrability, and perceived ease of use. Job relevance is defined as “an individual’s perception regarding the degree to which the target system is applicable to his or her job” (Venkatesh & Davis, 2000, p. 191). Individuals may realize the system usefulness if it can support very important tasks related to their job.Therefore, TAM2 posits that job relevance will positively affect perceived usefulness.

The second important cognitive instrumental process factor is the perception of output quality, which refers to “the degree to which an individual believes that the system performs his or her job tasks well” (Venkatesh & Bala, 2008, p. 277). Output quality is theorized to positively affect perceived usefulness. The basis of this relationship was found in a study conducted by Davis, Bagozzi, and Warshaw (1992).

The third cognitive instrumental process factor is result demonstrability, which refers to “the tangibility of the results of using the innovation” (Moore and Benbasat (1991, p. 203). In TAM2, result demonstrability is hypothesized to directly influence perceived usefulness. Finally, TAM2 hypothesizes that perceived usefulness will be directly influenced by perceived ease of use. TAM2 maintained perceived ease of use and its link with perceived usefulness from TAM (Davis et al., 1989; Venkatesh & Davis, 2000).

Venkatesh and Davis (2000) conducted four longitudinal studies to test TAM2 in four different organizations. The four longitudinal field studies were categorised into two sites for mandatory usage and two sites for voluntary usage to allow apparent evaluation of voluntariness. Measurement was done at three different time intervals (after initial training, one-month post-implementation, and three-months post-implementation). Similarly, self-reported usage behaviour was measured at three different time intervals (one-month post-implementation, three-months post-implementation, and five-months post-implementation). The findings proved the capability of the model by presenting its explanatory power for variance in perceived usefulness as 40%-60% and variance in usage intention as 34%-52%. In addition, the results supported the developed hypotheses since both social influence and cognitive instrumental processes have influence on user acceptance. It can also be observed from the findings that apart from supporting the original TAM relationships, subjective norm had direct influence on intention moderated by experience and voluntariness, similarly the impact of subjective norm on perceived usefulness was significantly moderated by experience.

Although TAM2 was developed to resolve some of the issues with TAM, but still carries other limitations of TAM. For example, the model does not identify and explain external variables related to perceived ease of use (Yang, Zhou, Hou, & Xiang, 2014). Additionally, Wilkins, Holt, and Swatman (2007) argued that TAM2 is also based on the assumption that when an individual forms an intention to act, he or she can act without limitation, even though in reality factors like unawareness behaviours, restricted ability and time, and limits of organisational or environmental will restrict the act of freedom.

3.2.6 Model of Determinants of Perceived Ease of Use

A theoretical framework was proposed by Venkatesh (2000) which presented and described determinants of perceived ease of use. The motivation of this work was creating determinants of perceived usefulness in TAM2 in order to understand the main TAM predictors better. Venkatesh (2000) pointed out that an individual’s perceived ease of use in using the system will be developed from the initial stage of system use until they acquire significant experience. The determinants of system-specific ease of use perception were conceptualized based on anchoring as well as adjustment from behavioural decision theory. The theory proposed anchoring and adjustment as an important "decision making heuristic" that individuals frequently used (Venkatesh, 2000).

The determinants of perceived ease of use are grouped as either anchors or adjustments as shown in Figure 3.5. Anchors include variables related to control, intrinsic motivation, and emotion. The control is categorized into perceptions of external control or facilitating conditions, and perceptions of internal control represented by computer self-efficacy. Intrinsic motivation and emotion are represented as computer playfulness and computer anxiety respectively. These anchors have significant impact on perceived ease of use especially at the starting of system use. However, when individual's experience with the system increases the adjustments will now have additional influence on perceived ease of use. Adjustments consist of objective usability and perceived enjoyment (Venkatesh, 2000).

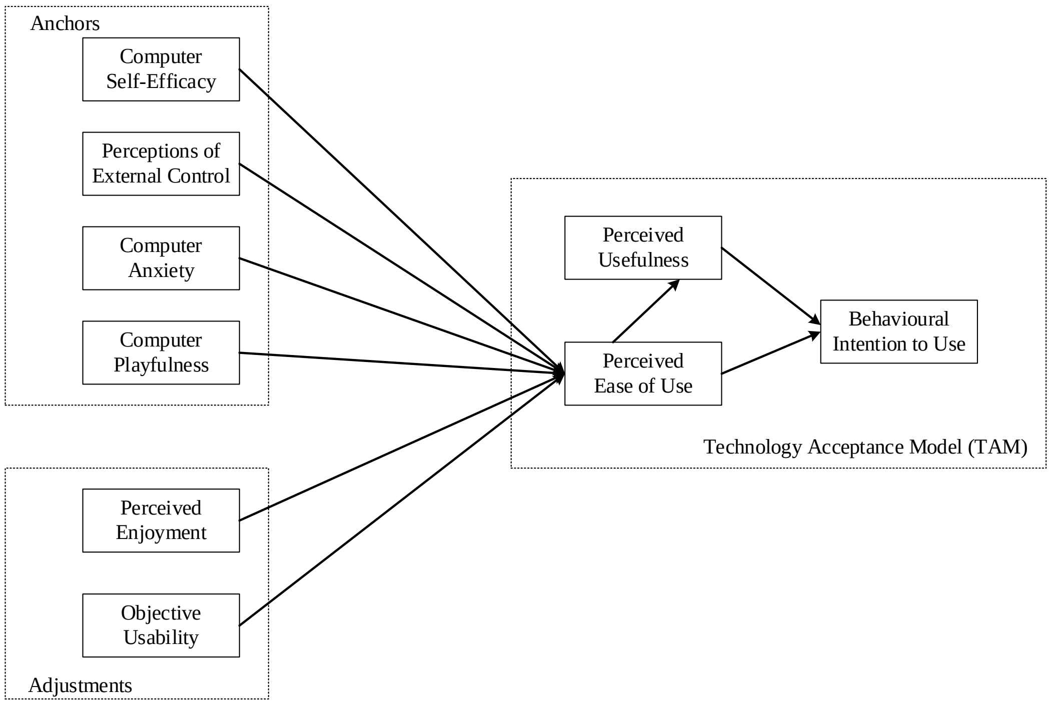


Figure 3-5 Model of Determinants of Perceived Ease of Use (Venkatesh, 2000)

The perceived ease of use determinants are defined as follows. Computer self-efficacy is defined as "one's belief about her/his ability to perform a specific task/job using a computer" (Venkatesh, 2000, p. 347). Perceptions of external control is "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh, Morris, Davis, & Davis, 2003, p. 453). Venkatesh (2000, p. 349) defined computer anxiety as "an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers". According to Webster and Martocchio (1992, p. 204) computer playfulness is "the degree of cognitive spontaneity in microcomputer interactions". Venkatesh (2000, p. 351) defined perceived enjoyment as "the extent to which the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use". Objective usability refers to "a construct that allows for a comparison of systems based on the actual level (rather than perceptions) of effort required to complete specific tasks" (Venkatesh, 2000, pp. 350-351).

Venkatesh (2000) postulates that the influence of perceptions of external control and computer self-efficacy remain significant even when the experience increases. On the contrary, the influence of computer playfulness and computer anxiety will weaken eventually. Perceived enjoyment and objective usability will have an influence in formation of perceived ease of use after gaining experience.

Three longitudinal studies were carried out by Venkatesh (2000) to examine the new model in three different organizations. The system usage was voluntary in all the three studies. Measurement was done at three different time intervals (after initial training, one month of use, and three months of use). All the constructs were measured at the three different time intervals with an exception of objective usability which was measured after initial training. This was because measuring objective usability required approximately 45 minutes from the subjects' time. The study supported the roles of computer self-efficacy, computer playfulness, facilitating conditions, computer anxiety that serve as anchors tohelp form perception of ease of using a new system. It was found that the adjustments (objective usability and perceived enjoyment) contributed to formation of perceived ease of use when the experience increased. Finally, the model accounted for 60% of the variance in perceived ease of use. This was two times the percentage of variance in perceived ease of use in comparison with previous study by Venkatesh and Davis (1996). This model only identified determinants of perceived ease of use, so it did not resolve issues of TAM and TAM2 raised in the preceding sections including lack of explanation for external variables, inability to explain causal relationships, acting without limitation when intention is formed, and disregard for effect of social factors on behaviour (Y. Lee et al., 2003; S. Taylor & P. A. Todd, 1995; Wilkins et al., 2007; Yang et al., 2014).

3.2.7 Technology Acceptance Model 3 (TAM3)

Venkatesh and Bala (2008) proposed a comprehensive version of TAM with a focus on influence of interventions on acceptance and succesful use of IT. The proposed model called TAM3, which is presented in Figure 3.6, is a product of merging TAM2 (Venkatesh & Davis, 2000) with the model of the perceived ease of use predictors (Venkatesh, 2000).

Venkatesh and Bala (2008) categorized the determinants of perceived ease of use and perceived usefulness into four different groups which are individual differences, social influence, system characteristics, and facilitating conditions. Individual differences are “personality and/or demographics (e.g., traits or states of individuals, gender, and age) that can influence individuals’ perceptions of perceived usefulness and perceived ease of use” (Venkatesh & Bala, 2008, p. 276). They include computer self-efficacy, computer anxiety, and computer playfulness from the determinants of preceived ease of use (Venkatesh, 2000). System characteristics represent “those salient features of a system that can help individuals develop favorable (or unfavorable) perceptions regarding the usefulness or ease of use of a system” (Venkatesh & Bala, 2008, p. 276). System characteristics comprise perceived ease of use, output quality, job relevance, and result demonstrability. Social influence “captures various social processes and mechanisms that guide individuals to formulate perceptions of various aspects of an IT” (Venkatesh & Bala, 2008, p. 276). Social influence variables are subjective norm and image. Facilitating conditions or perceptions of external control is “the degree to which an individual believes that organizational and technical resources exist to support the use of the system” (Venkatesh & Bala, 2008, p. 279).

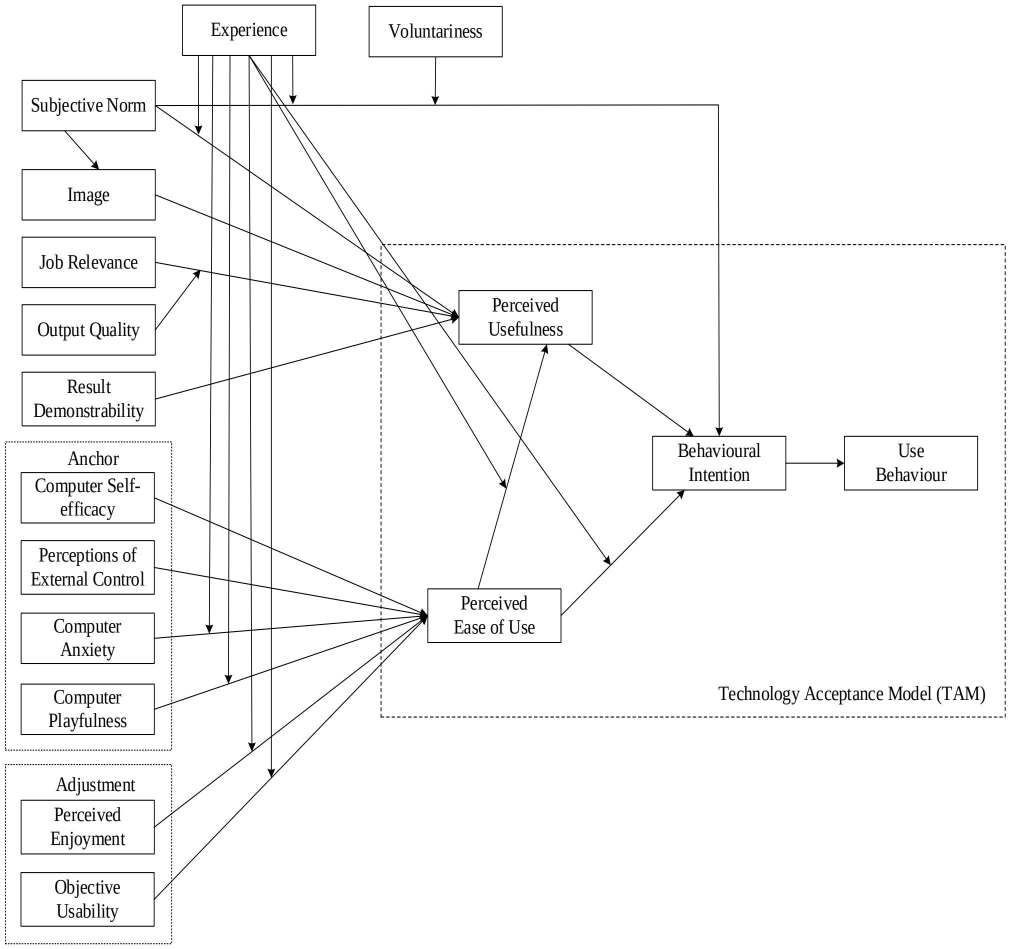


Figure 3-6 Technology Acceptance Model 3 (TAM3) (Venkatesh & Bala, 2008)

Experience and voluntariness are two moderator factors that moderate the relationships in the TAM3. Venkatesh and Davis (2000) hypothesizedand proved that experience moderates the subjective norm and behavioural intention relationship, and the subjective norm and perceived usefulness relationship. Voluntariness on the other hand moderates the effect of subjective norm on behavioural intention based on the type of system usage (mandatory or voluntary) (Venkatesh & Davis, 2000). In addition, Venkatesh (2000) hypothesized that the impact of computer playfulness on perceived ease of use becomes weak eventually when experience increases, whereas the impact of perceived enjoyment and objective usability on perceived ease of use becomes stronger with increase in experience.

TAM3 does not define a new pattern of relationships between the constructs, but rather maintains the same pattern with the two models (TAM2 and the model of determinants of perceived ease of use). Likewise, it suggests that the predictors of perceived usefulness have no impact on perceived ease of use. Furthermore, the predictors of perceived ease of use have no influence on perceived usefulness. Interestingly, three new relationships moderated by experience were proposed in TAM3, which are the moderating effect of experience on the influence of perceived ease of use on perceived usefulness; that of computer anxiety on perceived ease of use; and that of perceived ease of use on behavioural intention. Therefore, for the new relationships, TAM3 suggests that when experience increases the influence of perceived ease of use on perceived usefulness will be stronger; computer anxiety on perceived ease of use will be weaker; as well as perceived ease of use on behavioural intention will be weaker (Venkatesh & Bala, 2008).

longitudinal studies were conducted by Venkatesh and Bala (2008) to assess and validate TAM3. Four different organizations were considered for the data collection using validated items from previous studies. The survey data were collected at three time intervals: after initial training (T1), 1 month after implementation (T2), and 3 months after implementation (T3). The self-reported usage was measured at the second and third time interval and 5 months after implementation. Questionnaires were administered to 200 participants, out of which 156 were the usable responses. The findings revealed that perceived ease of use, result demonstrability, subjective norm, and image influenced perceived usefulness. Similarly, as found in TAM2, the interactive impact of job relevance and output quality on perceived usefulness was found in this study, in such a way that when the output quality increased job relevance influences on perceived usefulness became higher.

Venkatesh and Bala (2008) further found that experience had a moderating effect on influence of computer anxiety on perceived ease of use, perceived ease of use on perceived usefulness, as well as perceived ease of use on behavioural intention as hypothesized.It was also revealed that perceived ease of use was significantly determined by computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and objective usability. Additionally, perceived ease of use and perceived usefulness were found to have significant influence on behavioural intention with perceived usefulness being the strongest predictor at all the three time periods, and perceived ease of use only significant at time 1 and time 2. The three-way interaction between subjective norm, experience, and voluntariness on behavioural intention was also found to be significant in such a way that the influence of subjective norm on behavioural intention weakenedwhen the experience increased especially in the voluntary setting. On the other hand, a two-way interaction between subjective norm and voluntariness showed that the influence of subjective norm on behavioural intention was stronger in a mandatory setting. Finally, behavioural intention was found to be significant determinant of use at all points of measurements. The model accounted for 67%, 52%, and 53% of the variance in perceived usefulness, perceived ease of use, and behavioural intention respectively for the three time intervals when combined. Additionally, the model explained 35% of the variance in use behaviour.

3.3 Justification for Selecting the Research Model

In the previous sections, the technology adoption theories and models were examined in order to choose the appropriate model that will help us achieve the objectives of the study. It is equally important to know that the commonly used models in technology adoption studies and specifically in cloud computing adoption studies are TAM, TOE, UTAUT, and DOI (Al-Jabri, 2014; Alharbi, 2012; Cao et al., 2013; Coursaris et al., 2013; Li & Chang, 2012). Nevertheless, the models were criticized due to many limitations that were reported in various research. These limitations include: weak prediction of outcomes that help to improve the rate of innovation adoption, absence of identifying beliefs that would be appropriate in specific behaviour, lack of considering the influence of personal control and social factors on behaviour,lack of causality between the defined factors and inability to provide essential IS innovation adoption constructs, and inflexibility to adapt to different situations (Clarke, 1999; Davis et al., 1989; J. Liu, 2013; Rui, 2007; S. Taylor & P. A. Todd, 1995).

However, in an effort to improve TAM and address its limitations, the model has been adapted in various works and three extended versions (TAM2 by Venkatesh and Davis (2000), model of determinants of perceived ease of use by Venkatesh (2000), and TAM3 by Venkatesh and Bala (2008)) were proposed and validated. Thus, TAM3 is the latest and comprehensive version of the original TAM, which identifies and describes antecedents of the two main TAM determinants which are perceived usefulness and perceived ease of use. TAM3 provides valuable insights into how technology can be adopted and used by categorizing the factors into social influence, system characteristics, individual differences, and facilitating conditions (Al-Gahtani, 2014). In addition, the model has been evaluated and validated across multiple settings (Agudo-Peregrina, Hernández-García, & Pascual-Miguel, 2014; Al-Gahtani, 2014; S. J. Chang & Im, 2014; K. M. Faqih & Jaradat, 2015; Huang, Liu, & Chang, 2012). For instance, S. J. Chang and Im (2014) developed and evaluated TAM3-based model in a study that investigates Internet health information seeking behaviours. They found that perceived usefulness and perceived ease of use have indirect effect on Internet health information seeking behaviours through behavioural intention; perceived usefulness mediated the effects of health relevance and perceived ease of use on behavioural intention; computer self-efficacy, perceptions of external control, computer anxiety, and perceived enjoyment have indirectly influenced Internet health information seeking behaviours through perceived ease of use, and behavioural intention. Finally, Internet health information seeking behaviours is directly determined by prior experience with Internet use and behavioural intention.

K. M. Faqih and Jaradat (2015) utilized TAM3 in m-commerce adoption study in Jordan. Their findings support the impact of perceived ease of use and perceived usefulness on intention to adopt mobile commerce; the effect of self-efficacy and perceptions of external control on perceived of ease of use; and the influence of image and output quality on perceived usefulness. Similarly, Agudo-Peregrina et al. (2014) investigated factors affecting acceptance of e-Learning systems using TAM3. This study supported most of the original TAM3 hypotheses except the path between computer anxiety, playfulness, and self-efficacy to perceived ease of use; the path between subjective norm to flexibility and perceived usefulness; the path between perceived ease of use to intention; and lastly, the path between intention to use behaviour.

Behrend et al. (2011) studied factors affecting cloud computing adoption in higher education institutions using TAM3. The study found access to software, ease of travel to campus, technology anxiety, and reliability as antecedents of perceived usefulness; personal innovativeness, instructor support, and reliability as determinants of perceived ease of use; access to software and perceived ease of use as predictors of actual usage; perceived usefulness and perceived ease of use as predictors of intention for future use.

Similarly, Al-Gahtani (2014) empirically investigates the acceptance and assimilation of e-Learning in Saudi Arabian academic settings using TAM3. The findings reported a significant influence of image, perceived ease of use, job relevance, and subjective norm on perceived usefulness; significant influence of subjective norm on image; significant influence of computer self-efficacy, perceptions of external control, computer anxiety, and perceived enjoyment on perceived ease of use; likewise, significant influence of perceived usefulness, perceived ease of use, and subjective norm on intention to use the e-Learning system. Likewise, voluntariness was found to moderate subjective norm and intention relationship to use e-Learning system; output quality significantly moderates the relationship between job relevance and perceived usefulness; experience moderates relationships between subjective norm and perceived usefulness, perceived ease of use and perceived usefulness, perceived enjoyment and perceived ease of use, subjective norm and intention, and perceived ease of use and intention to use e-Learning system. The model explained 42%, 45%, and 42% of variance in perceived usefulness, perceived ease of use, and intention to use the e-Learning system, respectively.

Therefore, considering the potentials of TAM3 from prior studies and its comprehensiveness, suitability, validity and reliability in technology adoption studies in different contexts (Agudo-Peregrina et al., 2014; Al-Gahtani, 2014; Behrend et al., 2011; K. M. Faqih & Jaradat, 2015; Huang et al., 2012; Venkatesh & Bala, 2008), TAM3 is selected for this study as an appropriate model for examining factors influencing cloud computing applications adoption by Saudi Arabian higher education students. TAM3 considers many important features which are individual differences, social influence, system characteristics, and facilitating conditions that contribute to the understanding of factors affecting cloud computing applications adoption behaviour by university students. Therefore, TAM3 seems to be a suitable theoretical model for investigating factors affecting cloud computing applications adoption by Saudi university students.

3.4 Chapter Summary

This chapter critically examined technology adoption theories and models regarding their strengthsand weaknesses. Each of the models has its own strength and limitations, but generally a researcher will choose a model with minimal limitations which will better fit his or her study context. Understanding factors related to users' adoption of a technology is very important. Rejection rate of a technology can be reduced when factors that influence the adoption are identified and examined. Therefore, TAM3 is chosen as the research model in this study because it is found to be comprehensive to examine cloud computing applications adoption by students in Saudi Arabian higher education institutions.

Chapter 4: Research Model and Hypotheses

4.1 Introduction

This chapter presents the research model of this studyand explains the model constructs that constitute the research model with the relevant hypotheses.

4.2 The Research Model

This researchadapted Technology Acceptance Model 3 (TAM3) and extended it to suit the context of the study in order to accomplish the aim of the study. However, the research model differs from the original TAM3 in 5 aspects as shown in Figure 4.1.

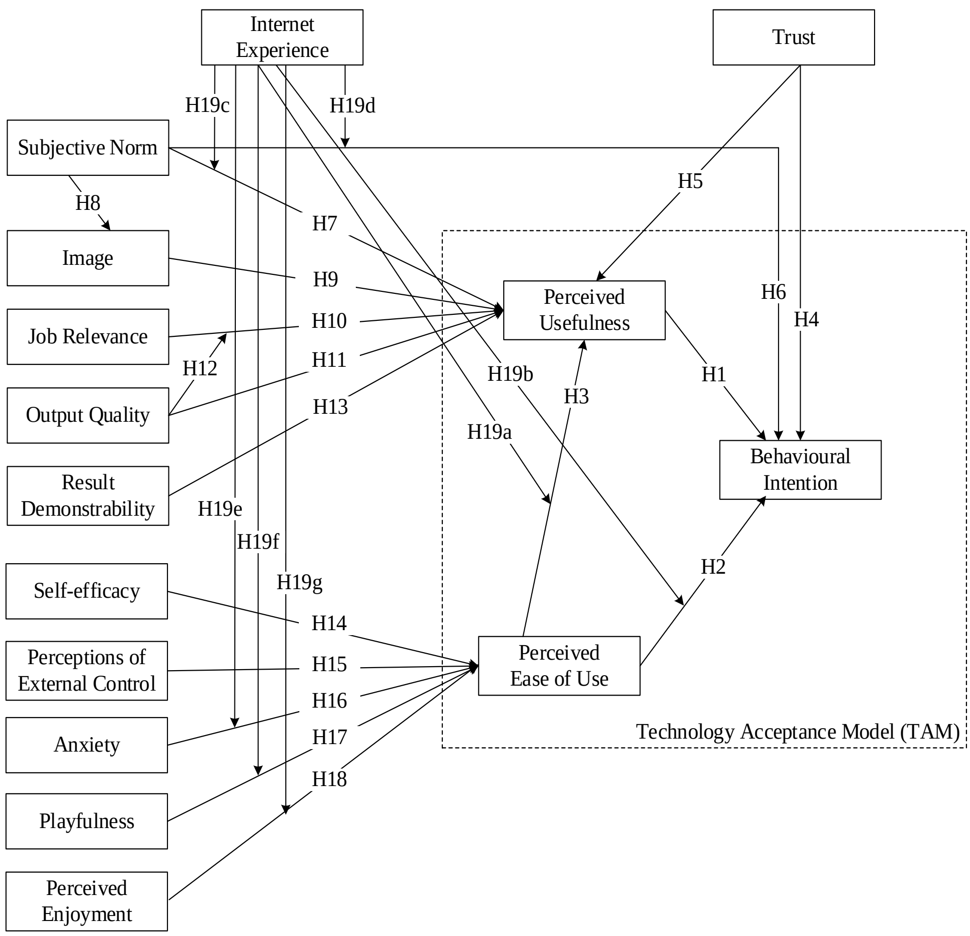


Figure 4-1 The research model

First, trust construct is introduced as a direct determinant of perceived usefulness and behavioural intention. The integration of trust is as a result of its influence in technology adoption process as claimed in various studies (Alharbi, 2014; Mary & Pauline, 2004; P. Pavlou, 2001; P. A. Pavlou, 2003; Van der Schyff & Krauss, 2014). For instance, Alharbi (2014) found that establishing trust was one of the challenges facing cloud services adoption by users. Likewise, scholars have identified trust as one of the key aspects in virtual teams like cloud computing, e-Commerce and e-Government (Carter & Campbell, 2011; Lai, Kan, & Ulhas, 2013; Li & Chang, 2012; P. A. Pavlou, 2003).

Second, usage construct is eliminated based on theoretical and empirical evidences that show direct effect of behavioural intention on technology adoption, and an established relation between behavioural intention and actual usage from renowned technology adoption studies (Mathieson, 1991; Venkatesh, 2000). Another rationale for excluding usage is that, the data for this study is collected cross-sectionally, while for the usage factor to be measured it requires assessments of users' beliefs and attitudes in different time periods. In this case, the choice of intention to measure the adoption is suitable because it allows the acceptance and beliefs to be assessed simultaneously (Agarwal & Prasad, 1999). Thus, in this study behavioural intention is used to assess the cloud services adoption by Saudi Arabian students.

Third, objective usability is omitted because it was typically operationalized in accordance with keystroke model, which is used to measure the novice-to-expert ratio of effort. This is achieved by computing time taken to carry out series of tasks with the system "in an error-free situation" by an expert and compare it with that of a beginner (Venkatesh, 2000). The cloud application that is used in this study, which is Google Docs, does not support keystroke model to measure objective usability. Therefore, the objective usability construct is dropped. Fourth, voluntariness construct which is a moderator factor in TAM3 is eliminated because of the fact that the use of cloud services by students is voluntary. Fifth, experience moderator construct is modified to Internet experience to reflect the context of our study. There are various studies that have shown the influence of experience on perceived usefulness and perceived ease of use which as a result influences the behavioural intention or actual usage of some systems (Agarwal & Prasad, 1999; Jiang, Hsu, Klein, & Lin, 2000). Thus, considering Internet experience in this study may help explain the behavioural intention better since cloud computing applications are Internet based applications that are more likely to be used by users with Internet experience.

The research model has 14 constructs and 2 moderators. The constructs are perceived usefulness, trust, perceived ease of use, behavioural intention, output quality, job relevance, result demonstrability, self-efficacy, anxiety, perceptions of external control, playfulness, perceived enjoyment, subjective norm, and image. The moderator variables are Internet experience and output quality. The details of these constructs with their relevant hypotheses are presented as follows.

4.2.1 Behavioural Intention (BI)

Behavioural intention is among the variables retained from TRA. It is a dependent variable in most of technology adoption studies (Huang et al., 2012; Jung, Hwang, & Ju, 2014; Venkatesh, 2000), although it may sometimes be an independent variable that determines system use (Davis et al., 1989; Venkatesh & Davis, 2000). Behavioural intention is defined as “a person’s subjective probability that he will perform some behaviour” (Fishbein & Ajzen, 1975, p. 288). TRA suggests that a strong relationship exists between attitude and intention because if an individual has favourable attitude toward an object, then that individual “will intend to perform positive behaviours with respect to that object” (Fishbein & Ajzen, 1975, p. 288).This type of relationship exists in the earlier version of TAM, but it was later removed from the model due to its partial or non-mediating influence on perceived usefulness-behavioural intention, and perceived ease of use-behavioural intention relationships (Davis et al., 1989; Davis & Venkatesh, 1996). In a study that compared TPB, TAM, and DTPB, behavioural intention was found to be the main direct determinant of usage behaviour (S. Taylor & P. A. Todd, 1995). Since behavioural intention is the main determinant of actual use, we can say that behavioural intention is the main factor that determines adoption of a technology. Hence, students who are willing to adopt cloud computing technology may have high intention to use the technology. In fact, Davis and Venkatesh (1996) consider intention as “the single best predictor of actual system usage”.

It is important to note that, in almost all TAM related studies that use system or actual use as the main dependent variable, behavioural intention is the only determinant of actual usage. This implies that it mediates the effect of the remaining factors on the actual usage. It is confirmed that behavioural intention mediates the impact of perceived usefulness, perceived ease of use, and subjective norm on usage behaviour (Venkatesh & Davis, 2000); and perceived usefulness and attitude on usage behaviour (Davis et al., 1989).Venkatesh and Bala (2008) in TAM3 used behavioural intention as the determinant of use behaviour which is predicted by subjective norm, perceived usefulness, and perceived ease of use. Although behavioural intention was found to be a strong determinant of use behaviour, only perceived usefulness strongly influenced it at all time periods (T1, T2, and T3). Perceived ease of use was found to have a significant influence on behavioural intention only at T1 and T2, while subjective norm had non-significant effect at all time periods (T1, T2, and T3). Overall, behavioural intention was explained between 40% and 48% of the variance through different time stages. Similarly, Venkatesh and Davis (2000) hypothesized subjective norm, perceived usefulness, and perceived ease of use as significant predictors of behavioural intention, and found all the three relationships significant but the significance of subjective norm was only in mandatory settings.

On the other hand, several studies found behavioural intention was a good determinant of technology adoption and use (Huang et al., 2012; Jung et al., 2014; Venkatesh, 2000). For instance, E. W. Baker, Al-Gahtani, and Hubona (2011) conducted a study in Saudi Arabia using TAM2 to investigate impact of culture on technology adoption. They used behavioural intention as the main determinant of technology adoption and their model explained a reasonable variance in intention to adopt desktop computers. Also, Al-Gahtani (2014) considered behavioural intention as a dependent factor in his TAM3 based model that predicted acceptance and assimilation of e-Learning with 42% of variance explained. Similarly, Li and Chang (2012) used a multi-theoretical approach to investigate acceptance of cloud computing by individuals. They combined TAM, TPB, computer learning theories, and social and economic exchange theories. They used behavioural intention as a dependent variable to measure the cloud computing applications use. The model explained 33% of the variance in user's perceived risk, 48% of the variance in user's attitude toward the use of the cloud applications, and 59% of the variance in intention to use the cloud computing applications. Use of behavioural intention as a dependent factor that determines the adoption and use of a technology in the aforementioned studies is consistent with other studies Huang et al. (2012); Jung et al. (2014); and Venkatesh (2000).

In this research, behavioural intention is considered as the main determinant (dependent factor) of cloud applications adoption by Saudi students. Therefore, behavioural intention is the main dependent factor in this study. The behavioural intention will be determined by trust, perceived usefulness, subjective norm, and perceived ease of use. The significant positive relationships between the four independent factors and behavioural intention will be considered as the influence of the factors on the adoption of cloud computing applications in higher education setting by students.

4.2.2 Perceived Usefulness (PU)

There are two main antecedents of behavioural intention to use a technology in TAM. Perceived usefulness is one of these antecedents. However, in most studies it is the most influential predictor of behavioural intention (Agudo-Peregrina et al., 2014; K. M. Faqih & Jaradat, 2015). Its influence can be seen from its direct effect on behavioural intention besides its indirect impact on behavioural intention through attitude in the earlier TAM version (Davis et al., 1989). Perceived usefulness is "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320). Specifically, perceived usefulness is the extent of students' belief that using cloud applications will improve the performance of their learning activities. In a study that tested TAM, Davis et al. (1989) found that perceived usefulness had the strongest influence on intention when compared with attitude. Similarly, perceived usefulness had a stronger influence on attitude than perceived ease of use. Hence, perceived usefulness is the strongest determinant of behavioural intention. This implies that people use a system mainly due to the fact that they believe their performance will be improved. Perceived usefulness is usually related to performance since its first conceptualization (Davis, 1989).

TAM3 proposed job relevance, result demonstrability, perceived ease of use, subjective norm, and image as the determinants of perceived usefulness (Venkatesh & Bala, 2008). In addition, Venkatesh and Bala (2008) posited that perceived usefulness will have direct positive effect on behavioural intention. A similar hypothesis was also postulated and proved by Venkatesh (2000) and Venkatesh and Davis (2000) that perceived usefulness had the strongest influence on behavioural intention at all time periods (T1, T2, and T3) (Venkatesh & Bala, 2008).

There are several studies that support the assumption that perceived usefulness has more influence on intention to use than perceived ease of use (Y.-C. Lee, 2006; Sternad & Bobek, 2013). For instance, Agudo-Peregrina et al. (2014) studied factors affecting e-Learning acceptance using TAM3. Findings showed that perceived usefulness had more influence on behavioural intention than perceived ease of use. This was in line with findings from a study on mobile commerce adoption in Jordan (K. M. Faqih & Jaradat, 2015). In addition, Al-Gahtani (2014) investigated factors affecting acceptance and use of e-Learning in academic settings. The results showed that perceived usefulness had more influence on intention to use. This significant effect of perceived usefulness was an indication that users were more likely to adopt a technology mainly because of its functions (Davis, 1989). Therefore, it is expected that when the students recognize the role of cloud computing applications in improving their learning and collaborative activities, it will increase the likelihood of adopting the technology. Hence, perceived usefulness is established as the major factor that determines students' behavioural intention to adopt cloud computing applications in higher educational environment. Thus, we hypothesize the following hypothesis:

H1. Perceived usefulness will have a positive effect on behavioural intention.

4.2.3 Perceived Ease of Use (PEOU)

In the original TAM, perceived ease of use is the second predictor of attitude after perceived usefulness. But in the subsequent versions (i.e. without attitude), it is one of the antecedents of behavioural intention (Venkatesh & Davis, 2000). Perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). In this context, it is defined as the perception of students on the ease of using, learning, and utilizing the cloud computing applications. Precisely, the possibility of adopting a technology depends on how individuals perceive it to be easy to use. Therefore, TAM2 classifies perceived ease of use as one of the cognitive instrumental processes that influence behavioural intention. Besides, perceived ease of use is among the predictors of perceived usefulness (Davis, 1989; Venkatesh & Davis, 2000). According to Davis (1986), job performance will increase when a system that is easier to use is given to individuals. The impact of perceived ease of use on intention is so important that it has a direct link with behavioural intention and indirect through perceived usefulness (Venkatesh, 2000; Venkatesh & Davis, 2000).

However, various studies were conducted to identify determinants of perceived ease of use (Venkatesh, 2000; Venkatesh & Davis, 1996). The determinants include: computer self-efficacy, computer playfulness, perceived enjoyment, perceptions of external control, objective usability, and hands-on experience (Rose & Fogarty, 2006; Venkatesh, 2000; Venkatesh, Davis, Gorgone, Longenecker, & Miller, 1994). The determinants of perceived ease of use defined in TAM3 were adopted from Venkatesh (2000), whichare computer self-efficacy, computer playfulness, computer anxiety, perceptions of external control, perceived enjoyment, and objective usability (Venkatesh & Bala, 2008).

In longitudinal field studies conducted by Venkatesh and Bala (2008), perceived ease of use was found to have significant influence on perceived usefulness at all time periods (T1, T2, and T3), while perceived ease of use significantly influenced intention only at T1 and T2. The finding on the influence of perceived ease of use on perceived usefulness and behavioural intention was consistent with other studies (Venkatesh, 2000; Venkatesh & Davis, 2000). Likewise, Al-Gahtani (2014) revealed that perceived ease of use had significant positive influence on perceived usefulness and behavioural intention. This finding was also supported in K. M. Faqih and Jaradat (2015). Therefore, we assume that if a cloud computing application is easy to use, the chance of adopting it by students will be high. Hence, perceived ease of use is hypothesized as a factor that determines perceived usefulness and students' behavioural intention to adopt cloud computing applications in higher education environment. Thus, we propose the following hypotheses:

H2. Perceived ease of use will have a positive effect on behavioural intention.

H3. Perceived ease of use will have a positive effect on perceived usefulness.

4.2.4 Trust (TR)

One of the earlier works on trust was on the influence of trust on a seller's tough bargaining strategy (Schurr & Ozanne, 1985). In that study, trust was referred to as the "belief that a party's word or promise is reliable and that a party will fulfil his/her obligations in an exchange relationship" (Schurr & Ozanne, 1985, p. 940). Higher trust beliefs lead to higher level of agreement, more positive attitude toward the seller, more positive attitude toward loyalty and fewer rejection of the seller as tough (Schurr & Ozanne, 1985). Trust is also defined as "the belief that the other party will behave in a socially responsible manner, and, by so doing, will fulfil the trusting party's expectations without taking advantage of its vulnerabilities" (P. A. Pavlou, 2003, p. 106). McKnight and Chervany (2002, p. 37) also defined trust as "beliefs regarding various attributes of the other party, such as fairness, goodness, strength, ability, benevolence, honesty, and predictability". Carter and Weerakkody (2008) further reported based on literature that trust is usually formed when a user has faith in the service provider and the medium that conveys the service. This is evident from studies of K. M. S. Faqih (2011) and Kaasinen (2005) that showed the effect of trust on users' decision to use a technology.

In fact, trust has been defined in many ways and the reason for these variances is either due to ambiguity of the word, perception of trust from different perspectives, or expressing trust to fit a particular type of research (McKnight & Chervany, 2002). However, its definitions are usually related to integrity, honesty, competence, benevolence and dependability (Gefen, Karahanna, & Straub, 2003; McKnight & Chervany, 2002). Moreover, McKnight and Chervany (2002) had the impression that security and risk should be part of trust definition. They suggested adding "with a feeling of relative security in a situation of risk" to the definition of trust (McKnight & Chervany, 2002). This was consistent with various studies that linked trust with security, risk, and privacy (Khan & Malluhi, 2010).

Additionally, previous studies established a strong relationship between trust and TAM constructs especially in online activities. For example, Gefen et al. (2003) added trust to TAM in order to examine the influence of trust on perceived usefulness and intention to use Business-to-Consumer (B2C) website. Thisstudy found that trust was the major determinant of intention after perceived usefulness. It also had a significant influence on informing usefulness perception. The study supported the influence of trust in online environments.

Similarly, P. A. Pavlou (2003) integrated trust and perceived risk into TAM to predict consumer e-Commerce acceptance. The integration of these variables was due to reported uncertainties and risks that surrounded the e-Commerce environment such as risk of monetary loss and risk related to privacy as a result of misusing customers' personal information. Two empirical studies were conducted in order to test the proposed model. The impact of trust on behavioural intention in both studies were significant, but it was weaker in the first study perhaps as a result of indirect effect through perceived usefulness. In the second study, trust was the most significant determinant of intention. In addition, trust had a strong positive influence on perceived usefulness in both studies. This supported the assumption that trust had a significant effect on consumer behavioural intention.

Moreover, Wu, Zhao, Zhu, Tan, and Zheng (2011) conducted a meta-analysis of the impact of trust on TAM. The meta-analysis considered 136 studies, wheretrust was found to have significant effect on perceived usefulness, perceived ease of use, attitude, and behavioural intention. Trust and perceived usefulness relationship was considered in 44 studies and a significant positive correlation was found in all studies. In addition, out of the 42 studies that assumed trust and perceived ease of use relationship, a significant positive correlation was found in 40 of them, a significant negative correlation was found in one study, and a non-significant correlation was found in the other study. For the trust and behavioural intention relationship, out of the 41 studies that hypothesized the relationship, 40 of them found significant positive correlation and only one found a non-significant correlation. Finally, only 18 studies suggesteda relationship between trust and attitude, and all studies reported a significant positive correlation. This study supported the significance of trust in technology adoption.

In fact, trust is usually included in studies associated with online activities like transaction, because people engaged in an online transaction do not physically see each other (Gefen et al., 2003). Therefore, in situations where uncertainty may be involved, trust is essential since it is one of the qualities required for the economic and social interactions (Gefen et al., 2003; P. A. Pavlou, 2003). This is the case in cloud computing where the uncertainty is high due to lack of standards, regulations and complexity of the cloud technology (Quynh, Heales, and Xu (2014). Thereby, trust concerns remain a key issue in the adoption of cloud computing and many studies reported that lack of trust can hinder the adoption of cloud services (Okai et al., 2014).

Khan and Malluhi (2010, p. 20) referred to trust as “an act of faith; confidence and reliance in something that’s expected to behave or deliver as promised”. Control, ownership, prevention, accountability, reputation, auditability, personal perception, structural assurance, and security are some of the identified issues related to trust (Khan & Malluhi, 2010; Ko et al., 2011; Quynh et al., 2014). Thus, in this study trust refers to students’ belief, confidence, and reliance in cloud computing applications and their providers. It is assumed that when students perceived or recognized the cloud applications as secure, confidential, and trustworthy, they will adopt them. Therefore, we anticipate trust to have an impact on students’ perceived usefulness of the cloud applications and intention to adopt the cloud computing applications. Hence, the following hypotheses are proposed:

H4. Trust will have a positive effect on behavioural intention.
H5. Trust will have a positive effect on perceived usefulness.

4.2.5 Subjective Norm (SN)

This is one of the social influence processes factors that was adopted from TRA in TAM2. The factor was also adopted into TAM3 from TAM2. Subjective norm is defined as “a person’s perception that most people who are important to him think he should or should not perform the behaviour in question” (Fishbein & Ajzen, 1975, p. 302). In this study subjective norm is defined as the perception of students that their instructors or peers think they should use the cloud computing applications.

Subjective norm appears in TRA and TPB as antecedent of behavioural intention (Ajzen, 1991; Fishbein & Ajzen, 1975). This is because it is assumed that an individual may decide to perform a behaviour if he/she believes that individuals who are important to him/her think he/she should perform the behaviour, even though he/she is not favourable toward the behaviour. Although prior studies obtain insignificant results for this relationship (Davis et al., 1989; Mathieson, 1991), it still appears in TAM2 and TAM3 because of the need to examine the “impact of social influences on usage behaviour” (Davis et al., 1989, p. 999). TAM2 proposesthe relationships between subjective norm and perceived usefulness, subjective norm and image, and subjective norm and intention. In the first case, subjective norm will have an indirect influence on intention via perceived usefulness. According to Venkatesh and Davis (2000, p. 189) this is based on the concept of internalization which implies a situation whereby “a superior or co-worker suggests that a particular system might be useful, a person may come to believe that it actually is useful, and in turn form an intention to use it”. In the second case, the influence of subjective norm on image is based on identification because “if important members of a person’s social group at work believe that he or she should perform a behaviour (e.g., using a system), then performing it will tend to elevate his or her standing within the group” (Venkatesh & Davis, 2000, p. 189). Furthermore, TAM2 assumes that the influence of subjective norm on behavioural intention and perceived usefulness decreases when experience increases over time. The influence of subjective norm let people form an intention based on the opinion of others, but after using the system for sometime users may now realize the strengths and weaknesses of the system. In this situation subjective norm impacts on perceived usefulness and behavioural intention may decline (Venkatesh & Davis, 2000).

S. Taylor and P. Todd (1995) investigated the impact of subjective norm on intention and found it significant for both experience and inexperience groups, but it was stronger for the inexperience group. This result contradictedwith the findings by Mathieson (1991) thatsubjective norm had an insignificant influence on intention. However, Venkatesh and Davis (2000) found that subjective norm was a significant determinant of perceived usefulness at the T1 and T2 stages but its effect decreased after users gained experience. On the other hand, the influence of subjective norm on behavioural intention was significant at bothT1 and T2 stages in mandatory settings, while the effect was not significant in voluntary settings. In addition, subjective norm had a significant influence on image. Furthermore, the result of the significant positive effect of subjective norm on perceived usefulness was also supported byVenkatesh and Bala (2008). Similarly, Al-Gahtani (2014) found a significant impact of subjective norm on image, perceived usefulness, and behavioural intention. Interestingly, unlike in previous studies, subjective norm was significant in voluntary settings as well, and it was the second strongest predictor of behavioural intention (Al-Gahtani, 2014). Therefore, we anticipate subjective norm to have an impact on students' perceived usefulness of the cloud applications, students' image as well as theirintention to adopt cloud applications. Hence, we suggest the following hypotheses based on the previous studies.

H6. Subjective norm will have a direct positive effect on behavioural intention.
H7. Subjective norm will have a positive effect on perceived usefulness.
H8. Subjective norm will have a positive effect on image.

4.2.6 Image (IMG)

This is the second social influence process factor that TAM3 adopted from TAM2. Moore and Benbasat (1991, p. 195) defined it as "the degree to which use of an innovation is perceived to enhance one's status in one's social system". Thus, image is the extent of students' belief that using the cloud applications will result in elevating their status in the academic environment. The influence of subjective norm on image is called identification (Venkatesh & Davis, 2000). The identification effect in TAM2 is determined by the influence of image on perceived usefulness as well as the influence of subjective norm on image. The assumption that subjective norm will affect perceived usefulness via image is that people tend to be more productive as their status elevates as a result of performing a behaviour and influence of others (Venkatesh & Bala, 2008; Venkatesh & Davis, 2000).

Venkatesh and Davis (2000) conducted longitudinal studies in four organizations and investigated the influence of image on perceived usefulness in mandatory and voluntary settings. They found that image had a significant effect on perceived usefulness at all different time stages (T1, T2, and T3); and the influence was stronger in mandatory settings. Similar findings were reported in another longitudinal studies by Venkatesh and Bala (2008). In addition, studies by Al-Gahtani (2014) in e-Learning context, and K. M. Faqih and Jaradat (2015) in m-commerce context supported the influence of image on perceived usefulness. In this research, it is anticipated that the perception of usefulness of the cloud applications will be influenced by the students who believe that using the cloud applications will enhance their status in the university. Therefore, we propose the following hypothesis:

H9. Image will have a positive effect on perceived usefulness.

4.2.7 Job Relevance (REL)

Job relevance is one of the cognitive instrumental processes identified in TAM2 that influence perceived usefulness (Venkatesh & Davis, 2000). It is defined as "an individual's perception regarding the degree to which the target system is applicable to his or her job" (Venkatesh & Davis, 2000, p. 191). Job relevance takes into account the significance of the tasks that can be accomplished by the system relevant to one's job or responsibility (Venkatesh & Davis, 2000). TAM2 posits that job relevance will positively influence perceived usefulness. In this context, we will consider job relevance as study relevance. It can be rearticulated as students' perception on the extent to which the cloud computing applications are relevant to their learning related activities and collaborative works.

It is empirically proved by Venkatesh and Davis (2000) that job relevance has a significant effect on perceived usefulness. Al-Gahtani (2014) also found a similar result. In another similar study, Agudo-Peregrina et al. (2014) revealed a significant influence of relevance for learning on perceived usefulness. Amazingly, relevance for learning is the most significant determinant of perceived usefulness in this study. Health relevance is an important predictor of perceived usefulness as shown in a study that investigated Internet health information seeking behaviours (S. J. Chang & Im, 2014). Thus, it is assumed that the relevance of cloud computing applications to students learning activities and collaborative works will influence the adoption of the cloud applications by students. Hence, it is expected that job relevance will be one of the predictors of perceived usefulness as postulated below:

H10. Job relevance will have a positive effect on perceived usefulness.

4.2.8 Output Quality (OUT)

Output quality was introduced to TAM by Davis et al. (1992) when investigating the influence of perceived enjoyment on usage intention. Later, Venkatesh and Davis (2000) added it as anantecedent of perceived usefulness due to various suggestions on its influence on adoption process. Output quality is defined as "the degree to which an individual believes that the system performs his or her job tasks well" (Venkatesh & Bala, 2008, p. 277). In this study output quality can be defined as the degree to which the students believe that the cloud computing applications are effective in performing the learning activities and other collaborative tasks better. This refers to the outcomes of using the cloud applications. In this regard, Venkatesh and Davis (2000) proposed that when various systems are presented to potential users, the system that delivers the highest output quality will be chosen. This implies that if the cloud computing applications produce high output quality, then the students will have the impression that the cloud applications will help them complete their study, learning, and collaborative related tasks. Hence, output quality is an essential requirement for cloud computing applications adoption. According to Davis et al. (1992) output quality can be assessed by examining the intermediate or final products of using the system.

There are empirical evidences that support the relationship between output quality and perceived usefulness. For instance, Davis et al. (1992) examined the influence of perceived enjoyment on intention to use computers and found output quality had a significant effect on perceived usefulness. Likewise, Mather, Caputi, and Jayasuriya (2002) proposed two TAM2-based models to investigate user satisfaction of an incident reporting system. They found that output quality had a significant effect on perceived usefulness in one study and a non-significant effect on the other. However, TAM2 found a strong two-way interaction effect between job relevance and output quality on perceived usefulness for all time periods. This effect was also tested in TAM3 and found significant,implying that the influence of job relevance on perceived usefulness will be stronger if output quality increases. In addition, Al-Gahtani (2014) reported that output quality moderated the effect of job relevance on perceived usefulness in a way that the effect of job relevance was stronger with the increase in output quality. It is believed that when students perceive the high output quality of the cloud computing application, they tend do adopt it. Hence, we posit output quality as a cognitive instrumental process factor that will influence perceived usefulness, and moderate the relationship between job relevance and perceived usefulness as hypothesized below:

H11. Output quality will have a positive effect on perceived usefulness.

H12.Output quality will moderate the relationship between job relevance and perceived usefulness.

4.2.9 Result Demonstrability (RES)

This is a cognitive instrumental process that predicts perceived usefulness as reported in TAM2 (Venkatesh & Davis, 2000). Venkatesh and Bala (2008, p. 277) defined result demonstrability as "the degree to which an individual believes that the results of using a system are tangible, observable, and communicable". This construct captures the visibility and communicability of the results of using an innovation (Moore & Benbasat, 1991). This indicates that the more visible the result of an innovation, the higher the possibility of perceiving the innovation as useful by individuals, which stands a high chance of being adopted (Moore & Benbasat, 1991; Venkatesh & Davis, 2000). Therefore, in this context result demonstrability can be viewed as the extent of students' beliefs that the result of using cloud computing applications is tangible, observable, and communicable. In TAM2, a strong positive correlation was found between result demonstrability and perceived usefulness at all time periods as hypothesized, which established result demonstrability as a predictor of perceived usefulness (Venkatesh & Davis, 2000). This hypothesis was also adopted and validated in TAM3 (Venkatesh & Bala, 2008). Likewise, Huang et al. (2012) found result demonstrability was a significant factor which directly impacted perceived usefulness. It is believed that the perception of students on the usefulness of cloud computing applications will increase when they can discriminate the result of using the cloud applications easily. Therefore, we posit the following hypothesis:

H13. Result demonstrability will have a positive effect on perceived usefulness.

4.2.10 Self-Efficacy (SE)

Computer self-efficacy is defined as "the degree to which an individual believes that he or she has the ability to perform a specific task/job using the computer" (Venkatesh & Bala, 2008, p. 279). This variable was introduced into TAM as part of anchors during the formation of ease of use perception (Venkatesh, 2000). Computer self-efficacy is also considered as an internal control variable that is required when performing a behaviour (Venkatesh, 2000). This concept originated from perceived self-efficacy which Bandura (1982, p. 122) defined it as a concept that “is concerned with judgments of how well one can execute courses of action required to deal with prospective situations”. According to Venkatesh and Davis (1996), there are both theoretical and practical bases for the relationship between perceived ease of use and self-efficacy. Practically, it is assumed that most people have a basic knowledge of computer or IT usage in one way or the other, so a user has the ability to use ICT in general (Venkatesh & Davis, 1996). With this assumption, users are able to imagine how easy a particular technology is regardless of having or not having knowledge about that particular technology. So, self-efficacy is regarded as a user’s ability to utilize a particular technology to perform his/her tasks. In this context, self-efficacy refers to students’ confidence in their ability to use cloud computing applications for learning and other collaborative works.

The impact of computer self-efficacy on perceived ease of use was examined by Venkatesh (2000) in three longitudinal studies. The studies established computer self-efficacy as one of the anchors that helped realize the perceived ease of using a new system. Likewise, findings from longitudinal studies by Venkatesh and Bala (2008) revealed that computer self-efficacy significantly influencedperceived ease of use at all points of measurement, whichsupported earlier findings that described computer-self-efficacy as an important predictor of perceived ease of use. On the other hand, Agarwal and Karahanna (2000) revealed that computer self-efficacy was a predictor of perceived usefulness. In this respect, Venkatesh and Bala (2008) argued that although the impact of computer self-efficacy on perceived usefulness reported in Agarwal and Karahanna (2000) was weak, the presence of social and cognitive variables will subsequently weaken the influence. Venkatesh (2000) further claimed that perceived ease of use mediated the impact of computer self-efficacy on behavioural intention.

Computer self-efficacy has been linked to perceived ease of using various technologies in different domains. For instance, Al-Gahtani (2014) found computer self-efficacy a significant predictor of perceived ease of use in e-Learning environment. K. M. Faqih and Jaradat (2015) concluded that improving self-efficacy will increase the perception of ease of using m-commerce by customers. Also in healthcare settings, S. J. Chang and Im (2014) identified computer self-efficacy as one of the factors that had an indirect influence on Internet health information seeking behaviour through perceived ease of use.

Therefore, it is believed that when students are confident in their ability to use the cloud computing applications especially for learning and collaborative works, they have better tendency of adopting the cloud applications. Hence, it is hypothesized that self-efficacy will influence students' perceived ease of using cloud applications as follows:

H14. Self-efficacy will have a positive effect on perceived ease of use.

4.2.11 Perceptions of External Control (PEC)

This is an external control factor that predicts perceived ease of use (Venkatesh, 2000). Perceptions of external control (facilitating conditions) refers to "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh et al., 2003, p. 453). In the context of cloud computing services adoption by students, perceptions of external control can be defined as the perception of students on the available resources in the university such as Internet, computer devices, support, and infrastructures that are required to use the cloud computing services. Although control in general has been discussed in various technology acceptance studies (Mathieson, 1991; S. Taylor & P. A. Todd, 1995), it was introduced into TAM by Venkatesh (2000) as one of the anchors that determine perceived ease of use.

Venkatesh and Bala (2008) confirmed the effect of perceptions of external control on perceived ease of use in their longitudinal studies. Consistent with Venkatesh (2000), they found the influence was significant at all measurement points. Various studies have demonstrated the function of perceptions of external control on perceived ease of use. For instance, Agudo-Peregrina et al. (2014) in their e-Learning related study found that perceptions of external control significantly influenced perceived ease of use. Similarly, Al-Gahtani (2014) showed the influence of perceptions of external control on perceived ease of use in his empirical study. The impact of perceptions of external control on perceived ease of use was even emphasized in a m-commerce study (K. M. Faqih & Jaradat, 2015).

It is expected that when the students believe that the university has the available resources required to use cloud computing applications, they will adopt the cloud applications easily. Based on the studies that reported the role of perceptions of external control in technology adoption, we believe that perceptions of external control of the students will influence perceived ease of use. Thus, we posit that:

H15. Perceptions of external control will have a positive effect on perceived ease of use.

4.2.12 Anxiety (ANX)

Computer anxiety is another anchor variable related to emotion that determines perceived ease of using a technology (Venkatesh, 2000). According to Venkatesh (2000, p. 349), computer anxiety refers to "an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers". This relates to negative reaction of users toward using a computer. Although computer anxiety has been widely investigated in psychology and IS studies prior to its integration into TAM (A. A. Anderson, 1996; Elasmar & Carter, 1996; Howard & Smith, 1986; Igbaria & Chakrabarti, 1990), Venkatesh (2000) felt the need to study it in order to see if its role is still relevant despite computers being almost everywhere. Anxiety, when is relatedtothe context of our study, can be considered as the degree of students' worry or fear when they are facing the possibility of using cloud computing services. The presence of anxiety, which is an unpleasant emotional situation among students, may result in developing unfavourable perception toward adoption and use of the cloud computing services. This may be a result of lack of computer skills, or preference for other conventional ways of learning, sharing, or collaboration.

TAM3 adopted the hypothesis that computer anxiety will have a negative influence on perceived ease of use from Venkatesh (2000). The hypothesis was proved at all the measurement points where computer anxiety had a significant negative effect on perceived ease of use. This supported the findings of Venkatesh (2000) which were later confirmed by Al-Gahtani (2014) in e-Learning context. Several studies demonstrated that computer anxiety was a determinant of perceived ease of use. Thus, it is expected that the presence of unpleasant emotional situation or worry among students will prevent them from using the cloud computing applications.

Therefore, this study proposes that anxiety will have a negative impact on students' perceived ease of using cloud applications. Therefore, we hypothesize that:

H16. Anxiety will have a negative effect on perceived ease of use.

4.2.13 Playfulness (PLAY)

This is another anchor factor related to intrinsic motivation that determines perceived ease of use (Venkatesh, 2000). Motivation is classified into extrinsic and intrinsic (Venkatesh, 2000). The extrinsic motivation is a need to carry out a behaviour to achieve particular goals or rewards, whereas intrinsic motivation concerns with perception of satisfaction and pleasure that can be gainedwhena behaviour is performed (Venkatesh, 2000). Thus, computer playfulness is related to intrinsic motivation, which is defined as "the degree of cognitive spontaneity in microcomputer interactions" (Webster & Martocchio, 1992, p. 204). Venkatesh (2000) observed that playfulness may not necessarily mean fun only, but it captures other aspects like exploration, discovery, curiosity and challenge. Therefore, in this study playfulness can be referred to as the extent to which the students will feel playful, spontaneous, and creative when using cloud computing applications.

Venkatesh (2000) assessed the role of antecedents of perceived ease of use, including playfulness and the findings revealed that computer playfulness had a significant impact on perceived ease of use. The influence of computer playfulness on perceived ease of use was further examined by Venkatesh and Bala (2008), and the effect was found to be significant at all the three measurements points. Therefore, it is believed that when students perceive that they will feel playful, spontaneous, and creative when using cloud computing applications, there is a chance that the students will find the cloud applications easy to use. Consequently, we propose that:

H17. Playfulness will have a positive effect on perceived ease of use.

4.2.14 Perceived Enjoyment (ENJ)

This is the only adjustment variable adopted from TAM3. Venkatesh (2000, p. 351) defined perceived enjoyment as the degree to which "the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use". Study of enjoyment related to computer use started from the context of computer games, but later researchers decided to find out if it can be applied to computer usage in workplace (Davis et al., 1992). In this study, it can be regarded as the degree in which the use of the cloud computing applications is perceived by students as enjoyable in its own right regardless of any performance consequences resulted from system use. The influence of perceived enjoyment on technology adoption has been extensively researched (Davis et al., 1992). An empirical study that investigatedthe relationship between perceived enjoyment and perceived ease of use was conducted by Sun and Zhang (2006). The study reported that the paths from perceived enjoyment to perceived ease of use, and from perceived ease of use to perceived enjoyment were both proposed and confirmed, but the path from perceived enjoyment to perceived ease of use was more dominant than the other. C. Anderson, Al-Gahtani, and Hubona (2008) investigated the influence of TAM antecedents in Saudi Arabia setting. They found perceived enjoyment as one of the important predictors of perceived ease of use. Likewise, Venkatesh and Bala (2008) in their longitudinal studies found a non-significant influence of perceived enjoyment on perceived ease of use at T1, but the effect was later significant at T2, and T3. Similar findings were reported by Al-Gahtani (2014) as he found it significant in his study in e-Learning context. Therefore, it is assumed that the perception of the students on the ease of using cloud computing applications will increase when they perceive the use of the cloud applications as enjoyable. Thus, we theorize that:

H18. Perceived enjoyment will have a positive effect on perceived ease of use.

4.2.15 The Moderating Variable: Internet Experience (IE)

User experience is defined as "a term used to describe the overall experience and satisfaction a user has when using a product or system" (Law, Roto, Vermeeren, Kort, & Hassenzahl, 2008, p. 2397). Therefore, information on the simplicity or difficulty of a system would be known by the user as hands-on experience with a system increases (Venkatesh and Bala (2008). There are several studies that reported the significance of experience in technology adoption (Liao & Lu, 2008). For example, S. Taylor and P. Todd (1995) investigated the factors that may influence users' intention to use an IT system. The study found differences in the effect of usage determinants (behavioural intention and perceived behavioural control) based on the experience. Likewise, Oh, Ahn, and Kim (2003) found experience as a good determinant of perceived usefulness and perceived ease of use.

In this study, experience is modified into Internet experience as a moderating variable. Moderator is referred to a variable “which systematically modifies either the form and/or strength of the relationship between a predictor and a criterion variable” (Sharma, Durand, & Gur-Arie, 1981, p. 291). Internet experience is described as “the extent of a person’s experience to perform specific tasks using the Internet” (Alenezi, Karim, Malek, & Veloo, 2010, p. 25). Findings from existing technology adoption studies suggest incorporating Internet experience into models that are used to assess online services adoption by users, due to its impact on attitude and intention to use such services (Nysveen & Pedersen, 2004; Varma Citrin, Sprott, Silverman, & Stem Jr, 2000). In most of the e-Services studies, users with high Internet experience were usually found to have positive attitude toward adopting and using the e-Services (Al-Harbi, 2010; Al-Sobhi, 2011).

Venkatesh and Davis (2000) suggested measuring the influence of experience of using a system on the social influence process. Therefore, they proposed that the influence of subjective norm on intentions for mandatory usage settings will be stronger before implementation and during early usage, but will become weaker as experience with the system increases. Likewise, the effect of subjective norm on perceived usefulness is expected to be weaker as experience increases. Further, Venkatesh (2000) proposed that the impact of computer playfulness on perceived ease of use becomes weak eventually when experience increases,whereas the impact of perceived enjoyment on perceived ease of use becomes stronger with increase in experience.

In addition, TAM3 proposes three new relationships, which are the moderating effect of experience on the influence of perceived ease of use on perceived usefulness, the moderating effect of experience on the influence of computer anxiety on perceived ease of use, and the moderating effect of experience on the influence of perceived ease of use on behavioural intention. In more detail, TAM3 suggests that when experience increases the influence of perceived ease of use on perceived usefulness will be stronger; with the increase in experience the effect of computer anxiety on perceived ease of use will be weaker; also when experience increases the impact of perceived ease of use on intention becomes weaker (Venkatesh & Bala, 2008).

Venkatesh and Bala (2008) tested all hypotheses associated with experience and found that experience had a moderating effect on the relationship between subjective norm and perceived usefulness, in such a way that the effect reduces as the experience increases. Experience had a moderating influence on perceived ease of use and perceived usefulness relationship, in a way that when experience increases the impact becomes stronger. Experience had a moderating influence on computer anxiety and perceived ease of use relationship, in which the influence will diminish when experience increases. Experience had a moderating effect on computer playfulness and perceived ease of use relationship, such that the influence will diminish with increase in experience. Experience had a moderating influence on perceived enjoyment and perceived ease of use relationship, such that the effect becomes stronger when the experience increases. Experience had a moderating effect on perceived ease of use and behavioural intention relationship, in a way that when experience increases the effect declines. Finally, experience had no moderating impact on the relationship between subjective norm and behavioural intention. The finding related to the effect of experience on subjective norm and perceived usefulness relationship is in line with the study of Venkatesh and Davis (2000). The results imply that experience plays a significant role in IT adoption process, since high level experience is associated with positive attitude toward adopting and using a technology.

Similarly, Al-Gahtani (2014) evaluated seven out of the eight TAM3 hypotheses moderated by experience and he found five of them significant. The excluded hypothesis was the moderating effect of experience on objective usability and perceived ease of use relationship. The five significant relationships that are moderated by experience are the effect of subjective norm on both behavioural intention and perceived usefulness; the effect of perceived ease of use on both behavioural intention and perceived usefulness; and the effect of perceived enjoyment on perceived ease of use. Likewise, Huang et al. (2012) conducted a study on adopting data mining tools using TAM3 and hypothesized that experience moderates computer anxiety and perceived ease of use relationship, computer playfulness and perceived ease of use relationship, perceived ease of use and perceived usefulness relationship, as well as perceived ease of use and behavioural intention relationship. Among these four relationships, experience moderates only perceived ease of use and behavioural intention relationship.

Internet experience is incorporated into our proposed model because cloud computing applications considered in this study are Internet-based applications. Therefore, students with higher Internet experience are likely more skilful in using such applications. Consequently, Internet experience is considered in this research as a variable that moderates the same relationships that were proposed in TAM3 by Venkatesh and Bala (2008) excluding objective usability and perceived ease of use relationship as the objective usability factor is excluded in this study. Therefore, we posit the following hypotheses:

H19a: The impact of perceived ease of use on perceived usefulness will be moderated by Internet experience, in which the impact of perceived ease of use will increase with greater Internet experience.

H19b: The impact of perceived ease of use on behavioural intention will be moderated by Internet experience, in which the impact of perceived ease of use will decrease with greater Internet experience.

H19c: The impact of subjective norm on perceived usefulness will be moderated by Internet experience, in which the impact of subjective norm will decrease with greater Internet experience.

H19d: The impact of subjective norm on behavioural intention will be moderated by Internet experience, in which the impact of subjective norm will decrease with greater Internet experience.

H19e: The impact of anxiety on perceived ease of use will be moderated by Internet experience, in which the impact of anxiety will decrease with greater Internet experience.

H19f: The impact of playfulness on perceived ease of use will be moderated by Internet experience, in which the impact of playfulness will decrease with greater Internet experience.

H19g: The impact of perceived enjoyment on perceived ease of use will be moderated by Internet experience, in which the impact of perceived enjoyment will increase with greater Internet experience.

4.3 Chapter Summary

This chapter presented the research model of this study which is based on TAM3. TAM3 is selected in this study as the theoretical foundation model because it is considered as a comprehensive version of TAM. In addtion, this chapter presentedthe differences between the research model and original TAM3 which are: (a) trust construct is introduced in the research model as a direct determinant of perceived usefulness and behavioural intention, (b) usage, voluntariness and objective usability constructs are not considered in the research model, and (c) experience moderator construct is modified to Internet experience. Consequently, the research model has 14 constructs and 2 moderators. The constructs are behavioural intention, perceived usefulness, perceived ease of use, trust, subjective norm, image, output quality, job relevance, result demonstrability, anxiety, self-efficacy, playfulness, perceptions of external control, and perceived enjoyment. The moderator variables are Internet experience and output quality.

Chapter 5: Research Methodology

5.1 Introduction

This chapter provides an overview of the research concept and paradigms, as well as research approaches. The chapter also discusses the research design and strategies. In addition, the chapter highlights the research design adopted in this study. The chapter also presents the study setting followed by the population and sample of the study. Furthermore, the chapter also discusses the data collection and analysis techniques, as well as reliability and validity of the instrument and focus group. Finally, the chapter presents the ethical issues relating to conducting the research.

5.2 Research Concept and Paradigms

According to Kothari (2004, p. 1) research is “a scientific and systematic search for pertinent information on a specific topic”. Similarly, Sekaran (2003, p. 3) defined research as “the process of finding solutions to a problem after a thorough study and analysis of the situational factors”. However, research paradigm is referred to as a view or belief of what a research topicis, it also describes different approaches to research (Michel, 2008). In this essence, paradigms give directions to researchers on how to conduct research (Michel, 2008). Paradigm is “a way of examining social phenomena from which particular understandings of these phenomena can be gained and explanations attempted” (Saunders, Lewis, & Thornhill, 2007, p. 112). Willis (2007, p. 8) defined paradigm as “a comprehensive belief system, world view, or framework that guides research and practice in a field”. There are three classifications of research paradigms which are positivism, critical theory, and interpretivism (Neuman, 2007; Willis, 2007). These categories and naming vary from scholar to scholar (Willis, 2007). However, the positivism, critical theory, and interpretivism are the three widely reported paradigms (Neuman, 2007). E. G. Guba and Lincoln (1994) and Willis (2007) expressed that paradigms are characterised based on some assumptions of fundamental issues such as ontology, epistemology, and methodology. The assumptions provide the complete view of how knowledge is perceived, how we view ourselves related to the knowledge, and how we discover knowledge (Scotland, 2012).

Ontology – is concerned with the philosophy of existence and various beliefs and positions of what is real and what is not (E. G. Guba & Lincoln, 1994; Saunders, Lewis, & Thornhill, 2009; Willis, 2007). Lincoln, Lynham, and Guba (2011, p. 102) defined ontology as “the worldviews and assumptions in which researchers operate in their search for new knowledge”. Ontological positions can be materialism, idealism or metaphysical subjectivism. In a materialist ontological belief, only physical things are real. So, they do not believe in things that are not physical like spirit. According to idealist position, “reality is mental and spiritual rather than material” (Willis, 2007, p. 9). Finally, metaphysical subjectivist claimed that reality is only created by perception (what we perceive in our senses); therefore, there is no other reality except what is in our heads (Willis, 2007). Ontological questions include what is the nature and form of reality (E. G. Guba & Lincoln, 1994; Lincoln et al., 2011).

Epistemology – The word “epistemology” is originated from Greek word “episteme” which denotes “knowledge” (Willis, 2007). Epistemology is “the process of thinking. The relationship between what we know and what we see. The truths we seek and believe as researchers” (Lincoln et al., 2011, p. 103). Some of the epistemological questions are “what is knowledge?, how do I acquire knowledge?” (Willis, 2007, p. 10), “what is the nature of the relationship between the knower or would-be knower and what can be known?” (E. G. Guba & Lincoln, 1994, p. 108), and “what is the relationship between the researcher and that being researched?” (Lincoln et al., 2011, p. 103).

Methodology – is concerned with how knowledge is gained (Jackson, 1991). Ellen (1984, p. 9) defined methodology as “the systematic study of the principles guiding anthropological investigation and the ways in which theory finds its application; an articulated, theoretically informed approach to the production of data”. Similarly, Lincoln et al. (2011, p. 104) defined methodology as “the process of how we seek out new knowledge, the principles of our inquiry and how inquiry should proceed”. Methodological questions include “how can the inquirer (would-be knower) go about finding out whatever he or she believes can be known?” (E. G. Guba & Lincoln, 1994, p. 108). Based on these three assumptions (ontology, epistemology, and methodology), the following subsections will introduce the three types of paradigms which are positivism, interpretivism, and critical theory.

5.2.1 Positivism

This paradigm was established by French philosopher Auguste Comte (Willis, 2007). Positivism paradigm is based on the realism ontology which believes that the reality is assumed to exist driven by natural laws (E. G. Guba & Lincoln, 1994). Positivist "assumes that an objective reality exists out there. The job of the scientist is to discover this reality by gathering empirical evidence, facts we can verify with our senses, say, by seeing, hearing, or touching" (Macionis, 2012, p. 29). Positivists are with the opinion that outcomes or effects are determine by causes (Creswell, 2009). Their approach to solve a problem is to break down ideas into portions that can be distinctly tested using variables, hypotheses, and research questions (Creswell, 2009). In addition, they hold a belief that in order to understand the world, some theories have to be tested or verified (Creswell, 2009). The process starts with a theory, then collects data to verify the theory, and revises the theory before conducting further assessment. Positivist makes sure the outcome is not influenced by factors such as bias during the process (Creswell, 2009).

5.2.2 Interpretivism

This is the philosophy of people who hold the view that human society cannot be measured through scientific ways (Macionis, 2012; Willis, 2007). That is why they reject positivist belief that same research methods used in scientific fields like chemistry and physics can be applied to examine human behaviour (Willis, 2007). Interpretivist focus "on the meanings people attach to their social world" (Macionis, 2012, p. 33). In other word, they focus on interpretation. They focus on people's understanding of their actions and surroundings (Macionis, 2012). Interpretivists assume that "reality is subjective, constructed by people in the course of their everyday lives" (Macionis, 2012, p. 33). In interpretivist ideology, research is conducted by interacting with people so that the researchers learn from their everyday lives (Macionis, 2012). That is why they prefer qualitative methods such as case studies, observation, and interviews, because they believe the methods are the best way of "getting at how humans interpret the world around them" (Willis, 2007, p. 6). Researchers following this approach will interact with participants in order to create meanings out of what they see, hear, and understand as they are conducting the investigation (Creswell, 2009). They usually visit the setting they want to study by themselves and use the experience and background to interpret their findings (Creswell, 2009).

5.2.3 Critical Theory

In critical theory the focus is “on the need for social change” (Macionis, 2012, p. 34). According to Macionis (2012, p. 34), critical theory takes an activist approach to understand world and improve it through asking moral and political questions like “Should society exist in its present form?, why can’t our society have less inequality?” instead of asking scientific question like “How does society work?”. Critical theorists focuse on critiquing and changing the whole society through social transformation. Critical theory assumes that reality is affected by factors such as ethnic, cultural, social, economic, political, and gender (E. G. Guba & Lincoln, 1994). Therefore, a critical theorist conducts a research work with a reform agenda to improve the life of the participants, the environment where people work or live, and the life of the researcher (Creswell, 2009). During a critical theory based study, the researcher starts with one of the social issues like “empowerment, inequality, oppression, domination, suppression, and alienation” as the core aspect of the research (Creswell, 2009, p. 207). This type of research is collaborative whereby the participants may partake in designing questions, collecting and analysing data, and gain from the outcome of the research (Creswell, 2009). So, critical theorist helps individuals to emancipate themselves from “humanly constructed and socially reproduced restrictions” (Martínez-Alemán, Pusser, & Bensimon, 2015, p. 9).

5.3 Research Approaches and Studies

There are two research approaches which are deductive and inductive. The researcher chooses the approach that will best answer the questions of research to accomplish the objectives of the research (Saunders et al., 2007). The former is useful if the researcher wants to test the validity of hypotheses or theories, whereas the latter is used to develop new theories (Saunders et al., 2009).

Furthermore, research studies are classified as either exploratory, descriptive, or explanatory (Neuman, 2007; Saunders et al., 2009). This classification is based on the purpose of the study, typically guided by the research questions (Saunders et al., 2009). Exploratory study is conducted to investigate a phenomenon or clarify researchers' understanding of a problem (Saunders et al., 2009; Sekaran, 2003). Exploratory research can be conducted through literature search, observation, interview, or focus group (Saunders et al., 2009; Sekaran, 2003). One of the significance of exploratory research is flexibility in the sense that the direction of the research can change as a result of new data obtained in the course of the research (Saunders et al., 2009). Descriptive study focuses on describing characteristics of a particular phenomenon under study (Saunders et al., 2009). Data for descriptive study is usually collected using survey, field research, and content analysis (Neuman, 2007). Explanatory study deals with establishing and testing causal relationships between variables (Saunders et al., 2009). In this case a problem is investigated with the aim of understanding relationships between variables and explaining how and why something happen (Neuman, 2007; Saunders et al., 2009). In explanatory study qualitative data may be useful, but quantitative data is used to statistically test the relationships between variables (Saunders et al., 2009).

5.4 Research Design

Research designs "are plans and procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis" (Creswell, 2009, p. 1). Research design involves decision of choosing a design that will be used to investigate a problem. This decision is based on worldview assumptions the researcher has concerning the study, procedure of enquiry, and particular data collection, analysis, and interpretation methods. The choice of the design also depends on the nature of the study problem, study audiences, and researcher's personal experience (Creswell, 2009). Three types of research design exist; they arequalitative, quantitative and mixed method designs (Creswell, 2009). The following subsections explain the above three types of research design.

5.4.1 Quantitative Research

Quantitative research is concerned with measurement of quantity or amount (Kothari, 2004). Quantitative research is based on the natural science approach for collecting quantitative (numeric) data to test hypothesis or theory (Johnson & Christensen, 2008). According to Creswell (2009, p. 1), quantitative research is an approach "for testing objective theories by examining the relationships among variables. These variables, in turn, can be measured, typically on instruments, so that numbered data can be analysed using statistical procedures". Quantitative research focuses on developing hypotheses based on some theories and collecting data using quantitative ways (Bryman, 2004). The collected data will be analysed in order to verify the causal connections between the concepts specified in the hypotheses (Bryman, 2004). Hence, quantitative research is predominantly concerned with establishing and verifying "causal relationships between concepts" (Bryman, 2004, p. 31). According to Johnson and Christensen (2008), quantitative research follows objective ontology and assumes that human behaviours are predictable by one or more causes. The main instruments of quantitative research methods are survey and experiment (Creswell, 2009). In survey design, questionnaire or structured interview is used for data collection from a sample as a representation of a population (Creswell, 2009). While in experimental research, subjects are grouped into control and experimental groups (Bryman, 2004; Creswell, 2009). In order to determine the cause of an outcome, treatment will be given to the experiment group only. Then the two groups (control and experiment) will be later examined (Creswell, 2009).

5.4.2 Qualitative Research

Qualitative research as opposed to quantitative research relates with qualitative phenomenon like exploring some aspects of human behaviour (Kothari, 2004).In qualitative research, qualitative (nonnumeric) data is collected to explore a particular topic or phenomenon (Johnson & Christensen, 2008). Creswell (2009, p. 1) described qualitative research as an approach "for exploring and understanding the meaning individuals or groups ascribe to a social or human problem. The process of research involves emerging questions and procedures, data typically collected in the participant's setting, data analysis inductively building from particulars to general themes, and the researcher making interpretations of the meaning of the data". Qualitative researcher personally collects data from participants in the natural settings in order to observe how they behave and act in the social settings under investigation (Bryman, 2004; Creswell, 2009). The data can be collected through observation, interview, or documents examination. In each case, the researcher is the "key instrument" (Creswell, 2009). In qualitative observation, the researcher observes the behaviour or activities of individuals in the study site, and takes notes of the activities. The researcher can participate in the activities or just observe the activities (Creswell, 2009). Similarly, qualitative interview can be conducted in different forms. It can be by face-to-face, telephone, or focus group (Creswell, 2009). Document examination is a type of qualitative data collection that allows an investigator to study documents "either to understand their substantive content or to illuminate deeper meanings which may be revealed by their style and coverage" (Ritchie, 2003, p. 35). The documents may be public (such as minutes of meetings, newspapers, and official report) or private (such as letters, personal journals and diaries, and e-mails) (Creswell, 2009; Ritchie, 2003). Qualitative research relies on the meaning derived from the document examination rather than what is in the literature or what the researcher conceives (Creswell, 2009). This will allow the researcher to have a compound picture of the problem, and can give holistic account of the phenomenon since the result is interpreted based on what the researcher sees, hears, and understands (Creswell, 2009).

5.4.3 Mixed Method Research

Mixed method is another strategy which some researchers consider as the third research approach (Creswell, 2011). Mixed method research refers to a "research which collects both qualitative and quantitative data in one study and integrates these data at some stage of the research process" (Andrew & Halcomb, 2009, pp. 9-10). According to Johnson and Christensen (2008, p. 51) when you combine two or more research approaches with diverse strengths and weaknesses in a research "you can make it less likely that you will miss something important or make a mistake". Bryman (2006) identified various reasons for combining quantitative and qualitative research which include: improveingvalidity of findings, answering different research questions, explaining findings, instrument development, enhancing credibility of findings, diversity of views, or enhancement of findings. Therefore, the quality of the research will improve since the strength of one method will complement the weakness of the other (Johnson & Christensen, 2008).

There are four main mixed method designs, which are: convergent, embedded, explanatory, and exploratory designs (Creswell & Clark, 2007; Punch, 2009).

Convergent involves collecting and analysing qualitative and quantitative data simultaneously and combines the results in the interpretation stage (Creswell & Clark, 2007). Researchers use convergent design when they want to understand problem better, complement weakness of one method with strength of the other, compare both quantitative and qualitative findings, or explain quantitative findings with qualitative results (Creswell & Clark, 2007). Convergent design is used when the time for collecting data is limited and the researcher must get both types of data during singlefield visit, the researcher has expertise in both qualitative and quantitative research methods, the researcher feels that collecting and analysing both quantitative and qualitative data are equally important for understanding the problem, or the researcher has the capability of managing extensive data collection and analysis (Creswell & Clark, 2007). Convergent design is sometimes called triangulation (Creswell & Clark, 2007). Triangulation is “the use of different data collection techniques within one study in order to ensure that the data are telling you what you think they are telling you” (Saunders et al., 2007, p. 139).

In embedded design, the researcher “combines the collection and analysis of both quantitative and qualitative data within a traditional quantitative research design or qualitative research design” (Creswell & Clark, 2007, p. 90). Embedded design is employed to compare data sources, assess different research questions, gain broader perspective on research issues, explore concepts prior to quantitative study, or explain quantitative findings (Creswell, 2009; Creswell & Clark, 2007). Embedded design is used when there are limited resources to place equal priority on both types of data, the researcher lack knowledge of the supplemental method, or the researcher is satisfied with the research being driven by either a qualitative orquantitative orientation (Creswell & Clark, 2007).

Explanatory on the other hand, is a technique in which the researcher starts with quantitative design in the first phase and use qualitative design in the second phase to explain the quantitative findings in a more detailed way (Creswell, 2009). According to Creswell and Clark (2007), explanatory design is used when the researcher is interested in investigationof trends and relationships with quantitative data and wants to explain the reason behind the outcome, the researcher and the research problem are quantitatively oriented, or the researcher knows the variables of interest and can get the quantitative instrument to measure the variables. Finally, exploratory design begins with qualitative phase and uses the findings to develop or validate an instrument that will be used in the quantitative or second phase (Creswell & Clark, 2007; Punch, 2009). Exploratory design is used to generalize qualitative findings in the first phase with data from larger sample collected in the second phase. This design is useful when the researcher and the research problem are more qualitative oriented, the researcher does not know the required constructs and cannot find relevant quantitative instruments, the researcher has limited resources, or the researcher identifies new research questions in the first phase that cannot be answered with qualitative data (Creswell & Clark, 2007). The three types of research design (quantitative, qualitative, and mixed method) are compared in Table 5.1.

Table 5-1 Comparison of quantitative, qualitative, and mixed method research

	Quantitative Research	Mixed Research	Qualitative Research
Scientific Method	Confirmatory or "top-down" The researcher *tests* hypotheses and theory with data	Confirmatory and exploratory	Exploratory or "bottom-up"
Ontology (i.e., nature of reality/truth)	Objective, material, structural, agreed-upon	Pluralism; appreciation of objective, subjective, and intersubjective reality and their interrelations	Subjective, mental, personal, and constructed
Epistemology (i.e., theory of knowledge)	Scientific realism; search for Truth; justification by empirical confirmation of hypotheses; universal scientific standards	Dialectical pragmatism; pragmatic justification (what works for whom in specific contexts); mixture of universal (e.g., *always* be ethical) and community-specific needs-based standards	Relativism; individual and group justification; varying standards
View of human thought and behaviour	Regular and predictable	Dynamic, complex, and partially predictable Multiple influences include environment/ nurture, biology/nature, freewill/agency, and chance/fortuity.	Situational, social, contextual, personal, and unpredictable
Most common research objectives	Quantitative/ numerical description, causal explanation, and prediction	Multiple objectives; provide complex and fuller explanation and understanding; understand multiple perspectives	Qualitative/subjective description, empathetic understanding, and exploration

	Quantitative Research	Mixed Research	Qualitative Research
Interest	Identify general scientific laws; inform national policy.	Connect theory and practice; understand multiple causation, nomothetic (i.e., general) causation, and idiographic (i.e., particular, individual) causation; connect national and local interests and policy.	Understand and appreciate particular groups and individuals; inform local policy.
“Focus”	Narrow-angle lens, testing specific hypotheses	Multilens focus	Wide-angle and “deep-angle” lens, examining the breadth and depth of phenomena to learn more about them
Nature of observation	Study behaviour under controlled conditions; isolate the causal effect of single variables	Study multiple contexts, perspectives, or conditions; study multiple factors as they operate together.	Study groups and individuals in natural settings; attempt to understand insiders’ views, meanings, and perspectives.
Form of data collected	Collect quantitative data based on precise measurement using structured and validated data-collection instruments.	Collect multiple kinds of data	Collect qualitative data such as in-depth interviews, participant observation, field notes, and open-ended questions. The researcher is the primary data collection instrument.
Nature of data	Variables	Mixture of variables, words, categories, and images	Words, images, categories
Data analysis	Identify statistical relationships among variables.	Quantitative and qualitative analysis used separately and in combination.	Use descriptive data; search for patterns, themes, and holistic features; and appreciate difference/variation.
Results	Generalizable findings providing representation of objective outsider viewpoint of populations	Provision of “subjective insider” and “objective outsider” viewpoints; presentation and integration of multiple dimensions and perspectives	Particularistic findings; provision of insider viewpoints
Form of final report	Formal statistical report (e.g., with correlations, comparisons of means, and reporting of statistical significance of findings)	Mixture of numbers and narrative	Informal narrative report with contextual description and direct quotations from research participants

Source: Johnson and Christensen (2008, pp. 34-35)

5.5 Research Strategies

The next stage after researcher selects an approach is to choose the method or strategy within the approach that will guide him/her on how to conduct the research (Creswell, 2009). Research strategies or strategies of inquiry are “types of qualitative, quantitative, and mixed methods designs or models that provide specific direction for procedures in a research design” (Creswell, 2009, p. 7). However, selecting research strategy is typically directed by research questions and aims (Saunders et al., 2009). The three research strategies (quantitative, qualitative, and mixed methods) are described as follows.

5.5.1 Quantitative Strategies

Quantitative strategies are techniques for collecting quantitative data which deals with numbers and anything that can be measured. Generally, quantitative strategies adopt positivist philosophy (Creswell, 2009). The popular ones which are survey and experiment are explained as follows.

5.5.1.1 Survey

Survey research “provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population. It includes cross-sectional and longitudinal studies using questionnaires or structured interviews for data collection, with the intent of generalizing from a sample to a population” (Creswell, 2009, p. 8). This strategy is usually linked to quantitative approach, even though it may be used in qualitative research (Saunders et al., 2009). It is often used to answer questions of the form: “who, what, where, how much and how many” (Saunders et al., 2009, p. 144). This method is widely used because it allows a researcher to inexpensively collect large data from a sample of a population (Saunders et al., 2009). Questionnaire is a data collection technique that is mostly used in quantitative research (Macionis, 2012). Other techniques include structured observations and structured interviews (Saunders et al., 2009). Using any of these techniques in a survey, data collected in a cross-sectional or longitudinal study can be generalized to a population. Survey data is considered “standardized”, which makes it easy for comparison as well as comprehension (Saunders et al., 2009). Using sampling, the data collected from the representative of the population is analysed using descriptive and inferential statistics. Computer software can be used during the analysis to establish and test relationships between variables (Creswell, 2009).

5.5.1.2 Experiment

Experimental research "seeks to determine if a specific treatment influences an outcome" (Creswell, 2009, p. 8). The aim of experimental research is to investigate causal relationships, by observing if one independent variable resultsin change in a dependant variable (Saunders et al., 2009). Although experimental research is associated with natural sciences, it is also applied in social science field (Saunders et al., 2009). According to Saunders et al. (2009), experiments can be simple or complex depending on the level of investigation intended to carry out. In a simple experiment, only relationship between two variables will be investigated, while in complex experiment the inquiry can go further than simple experiment to the extent that the researcher is interested in the degree or magnitude of the change and the weight of the contributing variables (Saunders et al., 2009). In a typical experimental research, participants or objects are randomly assigned to one of two groups (control and experimental groups). Intervention will be given to the experimental group and the control group will be denied. Both groups will be compared later in order to discover if there is change (Saunders et al., 2009). Experimental strategies are criticized for lack of external validity which may affect the generalization of the findings as a result of the size of the sample (Saunders et al., 2009). Additionally, experimental research is not employable for some studies such as business and management researches (Saunders et al., 2009).

5.5.2 Qualitative Strategies

Qualitative strategies are developed to overcome the difficulties in using quantitative methods to study human behaviour in relation to social environments (Snape & Spencer, 2003). Various qualitative strategies exist to describe social phenomena in the actual natural setting (Creswell, 2009). They include case study, grounded theory, ethnography, narrative research, and action research (Creswell, 2009). Researchers usually collect qualitative data using techniques such as interview, focus group, and observations (Bryman, 2004; Creswell, 2011; Snape & Spencer, 2003). The following subsections explain the qualitative strategies.

5.5.2.1 Case Study

Creswell (2009, p. 9) defined case study as “a strategy of inquiry in which the researcher explores in depth a program, event, activity, process, or one or more individuals. Cases are bounded by time and activity, and researchers collect detailed information using a variety of data collection procedures over a sustained period of time”. The researcher can use various techniques such as interviews, observations, or questionnaires to collect data from the subjects. So, the concept of triangulation may be applied in case study research (Saunders et al., 2009).

5.5.2.2 Grounded Theory

Grounded theory is “a strategy of inquiry in which the researcher derives a general, abstract theory of a process, action, or interaction grounded in the views of participants” (Creswell, 2009, p. 9). In this case, the researcher starts with collecting qualitative data, which will be refined/analysed and in some situations re-collected before being labelled it with codes which will later be grouped into categories. The researcher builds a theory from these categories (Creswell, 2009; Saunders et al., 2009). In grounded theory, data is collected until there is no emergence of new data that can add to the theory development (Spencer, Ritchie, & O'Connor, 2003).

5.5.2.3 Ethnography

Ethnography is carried out with the purpose of “understanding the social world of people being studied through immersion in their community to produce detailed description of people, their culture and beliefs” (Snape & Spencer, 2003, p. 12). Ethnography reports manifest the lives of the cultural group based on the researcher’s experience and other data sources. The task before the researcher is to find group that will enable him/her achieve the aim of the research and deal with challenges related to being a member of the group (Saunders et al., 2009).

5.5.2.4 Narrative Research

In this strategy, the researcher investigates lives of individuals based on their stories narrated by one or more individuals. The researcher reports narrative research by retelling the story in a narrative sequence of events including the researcher's experience (Creswell, 2009). Narrative is defined as "an account of an experience that is told in a sequenced way, indicating a flow of related events that, taken together, are significant for the narrator and which convey meaning to the researcher" (Saunders et al., 2009, p. 497). Narrative research put more emphasis on how the story or narrative is constructed, intention of the narrator, nature of the audience, and meaning of the story (Spencer et al., 2003).

5.5.2.5 Action Research

Action research is "a research design which entails a particular framework within which the relationship between researcher and subject takes place" (Bryman, 2005, p. 149). The researcher in this strategy works in collaboration with the participants to solve problem in a particular organization. Action research is conducted with the aim of improvement and involvement. Involvement "refers to the participation of practitioners in all phases of planning, acting, observing, and reflecting" (Schwandt, 2007, p. 4), while improvement is "a matter of changing the situation in which a particular social practice takes place, enhancing the understanding that practitioners have of their practice or their capacity to control it, remaking the practice itself, or all of these" (Schwandt, 2007, p. 4).

5.5.3 Mixed Method Strategies

The idea of mixed method strategies is combining qualitative strategies such as interviews and observations (qualitative data) with quantitative strategies like survey (quantitative data) (Creswell, 2009). There are various procedures for mixing qualitative and quantitative methods in mixed method strategy, which include sequential, concurrent, and transformative mixed methods (Creswell, 2009).

5.5.3.1 Sequential Mixed Methods

In this method, the researcher seeks to explain the findings of one method in detail with another method. For instance, the researcher may begin with qualitative interview for exploratory aims and follow it up with a quantitative questionnaire method using a large sample in order to generalize findings to a population. On the other hand, the researcher may begin with a quantitative method to test hypotheses or theory and follow it up with a qualitative method to explore the results in detail with few cases (Creswell, 2009).

5.5.3.2 Concurrent Mixed Methods

Concurrent design involves procedures for merging qualitative and quantitative data to present a complete analysis of the study problem. Both the qualitative and quantitative data in this design are collected at the same time and the information is integrated during interpretation. In addition, the researcher may embed one data collection method within another to assess different types of questions (e.g. analyse process using qualitative data and analyse the outcome with quantitative data) (Creswell, 2009).

5.5.3.3 Transformative Mixed Methods

In transformative method, the researcher uses theoretical lens (e.g., race, gender, and social science theory) as the main perspective in a study that has both qualitative and quantitative data. This lens gives a framework for areas of interest, data collection methods, and outcomes expected in the study. There may be data collection methods that include a sequential or a concurrent approach within this lens (Creswell, 2009).

5.6 Research Design for this Study

Choosing an appropriate research design method is vital as it determines how the research data will be collected and analysed (Creswell, 2009). Each method has its own merits and demerits, but the researcher selects a suitable method based on the research problem, objectives and questions (Creswell, 2009). This study adopts convergent design which involves collecting and analysing both quantitative and qualitative data concurrently. In terms of mixing both quantitative and qualitative studies, concurrent mixed method design was utilized. The study starts with collection of the quantitative data followed by the qualitative data in the same phase, and later analyse the quantitative and qualitative data in the second phase (Creswell & Clark, 2007). The results are combined during interpretation. This will allow the researcher to derive the benefits of mixing both studies as highlighted by Bryman (2006) and Creswell (2009). Some of the benefits include better understanding of the problem, complementing weakness of one method with strength of the other, and comparing both quantitative and qualitative findings.

The research problem of this study guides the selection of the research design. This study adapted TAM3 as the theoretical model to examine cloud computing applications adoption by students in Saudi Arabian higher education institutions. The modified TAM3 model will be assessed using quantitative method. However, the research problem needs to be investigated in greater depth since there is no study that has been conducted in Saudi Arabia to examine the factors influencing the adoption of cloud computing applications by university students. Hence, the exploratory nature of the qualitative research design when combined with quantitative research design will enable the researcher to understand the problem better,leading to better findingsthat can be generalized. Based on that, quantitative method is used to assess and identify factors that affect cloud computing applications adoption by students in Saudi Arabian higher education institutions. In addition, qualitative method is later used to investigate and validate the quantitative findings.

Moreover, questionnaire survey is adopted as the quantitative data collection technique since it is considered the most appropriate quantitative method to achieve the study aims and answer research questions, while for qualitative data collection, focus group and open-ended question techniques are chosen to validate the quantitative findings, as well as to identify additional factors and barriers that are not covered in the research model respectively.

5.7 Study Setting

To ensure that the sample is the actual representation of the whole population of Saudi Arabian undergraduate students, the sample is selected from two largest universities in Saudi Arabia. The universities are King Abdulaziz University (KAU) and Taibah University (TU). KAU is located in Jeddah, Western part of Saudi Arabia,while TU is situated in Madinah, the North Western part of Saudi Arabia. These two universities are randomly selected from 38 Saudi government universities. The reasons behind the choice of these universities are as follows. First, covering the whole population of the undergraduate students is difficult because of time and resources limitations. Second, these universities are located in large cities in Saudi Arabia that contain high proportion of student population with diverse culture from these two cities and other Saudi Arabian cities as well. Third, the selected universities have a long history and have research and IT centers that provide latest technologies innovation to students and lecturers for learning and research purpose. Fourth, the total number of registered undergraduate students in these two universities at the time of conducting this study (2014/2015 academic year) were 278,532, as obtained by the researcher from Deanship of Admission and Registration of the both universities. In this study all the undergraduate students studying in the targeted universities in the 2014/2015 academic year are considered as the target population.

5.8 Population and Sample

Population is the total number of items or group of items from which information is required (Kothari, 2004). A population is a “complete set of cases or group members” (Saunders et al., 2009, p. 597). In this situation, the target population is undergraduate students from Saudi Arabian institutions. The need for sampling arise because the population is very large and it will be impractical to consider the entire population (Saunders et al., 2009). Also, surveying the entire population requires budget and time (Saunders et al., 2009). This is in fact why sampling is needed

(Saunders et al., 2009). Sampling is therefore defined as “the process of selection of sampling units from the population to estimate population parameters in such a way that the sample truly represents the population” (K. Singh, 2007, p. 89). Selecting most appropriate sampling technique and deciding on a suitable sample size are important stages in sampling process (Saunders et al., 2007). These are explained in the following subsections.

5.8.1 Sampling Techniques

Sampling techniques are the processes of selecting a sample (Kothari, 2004). Sampling techniques “provide a range of methods that enable you to reduce the amount of data you need to collect by considering only data from a subgroup rather than all possible cases or elements” (Saunders et al., 2007, p. 204). There are two main categories of sampling techniques. They are probability and non-probability sampling techniques (Saunders et al., 2009). In probability sampling each case has the same chance of being selected from the population (Saunders et al., 2009). Probability sampling is further classified into simple random, systematic, stratified random, and cluster samplings (Saunders et al., 2009). In simple random sampling, the sample is selected at random from the sampling frame (Saunders et al., 2009). Systematic sampling concerns with selecting a sample from the sampling frame at regular interval (Saunders et al., 2009). Stratified random sampling involves splitting the population into two or more strata according to some attributes (Saunders et al., 2009). Cluster sampling involves grouping the population into clusters before sampling (Saunders et al., 2009). The difference between stratified and cluster sampling is that in stratified sampling items are selected from each stratum,whereas in cluster sampling, the group or cluster is chosen rather than individual items as a representative of the population (Saunders et al., 2009).

Non-probability sampling concerns with sampling in which the chance of selecting each case is not known. Quota, purposive, snowball, self-selection, and convenience are the techniques linked to non-probability sampling (Saunders et al., 2009). Quota sampling involves dividing the population into groups and selecting the sample based on the suitability and availability of the data (Saunders et al., 2009). In the purposive sampling, researchers use their judgements to select criteria that they think will help them choose who will answer their research questions and to achieve their objectives

(Saunders et al., 2009, p. 237). Snowball sampling is chosen by the researchers when they found it is difficult for them to get access to the target population. In snowball sampling, the researchers will find a case which will lead to another case in the population (Saunders et al., 2009). Self-selection sampling allows cases to decide to take part in the study or not (Saunders et al., 2009). Finally, convenience sampling involves selecting cases that are easy to access (Saunders et al., 2009).

Selecting appropriate sampling technique will make it possible to generalize findings from the sample to the whole population (Kothari, 2004). In this study, we are interested in generalizing the findings to the entire population of Saudi Arabian undergraduate students, so choosing a sample that truly represent the population is required as recommended by Kothari (2004). In other word, a sample that gives insignificant sampling error is required (Kothari, 2004). Generally, the larger the sample size the smaller the sampling error (Kothari, 2004). Hence, Kothari (2004, p. 58) suggested that “while selecting a sampling procedure, researcher must ensure that the procedure causes a relatively small sampling error and helps to control the systematic bias in a better way”.

This study considers probability sampling techniques due to its inherent benefits such as saving cost and time, and accuracy (Neuman, 2007). Kothari (2004) claimed that random sampling is the best technique for choosing a sample from population. Therefore, stratified cluster sampling technique was specifically employed in the quantitative study. One of the advantages of stratified random sampling is that, since the population was divided into strata the sample is “more likely to be representative” because the researcher can guarantee relative representation of each strata in the sample (Saunders et al., 2009). Likewise, the primary advantage of cluster sampling is employed when the researcher is unable to generate the lists of cases that form the population (Creswell, 2009). Thus, the selected sampling technique which is stratified cluster sampling combines the advantages of both stratified and cluster samplings.

The sample size was divided into two by the researcher so that half of the sample can be drawn from each of the two universities. The population in each university was firstly stratified using gender as major stratification variable (Saunders et al., 2009). The population was initially stratified into separate gender. The two strata (male and female) were further stratified by variable of interest which is students’ major (Arts and Sciences). Each final stratum represents students' major as either Arts or Sciences. The essence of this stratification was to group the population into homogeneous subgroups for improved representation of the elements of each subgroup (Saunders et al., 2009). In the second stage, clusters were randomly selected from each homogeneous subgroup (stratum). The clusters were the different sections in these universities since students were randomly assigned to different sections by the university management. The entire students from the randomly selected sections were invited to participate in this research by taking part in the practical sessions in the computer lab. Then the questionnaires were distributed to the students after completing the designed tasks. The aims of carrying out the practical sessions in this study are as follows. First, to introduce and demonstrate an example of cloud computing applications, specifically Google Docs since some students may not have prior experience with this cloud application used in this study. Second, to ask the participants to perform simple tasks using cloud based word processing applicationdesigned by the researcher to familiarize the participants with the cloud application and to enable them to answer the questionnaire more efficiently.

In the qualitative study, we used a combination of self-selection and purposive sampling techniques. In the first stage, we used self-selection technique and the participants were chosen by requesting their voluntary participation after completing the questionnaire survey. Interested students provided their contact details so that they can be reached to organize the focus groups. Self-selection technique reduces the time taken by researchers to select the appropriate cases, and also it increases commitment from the participants to participate in this study since they voluntarily decide to participate (Laerd Dissertation, 2012). The researcher later selected participants using purposive sampling to make sure the cases had some specific demographic characteristics that can allow them to respondto the research questions better and also allow the emergence of more issues related to the topic under study in order to give more insight into the situation (Cohen, Manion, & Morrison, 2007; Saunders et al., 2009).

5.8.2 Sample Size

Sample size is "the actual number of subjects chosen as a sample to represent the population characteristics" (Sekaran, 2003, p. 423). The sample is expected to be large especially in probability sampling (Saunders et al., 2009) and the size determines the researchers confidence in the data (Saunders et al., 2009). If the sample size is large then the possibility of having error in generalization is less (Saunders et al., 2009). The sample size was obtained based on suggestions from Kothari (2004), who recommended an optimum size sample selected based on factors such as the nature of study, type of sampling, availability of finance, size of the population, availability of trained investigators, and available time. In our case, the items (students) were selected in proportion to the size of each stratum (Saunders et al., 2009). Joseph F. Hair, Black, Babin, and Anderson (2010) provided a guideline for determining sample size. They suggested that a sample size of 100 or higher is required to conduct factor analysis. Additionally, it is recommended that a minimum of 500 sample size is required for models with more than seven constructs (Joseph F. Hair et al., 2010). Hence, 600 was chosen as our sample size.

5.9 Data Collection Methods

There are different data collection techniques such as survey questionnaire, interview, focus group, and observation (Bryman, 2004; Creswell, 2011; Kelly, Clark, Brown, & Sitzia, 2003; Macionis, 2012; Saunders et al., 2009; Sekaran, 2003); however, the purpose of the study guides the selection of the appropriate technique (Saunders et al., 2009). Moreover, Punch (2009, p. 290) emphasized that “qualitative methods can be strong in those areas where quantitative methods are weak, and similarly that quantitative methods can be strong in those areas where qualitative methods are weak. Combining the two methods therefore offers the possibility of combining these two sets of strengths, and compensating for the weaknesses”. Thus, we used three different techniques to collect data in this study. They are questionnaire survey, focus group, and open-ended question. These techniques were used in the quantitative and qualitative designs to collect the research data. These three data collection techniques are explained in detail in the following subsections.

5.9.1 Quantitative Data Collection

In quantitative phase, the data were collected using questionnaire. According to Sekaran (2003, p. 236), a questionnaire is “a pre-formulated written set of questions to which respondents record their answers, usually within rather closely defined alternatives". Questionnaire is one of the efficient and inexpensive data collection instrument that is easy to administer (Kelly et al., 2003; Sekaran, 2003). It can be administered personally, through mail, or electronically (Sekaran, 2003). Questionnaires are used when the researcher knows precisely what is needed, knowshow to assess the factors of interest, and requires large samples for more dependable and reliable findings (Kothari, 2004; Sekaran, 2003). The following subsections discuss the questionnaire design, questionnaire translation process, pre-testing and pilot study of the questionnaire, as well as questionnaire administration.

5.9.1.1 Questionnaire Design

Questionnaire is the commonly used data collection instrument in quantitative studies. Questionnaire design influences the response rate of the survey and will have an effect on the reliability and validity of the collected data (Saunders et al., 2009). Therefore, careful design of the questions, clear and beautiful layout, simple and clear explanation of the questionnaire purpose, pilot testing, good plan and administration of the questionnaire will improve the response rate as well as the reliability and validity of the collected data (Saunders et al., 2009).

However, Sekaran (2003) suggested three issues that the researcher should focus on during questionnaire design. The first issue is the questionnaire wording which concerns the approach of asking questions. The wording is guided by the appropriateness of the content, words and language used in the questions, type and form of the questions, sequence of the questions, and respondents' personal data. In this study, the researcher considered the purpose of each question and used simple terms that will be easy to understand by the participants. Closed-ended questionswere used in the questionnaire because they take less time to complete and analyse (Sekaran, 2003). In addition, open-ended question was added at the end of the questionnaire to identify additional factors not covered in this study. The researcher also avoided double barrelled, ambiguous, and long questions as recommended by Sekaran (2003). The second issue involves planning the appropriate measurement. In this respect, nominal and ordinal scales were used to label the variables(Sekaran, 2003). The ordinal scales were rated using 5-point Likert scale starting from 1 (strongly disagree) to 5 (strongly agree) (Johns, 2010). A5-point Likert scale was chosen because it is easier for the participants to read the items and complete the questionnaire and it is one of the most commonly used scale in cloud computing studies adoption (Alsanea & Barth, 2014; Behrend et al., 2011; P. Gupta et al., 2013). Finally, the third issue is concerned with appearance, that is how the questionnaire looks like, including alignment and well-organized instructions (Sekaran, 2003). In our study, the questions were organized neatly and logically with instructions on how to answer the questions.

In this study, the questionnaire was developed in English (see Appendix A), but the questionnaire had to be translated to Arabic language (see Appendix B) since Arabic is the official language in Saudi Arabia and most students do not speak English. The main content of the questionnaire was divided into three sections. It started with a brief explanation of cloud computing technology since cloud computing is a rather new concept for students in Saudi Arabia. Another rationale for the explanation is that cloud computing applications developed for academic purposes were not known or used by university students and academics in Saudi Arabia. Section one contains questions related to general information of the respondent. The questions cover the demographic information such as the university, gender, age, year of study, and major. Additionally, questions related to computer and Internet experience are also included. Section two comprises questions that examine the factors that affect the adoption of the cloud computing applications. In the beginning of this section, the respondents are given an example of how to answer Likert scale questions related to the research factors before they start responding to the questions in the questionnaire, which is to make it easy for the respondents to answer the questions appropriately. The questions in this section are based on the factors of the proposed TAM3 based model. The factors are perceived usefulness, trust, perceived ease of use, job relevance, result demonstrability, output quality, anxiety, playfulness, self-efficacy, perceptions of external control, subjective norm, image, perceived enjoyment, and behavioural intention. The factors are measured by using items validated in the prior studies. The items/questions are measured using 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree). The factors with their respective items as well as sources are presented in Table 5.2. The questions in each factor in the research model are grouped together in line with other researches. This is supported by Davis and Venkatesh (1996) who suggested that similar items should be grouped together in order to get higher reliability and validity of a model.

Section three containsan open-ended question, which was added at the end of the questionnaire. This enables the researcher to explore and discover other factors that are not covered in the proposed model. This type of questions provides “more diversified set of answers” (Reja, Manfreda, Hlebec, & Vehovar, 2003, p. 167). The open-ended question gives the participants the opportunity to express their opinions on factors influencing their intention to use cloud computing applications openly without any restrictions (Creswell, 2009). Finally, respondents were invited to take part in focus group at the end of this section. The interested respondents were invited to contact the researcher through his phone number or email he provided in the questionnaire, or they can give their contact number to researcher at which they can be reached. Respondents were appreciated for their participation.

Table 5-2 Model constructs with their items and sources

Construct	Item code	Items	Source
Perceived Usefulness (PU)	PU1	Using Google Docs in my study would enable me to accomplish learning tasks more quickly.	Davis (1989), Davis et al. (1989), and Venkatesh and Bala (2008)
	PU2	Using Google Docs would improve my performance in my study.	
	PU3	Using Google Docs in my study would increase my productivity.	
	PU4	Using Google Docs would enhance my effectiveness in my study.	
	PU5	Using Google Docs would make it easier to do my learning tasks.	
	PU6	I would find Google Docs useful in my study.	
Perceived Ease of Use (PEOU)	PEOU1	Learning to use Google Docs would be easy for me.	Davis (1989), Davis et al. (1989), and Venkatesh and Bala (2008)
	PEOU2	I would find it easy to get Google Docs to do what I want it to do.	
	PEOU3	My interaction with Google Docs would be clear and understandable.	
	PEOU4	I would find Google Docs to be flexible to interact with.	
	PEOU5	It would be easy for me to become skillful at using Google Docs.	
	PEOU6	I would find Google Docs easy to use.	
Behavioural Intention (BI)	BI1	Assuming I had access to Google Docs, I intend to use it.	Davis (1989), and Venkatesh and Bala (2008)
	BI2	Given that I had access to Google Docs, I predict that I would use it.	
	BI3	I plan to use Google Docs in the future.	

Construct	Item code	Items	Source
Self-Efficacy (SE)	I could complete the task using Google Docs…		Compeau and Higgins (1995)
	SE1	….If there was no one around to tell me what to do.	
	SE2	….If I had a lot of time to complete the task.	
	SE3	….If I had just the built-in help facility for assistance.	
	SE4	….If someone showed me how to do it first.	
	SE5	….If I had used similar systems before this one to do the same task.	
Perceptions of External Control (PEC)	PEC1	I would have control over using Google Docs (e.g., editing, sharing documents with others, etc.)	Mathieson (1991), S. Taylor and P. A. Todd (1995), Venkatesh and Bala (2008), and Venkatesh (2000)
	PEC2	I would have the resources necessary (e.g., computer, Internet, etc.) to use Google Docs.	
	PEC3	I would have the knowledge necessary to use Google Docs.	
	PEC4	Given the resources, opportunities and knowledge it takes to use Google Docs, it would be easy for me to use Google Docs.	
	PEC5	Google Docs would be compatible with other software that I use (e.g., Microsoft office).	
Playfulness (PLAY)	The following questions ask you how you would characterize yourself when you use Google Docs:		Webster and Martocchio (1992), and Venkatesh and Bala (2008)
	PLAY1	…spontaneous	
	PLAY2	…creative	
	PLAY3	…playful	
	PLAY4	…original	
Anxiety (ANX)	ANX1	I would feel apprehensive about using Google Docs.	Heinssen, Glass, and Knight (1987), and Venkatesh et al. (2003)
	ANX2	It would scare me to think that I could lose a lot of information using Google Docs by hitting the wrong key.	
	ANX3	I would hesitate to use Google Docs for fear of making mistakes that I cannot correct.	
	ANX4	Google Docs would be somewhat intimidating to me.	
Perceived Enjoyment (ENJ)	ENJ1	I would find using Google Docs to be enjoyable.	Davis et al. (1992), and Venkatesh and Bala (2008)
	ENJ2	The actual process of using Google Docs would be pleasant.	
	ENJ3	I would have fun using Google Docs.	
Subjective Norm (SN)	SN1	People (teachers/ friends) who influence my behaviour would think that I should use Google Docs.	S. Taylor and P. A. Todd (1995), Mathieson (1991), and Venkatesh and Bala (2008)
	SN2	People who are important to me would think that I should use Google Docs.	
	SN3	People whose opinions I value would prefer me to use Google Docs.	
Image (IMG)	IMG1	People (teachers/ friends) in my university who use Google Docs would have more prestige than those who do not.	Moore and Benbasat (1991), and Venkatesh and Bala (2008)
	IMG2	People in my university who use Google Docs would have a high profile.	
	IMG3	Having Google Docs would be a status symbol in my university.	

Construct	Item code	Items	Source
Job Relevance (REL)	REL1	In my study, usage of Google Docs would be important.	Davis et al. (1992), and Venkatesh and Bala (2008)
Job Relevance (REL)	REL2	In my study, usage of Google Docs would be relevant.	Davis et al. (1992), and Venkatesh and Bala (2008)
Job Relevance (REL)	REL3	The use of Google Docs would be pertinent to my various study-related tasks.	Davis et al. (1992), and Venkatesh and Bala (2008)
Output Quality (OUT)	OUT1	The quality of the output (e.g., the created documents) that I would get from using Google Docs would be high.	Davis et al. (1992), and Venkatesh and Bala (2008)
Output Quality (OUT)	OUT2	I would have no problem with the quality of Google Docs' output.	Davis et al. (1992), and Venkatesh and Bala (2008)
Output Quality (OUT)	OUT3	I would rate the results from Google Docs as excellent.	Davis et al. (1992), and Venkatesh and Bala (2008)
Result Demonstrability (RES)	RES1	I would have no difficulty telling others about the results of using Google Docs.	Moore and Benbasat (1991), and Venkatesh and Bala (2008)
Result Demonstrability (RES)	RES2	I believe I could communicate to others the consequences of using Google Docs.	Moore and Benbasat (1991), and Venkatesh and Bala (2008)
Result Demonstrability (RES)	RES3	The results of using Google Docs would be apparent to me.	Moore and Benbasat (1991), and Venkatesh and Bala (2008)
Result Demonstrability (RES)	RES4	I would have no difficulty explaining why using Google Docs may or may not be beneficial.	Moore and Benbasat (1991), and Venkatesh and Bala (2008)
Trust (TR)	TR1	Using Google Docs would be secure.	P. A. Pavlou (2003), and Pikkarainen, Pikkarainen, Karjaluoto, and Pahnila (2004)
Trust (TR)	TR2	I trust the ability of Google (the provider of cloud applications) that would protect my privacy.	P. A. Pavlou (2003), and Pikkarainen, Pikkarainen, Karjaluoto, and Pahnila (2004)
Trust (TR)	TR3	Google (the provider of cloud applications) would be trustworthy.	P. A. Pavlou (2003), and Pikkarainen, Pikkarainen, Karjaluoto, and Pahnila (2004)
Trust (TR)	TR4	Google (the provider of cloud applications) would keep its promises and commitments (e.g., cloud services availability).	P. A. Pavlou (2003), and Pikkarainen, Pikkarainen, Karjaluoto, and Pahnila (2004)
Trust (TR)	TR5	I trust that Google (the provider of cloud applications) would keep my best interests in mind.	P. A. Pavlou (2003), and Pikkarainen, Pikkarainen, Karjaluoto, and Pahnila (2004)

In this study, we used cloud computing application namely Google Docs which is considered as "a learning tool which helps to implement the learner-centered approach in a collaborative learning environment" (Suwantarathip & Wichadee, 2014, p. 149). Google Docs was chosen because it has been used in studies that investigated the adoption of cloud computing applications especially in academic settings by students and the studies reported positive attitudes of intended users toward adoption of the technology (Irshad & Johar, 2015; Ishtaiwa & Aburezeq, 2015; Li & Chang, 2012; X. Tan & Kim, 2011). It is also one of the popular free online tools used for collaboration, storing and sharing of files. It only requires users to have a Google account in order to use it, which is a very simple process (Irshad & Johar, 2015; Polites & Karahanna, 2011).

Furthermore, the researcher designed a practical session tasks guide (see Appendix C and D for English and Arabic versions respectively) to familiarize the students with the cloud application that was used in this study and also to enable them to answer the questionnaire more efficiently. The practical session tasks guide contains two sections as follows. In the first section, a brief introduction is presented in the first page of the task paper, which includes explanation about the aim of the practical session. In the second section, the participants are asked to perform a series of tasks related to Google Docs usage. The researcher designed 11 tasks such that they will take respondents about 40 minutes to complete. The aim of this exercise is to enable the participants to have experience with the cloud application in order to enable them to answer the questions of the questionnaire properly.

In addition, letter of introduction (see Appendix E and F for English and Arabic versions correspondingly), information sheet (see Appendix G and H for English and Arabic versions correspondingly), and consent form (see Appendix I and J for English and Arabic versions correspondingly) were provided to students. The letter of introduction and information sheet provided a background information about the study, purpose of the study, and an invitation to participate in the study by taking part in a practical session and completing a questionnaire, as well as participation in the focus group. Likewise, the letter of introduction and information sheet provided the estimated time it would take to participate in the practical session and the expected time to complete the questionnaire. Confidentiality assurance as well as the researcher and the supervisor details of contact were provided, so that the participants can enquire or obtain the outcomes of the research, if they wish. Finally, the letter of introduction and information sheet concluded with thankful message to the respondents. The consent form contains statements that give assurance to the respondents on the confidentiality of their data and also explain to them that their participation is based on voluntariness and they can withdraw any time they wish without any consequences. The respondents were required to sign the consent form as a sign of their agreement with the statements as well as their participation in the study.

5.9.1.2 Questionnaire Translation

The questionnaire was translated from English to Arabic in order to make it clear and easily understandable by the respondents as suggested by Sekaran (2003). Similarly, Sekaran (2003) emphasized the need for a researcher to ensure that the questionnaire in the original language matches accurately with the translated version. The questionnaire in the format described in the previous section was translated into Arabic by the researcher and then presented to language experts. The role of the language experts was to check the clarity of the instrument, the translation, and compare the two versions to ensure the accuracy of the translated Arabic version with the original English version of the instrument. Consequently, the following steps were followed during the translation process in this study. First, the researcher translated the original English version of the questionnaire into Arabic. Second, the two versions (Arabic and English) were reviewed by two professors (bilingual experts in English and Arabic) working in English department of the King Abdulaziz university, Saudi Arabia. They reviewed the versions in terms of the accuracy of translation, clarity and simplicity of the instrument, and wording; and based on their suggestions the Arabic version was updated. Third, the Arabic version was then reviewed by a teacher specialist in Arabic language, working in Ministry of Education in Saudi Arabia, to check the grammar, wording, clarity issues and simplicity of the questionnaire. The researcher then updated the Arabic version based on her useful comments and feedback obtained from this step. Fourth, the updated Arabic version and English version were then reviewed by a professor (bilingual expert in English and Arabic) also working in English department of the King Abdulaziz university, Saudi Arabia. Consequently, the two versions were finally compared and found both versions identical. This validated the translation process as well as the quality of the Arabic version of the questionnaire.

5.9.1.3 Pre-Testing and Pilot Study

Pre-testing a questionnaire and pilot study are highly recommended practices in a study that employ survey questionnaire to make sure that the respondents understood the questionnaire items (Kothari, 2004). Pre-testing “involves the use of a small number of respondents to test the appropriateness of the questions and their comprehension” (Sekaran, 2003, p. 249). On the other hand, validity is referred to as “the extent to which data collection method or methods accurately measure what they were intended to measure” (Saunders et al., 2007, p. 614). Content validity is among the categories of validity. Content validity “refers to the extent to which the measurement device, in our case the measurement questions in the questionnaire, provides adequate coverage of the investigative questions” (Saunders et al., 2007, p. 366). Face validity is usually considered as “a basic and a very minimum index of content validity” (Sekaran, 2003, p. 206). Face validity refers to an “agreement that a question, scale, or measure appears logically to reflect accurately what it was intended to measure” (Saunders et al., 2007, p. 598).

The items were pre-tested by experts in the research field and questionnaire design, PhD students, and students from the target population. The wisdom of including experts was to carry out content and face validity, and also to check for possible linguistic and technical errors (Kothari, 2004; Saunders et al., 2009). Likewise, the students were involved because the questionnaire will be administered to students, so they can identify issues related to layout, clarity, and ambiguity of the questions and the questionnaire in general (Saunders et al., 2009; Sekaran, 2003).

Furthermore, the questionnaire was evaluated by experts and sample participants in order to evaluate the validity (face and content) of the questionnaire (Creswell, 2009; Saunders et al., 2009; Sekaran, 2003). This was conducted during the questionnaire pre-testing stage with 4 experts in research field, 2 academic staff from student learning centre at Flinders University who have experience in questionnaire design,3 academic staff working in mathematics department of King Abdulaziz University who have experience in statistics and questionnaire design, and 7 researchers (PhD students) who have extensive knowledge of e-Learning, and e-applications. The experts and participants recommended some changes related to wording, changing of the order of some questions, and layout of the questionnaire. The questionnaire was modified based on suggestions from the pre-test participants. After that, two pilot studies were conducted to asses and improve the questionnaire reliability and validity, and also to make sure that the questionnaire is clear and understandable by students (Saunders et al., 2009).

5.9.1.4 Initial Pilot Study

The questionnaire was pilot tested by students from the target sample population before being used in the main study. The goal of pilot test was to "refine the questionnaire so that respondents will have no problems in answering the questions and there will be no problems in recording the data" (Saunders et al., 2009, p. 394). The researcher can assess the reliability and validity of the questionnaire using the pilot study to "ensure that the data collected will enable your investigative questions to be answered" (Saunders et al., 2009, p. 394). According to Adams, Khan, Raeside, and White (2007) pilot study tests wording of the questions, sequence and layout of the questionnaire, fieldwork arrangements, and analysis procedures.

The initial pilot study was conducted with 6 students who were selected through convenience sampling to participate in the practical session of the study in a computer lab. In the practical session, a cloud-based application (Google Docs) more specifically a "Software as a Service" cloud application was used. The participants were given an introduction for approximately 50 minutes on cloud computing and a live demonstration on how to access and use Google Docs. They were then asked to use Google Docs to perform tasks designed by the researcher. The participants were specifically informed that their documents would not be stored on their local computers but in a remote server hosted by Google Incorporation. After the assigned tasks were completed, the survey questionnaires were administered to the students. After completing the questionnaire, the researcher asked each student for any difficulty experienced or suggestions. They were asked specifically to give feedback on the length of time needed to complete the given tasks, time needed to complete the questionnaire, the clarity of the statements and instructions, and layout of the questionnaire. They were also asked to evaluate the simplicity of the given tasks. In this initial pilot study, useful feedback was obtained related to questionnaire wording, layout, and font size. Finally, the questionnaire was modified according to the suggestions from the participants.

5.9.1.5 Main Pilot Study

In the main pilot study, 31 students were selected randomly from the same environment using the same cloud application as in the initial pilot study. Prior to the beginning of the practical session, the researcher described the aims of the research and informed the students that they can withdraw from the practical session at any time without any consequences and their participation will be confidential. The students were also given letter of introduction, information sheet, consent form, and tasks paper before conducting the practical session. The students were asked to sign the consent form before the commencement of the practical session.

This main pilot study was conducted in the same way as explained in the initial pilot study. After the designated tasks were completed, the survey questionnaires were administered to the students. The completed and usable questionnaires were 29 after excluding two questionnaires as a result of a few unanswered questions. There were no comments suggested during this pilot study. Preliminary reliability of the questionnaire was assessed using the data of this pilot study.

In this pilot study, the measurement items' reliability was assessed by evaluating the internal consistency of each measure. Reliability is "the dependability or consistency of the measure of a variable" (Neuman, 2007, p. 373). Likewise, Saunders et al. (2007, p. 149) viewed reliability as "the extent to which your data collection techniques or analysis procedures will yield consistent findings". Cronbach's alpha reliability coefficients were used to measure the internal consistency of the scales in the research model (Creswell, 2009). Sekaran (2003) suggested that reliability coefficients below 0.60 is deemed poor, 0.70 is considered acceptable, and above 0.80 is considered good. In this regard, Joseph F. Hair et al. (2010) recommend that Cronbach's alpha value equal to or greater than 0.70 indicates adequate internal consistency. Thus, 0.70 value was considered as the threshold in this study. Additionally, Joseph F. Hair et al. (2010) recommended that item-to-total correlation among all items should be above 0.50. Item-to-total correlation gives "an indication of the degree to which each item correlates with the total score" (Pallant, 2011, p. 100). Therefore, these two metrics (Cronbach's alpha and item-to-total correlation) were used in this study to measure the reliability of the scales in the research model. Table 5.3 shows the Cronbach's alpha and item-to-total correlation results for all the constructs of the research model that were examined in the pilot study using SPSS version 19.

Table 5-3 Cronbach's alpha and item-to-total correlation results

Construct	Total of Items	Item-to-Total Correlation	Cronbach's Alpha (α)
Perceived Usefulness	6	.694, .666, .649, .699, .568, .617	0.849
Perceived Ease of Use	6	.718, .550, .747, .652, .759, .677	0.861
Behavioural Intention	3	.714, .788, .728	0.862
Self-Efficacy	5	.768, .746, .673, .608, .678	0.865
Playfulness	4	.525, .631, .592, .783	0.799
Perceptions of External Control	5	.501, .675, .636, .668, .530	0.802
Anxiety	4	.758, .789, .782, .766	0.896
Perceived Enjoyment	3	.722, .668, .647	0.822
Subjective Norm	3	.765, .775, .755	0.875
Image	3	.749, .677, .695	0.839
Job Relevance	3	.737, .771, .718	0.862
Output Quality	3	.720, .750, .665	0.843
Result Demonstrability	4	.693, .765, .747, .758	0.875
Trust	5	.674, .726, .737, .654, .698	0.871

It can be seen from Table 5.3 that the Cronbach's alpha values for all the constructs ranged from 0.799 to 0.896, indicating that the measurement scales were reliable since the values exceeded 0.70 threshold. Similarly, the item-to-total correlation values were between 0.501 and 0.789, implying that the values were within the acceptable range since they were above 0.50 threshold. Hence, the instrument was considered reliable. Consequently, all items were retained, suggestingthat the instrument can now be used to collect data in the main study.

5.9.1.6 Questionnaire Administration

The questionnaire was administered after the researcher obtained the approvals from the target universitiesin this study which are King Abdulaziz University (KAU) and Taibah University (TU) to conduct the study with their students and in their environmentand after the questionnaire was pre-tested, pilot-tested and revised according to the collected feedback. It is important to note that since the universities in Saudi Arabia are sex segregated, the questionnaire was administered personally by the researcher in male campus of the chosen universities, while in the female campus, 5 female academic assistants (3 from KAU and 2 from TU) assisted the researcher in the questionnaire administration. The researcher and the female academic assistants visited the computer lab before the participants arrived and spent some time in order to make sure that the computers devices were working and to ascertain the availability of the Internet service. This was to prevent obstacles that will affect the process of conducting the practical session. When the participants arrived at the lab, the researcher and the female academic assistants welcomed them and gave them the letter of introduction, information sheet, consent form, and the tasks paper. The participants were asked to sign the consent form before the commencement of the practical session. The participants were told before the commencement of the practical session that their participation is voluntary and they can withdraw from the practical session anytime without any consequences. The whole process took about 2 hours out of which the first 50 minutes was reserved for the introduction. The participants were introduced and given a live demonstration on how to access and use Google Docs. Then, they were asked to use Google Docs to perform tasks designed by the researcher which took about 40 minutes. The participants were specifically reminded that when they completed and saved their tasks, the documents would be stored in a remote server, which is hosted by Google Incorporation, unlike in a typical document creation and saving process where documents are stored on the local computer. The questionnaire was then administered to the students after they completed the tasks. The time given to students to complete the questionnaire in the computer lab was between 20-30 minutes. After the students completed the tasks and the questionnaire, the researcher and the female academic assistants expressed thanks to the participants for their participation and time. The quantitative data were collected in three months, specifically from March 1st to May 30th, 2014.

5.9.2 Qualitative Data Collection

Although quantitative methods show promising results on the attitude towards adoption and use of cloud computing applications by students, exploring and understanding this issue in more detail using different approaches is important. In this regard, qualitative methods were also employed to achieve some of the objectives of this research. The qualitative data collection techniques adopted in this study were focus group and open-ended question. Typically, qualitative data is obtained through direct encounter. Researchers usually combine quantitative research with focus groups (Neuman, 2007). The qualitative data collection techniques employed in this research are explained as follows.

5.9.2.1 Focus Group

According to Saunders et al. (2009) focus group is considered a special type of non-standardized interview where the researcher interview group of participants. It "focuses clearly upon a particular issue, product, service or topic and encompasses the need for interactive discussion amongst participants" (Saunders et al., 2009, p. 347). Focus group is "relatively inexpensive and can provide fairly dependable data within a short time frame" (Sekaran, 2003, p. 220). Focus group allows the researcher to know more about participants' experiences, opinions, and feelings (Creswell, 2009; Macionis, 2012).

Focus group usually involves between four to twelve participants depending on the experience of the interviewer, nature of the participants, and the problem under discussion (Saunders et al., 2009). The participants are usually selected using non-probability sampling (Saunders et al., 2009). The following suggestions are important when conducting a focus group as recommended by Saunders et al. (2009). The researcher should select group members that have some characteristics in common relevant to the issue being discussed, not allow one or two members of the focus group to dominate the discussion and tactically bring others into the discussion. Moreover, the researcher should make sure that the participants understand the contribution of each other, which enables him/her to establish accurate understanding of the contributions provided, and should choose a "neutral setting" where the participants will feel free and comfortable (Saunders et al., 2009). The following subsections discuss the design of the focus group of this study, pilot study of focus group, and the process of selecting the participants and carrying out the focus groups in this study.

5.9.2.1.1 Focus Group Schedule Design

The questions for the focus groups were based on the same factors of the modified TAM3 model used in the quantitative phase. A focus group schedule was developed to guide the researcher during conducting the focus groups. The schedule was translated into Arabic language (see Appendix K and L for English and Arabic versions respectively) and divided into three parts as follows. The first part of the schedule contains questions related to the participants' demographic information.

The second part includes questions related to the factors in the proposed TAM3 based model that assess the perception of the participants on the adoption of cloud computing applications. The last part has an open-end question that asks the participants about any additional factors or barriers they think affect the adoption of cloud computing applications, which are not covered in this study. Finally, the researcher thanks the students for their participation and time at the end of the part three.

In addition, letter of introduction, information sheet (see Appendix M and N for English and Arabic versions respectively), and consent form (see Appendix O and P for English and Arabic versions respectively) were provided to the participants. The letter of introduction and information sheet contain information about the study and explain the objectives of the focus group; and assurance of the confidentiality of participants' responses and answers, and their right to withdraw at any time without any consequences. The consent form provides assurance to the participants that their responses will be kept confidential, and they can withdraw at any time they wish from the focus group without any consequences; and seeks to obtain their agreement to audio record their answers, and again a verbal agreement from the participants to maintain the anonymity of other participants in the focus group and the confidentiality of the discussion.

5.9.2.1.2 Pilot Study for Focus Group

According to Saunders et al. (2009, p. 597), a pilot test is a "small-scale study to test a questionnaire, interview checklist or observation schedule, to minimise the likelihood of respondents having problems in answering the questions and of data recording problems as well as to allow some assessment of the questions' validity and the reliability of the data that will be collected". Conducting a pilot study for focus group is an important practice that can improve the quality of the focus groups data. According to Breen (2007), pilot study enables the researcher to identify which kind of approaches and questions is more convenient for him/her to conduct the actual study. A pilot study will help the researcher obtains comments on the questions from the representatives of the target group, revise questions structure, make decisions on whether to add or remove some questions, and get ideas about the effectiveness of the researcher as a moderator (Breen, 2007).

The questions in the focus group schedule were based on the same factors of the proposed research model considered in quantitative phase of the study. These questions were validated by experts, language experts, PhD students and also sample students from the target population in the quantitative phase. The focus group questions were prepared in Arabic language, which were also based on the Arabic version of the questionnaire validated in the quantitative phase by language experts and students from the target population. The focus groups were conducted with the participants in Arabic language. In addition, the structure of the focus group schedule and the questions were reviewed by 3 PhD students who suggested minor corrections in terms of the layout of the schedule. The researcher updated the structure of the focus group schedule and invited 4 students using convenience sampling from the target population to participate in focus group pilot study. The essence of conducting focus group pilot study was to ensure that the questions were clear, and to determine the time required to conduct the focus groups. The researcher asked the focus group participants the questions related to the proposed model factors that were prepared in the schedule. The researcher specifically asked the focus group participants to comment on the clarity of the questions, difficulty faced in understanding the questions, and any other issues related to the questions. The focus group participants confirmed that the questions were clear and understandable.

5.9.2.1.3 Conducting the Focus Group

The focus groups participants were chosen using self-selection and purposive sampling techniques during the quantitative phase of the study. A request was made at the end of the questionnaire to all respondents that if they wish to voluntarily participate in the focus group, they should contact the researcher through his phone number or email address he provided in the questionnaire, or to provide their phone number. The contact information of the interested participants will make it easier for the researcher to reach and inform them about the time and place of the focus group. The number of the interested participants from both universities is 93, and the researcher selected only male students from King Abdulaziz University. Out of the

37 interested male students, the researcher selected 15 students from different ages, majors (Arts and Sciences), and year of study. The participants were selected because they have some features in common that will allow them to discuss more in the issues related to the topic of the study (Adams et al., 2007; Saunders et al., 2009). Due to time, budget and culture constraints, the focus groups were conducted only with male students of the King Abdulaziz University. The female students from both universities were excluded because they have their own campus (gender segregated campus) due to cultural constraints stemming from Islamic religion which forbids intermingling of unrelated males with females. Therefore, it was difficult for the researcher to conduct face-to-face focus group interview with female students. Equally, the male students from Taibah University were excluded from the focus group due to time and budget constraints.

The researcher divided the participants into three groups by considering the time limitation, classes of students in these focus groups, and the fact that the researcher believed that three groups were sufficient to achieve the aim of conducting the focus groups. Three different times were proposed by the researcher to conduct the focus groups. The researcher also limited the number of participants to 5 per group in accordance with Ritchie (2003), who suggested that a focus group requires between four and ten participants in order to generate adequate content. The questionnaire respondents that showed interest to participate in the focus groups were invited via SMS to participate in the focus groups. The selected students agreed to take part in the focus group and the researcher asked the volunteer students to select the suitable time from three proposed times suggested by the researcher. The invited students confirmed their participation by selecting suitable time.

At the beginning of the focus groups, the researcher started with welcoming and thanking the participants for their time, and then the researcher personally introduced himself and explain the aim of the research as well as the focus group. Ethical issues were considered by presenting letter of introduction, information sheet, and consent form which contain explanation about the objectives of the study and focus group, assurance of the confidentiality of the participant’s responses, and the right of the participants to withdraw at any time without any consequences. The participants were specifically notified that their participation was voluntary. Other ethical issues considered were anonymity and confidentiality. Anonymity is “the process of concealing the identity of participants in all documents resulting from the research" (Saunders et al., 2009, p. 587). Confidentiality is a "concern relating to the right of access to the data provided by the participants and, in particular the need to keep these data secret or private" (Saunders et al., 2009, p. 589). The researcher gave assurance to the participants that their identities would not be disclosed, and names would not be used throughout the research. They were also guaranteed that their recorded focus groups data and excerpts from the interviews would be anonymously used, and the data would only be accessed by the researcher alone. The focus groups were recorded using a high quality digital recorder which took about 1 hour and 30 minutes to 2 hours. All participants were informed about the recording device and their permission to record the focus groups was sought before starting the focus groups. They were also requested to sign the consent form before the commencement of the focus groups. Finally, the researcher thanked the participants for their participation and time at the end of each interview of focus group. The focus groups were conducted within two days: on June 18, 2015 with the first group, and on June 20, 2015 with the second and third groups in King Abdulaziz University library. The venue of the focus groups was chosen based on the suggestion that focus group setting should be quiet, private, uninterrupted place, and easy to locate; and also to make sure the venue has adequate facilities (Finch & Lewis, 2003; Saunders et al., 2009). Prior to conducting the focus groups the researcher got permission to use a room in the university library for conducting the 3 focus groups with the students. Consequently, 3 focus groups were conducted in this study. The first and third groups had 5 participants each, while the second group had 4 participants.

5.9.2.2 Open-Ended Question

Open-ended questions allow "subjects to respond freely, expressing various shades of opinion" (Macionis, 2012, p. 39). According to Sekaran (2003, p. 421) open-ended questions are "questions that the respondent can answer in a free-flowing format without restricting the range of choices to a set of specific alternatives suggested by the researcher". Although open-ended questions have weaknesses which include difficult and time consuming to analyse, and need for coding the answers (Adams et al., 2007; Kothari, 2004), a respondent can express whatever is in their mind in their own words which gives the researcher "a more complete picture of the respondent’s feelings and attitudes” (Kothari, 2004, p. 103; Macionis, 2012). Therefore, the open-ended question was included at the end of the questionnaire as supported by Sekaran (2003), and also in the last section in focus group schedule.

5.10 Data Analysis

Both the quantitative and qualitative data were analysed separately. Data analysis involves organizing, examining, and categorizing data with the aim of deriving meaning out of it to find answers to the study questions (Creswell, 2009). The specific analysis strategies employed in both quantitative and qualitative analysis phases are described in the following subsections.

5.10.1 Quantitative Data Analysis

The quantitative data collected using the survey questionnaire were analysed using SPSS software (version 22) and AMOS software (version 19). Descriptive statistics from SPSS software was utilized to analyse the demographic data. The relationship between the variables was examined using Structural Equation Modelling (SEM) by using AMOS software. According to Joseph F Hair, Hult, Ringle, and Sarstedt (2014), relationships in SEM are estimated using either Partial least Squares Structural Equation Modelling (PLS-SEM) or Covariance-Based Structural Equation Modelling (CB-SEM). PLS-SEM based software such as PLS are used when the aim of a study is to predict or identify constructs, structural model is complex, sample size is small, or data are non-normally distributed (Joseph F Hair et al., 2014). On the other hand, CB-SEM based software like AMOS are used if the aim of the study is to test, confirm, or compare theories (Joseph F Hair et al., 2014). Therefore, AMOS was chosen since the aim of our study requires CB-SEM approach as suggested by Joseph F Hair et al. (2014) and AMOS is user-friendly software with well-organized output format and excellent graphical interface (Clayton & Pett, 2008; Narayanan, 2012). We employed a two stage approach in SEM to assess the model (Joseph F. Hair et al., 2010). In the first stage, reliability and validity of the model were measured, and the hypotheses were tested in the second stage.

5.10.2 Qualitative Data Analysis

Analysis of qualitative data involves understanding the data in a more detailed way (Creswell, 2009). The focus groups data were transcribed after conducting the interviews. Creswell (2009) presented stages involved in qualitative data analysis. The researcher begins by organizing the transcribed data and prepares it for the analysis. The next stage is to read the data in order to have a general understanding of the data. The data will then be organized into chunks called codes. The codes are further grouped into categories that will give meaning to the data. Therefore, in this case the transcribed data were coded and categorized based on the factors of the proposed model. In the case of open-ended question analysis, new categories were created based on the new factors and barriers emerged that were not related to the factors of the research model.

5.11 Reliability and Validity

Reliability and validity are two important issues that need to be considered when discussing the quality of instrument or research findings in general (Creswell, 2009; Saunders et al., 2009).

5.11.1 Reliability of the Questionnaire

Reliability deals with the extent of consistency of measurement items with the variables (Joseph F. Hair et al., 2010). In our study, reliability in the quantitative strategy was measured using construct reliability, Cronbach's alpha, and item-to-total correlation. Joseph F. Hair et al. (2010) suggested value greater than 0.70 as the recommended limit for both construct reliability and Cronbach's alpha. Sekaran (2003) further suggested that reliabilities less than 0.60, in the range 0.70, and above 0.80 are considered poor, acceptable, and good respectively. This indicates that "the closer the reliability coefficient gets to 1.0, the better" (Sekaran, 2003, p. 311). The reliability of the scale was measured using popular measure called construct reliability and Cronbach's alpha, whereas the reliability of the individual items was assessed using item-to-total correlation (Gliem & Gliem, 2003; Joseph F. Hair et al., 2010). The recommended value of construct reliability and Cronbach's alpha is 0.70 or above (Joseph F. Hair et al., 2010). The item-to-total correlation is the correlation between the items and summated scales score. Joseph F. Hair et al. (2010) recommended an acceptable threshold for item-to-total correlation to be above 0.50. Therefore, in this study construct reliability, Cronbach's alpha, and item-to-total correlation were used to examine the reliability of the scale.

5.11.2 Validity of the Questionnaire

Validity is "concerned with whether the findings are really about what they appear to be about" (Saunders et al., 2009, p. 157). Joseph F. Hair et al. (2010, p. 94) defined validity as the "extent to which a measure or set of measures correctly represents the concept of study". Two types of validity were used in this study, which are: content validity and construct validity (Creswell, 2009; Kothari, 2004; Saunders et al., 2009; Sekaran, 2003). Content validity is "the extent to which a measuring instrument provides adequate coverage of the topic under study" (Kothari, 2004, p. 74). There is no numerical way of examining this type of validity, but it can be assessed by panel of experts who will assess how the questionnaire meets the standards (Kothari, 2004). The content validity was assessed during the pre-test and pilot study. Construct validity "refers to the extent to which your measurement questions actually measure the presence of those constructs you intended them to measure" (Saunders et al., 2009, p. 373). The construct validity was assessed using convergent and discriminant validity as recommended by Joseph F. Hair et al. (2010).

5.11.3 Reliability and Validity of the Focus Groups

The reliability and validity of the focus groups were measured by determining the rigor or trustworthiness of the study using the four suggested measures: credibility, transferability, dependability, and confirmability (Houghton, Casey, Shaw, & Murphy, 2013; Morse, Barret, Mayan, Olson, & Spiers, 2002). Credibility measures the integrity of the findings. It can be achieved "only by taking data and interpretations to the sources from which they were drawn and asking directly whether they believe - find plausible - the results" (E. Guba & Lincoln, 1981, p. 110). In this regard, the researcher asked all focus groups participants to read the transcription of their interviews. The participants confirmed that the focus groups have been accurately recorded and transcribed, and hence the credibility in this study was achieved (Houghton et al., 2013). Transferability is referred as fittingness which is fulfilled when the findings of the study fit into the external context of the scope of study (Ryan-Nicholls & Will, 2009). The fittingness can be established through discussions with undergraduate students from different higher education institutions in Saudi Arabia and the findings is applicable to other contexts. Dependability measures the consistency of the qualitative study which can be established and referred to as auditable when another researcher can follow the researcher's decision trail (Ryan-Nicholls & Will, 2009). This implies that when the data is given to another researcher in the same perspective and context using clear analysis procedure followed by the researcher, he/she should arrive at similar findings. Generally, the researcher is part of the research instrument in qualitative studies. Therefore, the reliability of the researcher was increased by conducting one pilot focus group with 4 students to develop and improve interviewing skills in order to solve any difficulties that may arise during the focus groups. Finally, confirmability refers to the neutrality and accurateness of the data (Ryan-Nicholls & Will, 2009). Neutrality is "the freedom from bias in the research process and product" (Ryan-Nicholls & Will, 2009, p. 78). Confirmability which determine neutrality is assessed by establishing truth value, applicability and auditability (Ryan-Nicholls & Will, 2009). In the focus groups, confirmability was achieved since the first three suggested criteria (credibility, transferability and dependability) were met (Ryan-Nicholls & Will, 2009).

5.12 Ethical Issues

This research involve collecting data from students, therefore the researcher need to respect the participants as well as the environment were the data were collected (Creswell, 2009). In this study, several steps were taken to ensure that the research followed the standards of ethical research practice. First, the ethics committee in Flinders University approved the research with project number 6379. Second, the researcher described the aims and objective of the study to the participants. The importance of cloud computing services especially to students were highlighted in order to make the students realize the benefits that could be reaped when the services are adopted. The researcher also explained to the students how this study will assist decision makers in universities and cloud services providers to comprehend the factors that influence the adoption of cloud computing applications by students. Third, consent from the participants was sought at the beginning of the study. Assurance was also given to the participants that their data including personal information will be private and secured by the researcher even after publishing the PhD thesis. Fourth, the researcher also ensured that personal information of the participants from both questionnaires and focus groups were coded and stored in a secured folder. The secured folder was protected in such a way that only the researcher can access its contents. In addition, focus groups data were kept confidentially using letters and numbers instead of names to protect the privacy of the participants. Finally, voluntary participation was emphasized to give the participants right to participate and withdraw at any time. The researcher provided his contacts details and that of the researcher's supervisor in the information sheet in case of any further enquiry or any ethical concerns.

5.13 Chapter Summary

This chapter explained the research methodology employed in this research. The objectives of this study guided the selection of the appropriate research design, which was mixed method design. In this design, quantitative and qualitative strategies were used to collect and analyse the relevant data. The chapter also presented a justification for the selection of the research design. In addition, the chapter described in detail the study setting, the target population, sampling techniques and sample size. Furthermore, the three different data collection methods employed in this study which were survey questionnaire, open-ended question, and focus group were presented in detail in this chapter. Likewise, the chapter discussed the analysis techniques employed in both the quantitative and qualitative phases. Finally, this chapter discussed reliability and validity of the instrument and focus group, as well as the ethical considerations.

Chapter 6: Quantitative Data Analysis and Results

6.1 Introduction

This chapter presents the analysis and results of the quantitative data which were collected using survey questionnaire. The chapter discusses data screening issues including missing data, normality, outliers, and multicollinearity. The chapter also presents the demographic characteristics of the respondents which were analysed using descriptive statistics. In addition, this chapter assesses the reliability and validity of the proposed model constructs. Subsequently, the chapter presents the results of Exploratory Factor Analysis (EFA). Finally, this chapter presents the results of Confirmatory Factor Analysis (CFA), and the structural model evaluation and hypotheses testing.

6.2 Data Screening

The quantitative data were screened prior to start of the main analysis. According to Pallant (2011), data screening or data examination is essential because errors that occur during data entry can be identified and addressed prior to the analysis of the data. This is useful since errors can distort results of analyses such as correlation. Four issues are considered during the data screening process, which are: missing data, outliers, normality, and multicollinearity (Joseph F. Hair et al., 2010; Newton & Rudestam, 2013; Pallant, 2011).

6.2.1 Missing Data

Missing data represent information related to subject or case that is not available. Missing data usually occur as a result of failure of respondents to answer one or more survey questions, or an error during data entry (Joseph F. Hair et al., 2010; Osborne, 2013). Identifying missing data is important because it affects the generalizability of the results (Joseph F. Hair et al., 2010). Although there exist various ways of handling missing data such as mean substitution, regression imputation, case substitution, and complete data, respondents with missing data are eliminated because they affect the validity of the findings (Joseph F. Hair et al., 2010). In our study, the questionnaires distributed among the students were 527. The total questionnaires used for the analysis were 451 (86%) after eliminating 76 unusable questionnaires due to missing data (54) and unengaged responses (22). The response rate of 86% was sufficient according to various suggestions that responses rate should be reasonably high (Nulty, 2008; Saunders et al., 2009). According to Saunders et al. (2009), 30% response rate is considered reasonable.

6.2.2 Assessment of Normality

Normality assumption is essential because it is one of the important assumptions in multivariate analysis. According to Joseph F. Hair et al. (2010) normality is an extent to which the distribution of a sample data resembles normal distribution. Generally, normality is measured by observing the shape of the data distribution, and by examining skewness and kurtosis. Therefore, to assess whether the data are normal in this study the researcher examined two measures of distributions - skewness and kurtosis - to allow assess to what extent the data deviate from normality (Joseph F. Hair et al., 2010). Skewness is “the measure of the symmetry of a distribution; in most instances the comparison is made to a normal distribution” (Joseph F. Hair et al., 2010, p. 36), while kurtosis is “the measure of the peakedness or flatness of a distribution when compared with a normal distribution” (Joseph F. Hair et al., 2010, p. 35). Skewness and kurtosis are generally used by researchers since they are the components of normality (Tabachnick & Fidell, 2007). Kline (2011) suggested that when skewness is <= ±3 and kurtosis is <= ±10 then a data distribution will be considered normal. The results of skewness and kurtosis in Table 6.1 show that they were within the acceptable range for all the research factors as recommended by Kline (2011).

Table 6-1 Skewness and kurtosis results

Construct	Mean	Std. Deviation	Skewness	Kurtosis
Perceived Usefulness	3.9993	.64645	-1.569-	3.643
Perceived Ease of Use	4.0196	.61988	-1.177-	2.789
Behavioural Intention	4.1360	.71127	-1.346-	2.700
Self-Efficacy	3.8213	.64325	-1.167-	2.515
Playfulness	3.8126	.72636	-1.016-	1.713
Perceptions of External Control	3.8692	.59435	-1.110-	1.718
Anxiety	2.8115	1.04281	-.071-	-.944-
Perceived Enjoyment	3.7990	.73130	-.785-	.934
Subjective Norm	3.4738	.84063	-.665-	.287

Construct	Mean	Std. Deviation	Skewness	Kurtosis
Image	3.5551	.87833	-.697-	.319
Job Relevance	3.9017	.69242	-.898-	1.518
Output Quality	3.6208	.82693	-.606-	.296
Result Demonstrability	3.7511	.81223	-1.197-	2.179
Trust	3.8013	.74851	-.858-	1.377

6.2.3 Outliers Screening

Outliers affect the sample distribution and inferential statistics which will consequently influence the results of statistical analyses. An outlier is referred to as "an observation that is substantially different from the other observations (i.e., has an extreme value) on one or more characteristics (variables)" (Joseph F. Hair et al., 2010, p. 36). Outlier screening involves assessment of univariate and multivariate outliers. An outlier is univariate "if it is extreme on a single variable" (Kline, 2011, p. 54), whereas an outlier is multivariate if it "has extreme scores on two or more variables" (Kline, 2011, p. 54). To examine univariate outliers, SPSS was used to examine the 57 variables for measuring the extended TAM3 model constructs by computing the standard score (z-score) for each variable (Joseph F. Hair et al., 2010). The z-scores were compared with the recommended threshold.Tabachnick and Fidell (2007) suggested a threshold of z-score not more than ±3.29, similarly Joseph F. Hair et al. (2010) recommended a value of z-score not higher than ±4 for study with a large sample size (above 80 responses). Hence, the threshold recommended by Joseph F. Hair et al. (2010) was used in this study since the sample size for this study is large.The smallest value for computed z-scores in this study (see Appendix Q) was -3.9, and the largest was +1.9 which showed that the values for all the variables were within the ±4 range suggested by Joseph F. Hair et al. (2010). Thus, there was no presence of univariate outliers.

On the other hand, multivariate outlier can be assessed using Mahalanobis distance (D^2) measure. To examine a multivariate outlier, a quotient of D^2 and degree of freedom (*df*) is computed (D^2/df). If the value exceeds 4 for larger samples then the observation is a potential multivariate outlier which "represents observations farther removed from the general distribution of observations in this multidimensional space" (Joseph F. Hair et al., 2010, p. 66). D^2 is "a multivariate assessment of each observation across a set of variables" (Joseph F. Hair et al., 2010, p. 66), and *df* is the number of measured variables (Joseph F. Hair et al., 2010). The multivariate outlier was assessed using SPSS by firstly determining the D^2 for all the observations and then the D^2 values were divided by *df* which is 57. Table 6.2 shows the results of six observations with highest D^2/df values. The results show that all the observed values are below the threshold of 4. Thus, there is no evidence of multivariate outlier detected in the observations.

Table 6-2 Multivariate outlier results for the six observations with highest values

Observation number	Mahalanobis D^2	D^2/df
337	161.92797	2.84
348	137.96290	2.42
342	130.84101	2.30
280	128.79275	2.26
20	125.31985	2.20
168	123.54865	2.17

6.2.4 Multicollinearity Test

Multicollinearity is another important assumption that needs to be met before conducting multiple regression analysis because the presence of multicollinearity leads to a bad regression model (Pallant, 2011). This makes it “impossible to obtain unique estimates of the regression coefficients because there are an infinite number of combinations of coefficients that would work equally well” (Field, 2009, p. 223). Multicollinearity can be assessed by examining the correlation between independent variables. Multicollinearity occurs when there is high correlation between the independent variables (r=.9 and above) (Pallant, 2011). The correlations between the independent variables are examined using Pearson correlation test (Greasley, 2008). As shown in Table 6.3, the highest correlation value is 0.575, indicating that all the correlations between the independent variables are not high.

Table 6-3 Pearson correlations test results

		PU	PEOU	BI	SE	PLAY	PEC	ANX	ENJ	SN	IMG	REL	OUT	RES	TR
PU	Pearson Correlation	1	.511	.575	.306	.299	.318	-.023-	.452	.284	.262	.456	.313	.224	.342
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.622	.000	.000	.000	.000	.000	.000	.000
PEOU	Pearson Correlation	.511	1	.556	.206	.346	.356	-.124-	.424	.221	.205	.302	.226	.231	.259
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.009	.000	.000	.000	.000	.000	.000	.000
BI	Pearson Correlation	.575	.556	1	.272	.318	.286	-.035-	.365	.236	.252	.382	.272	.248	.281
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.455	.000	.000	.000	.000	.000	.000	.000
SE	Pearson Correlation	.306	.206	.272	1	.270	.214	.044	.181	.277	.208	.216	.245	.174	.252
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.352	.000	.000	.000	.000	.000	.000	.000
PLAY	Pearson Correlation	.299	.346	.318	.270	1	.309	-.040-	.374	.265	.265	.267	.163	.155	.303
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.397	.000	.000	.000	.000	.000	.001	.000
PEC	Pearson Correlation	.318	.356	.286	.214	.309	1	-.075-	.386	.242	.247	.383	.276	.316	.297
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.113	.000	.000	.000	.000	.000	.000	.000
ANX	Pearson Correlation	-.023-	-.124-	-.035-	.044	-.040-	-.075-	1	-.032-	.145	.146	.028	.022	-.089-	-.004-
	Sig. (2-tailed)	.622	.009	.455	.352	.397	.113		.494	.002	.002	.558	.639	.059	.938
ENJ	Pearson Correlation	.452	.424	.365	.181	.374	.386	-.032-	1	.350	.322	.461	.380	.277	.306
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.494		.000	.000	.000	.000	.000	.000
SN	Pearson Correlation	.284	.221	.236	.277	.265	.242	.145	.350	1	.456	.341	.335	.160	.294
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.002	.000		.000	.000	.000	.001	.000
IMG	Pearson Correlation	.262	.205	.252	.208	.265	.247	.146	.322	.456	1	.385	.268	.223	.355
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.002	.000	.000		.000	.000	.000	.000
REL	Pearson Correlation	.456	.302	.382	.216	.267	.383	.028	.461	.341	.385	1	.344	.318	.259
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.558	.000	.000	.000		.000	.000	.000
OUT	Pearson Correlation	.313	.226	.272	.245	.163	.276	.022	.380	.335	.268	.344	1	.258	.281
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.639	.000	.000	.000	.000		.000	.000
RES	Pearson Correlation	.224	.231	.248	.174	.155	.316	-.089-	.277	.160	.223	.318	.258	1	.160
	Sig. (2-tailed)	.000	.000	.000	.000	.001	.000	.059	.000	.001	.000	.000	.000		.001
TR	Pearson Correlation	.342	.259	.281	.252	.303	.297	-.004-	.306	.294	.355	.259	.281	.160	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.938	.000	.000	.000	.000	.000	.001	

Furthermore, multicollinearity problems were further assessed by performing collinearity diagnostics on the model's constructs. Tolerance and Variance Inflation Factor (VIF) were used to determine the multicollinearity (Pallant, 2011; Tabachnick & Fidell, 2007). Tolerance is "an indicator of how much of the variability of the specified independent variableis not explained by the other independent variables in the model" (Pallant, 2011, p. 158). VIF "indicates whether a predictor has a strong linear relationship with the other predictor(s)" (Field, 2009, p. 224). According to Pallant (2011), a tolerance value below 0.10 indicates the possibility of multicollinearity, and VIF value above 10 is an indication of multicollinearity. The results of the multicollinearity are presented in Table 6.4. It can be observed from Table 6.4 that the tolerance and VIF values for all constructs are all above 0.10 and below 10 respectively as recommended by Pallant (2011). Therefore, since the tolerance and VIF values have not exceeded the recommended threshold, it can be concluded that the data are appropriate for conducting multiple regression analysis since there is no evidence of multicollinearity in the examined constructs.

Table 6-4 Multicollinearity test results

Construct	Tolerance	VIF
Perceived Usefulness	0.525	1.904
Perceived Ease of Use	0.573	1.746
Behavioural Intention	0.551	1.815
Self-Efficacy	0.812	1.232
Playfulness	0.741	1.350
Perceptions of External Control	0.709	1.410
Anxiety	0.922	1.084
Perceived Enjoyment	0.591	1.693
Subjective Norm	0.681	1.468
Image	0.673	1.487
Job Relevance	0.613	1.633
Output Quality	0.743	1.346
Result Demonstrability	0.812	1.232
Trust	0.746	1.341

6.3 Descriptive Statistics

The descriptive statistics, which is the analysis of the demographic and personal information of the respondents, was conducted using SPSS after the data were screened. The total valid responses were 451 after screening the data, and the statistical analysis was conducted with all the 451 responses. Table 6.5 shows the characteristics of the respondents including their university, academic major, gender, age group, year of study, computer ownership, number of years using a computer, computer knowledge, availability of high-speed Internet connection at home and university, availability of computer labs at their schools, number of years using Internet, time spend on the Internet daily, and Internet proficiency. The following subsections will describe the results obtained related to all of the above demographic variables.

Table 6-5 Demographic profile of the respondents

Variable		Frequency	Percentage
University	King Abdulaziz University	253	56.1
	Taibah University	198	43.9
Major	Arts	237	52.5
	Sciences	214	47.5
Gender	Male	242	53.7
	Female	209	46.3
Age group	18 - 22 Years	371	82.3
	23 - 27 Years	80	17.7
The year of study	First Year	78	17.3
	Second Year	184	40.8
	Third Year	126	27.9
	Fourth Year	34	7.5
	Other	29	6.4
Computer ownership	Yes	393	87.1
	No	58	12.9
Number of years using a computer	< 1 year	3	.7
	1 - 3 years	40	8.9
	4 - 6 years	183	40.6
	7 - 9 years	138	30.6
	> 9 years	87	19.3
Computer knowledge	Poor	25	5.5
	Fair	61	13.5
	Good	176	39.0
	Very Good	126	27.9
	Excellent	63	14.0
Availability of high-speed Internet connection at home	Yes	340	75.4
	No	111	24.6
Availability of Internet at the university	Yes	149	33.0
	No	302	67.0
Availability of computer lab in school	Yes	97	21.5
	No	354	78.5
Number of years using the Internet	< 1 year	24	5.3
	1 - 3 years	200	44.3
	4 - 6 years	137	30.4
	7 - 9 years	73	16.2
	> 9 years	17	3.8
Time spend on the Internet daily	< 1 hours	47	10.4
	1 - 3 hours	160	35.5
	4 - 6 hours	144	31.9
	7 - 9 hours	49	10.9
	> 9 hours	51	11.3

Variable		Frequency	Percentage
Internet proficiency	Poor	19	4.2
	Fair	52	11.5
	Good	158	35.0
	Very Good	142	31.5
	Excellent	80	17.7

6.3.1 University and Academic Major

The respondents were asked to indicate their institution, and academic major. The demographic profile of the respondents reveals that 253 (56.1%) are from King Abdulaziz University and 198 (43.9%) are from Taibah University as shown in Table 6.5. Slightly more than half of the respondents 237 (52.5%) are majored in Arts and the remaining 214 (47.5%) are majored in Sciences.

6.3.2 Gender, Age Group, and Year of Study

The respondents were asked to specify their gender, age group, and year of study. It can be seen from Table 6.5 that, more than half of the respondents 242 (53.7%) are males and the remaining 209 (46.3%) are females. Similarly, majority of the respondents 371 (82.3%) are within the age range of 18-22 years and the remaining 80 (17.7%) fall within the age range 23-27 years. The students that responded to the questionnaire were mostly in their second year (40.8%), while the percentages of those in their first year, third year, fourth year, and others are 17.3%, 27.9%, 7.5%, and 6.4% respectively.

6.3.3 Availability of Computer, Number of Years Using Computer, and Computer Knowledge

In the questionnaire, the respondents were asked to indicate if they own a computer, the number of years they have been using computer, and their level of computer knowledge. It can be observed from Table 6.5 that, a total of 393 (87.1%) students have a computer and only 58 (12.9%) have no computer at the time of this study. Also, the number of the respondents that use computer in less than 1 year, between 1 to 3 years, between 4 to 6 years, between 7 to 9 years, or in more than 9 years is 3

(0.7%), 40 (8.9%), 183 (40.6%), 138 (30.6%), or 87 (19.3%) respectively. Additionally, the respondents with poor, fair, good, very good and excellent computer skills are 25 (5.5%), 61 (13.5%), 176 (39.0%), 126 (27.9%) and 63 (14.0%) respectively.

6.3.4 Availability of High-Speed Internet Connection at Home and University and Availability of Computer Labs

As shown in Table 6.5, concerning the availability of high-speed Internet connection at home, 340 (75.4%) respondents admit that they have high-speed Internet connectivity at home, while 111 (24.6%) do not have the high-speed Internet connectivity in their homes. Similarly, 149 (33.0%) respondents revealed that the Internet is available in their universities, whereas 302 (67.0%) of the respondents reported that the Internet is not available. Most of the respondents 354 (78.5%) admit that computer labs are not available in their various schools, and only 97 (21.5%) respondents have computer labs in their schools.

6.3.5 Number of Years Using Internet, Time Spend on Internet Daily, and Internet Proficiency

The respondents were requested to specify the number of years they have been using Internet, time spend on Internet daily, and their Internet proficiency. As shown in Table 6.5, concerning the number of years using the Internet, the respondents that used Internet in less than 1 year, between 1 and 3 years, between 4 and 6 years, between 7 and 9 years, or in more than 9 years are 24 (5.3%), 200 (44.3%), 137 (30.4%), 73 (16.2%), or 17 (3.8%) respectively. Concerning the time spent using Internet daily, the number of respondents that spend less than 1 hour, between 1 to 3 hours, between 4 to 6 hours, between 7 to 9 hours, or above 9 hours is 47 (10.4%), 160 (35.5%), 144 (31.9%), 49 (10.9%), or 51 (11.3%) respectively. Moreover, the respondents with poor, fair, good, very good and excellent Internet proficiency are 19 (4.2%), 52 (11.5%), 158 (35.0%), 142 (31.5%) and 80 (17.7%) respectively.

6.4 Assessment of Reliability and Validity

The two important characteristics of scales considered in this study are reliability and validity. Reliability is an indication of how free a scale is from random error, while validity is the degree to which a scale measures what it should measure (Pallant, 2011). These two characteristics of scales are presented in the following subsections.

6.4.1 Reliability

Reliability measures the extent at which the measurement scale is consistent. Reliability is assessed during exploratory stage of the research to ensure that the scale consistently produces similar and meaningful results. It is highly recommended that the reliability of each scale should be assessed. Thus, the reliability of the scales was measured using internal consistency and item-to-total correlation (Joseph F. Hair et al., 2010). The reliability assessment procedures used in this study are presented in the following subsections.

6.4.1.1 Internal Consistency

Internal consistency is defined as “the degree to which responses are consistent across the items within a measure” (Kline, 2011, p. 69). This measures the consistency of a scale based on the popular measure called Cronbach’s Alpha. Joseph F. Hair et al. (2010) suggested that, Cronbach’s Alpha should not be below 0.70. Furthermore, reliability below 0.60 is considered poor, 0.70 is acceptable, and above 0.80 is good according to Sekaran (2003). The Cronbach’s Alpha values for the 14 constructs are presented in Table 6.6, which shows good values between 0.75 and 0.89. Cronbach’s Alpha values for self-efficacy and perceptions of external control constructs were obtained after deleting items SE1 and PEC3 from each construct respectively, which resulted in substantial increase in the Cronbach’s Alpha values of their corresponding constructs. The Cronbach’s Alpha coefficients for all the research constructs are above the lower acceptable limit suggested in literature (Joseph F. Hair et al., 2010). Hence, the measurement scales are consistent since they show adequate evidence of reliability.

Table 6-6 Cronbach's Alpha values for the research constructs

Construct	No. of Items	Cronbach's Alpha (α)
Perceived Usefulness	6	.885
Perceived Ease of Use	6	.872
Behavioural Intention	3	.850
Self-Efficacy	4	.804
Playfulness	4	.804
Perceptions of External Control	4	.808
Anxiety	4	.858
Perceived Enjoyment	3	.882
Subjective Norm	3	.826
Image	3	.779
Job Relevance	3	.843
Output Quality	3	.753
Result Demonstrability	4	.883
Trust	5	.877

6.4.1.2 Item-to-Total Correlation

Item-to-total correlation is one of the measures of internal consistency related to the individual items (Joseph F. Hair et al., 2010). Item-to-total correlation measures "the degree to which each item correlates with the total score" (Pallant, 2011, p. 100), which should exceed 0.50 as recommended by Joseph F. Hair et al. (2010). Items with values lower than 0.30 indicate that they are "measuring something different from the scale as a whole" (Pallant, 2011, p. 100). The item-to-total correlations presented in Table 6.7 shows that all the values are within the acceptable range since they are all above 0.50, the recommended threshold by Joseph F. Hair et al. (2010). Therefore, the items retained are measuring their respective target scales.

Table 6-7 Item-to-total correlations values for the items of constructs

Construct	No. of Items	Item-to-Total Correlation
Perceived Usefulness	6	.733, .722, .701, .719, .616, .701
Perceived Ease of Use	6	.642, .659, .702, .726, .662, .655
Behavioural Intention	3	.733, .746, .679
Self-Efficacy	4	.624, .591, .659, .610
Playfulness	4	.606, .633, .643, .600
Perceptions of External Control	4	.569, .598, .672, .662
Anxiety	4	.616, .673, .769, .754
Perceived Enjoyment	3	.754, .789, .770
Subjective Norm	3	.662, .735, .657
Image	3	.570, .692, .592
Job Relevance	3	.692, .730, .704
Output Quality	3	.590, .633, .548
Result Demonstrability	4	.774, .731, .787, .693
Trust	5	.691, .790, .793, .651, .638

6.4.2 Validity

In this study, two types of validity were empirically examined, which were convergent and discriminant validity. These two validity measures were assessed during Exploratory Factor Analysis (EFA) as well as Confirmatory Factor Analysis (CFA) (Joseph F. Hair et al., 2010). Convergent validity assesses the extent to which two variables that measure the same concept are correlated (Joseph F. Hair et al., 2010). This implies that the items within the same factor are correlated. The evidence of convergent validity can be checked in EFA from the factor loadings which should be 0.50 or above (Joseph F. Hair et al., 2010; Raubenheimer, 2004). In our study, the factor loadings were obtained by utilizing Principal Components Analysis (PCA) with Varimax rotation in EFA, and the items in each factor loaded significantly within the range of 0.644-0.866 as shown in Table 6.11. Hence, the convergent validity is achieved since the items within every single factor are highly correlated.

Similarly, discriminant validity is viewed as the degree to which a factor is different from other factors (Joseph F. Hair et al., 2010). In EFA, discriminant validity requires the items to strongly correlate with their own factors than with other factors (Bryman, 2005; Joseph F. Hair et al., 2010; Raubenheimer, 2004). It can be observed from Table 6.11 that the items correlate strongly with their own factors than with other factors. Therefore, discriminant validity is also achieved in EFA. Finally, the evidence of convergent and discriminant validity support the construct validity of the measurement scales.

6.5 Exploratory Factor Analysis (EFA)

EFA is a statistical method for defining the structure of variables in a dataset based on correlation among the variables (Joseph F. Hair et al., 2010). Usually, EFA is conducted to explore factor structure or to reduce number of variables (Joseph F. Hair et al., 2010). Since most of the measured items for the research factors used in this research were adapted from previous studies, performing EFA was deemed useful since some items were conceptualized and/or operationalized to suit the context of our study. Consequently, the EFA was conducted for all the 14 research constructs using SPSS software. However to conduct the EFA, several assumptions should be taken into consideration: 1) assessment of the appropriateness of the data for factor analysis, 2) assessment of the communalities values for all the items, and 3) factor extraction and rotation.

6.5.1 Assessment of Appropriateness of Data

Factorability of data is the suitability of the data to perform factor analysis (Pallant, 2011). Generally, some assumptions related to the data set need to be considered before conducting factor analysis (Williams, Brown, & Onsman, 2012). Firstly, the sample size should be sufficiently large. Although there is no general rule for the sample size in all situations but basically it is recommended that the sample size should be sufficiently large or the sample data should contain minimum of 300 responses (Pallant, 2011). Secondly, the correlation coefficients between the items in the correlation matrix should be greater than 0.30 (Pallant, 2011). Likewise, the correlation coefficients between the items should not be above 0.90, since correlation of above 0.90 is regarded as multicollinearity; the items with this high correlation are candidate for removal (Tabachnick & Fidell, 2007). Thirdly, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, as well as Bartlett's test of sphericity are used to assess the factorability of the sample data. The KMO value should be 0.60 or above, and Bartlett's test of sphericity should be significant at $p < 0.05$ for the sample to be considered adequate for conducting factor analysis (Joseph F. Hair et al., 2010; Pallant, 2011; Williams et al., 2012).

In the present study, all the above conditions were met. Firstly, in terms of the sample size, the 451 responses in this study satisfied the condition that for factor analysis, the responses should be at least 300 (Pallant, 2011). Secondly, the correlation matrix coefficients for all the items in each factor in the proposed model were calculated using SPSS software, and the results (see Appendix R) showed that the correlation coefficients between items in all the factors were all above 0.30 and there was no high correlation (above 0.90) between the items found. Thirdly, the KMO value was 0.891 which was above the acceptable threshold of 0.60 (Pallant, 2011) as shown in Table 6.8. Also, Bartlett's test of sphericity was strongly significant at $p<0.05$ (p = 0.000), supporting the assumption that there were satisfactory relationships between the variables (Joseph F. Hair et al., 2010).

Table 6-8 KMO and Bartlett's test of sphericity result

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.891
Bartlett's Test of Sphericity	Approx. Chi-Square	13328.235
	df	1485
	Sig.	0.000

Hence, based on the sample size in this study (451 responses), correlation matrix coefficients between the items, KMO as well as Bartlett's test of sphericity results we can conclude that the data set was appropriate for conducting factor analysis.

6.5.2 Communalities

Another metric that is used to improve the total variance explained by the items retained is communality (Pallant, 2011). Communalities give "information about how much of the variance in each item is explained" (Pallant, 2011, p. 198). Items with communality values less than 0.30 mean they do not fit well with other items in their components; thus, they can be deleted in order to improve their corresponding scale (Pallant, 2011). In the present study, the communality values for the measured items varied from 0.556 for PU5 to 0.820 for ENJ2 as shown in Table 6.9. Therefore, no item was deleted based on communality value since the communality values for all the items were above 0.30 recommended threshold (Pallant, 2011).

Table 6-9 Communality values for all the items

Item	Extraction
PU1	.698
PU2	.688
PU3	.659
PU4	.667
PU5	.556
PU6	.648
PEOU1	.612
PEOU2	.626
PEOU3	.686
PEOU4	.717
PEOU5	.610
PEOU6	.645
BI1	.756
BI2	.818
BI3	.726
SE2	.657
SE3	.614

Item	Extraction
SE4	.702
SE5	.644
PLAY1	.660
PLAY2	.641
PLAY3	.721
PLAY4	.696
PEC1	.590
PEC2	.682
PEC4	.697
PEC5	.690
ANX1	.614
ANX2	.709
ANX3	.775
ANX4	.766
ENJ1	.794
ENJ2	.820
ENJ3	.817
SN1	.747
SN2	.810
SN3	.712
IMG1	.659
IMG2	.774
IMG3	.670
REL1	.745
REL2	.796
REL3	.751
OUT1	.766
OUT2	.729
OUT3	.629
RES1	.786
RES2	.740
RES3	.781
RES4	.704
TR1	.668
TR2	.788
TR3	.779
TR4	.611
TR5	.614

6.5.3 Factor Extraction and Rotation

Selecting items that best describe a particular construct in EFA is a two-stage process, including factor extraction, and factor rotation and interpretation. Factor extraction is the process of defining the minimum number of the factors which can constitute the structure of the variables in the analysis (Joseph F. Hair et al., 2010; Pallant, 2011). Factors can be extracted using different approaches such as Principal Components Analysis (PCA), principal factors, image factoring, unweighted least squares, alpha factoring, maximum likelihood factoring, and generalized least squares (Pallant, 2011). The researchers usually choose an approach that will give a number of factors that best explain the relationships among the variables. PCAis adopted in this study since it is the commonly used method (Pallant, 2011).

Furthermore, determining the number of factors to be extracted can be achieved using latent root (Kaiser's criterion), priori criterion, percentage of variance, or scree test criterion (Joseph F. Hair et al., 2010; Pallant, 2011). Latent root or Kaiser's criterion is the most commonly used approach that assumes any factor with latent roots (eigenvalues) larger than 1 is considered significant and has to be retained based on the fact that any factor must account for the variance of at least one variable (Joseph F. Hair et al., 2010; Pallant, 2011). Priori criterion is used to extract the specified number of factors the researcher considers appropriate before the beginning of the analysis (Joseph F. Hair et al., 2010; Pallant, 2011). The percentage of variance criterion is used when the researcher wants to extract factors that cumulatively explain a certain percentage of total variance extracted to "ensure practical significance for the derived factors" (Joseph F. Hair et al., 2010, p. 109). In the percentage of variance criterion, it is recommended that the factoring process should be stopped when the factors explain at least 95% for natural science research or 60% for social sciences research (Joseph F. Hair et al., 2010). Finally, the Catell's scree test is a graphical way of extracting factors by plotting the eigenvalues against the number of factors and observing the shape of the graph to find a point at which the curve begins to straighten out. The factors above the point at which the curve becomes horizontal are retained (Joseph F. Hair et al., 2010; Pallant, 2011). Hence, latent root (Kaiser's criterion), scree test criterion, and percentage of variance criterion were used in this study to identify the number of factors to be extracted.

On the other hand, factor rotation and interpretation is a process that rotates the factors to present "the pattern of loadings in a manner that is easier to interpret" (Pallant, 2011, p. 184). There are two ways of rotating the factors, namely orthogonal (uncorrelated) and oblique (correlated) rotations (Joseph F. Hair et al., 2010). The main difference between these two approaches is that in orthogonal rotation the constructs are assumed to be unrelated while in oblique rotation the constructs are assumed to be related (Tabachnick & Fidell, 2007). In this study we used orthogonal approach due to its simplicity in interpretation and reporting (Pallant, 2011). However, in the orthogonal category there are three rotation methods (Varimax, Quartimax, and Equamax). Varimax method, which is the most commonly used rotation method was chosen in this study as it can "minimise the number of variables that have high loadings on each factor" (Pallant, 2011, p. 185).

In this research, EFA was conducted by employing PCA and orthogonal method with Varimax rotation using SPSS. It can be observed from Table 6.10 that fourteen components are extracted by using both latent root (Kaiser's criterion) and percentage of variance criteria. Using the first criterion (latent root), all the fourteen components have eigenvalue greater than 1. The remaining components have eigenvalues less than 1. Therefore, only the components with eigenvalue above 1 are retained as recommended by Joseph F. Hair et al. (2010). Similarly, Table 6.10 shows that the total percentage of variance explained by the fourteen components is 70.3%, above the minimum of 60% expected from non-natural science research (Joseph F. Hair et al., 2010).

Table 6-10 Total number of factors extracted as well as total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.760	23.199	23.199	12.760	23.199	23.199	4.292	7.803	7.803
2	3.793	6.896	30.095	3.793	6.896	30.095	3.946	7.174	14.977
3	3.018	5.487	35.582	3.018	5.487	35.582	3.606	6.557	21.533
4	2.732	4.967	40.550	2.732	4.967	40.550	3.113	5.659	27.193
5	2.346	4.266	44.815	2.346	4.266	44.815	2.913	5.297	32.490
6	2.130	3.873	48.689	2.130	3.873	48.689	2.634	4.789	37.279
7	1.963	3.568	52.257	1.963	3.568	52.257	2.617	4.759	42.038
8	1.867	3.395	55.652	1.867	3.395	55.652	2.552	4.640	46.679
9	1.654	3.007	58.658	1.654	3.007	58.658	2.318	4.214	50.893
10	1.568	2.852	61.510	1.568	2.852	61.510	2.276	4.138	55.031
11	1.328	2.414	63.924	1.328	2.414	63.924	2.256	4.101	59.132
12	1.249	2.272	66.195	1.249	2.272	66.195	2.150	3.909	63.041
13	1.154	2.097	68.293	1.154	2.097	68.293	2.005	3.645	66.686
14	1.100	2.000	70.293	1.100	2.000	70.293	1.984	3.607	70.293
15	0.781	1.419	71.712						
16	0.750	1.363	73.075						
17	0.680	1.236	74.311						
18	0.665	1.210	75.521						
19	0.600	1.091	76.612						
20	0.592	1.076	77.688						
21	0.578	1.051	78.740						
22	0.570	1.036	79.776						
23	0.552	1.004	80.780						

24	0.532	0.967	81.747						
25	0.522	0.949	82.696						
26	0.512	0.931	83.627						
27	0.495	0.900	84.527						
28	0.478	0.869	85.396						
29	0.453	0.823	86.220						
30	0.447	0.813	87.033						
31	0.437	0.795	87.828						
32	0.428	0.778	88.605						
33	0.407	0.740	89.346						
34	0.394	0.717	90.063						
35	0.375	0.682	90.745						
36	0.367	0.667	91.412						
37	0.356	0.648	92.060						
38	0.330	0.600	92.660						
39	0.327	0.595	93.255						
40	0.311	0.565	93.820						
41	0.301	0.547	94.366						
42	0.284	0.517	94.883						
43	0.273	0.496	95.379						
44	0.264	0.481	95.860						
45	0.252	0.458	96.318						
46	0.246	0.448	96.766						
47	0.235	0.427	97.193						
48	0.222	0.404	97.598						
49	0.219	0.399	97.996						
50	0.210	0.381	98.377						
51	0.204	0.370	98.748						
52	0.193	0.350	99.098						
53	0.186	0.338	99.436						
54	0.170	0.310	99.746						
55	0.140	0.254	100.000						

In addition, the scree plot test result shown in Figure 6.1 shows that 14 factors are extracted, same as the number of factors extracted from the earlier two criteria (latent root and percentage of variance).

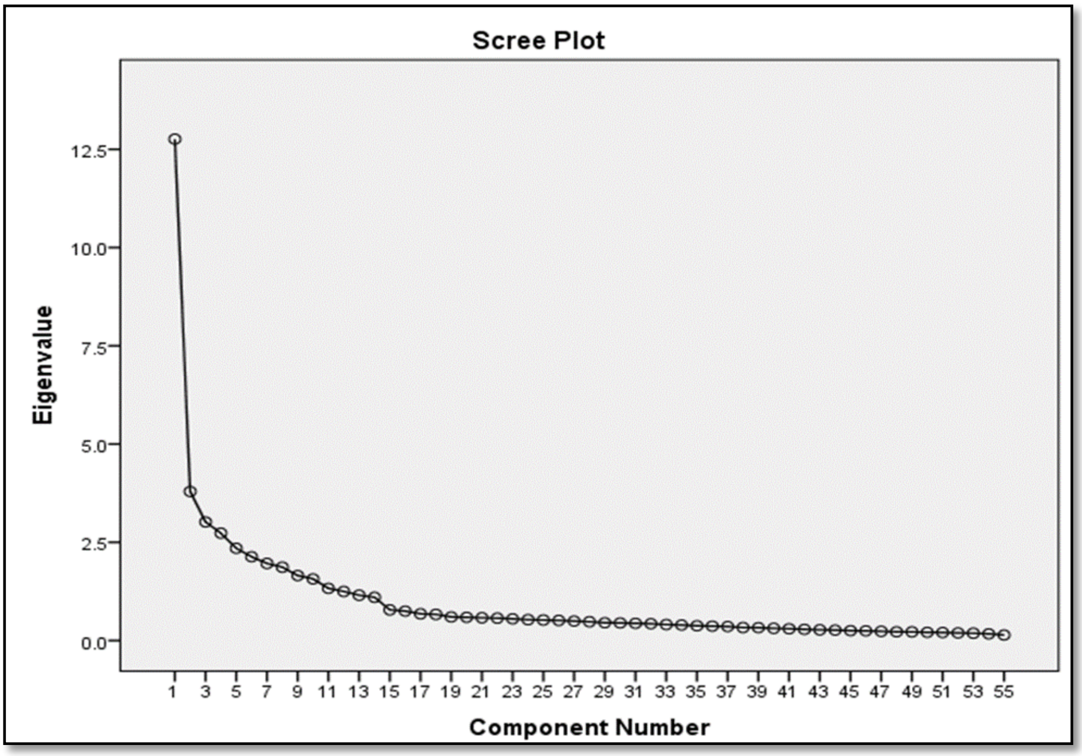


Figure 6-1 Scree plot test graph

Moreover, the results of the rotated fourteen-factor solution using PCA and Varimax rotation method are presented in Table 6.11, where all the items loaded on the fourteen factors with each item having strong loading of above 0.50 recommended threshold and all the items have not loaded highly on more than one factor (Joseph F. Hair et al., 2010). None of the items is removed since they all load substantially on their respective factors.

Table 6-11 Rotated component matrix

	Components													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
PU1	**0.760**	0.157	0.079	0.002	0.022	0.109	0.124	0.073	0.098	0.172	0.009	0.023	0.041	0.123
PU2	**0.756**	0.156	0.151	0.033	0.080	0.069	0.095	0.054	0.083	0.157	0.077	0.054	0.057	0.045
PU6	**0.734**	0.156	0.101	0.078	-0.064	0.103	0.036	0.068	0.072	0.080	0.026	0.008	0.130	0.137
PU3	**0.732**	0.162	0.075	0.092	0.038	0.059	0.138	0.137	0.087	0.053	0.057	0.121	0.018	0.108
PU4	**0.725**	0.232	0.124	0.021	0.033	0.117	0.057	0.031	0.118	0.053	0.127	0.040	0.045	0.127
PU5	**0.650**	0.164	0.120	0.108	-0.136	0.071	0.012	0.007	0.108	0.107	0.048	0.035	0.090	0.149
PEOU4	0.088	**0.789**	0.102	0.092	-0.015	0.078	0.119	0.088	0.098	0.118	0.031	0.075	0.043	0.086
PEOU3	0.198	**0.761**	0.137	0.019	-0.017	-0.042	0.056	0.117	0.064	0.066	0.067	0.094	0.088	0.011
PEOU5	0.147	**0.727**	0.054	0.046	-0.067	0.031	0.123	0.131	0.060	0.023	-0.044	0.022	0.002	0.107
PEOU6	0.075	**0.700**	0.037	0.047	-0.022	0.057	0.046	0.033	0.145	0.080	0.092	0.032	0.062	0.313
PEOU1	0.277	**0.672**	0.009	0.141	-0.106	0.027	0.106	0.076	0.091	-0.019	0.015	-0.118	0.036	0.101

PEOU2	0.347	**0.670**	0.078	0.035	-0.071	0.040	0.007	0.104	0.069	0.018	0.104	0.100	-0.007	0.084
TR2	0.062	0.050	**0.848**	0.043	-0.013	0.138	0.022	0.095	0.031	-0.011	0.092	0.139	0.031	0.048
TR3	0.157	0.088	**0.839**	-0.027	0.004	0.077	0.027	0.122	0.048	0.008	0.079	0.090	0.034	0.046
TR1	0.063	0.030	**0.783**	0.061	-0.046	0.083	0.076	0.057	0.062	0.028	0.050	0.122	0.067	-0.034
TR5	0.134	0.117	**0.711**	0.084	0.058	0.018	0.081	0.026	0.060	0.124	0.024	0.060	0.143	0.124
TR4	0.162	0.092	**0.709**	0.026	-0.008	0.080	0.151	0.109	0.104	0.084	0.088	0.024	0.031	0.062
RES3	0.060	0.114	0.053	**0.853**	-0.076	0.030	0.091	0.016	0.081	0.074	0.026	0.057	0.037	0.040
RES1	0.021	0.049	0.103	**0.831**	-0.020	0.034	0.155	0.035	0.157	0.096	0.072	0.041	0.112	0.050
RES4	0.074	0.032	0.034	**0.824**	-0.049	0.049	0.038	0.016	-0.010	0.029	0.045	0.028	0.058	0.055
RES2	0.111	0.107	-0.013	**0.816**	-0.008	0.071	0.089	0.052	0.035	0.130	-0.019	0.106	0.053	0.042
ANX4	0.012	0.008	-0.018	-0.097	**0.866**	0.012	0.001	0.010	0.000	0.031	0.051	0.042	0.026	-0.009
ANX3	0.007	-0.072	-0.007	-0.010	**0.865**	0.055	-0.032	-0.043	-0.028	0.051	0.102	0.036	0.008	-0.013
ANX2	0.003	-0.058	0.004	-0.029	**0.818**	0.128	-0.044	-0.018	0.040	-0.055	-0.078	0.054	0.013	-0.055
ANX1	-0.046	-0.090	0.010	-0.009	**0.760**	-0.049	-0.034	-0.003	-0.039	0.012	0.115	0.061	-0.020	0.055
SE4	0.116	-0.039	0.101	-0.028	0.026	**0.795**	0.036	0.036	0.037	0.116	0.068	0.145	0.001	0.011
SE5	0.070	0.010	0.108	0.080	-0.003	**0.774**	0.063	-0.018	-0.035	0.079	0.022	0.048	0.076	0.025
SE2	0.078	0.051	0.073	0.034	0.032	**0.770**	0.071	0.109	0.033	0.012	0.097	-0.068	0.044	0.115
SE3	0.152	0.130	0.070	0.092	0.097	**0.721**	0.005	0.107	0.007	-0.054	0.049	0.084	0.084	0.037
PEC2	0.079	0.007	-0.030	0.055	-0.022	0.078	**0.801**	0.081	0.035	-0.012	0.008	0.058	0.043	0.098
PEC4	0.180	0.124	0.109	0.131	-0.041	0.101	**0.753**	0.046	0.102	0.151	0.052	0.020	-0.003	0.056
PEC5	0.074	0.159	0.127	0.172	-0.088	0.021	**0.728**	0.135	0.035	0.214	0.065	0.051	0.050	-0.020
PEC1	0.065	0.144	0.171	0.052	0.010	-0.006	**0.698**	0.085	0.110	0.028	0.060	0.076	0.124	0.036
PLAY1	0.080	0.140	0.032	0.034	-0.002	0.085	0.061	**0.774**	-0.031	0.053	0.066	0.078	0.020	0.087
PLAY4	0.020	0.176	0.217	0.012	-0.015	0.020	0.102	**0.762**	0.001	0.086	0.042	-0.083	0.040	-0.090
PLAY2	0.086	0.143	0.068	-0.005	-0.006	0.097	0.103	**0.734**	0.152	0.034	0.075	0.126	0.001	0.060
PLAY3	0.167	0.013	0.124	0.108	-0.049	0.045	0.092	**0.711**	0.296	0.021	0.066	0.125	0.014	0.198
ENJ2	0.176	0.131	0.132	0.113	-0.005	0.011	0.093	0.110	**0.803**	0.125	0.107	0.116	0.166	0.093
ENJ3	0.206	0.179	0.146	0.083	-0.026	-0.025	0.105	0.119	**0.791**	0.113	0.170	0.097	0.097	0.031
ENJ1	0.203	0.247	0.065	0.110	-0.008	0.060	0.136	0.139	**0.752**	0.210	0.055	0.053	0.114	0.068
REL2	0.192	0.084	0.064	0.122	0.045	0.108	0.120	0.044	0.065	**0.796**	0.097	0.170	0.094	0.136
REL1	0.192	0.102	0.063	0.137	-0.004	0.052	0.068	0.066	0.157	**0.771**	0.061	0.142	0.094	0.108
REL3	0.228	0.082	0.110	0.126	0.017	0.026	0.194	0.109	0.198	**0.736**	0.145	0.064	0.091	0.010
SN2	0.139	0.069	0.157	0.089	0.041	0.063	0.047	0.086	0.101	0.038	**0.838**	0.105	0.115	0.010
SN1	0.036	0.049	0.063	0.008	0.182	0.089	0.047	0.098	0.067	0.105	**0.800**	0.137	0.102	0.048
SN3	0.123	0.088	0.115	0.031	0.006	0.116	0.088	0.061	0.123	0.129	**0.737**	0.254	0.089	0.053
IMG2	0.058	0.052	0.146	0.047	0.129	0.106	0.055	0.061	0.085	0.104	0.172	**0.811**	0.067	0.008
IMG1	0.039	0.033	0.091	0.091	0.110	0.093	0.025	0.112	0.042	0.098	0.213	**0.735**	0.053	0.082
IMG3	0.134	0.094	0.219	0.111	-0.007	0.017	0.138	0.051	0.105	0.138	0.083	**0.720**	0.067	0.042
OUT1	0.053	0.047	-0.002	0.026	-0.028	0.136	0.064	0.039	0.060	0.001	0.075	-0.007	**0.847**	0.091
OUT2	0.130	0.066	0.165	0.122	0.054	0.031	0.055	-0.009	0.160	0.093	0.101	0.097	**0.777**	0.032
OUT3	0.169	0.082	0.187	0.163	0.012	0.052	0.113	0.044	0.110	0.220	0.149	0.130	**0.644**	0.011
BI2	0.280	0.260	0.100	0.052	0.029	0.048	0.119	0.101	0.115	0.051	0.010	0.051	0.047	**0.782**
BI3	0.284	0.223	0.092	0.127	-0.068	0.163	0.060	0.072	0.033	0.167	0.073	0.070	0.047	**0.700**
BI1	0.322	0.346	0.100	0.083	0.016	0.063	0.059	0.107	0.054	0.093	0.056	0.053	0.107	**0.684**

In summary, 14 factors are extracted based on latent root (Kaiser's criterion), percentage of variance criteria, as well as scree plot test graph. The total percentage of variance explained by these 14 factors is 70.293%.

6.6 Structural Equation Modelling (SEM)

SEM technique was used to examine the relationships between the constructs in the study model. SEM is a multivariate technique "combining aspects of factor analysis and multiple regression that enables the researcher to simultaneously examine a series of interrelated dependence relationships among the measured variables and latent constructs (variates) as well as between several latent constructs" (Joseph F. Hair et al., 2010, p. 634). The main aim of SEM is to describe relationships among multiple constructs by examining the structure of the relationships between the constructs. Constructs are dependent or independent variables represented in SEM as unobservable or latent variables. Constructs are represented and measured indirectly by measurable variables called indicators (Joseph F. Hair et al., 2010). In this study, a two-step approach was employed to conduct the SEM analysis as suggested by Joseph F. Hair et al. (2010). The first step examined the measurement model using CFA in order to validate the items that measure the constructs and determine the fitness of the measurement model. Constructs reliability, convergent validity, and discriminant validity were established in this step. In the second step, a structural model was developed by setting dependence relationships between the hypothesized constructs in the research model (Joseph F. Hair et al., 2010). The hypotheses were tested during the second stage of SEM. The SEM analysis was employed using AMOS software. The following subsections present the results related to CFA, structural model evaluation and hypotheses testing, as well as testing the impact of the moderating constructs in the research model.

6.6.1 Confirmatory Factor Analysis (CFA)

CFA is a multivariate technique that provides confirmatory test of a measurement theory. One of the distinction between EFA and CFA is that, in EFA factors are extracted from statistical results, whereas in CFA the factors and relationships between measured variables are first defined based on a theory (Joseph F. Hair et al., 2010). The theory, which is the measurement model, “specifies how measured variables logically and systematically represent constructs involved in a theoretical model” (Joseph F. Hair et al., 2010, p. 693). Therefore, CFA is a procedure to validate or confirm predefined relationship unlike in EFA where the relationships are created. Moreover, CFA is used to determine if the measurement model fits the data collected by the researcher (Kline, 2011).

In this study, CFA was carried out to assess the construct reliability and validity of measurement model based on two measures, namely convergent and discriminant validity as recommended by Joseph F. Hair et al. (2010). However, the overall measurement model fit was examined prior to assessment of the construct validity as presented in the following subsections. The CFA was conducted using SEM software called AMOS.

6.6.1.1 Measurement Model Assessment

Measurement model is the first of the two models (measurement and structural) in the SEM analysis that identifies indicators for each construct and allows the assessment of construct validity. Testing the measurement model is done using CFA (Joseph F. Hair et al., 2010). In AMOS, CFA is visually depicted as a collection of shapes and arrows representing the variables and relationships respectively. The latent constructs are represented by oval shapes, indicators are represented by rectangular shapes, while error terms are represented by circles. A single headed arrow that links constructs with indicators represent their relationships in the form of factor loadings. Similarly, two headed arrows indicate the correlational relationship (covariance) between the constructs (Joseph F. Hair et al., 2010).

The main objective of conducting CFA in this study was to assess the construct validity of the measurement model shown in Figure 6.2, which involves an assessment of the convergent and discriminant validity. However, prior to assessment of the construct validity the overall goodness of fit (GOF) for the measurement model was examined. GOF is “an index of how well a model fits the data from which it was generated” (Field, 2009, p. 786). Different measures of GOF exist that assess “the similarity of the estimated covariance matrix (theory) to reality (the observed covariance matrix)” (Joseph F. Hair et al., 2010, p. 665). The measures are classified as absolute, incremental, and parsimony indices (Joseph F. Hair et al., 2010). Absolute fit indices is a "measure of overall goodness-of-fit for both the structural and measurement models" (Joseph F. Hair et al., 2010, p. 630). They include Chi-square(X^2), Goodness-Of-Fit Index (GFI), Root Mean Square Residual (RMR), Normed chi-square (X^2/df), and Root Mean Square Error of Approximation (RMSEA) (Joseph F. Hair et al., 2010). Incremental indices are "group of goodness-of-fit indices that assesses how well a specified model fits relative to some alternative baseline model" (Joseph F. Hair et al., 2010, p. 632), including Relative Noncentrality Index (RNI), Comparative Fit Index (CFI), Normed Fit Index (NFI), and Tucker Lewis Index (TLI). Finally, the parsimony fit indices is a "measures of overall goodness-of-fit representing the degree of model fit per estimated coefficient" (Joseph F. Hair et al., 2010, p. 633). These indices report the best model among competing models after comparing the model fit with its complexity and they include Parsimony Normed Fit Index (PNFI) as well as Adjusted Goodness of Fit Index (AGFI) (Joseph F. Hair et al., 2010).

The measurement model was assessed using various measures of GOF. Specifically, X^2/df, GFI, CFI, AGFI, RMSEA, TLI from the three categories of the measures (absolute, incremental, and parsimony indices) were used based on the recommendation of selecting at least one index from each category (Joseph F. Hair et al., 2010). According to Joseph F. Hair et al. (2010) three to four measures (at least one from each category) together with X^2 and df are sufficient to support fitness of a model. However, X^2 was not used as a measure of GOF in this study because of its sensitivity to large sample size (Joseph F. Hair et al., 2010; Schumacker & Lomax, 2010). Joseph F. Hair et al. (2010) revealed that X^2 of a model with for instance sample size above 250 and variables of more than 12 is expected to be significant. Hence, X^2/df is used as part of the indices to assess the model. In addition, factor loading of items was used to assess the measurement model. The factor loadings for each item should be above 0.50 as recommended by Joseph F. Hair et al. (2010). The recommended thresholds of the fit indices used in this study is presented in Table 6.12 based on the recommendation of Joseph F. Hair et al. (2010), Hoyle (1995), and Suh and Han (2002).

Table 6-12 Goodness of fit indices recommended threshold

Fit Measure	Recommended
X^2/df	< 3
GFI	> 0.90
AGFI	> 0.80
CFI	> 0.90
TLI	> 0.90
RMSEA	< 0.08

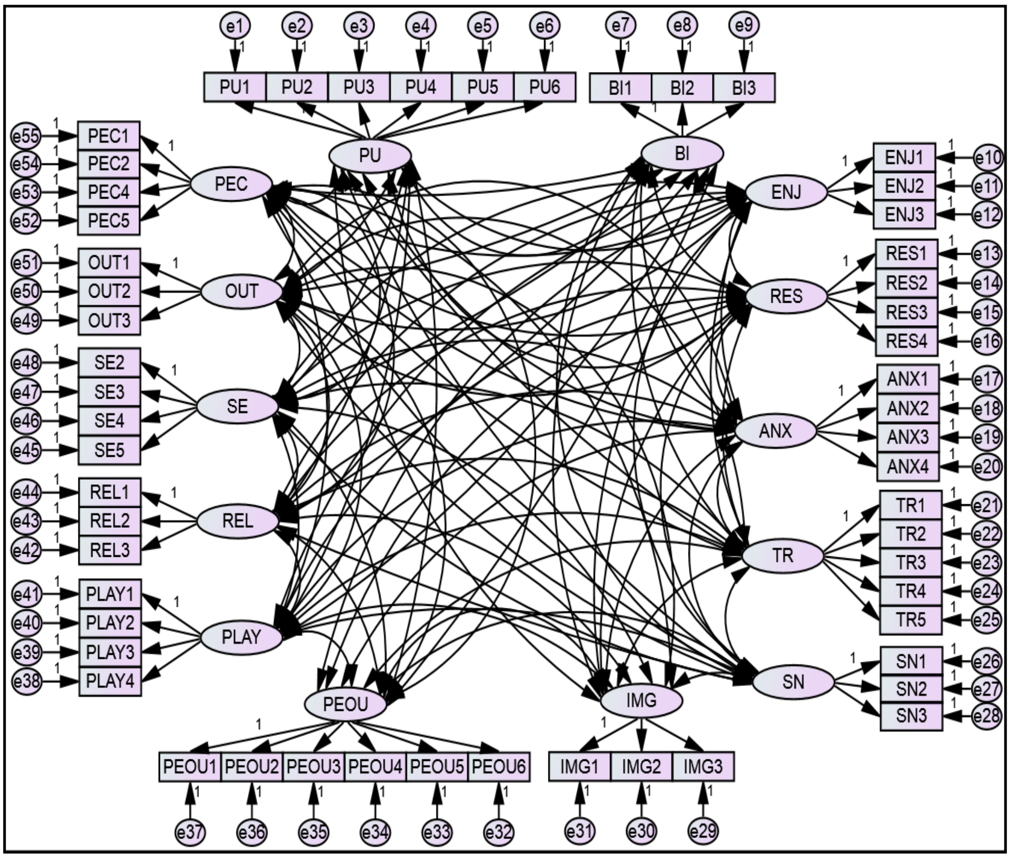


Figure 6-2 The measurement model

As shown in Table 6.13, the values for all the GOF indices in the measurement model initially were within the acceptable range except GFI, which was below the minimum threshold (X^2/df = 1.630, GFI = 0.854, AGFI = 0.832, CFI = 0.932, TLI = 0.925, and RMSEA = 0.037), thus, the measurement model was later re-specified and improved based on 3 recommended methods (Byrne, 2010; Joseph F. Hair et al., 2010; Kline, 2011). The methods are factor loading (standardized regression weight) in which each item should be above 0.50, Squared Multiple Correlation (SMC) value in which each item should be above 0.30, and modification indices (MI) in which items with high covariance above 4.0 between measurement errors can possibly be deleted (Byrne, 2010; Joseph F. Hair et al., 2010; Kline, 2011; Pallant, 2011).

Checking of the factor loadings found that the values for all the items were above 0.50 recommended threshold. The process continued by checking the SMC whose values for all the items were found to be above 0.30 threshold. Finally, in the MI test, 13 problematic items were found to have high covariance with other items, which were PU5, PEOU1, ANX2, PU1, PEOU3, TR1, PLAY4, SE3, TR2, RES1, PEC1, PEOU6, and PU2. Thus, these items were deleted to improve the GOF of the measurement model. After deleting the problematic items one after another, the final measurement model presented in Figure 6.3 showed the acceptable fit indices (X^2/df = 1.396, GFI = 0.907, AGFI = 0.885, CFI = 0.965, TLI = 0.958, and RMSEA = 0.030), as shown in Table 6.13.

Table 6-13 Goodness of fit indices for the measurement model

Fit Measure	Recommended	Initial	Final
X^2/df	< 3	1.630	1.396
GFI	> 0.90	0.854	0.907
AGFI	> 0.80	0.832	0.885
CFI	> 0.90	0.932	0.965
TLI	> 0.90	0.925	0.958
RMSEA	< 0.08	0.037	0.030

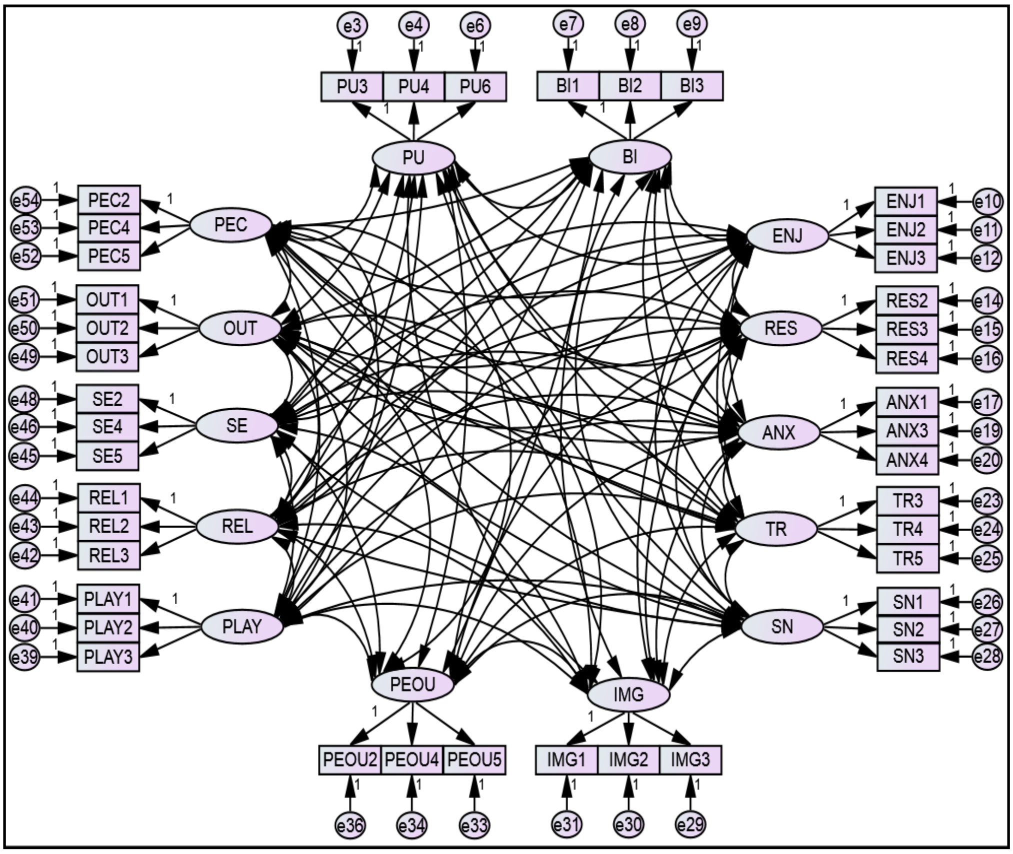


Figure 6-3 The final measurement model

After the measurement model was examined using the GOF tests, the validity of the measurement model was examined using construct validity based on two measures, namely convergent validity and discriminant validity as recommended by Joseph F. Hair et al. (2010). According to Joseph F. Hair et al. (2010, p. 689), construct validity is an “extent to which a set of measured variables actually represents the theoretical latent construct those variables are designed to measure”. The results of convergent and discriminant validity for the constructs are presented in the following subsections.

6.6.1.2 Convergent Validity

According to Joseph F. Hair et al. (2010, p. 689), convergent validity is the “extent to which indicators of a specific construct converge or share a high proportion of variance in common”. In CFA, the convergent validity for all the constructs is determined by factor loadings, Average Variance Extracted (AVE), and construct reliability (Joseph F. Hair et al., 2010). The factor loadings should be high on a factor to demonstrate high convergence validity. Factor loadings are expected to be equal to or exceed the recommended value of 0.50 (Joseph F. Hair et al., 2010). AVE is “a summary measure of convergence among a set of items representing a latent construct. It is the average percentage of variation explained *(variance extracted)* among the items of a construct” (Joseph F. Hair et al., 2010, p. 688). The AVE is suggested to be 0.50 or higher for an indication of adequate convergence. Finally, construct reliability is the third indicator of convergent validity. In CFA, construct reliability estimate is used to represent the reliability. Although a reliability value of 0.60 is acceptable, an estimate of 0.70 is an indication of good reliability. Higher construct reliability is associated with presence of internal consistency (Joseph F. Hair et al., 2010). The AVE and construct reliability estimates for the constructs are presented in Table 6.14, where the values are all above the recommended threshold of 0.50 and 0.70 for AVE and construct reliability respectively (Joseph F. Hair et al., 2010).

Table 6-14 Construct reliability and average variance extracted results

Construct	Construct Reliability	Average Variance Extracted
Perceived Usefulness	0.800	0.572
Perceived Ease of Use	0.770	0.528
Behavioural Intention	0.852	0.658
Self-Efficacy	0.771	0.531
Playfulness	0.766	0.524
Perceptions of External Control	0.786	0.553
Anxiety	0.834	0.628
Perceived Enjoyment	0.883	0.715
Subjective Norm	0.830	0.620
Image	0.786	0.552
Job Relevance	0.844	0.643
Output Quality	0.759	0.513
Result Demonstrability	0.843	0.643
Trust	0.812	0.590

Additionally, Table 6.15 presents the factor loadings, SMC values for all the items, and the correlations between the constructs. It can be observed from Table 6.15 that the factor loadings for all the items are all above the recommended threshold of 0.50, SMC values for all the items are greater than 0.30 recommended threshold, and all the correlations between the constructs are below 0.85 recommended threshold (Joseph F. Hair et al., 2010; Kline, 2011; Pallant, 2011; Tabachnick & Fidell, 2007). Thus, the results of factor loadings, AVE, and construct reliability indicate adequate convergent validity for all the constructs in the measurement model.

6.6.1.3 Discriminant Validity

Discriminant validity is the “extent to which a construct is truly distinct from other constructs” (Joseph F. Hair et al., 2010, p. 689). The discriminant validity in CFA can be realized when the square root of AVE for each construct is higher than the correlations between the constructs (Fornell & Larcker, 1981). Table 6.16 shows that the square roots of AVEs for all the constructs are greater than the correlations between the constructs as suggested by Fornell and Larcker (1981), implying that the discriminant validity is also supported. Therefore, the results of convergent validity and discriminant validity are sufficient to support the construct validity of the measurement scales in this study.

Table 6-15 Complete measurement model assessment results

Construct	Item	Factor Loading	Squared Multiple Correlation	Composite Reliability	Average Variance Extracted	Correlation between Constructs	
Perceived Usefulness (PU)				0.800	0.572	PU ↔ PEOU: 0.605	PU ↔ SE: 0.327
	PU3	0.780	0.609			PU ↔ TR: 0.432	PU ↔ PLAY: 0.419
	PU4	0.766	0.587			PU ↔ SN: 0.353	PU ↔ IMG: 0.318
	PU6	0.721	0.520			PU ↔ REL: 0.489	PU ↔ OUT: 0.389
Perceived Ease of Use (PEOU)				0.770	0.528	PU ↔ ENJ: 0.506	PU ↔ BI: 0.664
	PEOU2	0.743	0.552			PU ↔ PEC: 0.393	PU ↔ ANX: -0.006
	PEOU4	0.739	0.546			PU ↔ RES: 0.26	PEOU↔ SE: 0.17
	PEOU5	0.696	0.485			PEOU ↔ TR: 0.356	PEOU↔ PLAY: 0.422
Behavioural Intention (BI)				0.852	0.658	PEOU ↔ SN: 0.271	PEOU ↔ IMG: 0.273
	BI1	0.851	0.724			PEOU ↔ REL: 0.363	PEOU ↔ OUT: 0.273
	BI2	0.827	0.684			PEOU ↔ ENJ: 0.478	PEOU ↔ BI: 0.649
	BI3	0.752	0.566			PEOU ↔ PEC: 0.392	PEOU ↔ ANX: -0.112
Self-Efficacy (SE)				0.771	0.531	PEOU ↔ RES: 0.275	SE ↔ TR: 0.273
	SE2	0.658	0.433			SE ↔ PLAY: 0.242	SE ↔ SN: 0.285
	SE4	0.783	0.614			SE ↔ IMG: 0.285	SE ↔ REL: 0.279
	SE5	0.739	0.546			SE ↔ OUT: 0.253	SE ↔ ENJ: 0.147

Table 6-15 Complete measurement model assessment results (cont.)

Construct	Item	Factor Loading	Squared Multiple Correlation	Composite Reliability	Average Variance Extracted	Correlation between Constructs	
Playfulness (PLAY)				0.766	0.524	SE ↔ BI: 0.265	SE ↔ PEC: 0.23
	PLAY1	0.622	0.387			SE ↔ ANX: 0.071	SE ↔ RES: 0.142
	PLAY2	0.720	0.518			TR ↔ PLAY: 0.375	TR ↔ SN: 0.358
	PLAY3	0.817	0.668			TR ↔ IMG: 0.396	TR ↔ REL: 0.337
Perceptions of External Control (PEC)				0.786	0.553	TR ↔ OUT: 0.388	TR ↔ ENJ: 0.376
	PEC2	0.634	0.402			TR ↔ BI: 0.369	TR ↔ PEC: 0.335
	PEC4	0.801	0.642			TR ↔ ANX: 0.018	TR ↔ RES: 0.157
	PEC5	0.785	0.616			PLAY ↔ SN: 0.34	PLAY ↔ IMG: 0.361
Anxiety (ANX)				0.834	0.628	PLAY ↔ REL: 0.342	PLAY ↔ OUT: 0.229
	ANX1	0.699	0.489			PLAY ↔ ENJ: 0.501	PLAY ↔ BI: 0.428
	ANX3	0.825	0.680			PLAY ↔ PEC: 0.363	PLAY ↔ ANX: -0.034
	ANX4	0.846	0.716			PLAY ↔ RES: 0.2	SN ↔ IMG: 0.544
Perceived Enjoyment (ENJ)				0.883	0.715	SN ↔ REL: 0.401	SN ↔ OUT: 0.438
	ENJ1	0.832	0.691			SN ↔ ENJ: 0.411	SN ↔ BI: 0.276
	ENJ2	0.859	0.738			SN ↔ PEC: 0.261	SN ↔ ANX: 0.191
	ENJ3	0.845	0.714			SN ↔ RES: 0.163	IMG ↔ REL: 0.461

Table 6-15 Complete measurement model assessment results (cont.)

Construct	Item	Factor Loading	Squared Multiple Correlation	Composite Reliability	Average Variance Extracted	Correlation between Constructs	
Subjective Norm (SN)				0.830	0.620	IMG ↔ OUT: 0.369	IMG ↔ ENJ: 0.382
	SN1	0.751	0.564			IMG ↔ BI: 0.287	IMG ↔ PEC: 0.28
	SN2	0.836	0.698			IMG ↔ ANX: 0.178	IMG ↔ RES: 0.235
	SN3	0.772	0.597			REL ↔ OUT: 0.454	REL ↔ ENJ: 0.527
Image (IMG)				0.786	0.552	REL ↔ BI: 0.438	REL ↔ PEC: 0.471
	IMG1	0.684	0.469			REL ↔ ANX: 0.062	REL ↔ RES: 0.349
	IMG2	0.819	0.670			OUT ↔ ENJ: 0.487	OUT ↔ BI: 0.344
	IMG3	0.720	0.518			OUT ↔ PEC: 0.307	OUT ↔ ANX: 0.048
Job Relevance (REL)				0.844	0.643	OUT ↔ RES: 0.294	ENJ ↔ BI: 0.421
	REL1	0.775	0.600			ENJ ↔ PEC: 0.39	ENJ ↔ ANX: -0.029
	REL2	0.823	0.677			ENJ ↔ RES: 0.291	BI ↔ PEC: 0.338
	REL3	0.807	0.651			BI ↔ ANX: -0.019	BI ↔ RES: 0.268
Output Quality (OUT)				0.759	0.513	PEC ↔ ANX: -0.089	PEC ↔ RES: 0.339
	OUT1	0.653	0.427			ANX ↔ RES: -0.116	
	OUT2	0.772	0.596				
	OUT3	0.718	0.515				

Table 6-15 Complete measurement model assessment results (cont.)

Construct	Item	Factor Loading	Squared Multiple Correlation	Composite Reliability	Average Variance Extracted	Correlation between Constructs
Result Demonstrability (RES)				0.843	0.643	
	RES2	0.755	0.570			
	RES3	0.895	0.802			
	RES4	0.747	0.558			
Trust (TR)				0.812	0.590	
	TR3	0.801	0.641			
	TR4	0.747	0.559			
	TR5	0.755	0.570			

Table 6-16 Discriminant validity result for the constructs

Construct	ANX	PU	PEOU	SE	TR	PLAY	SN	IMG	REL	OUT	ENJ	BI	PEC	RES
Anxiety (ANX)	**0.793**													
Perceived Usefulness (PU)	-0.006	**0.756**												
Perceived Ease of Use (PEOU)	-0.112	0.605	**0.726**											
Self-Efficacy (SE)	0.071	0.327	0.170	**0.729**										
Trust (TR)	0.018	0.432	0.356	0.273	**0.768**									
Playfulness (PLAY)	-0.034	0.419	0.422	0.242	0.375	**0.724**								
Subjective Norm (SN)	0.191	0.353	0.271	0.285	0.358	0.340	**0.787**							
Image (IMG)	0.178	0.318	0.273	0.285	0.396	0.361	0.544	**0.743**						
Job Relevance (REL)	0.062	0.489	0.363	0.279	0.337	0.342	0.401	0.461	**0.802**					
Output Quality (OUT)	0.048	0.389	0.273	0.253	0.388	0.229	0.438	0.369	0.454	**0.716**				
Perceived Enjoyment (ENJ)	-0.029	0.506	0.478	0.147	0.376	0.501	0.411	0.382	0.527	0.487	**0.845**			
Behavioural Intention (BI)	-0.019	0.664	0.649	0.265	0.369	0.428	0.276	0.287	0.438	0.344	0.421	**0.811**		
Perceptions of External Control (PEC)	-0.089	0.393	0.392	0.230	0.335	0.363	0.261	0.280	0.471	0.307	0.390	0.338	**0.744**	
Result Demonstrability (RES)	-0.116	0.260	0.275	0.142	0.157	0.200	0.163	0.235	0.349	0.294	0.291	0.268	0.339	**0.802**

Note that, the diagonal (bold) values are the square root of AVE; while the remaining values are the correlations between the constructs.

6.6.2 Structural Model Evaluation and Hypotheses Testing

A structural model is a model "that relates exogenous and/or endogenous constructs to endogenous constructs" (Nunnally & Bernstein, 1994, p. 579). Structural model is used to test a theoretical model by presenting the model's constructs with their dependence relationships. These relationships link exogenous variables with endogenous variables presented with one-headed arrow. The visual representation of the structural model with the exogenous-endogenous relationships is called path diagram, which is assessed using path analysis. Path analysis enables estimation of relationships between constructs with the strength of the relationship using simple bivariate correlations (Joseph F. Hair et al., 2010). A structural model is viewed simply as a constrained measurement model. The differences between measurement and structural models include: the correlations between the constructs in measurement model are replaced with structural paths which show the significance of the relationships between the constructs; and only hypothesized direct paths are drawn with the exception of correlational associations (covariances) between exogenous variables (Joseph F. Hair et al., 2010). Figure 6.4 shows the full structural model of this study which includes 14 constructs with 17 hypothesized relationships, and 2 moderator constructs with 8 hypothesized relationships. The constructs are classified as exogenous constructs which are perceived usefulness, subjective norm, perceived ease of use, image, output quality, job relevance, result demonstrability, anxiety, playfulness, self-efficacy, perceptions of external control, perceived enjoyment, and trust; endogenous construct which is behavioural intention; and two moderator constructs which are output quality and Internet experience.

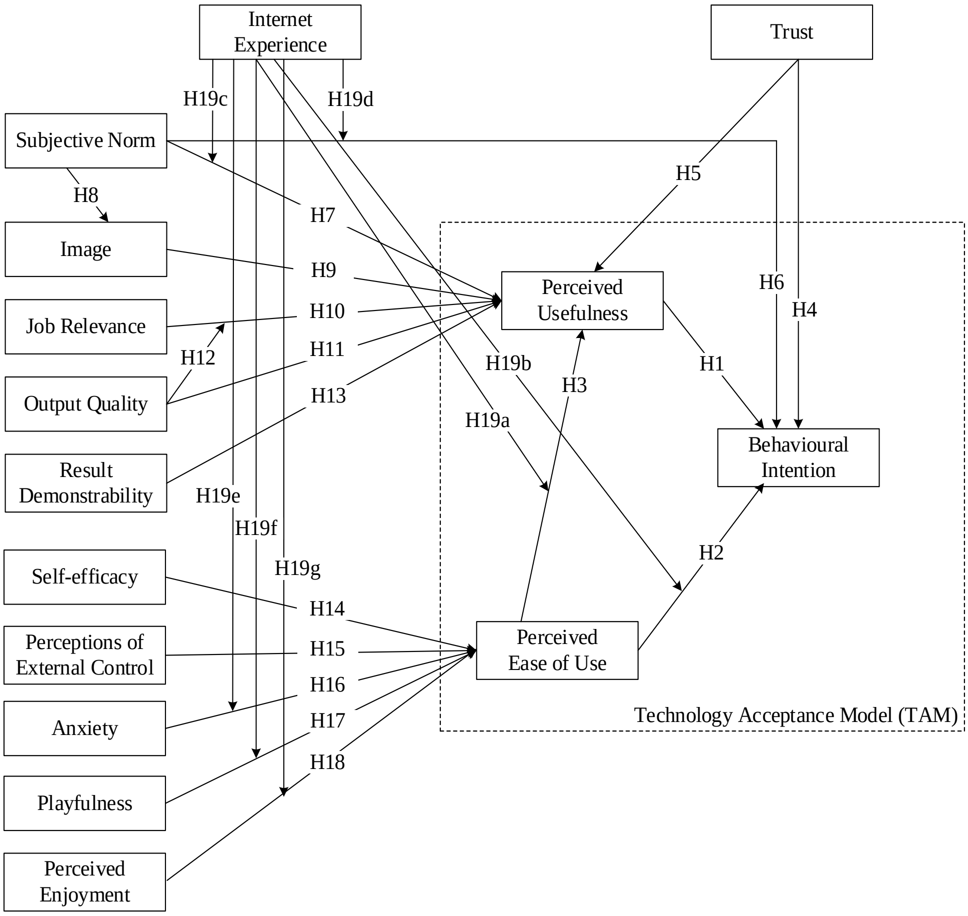


Figure 6-4 Proposed model with hypotheses

The structural model is assessed by examining the structural model fit and the standardized path coefficients to find out if the hypothesized relationships are supported or not. In the present study, the assessment of the structural model fit was conducted in a way similar to assessment of measurement model fit using the same GOF indices. Table 6.17 shows the fit indices for the structural model which suggested acceptable fit to the data (X^2/df = 1.440, GFI = 0.900, AGFI = 0.881, CFI = 0.959, TLI = 0.954, and RMSEA = 0.031).

Table 6-17 Goodness of fit indices for the structural model

Fit Measure	Recommended	Structural Model
X^2/df	< 3	1.440
GFI	> 0.90	0.900
AGFI	> 0.80	0.881
CFI	> 0.90	0.959
TLI	> 0.90	0.954
RMSEA	< 0.08	0.031

Hypotheses testing is usually conducted with the aim of determining the independent variables that contribute significantly to explaining the dependent variables (Joseph F. Hair et al., 2010). The hypothesized relationships are significant at $p< 0.05$ if their corresponding values for critical ratio are greater than 1.96 (Tabachnick & Fidell, 2007). Critical ratio "represents the parameter estimate divided by its standard error; as such, it operates as a z-statistic in testing that the estimate is statistically different from zero" (Byrne, 2010, p. 68). Moreover, the structural parameter estimates are also considered as part of the structural model assessment. The estimate of structural parameter is the "SEM equivalent of a regression coefficient that measures the linear relationship between a predictor construct and an outcome construct. Also called a path estimate" (Joseph F. Hair et al., 2010, p. 692). The path estimates and critical ratio are used in determining the significant hypotheses. The path estimate shows the extent to which the hypothesized relationships are significant and it also shows the prediction direction (Joseph F. Hair et al., 2010). The results of testing the main 14 constructs in the structural model reveal that nine out of the seventeen hypotheses are statistically significant as shown in Figure 6.5 and Table 6.18. The significant relationships are represented as thick lines with their path coefficients on the line as well as asterisks (*) that indicate the level of the significance, whereas the insignificant paths are presented as thin lines with their path coefficients.

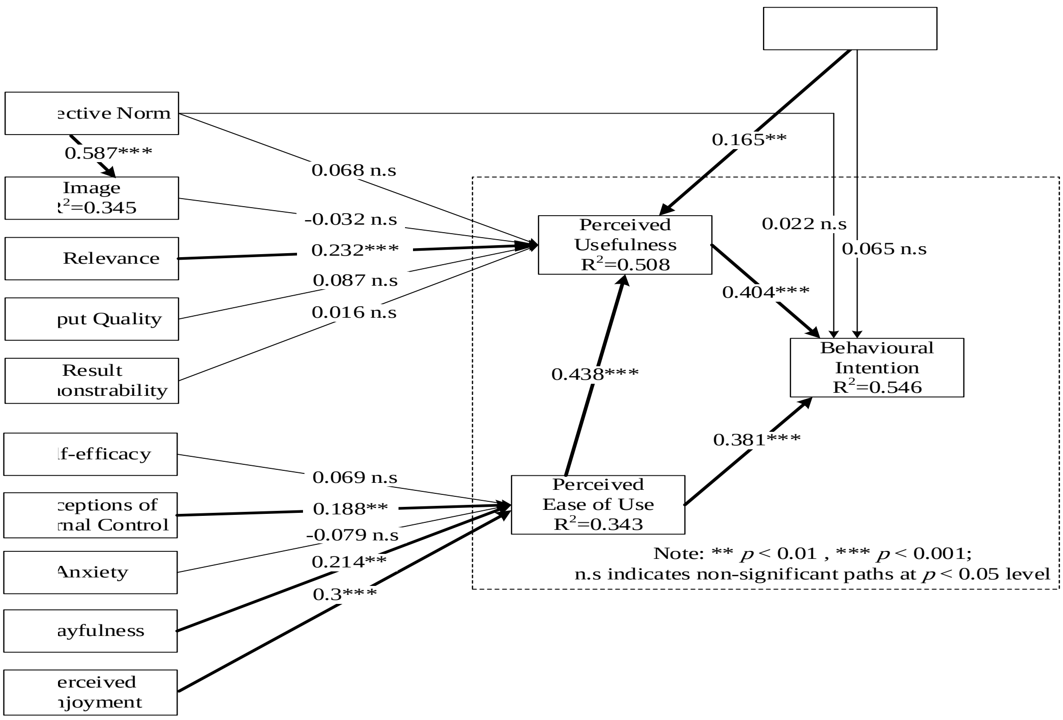


Figure 6-5 Structural model results with standardized path coefficients

The findings showed that perceived usefulness of the cloud computing applications had a strong positive effect on behavioural intention ($\beta = 0.404$, $p < 0.001$), which supported H1. Perceived ease of use had a strong positive influence on behavioural intention ($\beta = 0.381$, $p < 0.001$), and perceived usefulness ($\beta = 0.438$, $p < 0.001$), thus, supporting H2 and H3. Trust had a non-significant influence on behavioural intention ($\beta = 0.065$, $p = 0.213$), while it positively predicted perceived usefulness ($\beta = 0.165$, $p < 0.01$). Hence, H4 was rejected and H5 was accepted. Subjective norm had a non-significant influence on behavioural intention ($\beta = 0.022$, $p = 0.657$), and perceived usefulness ($\beta = 0.068$, $p = 0.356$); therefore, both H6 and H7 were rejected. Subjective norm had a strong positive influence on image ($\beta = 0.587$, $p < 0.001$), which supported H8. Image did not significantly influence perceived usefulness ($\beta = -0.032$, $p = 0.607$), thus, rejecting H9. Job relevance had a strong positive influence on perceived usefulness ($\beta = 0.232$, $p < 0.001$), hence, supporting H10. Output quality had no significant effect on perceived usefulness ($\beta = 0.087$, $p = 0.172$), hence, H11 was rejected. Result demonstrability had no significant effect on perceived usefulness ($\beta = 0.016$, $p = 0.752$), which led to rejection of H13. Additionally, self-efficacy did not influence perceived ease of use ($\beta = 0.069$, $p = 0.219$), therefore, H14 was rejected. Perceptions of external control significantly predicted perceived ease of use ($\beta = 0.188$, $p < 0.01$), thus H15 was supported. Anxiety had not influenced perceived ease of use ($\beta = -0.079$, $p = 0.12$), resulting in the rejection of H16. Playfulness significantly predicted perceived ease of use ($\beta = 0.214$, $p < 0.01$), which supported H17. Finally, perceived enjoyment had a strong effect on perceived ease of use ($\beta = 0.3$, $p < 0.001$), which resulted in the acceptance of H18. The variance explained by behavioural intention, perceived ease of use, and perceived usefulness were 55%, 34%, and 51% respectively.

Table 6-18 Hypothesis testing results

Path	Hypothesis	Standardized Path Coefficients	*t*-value	Hypothesis Testing Result
PU → BI	(H1)	0.404	5.622***	Supported
PEOU → BI	(H2)	0.381	5.65***	Supported
PEOU → PU	(H3)	0.438	7.169***	Supported
TR → BI	(H4)	0.065	$1.246^{n.s.}$	Not supported
TR → PU	(H5)	0.165	2.923**	Supported
SN → BI	(H6)	0.022	$0.444^{n.s.}$	Not supported
SN → PU	(H7)	0.068	$0.923^{n.s.}$	Not supported
SN →IMG	(H8)	0.587	9.241***	Supported

IMG → PU	(H9)	-0.032	$-0.514^{n.s.}$	Not supported
REL → PU	(H10)	0.232	3.767***	Supported
OUT → PU	(H11)	0.087	$1.367^{n.s.}$	Not supported
RES → PU	(H13)	0.016	$0.316^{n.s.}$	Not supported
SE → PEOU	(H14)	0.069	$1.229^{n.s.}$	Not supported
PEC → PEOU	(H15)	0.188	3.056**	Supported
ANX→ PEOU	(H16)	-0.079	$-1.554^{n.s.}$	Not supported
PLYA → PEOU	(H17)	0.214	3.135**	Supported
ENJ → PEOU	(H18)	0.3	4.657***	Supported

** $p< 0.01$; *** $p< 0.001$; $^{n.s.}$ Not significant at $p< 0.05$ level.

6.6.3 Testing the Moderating Effect

A moderator is "a variable which affects the correlation between two other variables" (Nunnally & Bernstein, 1994, p. 194). The moderating effect or interaction effect examines the relation between dependent and independent variables by observing how a third variable influences the direction and/or strength of the relationship (Joseph F. Hair et al., 2010; Kline, 2011). The variable between the dependent and independent variables is called a moderator variable. The moderator variables considered in this study are output quality and Internet experience. The effect of these two moderators on the specified paths in the research model is examined and presented in the following subsections.

6.6.3.1 Output Quality (OUT)

In this study, we performed interaction term test in order to examine if output quality significantly moderates the relationship between job relevance and perceived usefulness. In this case, the moderator variable (output quality) and independent variable (job relevance) were mean centred prior to creating the interaction term. Mean centering "occurs when the average of a variable is adjusted to zero (the mean is subtracted from every score), and centering tends to reduce—but not typically to eliminate—correlations between product terms and constituent variables" (Kline, 2011, p. 331). This process "helps limit potential multicollinearity" (Venkatesh & Bala, 2008, p. 285). The product of moderator variable (output quality) and independent variable (job relevance) was computed after mean centering these variables to get interaction term (Kline, 2011). After creating the interaction term, the interaction term was added to the structural model and regressed on the dependent variable (perceived usefulness) in order to test the moderating effect. The interaction term coefficient was later assessed to find out if it is significant at 0.05, which implies that output quality moderates the relationship between job relevance and perceived usefulness. This study found that the interaction term was not significant (REL*OUT → PU = (β) 0.047, p = 0.286), indicating that output quality did not moderate the relationship between job relevance and perceived usefulness. Therefore, H12 was rejected.

6.6.3.2 Internet Experience (IE)

The moderating effect of Internet experience was examined using multi-group analysis as recommended by Byrne (2010) and Keith (2015). The multi-group analysis involves splitting the data into two groups using median split approach (high and low Internet experience groups) to facilitate the multi-group analysis examination; testing baseline model for both groups simultaneously by allowing all paths to vary freely; testing constrained model for both groups simultaneously by constraining all the specified paths in the extended TAM3 model to be equal in order to get the change in chi-square between the baseline and constrained models. If the change in chi-square is not statistically significant at 0.05, the simultaneous group analysis will stop and conclude that Internet experience variable has no moderating influence on the specified paths in the proposed model. If the change in chi-square is statistically significant which implies that both groups are different, then a further assessment will be carried out to find out the paths that are not invariant across groups and the paths that are moderated by the Internet experience variable (Byrne, 2010; Keith, 2015). Thus, in this study the moderating effect of Internet experience on specified paths in the proposed model was assessed by conducting multi-group analysis. The analysis of the influence of Internet experience on the path from anxiety, playfulness, and perceived enjoyment to perceived ease of use; from subjective norm and perceived ease of use to perceived usefulness; and from subjective norm and perceived ease of use to behavioural intention was conducted by testing 7 hypotheses related to these moderating effect, which were: H19a, H19b, H19c, H19d, H19e, H19f, and H19g.

The multi-group analysis for both groups was carried out in both the baseline and constrained models at the same time to assess the change in chi-square. It can be seen from Table 6.19 that the change in chi-square from the baseline model to the constrained model is not statistically significant ($\Delta\chi2$ (7) = 12.798, p = 0.077).

Table 6-19 Change in chi-square result

Model	χ^2	*df*	$\Delta\chi^2$	Δ*df*	p< 0.05
Unconstrained model (baseline)	2032.869	1514			
Fully constrained model	2045.667	1521	12.798	7	0.077

Hence, all the specified paths in the proposed model are invariant across Internet experience groups, which implies that Internet experience has no moderating effect on the relationships between subjective norm and behavioural intention, between subjective norm and perceived usefulness, between anxiety and perceived ease of use, between playfulness and perceived ease of use, between perceived enjoyment and perceived ease of use, between perceived ease of use and perceived usefulness, and between perceived ease of use and behavioural intention. Therefore, H19a, H19b, H19c, H19d, H19e, H19f, and H19g are all rejected on the basis of the insignificant change in chi-square.

6.7 Chapter Summary

This chapter presented the analysis of the quantitative phase of this study. The quantitative data were collected from Saudi Arabian students using a survey questionnaire. The chapter described the data screening processes which included assessment of missing data, normality, outliers, and multicollinearity. The chapter also presented the demographic characteristics of the respondents which were analysed using SPSS. In addition, the chapter also presented the results of reliability and validity of the constructs during EFA and CFA. The results provided evidences of reliability (construct reliability and Cronbach's Alpha), as well as validity (convergent and discriminant) in both EFA and CFA which supported adequacy of the reliability and validity for the research model constructs. In addition, the measurement and structural models fits were tested in this chapter, and the results showed acceptable fits. Moreover, in this chapter, the structural model was tested to examine the hypothesized relationships in the proposed model. Findings related to the hypotheses tested revealed that nine hypotheses were found significant out of the seventeen proposed hypotheses. The findings showed that the determinants of perceived ease of use were perceived enjoyment, playfulness, and perceptions of external control. Likewise, perceived ease of use, job relevance, and trust predicted perceived usefulness; subjective norm determined image only; behavioural intention was predicted by perceived ease of use and perceived usefulness. Finally, the moderator variables (output quality and Internet experience) were examined, and found both insignificant in moderating the proposed relationships.

Chapter 7: Qualitative Data Analysis and Results

7.1 Introduction

This chapter presents the results of analysis of the qualitative data, which were collected using focus group and open-ended question techniques. The first part of the chapter presents the analysis and discussion of the results of the focus groups including the demographic profile of the participants. The second part presents the analysis and discussion of the additional factors and barriers highlighted by the survey respondents and focus groups participants, which were obtained using an open-ended question technique.

7.2 Focus Groups Analysis and Findings

The focus groups were conducted in Arabic with three focus groups (A, B, and C) to validate the quantitative findings presented in Chapter 6. The focus groups questions were designed and worded based on the survey questions. These questions were formed base on the constructs of the research model as presented in Chapter 4. During the focus groups, the participants' answers were recorded. The recorded conversations were then transcribed and analysed. Thematic analysis was used during the analysis of the focus groups. The analysis commenced by organizing the transcribed data, and then read them carefully to enable the researcher to have general understanding of the data. After that, the data were organized into codes, and the codes were further grouped into related categories or themes which were based on the constructs of the extended TAM3 model. Next subsections present the demographic profile of the focus groups participants and the focus groups analysis findings.

7.2.1 Demographic Profile of the Focus Groups Participants

This section presents the demographic information of the focus groups participants. The focus groups participants were 5, 4, and 5 members for group A, B, and C respectively. The participants in the three focus groups were labelled as A1 to A5, B1 to B4, and C1 to C5. The demographic variables used in the focus groups were age, academic major, year of study, computer knowledge, and Internet experience.

The complete demographic information for all the participants in the three groups A, B, and C was presented in Table 7.1, Table 7.2, and Table 7.3 respectively.

Table 7-1 Demographic information for Group A

Participant	Age	Academic Major	Year of Study	Computer Knowledge	Internet Experience
A1	22	Arts	3	Very Good	Excellent
A2	23	Arts	3	Fair	Good
A3	23	Arts	3	Good	Good
A4	22	Arts	2	Very Good	Very Good
A5	22	Arts	3	Good	Very Good

Table 7-2 Demographic information for Group B

Participant	Age	Academic Major	Year of Study	Computer Knowledge	Internet Experence
B1	22	Sciences	3	Very Good	Very Good
B2	21	Sciences	3	Very Good	Very Good
B3	21	Sciences	3	Excellent	Excellent
B4	21	Sciences	3	Good	Very Good

Table 7-3 Demographic information for Group C

Participant	Age	Academic Major	Year of Study	Computer Knowledge	Internet Experience
C1	23	Sciences	4	Very Good	Very Good
C2	22	Sciences	4	Excellent	Excellent
C3	21	Sciences	3	Good	Very Good
C4	23	Sciences	4	Very Good	Excellent
C5	22	Sciences	4	Very Good	Very Good

7.2.2 Focus Groups Findings

This section presents the results of the analysis of the focus groups responses to the questions developed according to the proposed model constructs. The aim of the analysis was to validate the findings of the quantitative phase of this study. The following subsections present the findings of analysis related to the research model constructs in more details.

7.2.2.1 Behavioural Intention (BI)

The behavioural intention in this study is the main determinant of students' intention to adopt cloud computing applications. Therefore, the students' willingness to adopt the cloud computing applications will be determined by the level of student's intention; this implies that students who are willing to adopt the cloud computing applications would have high intention to adopt them once applied in their universities. The following was the participants' responses regarding their intention to adopt cloud computing applications.

Concerning a question that asked the participants if they intend to use cloud applications such as Google Docs when they had access to it, there was complete agreement among the participants concerning the adoption of cloud computing applications once applied in the university. They all showed favourable attitude towards adopting the technology because of the potential benefits that they could gain such as saving time and effort. According to participant A1, he intends to use cloud computing applications such as Google Docs since he can use it to edit and submit assignments easily and comfortably. Participant C5 agreed that he will use cloud applications such as Google Docs, "because it will facilitate too many things". Similarly, participant B3 mentioned that, "surely I think that the majority will agree to this idea to use the cloud applications".

All the participants perceived that they will use cloud computing applications such as Google Docs if they are applied in their university and they have the permissions to access them. One of the participants (A1) mentioned that, he thought there would be no hesitation on using cloud applications such as Google Docs especially to send assignments because it would be better than submitting hardcopy assignments. Participants C2 and C4 mentioned that, they would use cloud computing applications such as Google Docs if it is available and accessible.

Finally, all the participants agreed that they will use cloud computing applications such as Google Docs in the future. Participant B3 indicated that, "if this technology is able to make things easier for us, sure we are going to use it". In the same way, participants C2 and C5 mentioned that, they are planning to use cloud applications such as Google Docs in the future because it is easy for them and other students to do their learning and collaborative tasks like assignments. As participant C2 mentioned that, "I am planning to use it since it is helpful to do my assignments".

Therefore, these conversations were evidence of the participants' readiness to adopt cloud computing applications when applied in their university. Hence, this confirmed students' intention to adopt cloud computing applications for learning and other collaborative tasks.

7.2.2.2 Perceived Usefulness (PU)

In this study, perceived usefulness is referred to the extent to which the students believe that using cloud computing applications will improve the performance of their learning and collaborative activities. The participants' responses related to this factor are presented below.

All the participants believed that using cloud computing applications such as Google Docs would enable them to accomplish their learning tasks like assignments more quickly when compared with conventional ways. Participant B4 stated that "if we have any assignment, we can do it and share it with our teachers via Google Docs without any need to meet physically, it is a faster and easier way". Similarly, participant C4 felt the same and commented that "instead of going to the university, you may find the teacher or not; from Google Docs I can send my assignments easily from house". Participant B3 expressed the same idea and argued that, "as mentioned by my colleagues, with this service we will save too much time, if we have any work we can do it and share it with our colleagues and teachers more quickly while we are at home, so I think that it is too useful". Participants A1 and A2 supported the same argument and agreed that it is easier and faster to do assignment using cloud computing applications especially group assignments because students from different parts of the country do not have to meet physically in order to do their assignments. For instance, participant A1 argued that "if we have a group assignment, for example, of the distance, if one in the north and one in the south, instead of being forced to going to him, just by a button click, we can send and do everything". Further, participant C1 indicated how cloud computing applications assist in simplifying their study by providing the necessary resources for every assignment, which in turn contributes to savings of time and effort. He stated that "it enables me to achieve my assignments faster because I can get the scientific materials that I want anytime from anywhere through Internet".

The majority of the participants agreed that cloud computing applications would improve their performance in their study. Participant C5 commented that "yes, it could be useful for me in too many things, it may encourage me to send my assignments, encourages me to talk to the teacher more easily, you may establish a group that contains all your classmates, so in case you have any problem or if you have anything to discuss you may find four or five people to help you". Similarly, participant C1 stated that, “it improves my performance in study because I can contact with my teachers anytime I want”.

All the participants believed that their productivity in study would be increased when they use cloud computing applications. Participant B3 thought that “since I can get ideas from my colleagues’ shared assignments with them, so sure my productivity would be enhanced”. Similarly, participant C3 concluded that “absolutely cloud computing applications would increase our productivity since it can improve our performance”.

Majority of the participants agreed that cloud computing applications such as Google Docs would enhance their effectiveness in study since it enables them to simplify and accomplish their tasks more quickly compared to the traditional way. For example, participant C3 stated that “as long as it facilitated too many things for us, and solve the go and come issue, sure there will be effectiveness, it means, there are no obstacles, like movement from home to university for simple issues”. Similarly, participant B3 related that, “for example during exams time, if we have too many assignments we can submit them easily from home, instead of going to the university and wasting your time so it saves our time to prepare for the exams, the matter that will improve effectiveness”. Equally, participant C5 supported the same argument and commented that, “yes it will encourage you to study, encourage you to do your assignments, I mean, it facilitates many things for you”.

There was a total agreement among the participants concerning the ability of cloud computing applications to make it easier for the students to perform learning tasks. Participant A3 agreed that doing tasks using cloud computing applications would be easier because other students’ works would be available during collaboration or sharing which will give ideas to some students. Another participant C2 expressed that, the whole study task processes are become easier using cloud computing applications since typically if a task is given to the student and he has to return it to the teacher in a short time, so if there is any mistakes the student has to go back home and do it again; but using cloud computing applications the task can be sent in less than a minute and the teacher can immediately acknowledge and comment on the task. In terms of the functionalities of cloud computing applications such as Google Docs, participant C3 stressed that, “for example, I have a task that I need to add some pictures on it, or videos, make tables or researches, things like that, all these features are available in Google Docs”.

All the participants were with the opinion that cloud computing applications would be useful in their study especially related to interacting with teachers and colleagues, and accomplishing learning and collaborative tasks such as sending assignments. Participants A3, B3, C1, and C4 emphasized that cloud computing applications such as Google Docs would be useful since the documents created such as assignments and projects would be stored electronically on the cloud, so any time like during exam students can access the documents from anywhere. Specifically, participant C1 mentioned that, “if I needed to review my assignment from anywhere I can open it, but if it was saved on my computer, I cannot access it, so by using Google Docs even if I was out home and there is another available computer I can log in to my account and see all the documents”.

The focus groups discussion presented above supported the positive influence of perceived usefulness on the students’ intention to adopt cloud computing applications.

7.2.2.3 Perceived Ease of Use (PEOU)

In the context of this study, perceived ease of use is defined as the perception of students that using cloud computing applications would be easy. The following opinions are from the discussion of the focus groups participants.

Nearly all the participants agreed that learning to use cloud computing applications such as Google Docs would be easy since most of the students use Microsoft Office program. As participant A1 highlighted that “cloud computing applications are easy to use because everyone has used Microsoft Office program, so it is the same as Microsoft Office”. Similarly, participants A3 and C3 mentioned that, learning to use cloud computing applications such as Google Docs is easy because its interface is easy and everything about it is clear. Participants also further elaborated that using cloud computing applications could be easy for those students who have experience in using computers; however it could be difficult for those who do not. Participant C2 clearly explained this concern “some of them know how to use computer and it will be easy to them, and some don’t know how to use computer and it will be difficult to them”. Likewise, participants A2 and B3 supported the same argument and explained how providing training courses to those who are not familiar with cloud computing applications can enhance their abilities to use the cloud computing applications. For instance, participant B3 stated that “the university must provide a brief introduction to it, at least one or two lectures in order to make the students practice and use it easily”.

All the participants strongly agree that they can easily use cloud computing applications to perform activities related to their learning process such as accessibility of documents, doing and sending assignments, and collaboration among students and with their teachers. Participant A3 related that, “I can get any document at any time in any place easily”. Similarly, participant B4 mentioned that “for me it will be easy for accessing the task solution and all the saved Google Docs I have”.

The majority of the participants believed that, their interaction with cloud computing applications would be clear and understandable. For example, participants C1 and C2 maintained that the interaction with cloud computing applications such as Google Docs would be clear and understandable since its icons and interface design are clear and easy to understand. Participant C1 stated that “yes it would be easy to use, because its interface designed is easy and comfortable so it would not be complicated”. On the other hand, a few participants expressed that it can only be clear and understandable if a student has a previous experience or a background about these applications. Participant B4 said, “you must have a background in order to be clear and understood, but if it was the first time to use it, it will not be easy and understood”.

All the participants thought that, since cloud computing applications are easy, clear, and use different languages then it would be flexible. For instance, participants A3 and B3 expressed that the interaction with cloud applications such as Google Docs would be flexible since it is easy to use and it supports various languages. Participant B3 stated that “the system would not be difficult to use and the used language would be understood, so it would be flexible”.

All the participants agreed that students can easily become skilful in using cloud computing applications such as Google Docs since it includes programs like Microsoft Office package with which most of the students are familiar. Participant B3 said, “possibly, because we already have the skills in using Microsoft programs so Google Docs is the same". Participant C4 expressed that by continuously using cloud computing applications such as Google Docs he will surely become skilful at using the cloud applications; as he said, "even the students who did not understand this application in the beginning by continuing using they will become skilful".

All the participants strongly agreed that cloud computing applications would be easy to use. Participant A1 expressed that, "I think no one will find it difficult because even in high schools they study computer course, studying Word and PowerPoint, and they make presentations, so it is not a difficult thing to them, they have learned the basics". Participants A2 and B4 mentioned that experience is needed in order to better utilize cloud computing applications such as Google Docs.

Taken together, the focus groups analysis results suggested that perceived ease of use positively influence the adoptionof cloud computing applications by students.

7.2.2.4 Trust (TR)

Trust in the context of this study is referred to the confidence and reliance of students in both cloud computing applications and cloud applications providers. The following are the participants' responses regarding trust.

Majority of the participants are with the opinion that using cloud computing applications would be secure due to the requirement that users must provide a valid username and password before they can be granted access to the cloud applications, and their trust on the cloud applications providers. In relation to this, participant A1 expressed that "not anyone can log in except by user name and password, I can open the password of the computer but this (Google Docs) I cannot". Another participant B4 related that, "it will be enough for you to know that it is by Google, so it is safe". However, participant C4 claimed that it is difficult to ascertain the security of cloud computing applications before use, so the assessment can only be done after trial. He commented that "we can judge it after trial it is safe or not, it is hard to be judged in advance whether it is safe or not".

Majority of the participants agreed that they can trust the ability of cloud applications providers such as Google to protect their personal data. Participant C2 said, "I think that it will keep your privacy with very strong protection". One of the participants (B1) believes that strong cloud applications providers companies like Google keep privacy of users’ data. On the other hand, a few participants argued that the ability of the cloud applications providers such as Google to protect their data would not guarantee 100%. As participant B3 argued that “there is no 100% guarantee even though the company name is strong”. Similarly, participant C3 argued that there is no guarantee that cloud applications providers would protect privacy of their data because, “since I will not save my data in my computer, I will save them to an external server, it means that anyone could see them, it is possible for the person who designed the protection to see the data of all people, it is normal, so it would not be that much secure”.

Majority of the participants emphasized that they consider cloud applications providers like Google as trustworthy since it is a big company with a good record and reputation. Participant B1argued that, “sure all people trust Google applications”. Participants A1 and B2 agreed that cloud applications providers like Google can be trusted since they are very strong companies with good reputation.

Most of the participants agreed that cloud applications providers would keep their promises and commitments. Participant A1 claimed that, “if it doesn’t fulfil its promises and commitments first it will lose a number of its users”. In contrast, another participant (B3) argued that in order to know if cloud applications providers such as Google would keep its promises, its services must first be tried. He commented that “we must try, we do not know”.

Most of the participants believed that cloud applications providers would keep their best interests in mind. As participant (B4) emphasized that, people will not be using cloud applications if the cloud applications providers did not protect the interests of their customers.

The above focus groups results are an evidence of the positive effect of trust on the adoption of cloud computing applications by students.

7.2.2.5 Subjective Norm (SN)

In this study, subjective norm is the perception of students regarding how their instructors or peers can influence their cloud computing applications usage behaviour. The views of the focus groups participants concerning the influence of subjective norm are presented as follows.

The majority of the participants argued that their teachers and colleagues that influence them would not think that they should use cloud computing applications since they need to know the technique well before using it. As participant B4 said "no, because I did not understand what is included or what is excluded". On the other hand, some of the participants stressed that their teachers and colleagues that influence them would think that they should use cloud computing applications. Participant C5 mentioned that, "for sure I will use it if a colleague comes and tells me that it is easy and contains lots of things and shows me that it is too much better for me I will certainly use it".

The majority of the participants disagreed with the opinion that, people who are important to them would think that they should use cloud computing applications. The participants argued that their decision to adopt the cloud computing applications depends on the perception of the benefits they can derive from using the cloud applications rather than the influence of their friends or teachers. Participants A1, B2,and B4 stated that their decision to adopt the cloud computing applications would only be influenced by the benefits the cloud applications provide. Participant B2 said, "you will not use unless you see a benefit from it". Similarly, participant A1 confirmed that he will only use cloud applications such as Google Docs because of its benefits. However, a few participants agreed with the opinion that, people who are important to them would think that they should use cloud computing applications. One participant (C4) emphasized that, "if the important people are using Google Docs and they recommend it to me I will for sure use it".

Likewise, the majority of the participants disagreed with the opinion that, people who they value their opinions would rather want them use cloud computing applications. Participants C2 and C3 mentioned that their decision to adopt the cloud computing applications would not be influenced by the opinions of people they value, but rather would be influenced by the benefits expected, and how easy and enjoyable are the cloud applications. In contrast, some participants agreed that people who they value their opinions would rather want them use cloud computing applications. Participant C5 commented that, "sure, I will use it because I appreciate the views of my friends".

The above responses explain the role of subjective norm on the cloud computing applications adoption. Some participants were in agreement with the statements that suggest a significant influence of subjective norm on the adoption of cloud computing applications, whereas majority of the participants were not in agreement with the statements. Therefore, it can be concluded that subjective norm has no significant effect on adopting cloud computing applications by students.

7.2.2.6 Image (IMG)

In this study, image is the extent to which students believe that using the cloud applications will result in elevating their status in the academic environment. The following statements are the views of the focus groups participants regarding the influence of image factor.

The majority of the participants thought that those who use cloud computing applications such as lecturers and their colleagues would not be honoured more than those who do not. As participant A1 argued that “the fame doesn’t come from using the technologies but by cooperation”.

Majority of the participants disagreed that students who use cloud computing applications in their university would have high profile. For instance, participant B3 argued that, “I do not expect that if someone uses these technologies he would gain a high rank, I think it is natural things that anyone can use them”. Similarly, participant A2 confirmed that using cloud applications such as Google Docs would not increase the rank of the user. He stated that “for me I think this technology does not play an important role, there is no problem if I use it or not, it means I do not feel any impact”.

When asked if having cloud computing applications such as Google Docs would be a status symbol in the participants’ university, the majority of the participants disagreed with this argument. For example, participant C1 did not believe that having cloud computing applications such as Google Docs would be a status symbol in his university. He stated that, “it is natural, anyone can use Google Docs, so for me using Google Docs is very normal”.

The results of the focus groups above indicate the non-significant influence of image on the adoption of cloud computing applications by students since majority of the participants did not agree with the statements.

7.2.2.7 Job Relevance (REL)

Job relevance in this study is conceptualized as study relevance. Study relevance is the degree to which the students perceive cloud computing applications as relevant for collaboration and learning related activities. The following opinions are from the participants of the focus groups.

All the participants stressed that using cloud computing applications would really be important in their study, especially in terms of the activities related to assignments and collaboration works. Participant C5 expressed that cloud computing applications such as Google Docs are important for doing their learning activities and collaboration works. He commented that “the benefits are for sending assignments, researching, discussing with teachers, discussing with colleagues, we can make a group”. Another participant (C1) expressed a similar view that using cloud computing applications would be important because, they could find all the study related documents easily. He stated that “all the scientific subjects or materials I upload them to Google Docs so I can access them when I need them”. Likewise, participant B3 agreed that cloud computing applications such as Google Docs would be important since they would be flexible, save time, and are easy to learn. He commented that “since there is flexibility, easiness of learning, efficiency, so no difficulty would be there, but it needs practice, and it will be really helpful in our study”.

When asked whether cloud computing applications are relevant to their study, all the participants emphasized that they would be relevant to their study since they could do assignments, access files from anywhere and anytime, share lectures materials, and collaborate with their teachers and colleagues. Participant A1 mentioned that, “we can deliver our assignments, sharing it and modifying any part in the assignment”. Similarly, participant C5 said, “sure it will be related if my university is using it, it will be tightly related to my study”.

All the participants agreed that using cloud computing applications would be pertinent to their various study related tasks since they can communicate with their teachers and colleagues; and access course materials, course assignments and files from anywhere and anytime as pointed out by participants C2 and C3. In the same way, participant A1 believed that cloud computing applications such as Google Docs would be very important since lecturers can use it to send course materials, like notes to students and ensure that each student have received them, unlike in the conventional way where the notes may be missing or some students may not get it at the right time. Participant C3 supported the same argument and he explained further, how cloud computing applications would provide them with the speed for accessing the files they need for their study from anywhere. He argued that “cloud computing applications would give us the speed in accessing the files we need, for example, if I was in the university and I needed an assignment or something else, in case I have forgotten my notebook in the house so no problem as long as I have Internet I can see my assignment and anything I want”. Similarly, participant C5 felt the same and commented that, “it is really important and it will be of benefit to both students, as well as teachers, they can make lots of things easy so they have to accelerate the process of using it, it will be much better”.

The positive influence of job relevance on the adoptionof cloud computing applications by students can be seen from the above conversations since the participants agreed with the questions asked.

7.2.2.8 Output Quality (OUT)

In this context, output quality is the extent to which students believe that the cloud computing applications perform learning activities and other collaborative works well. The views of the focus groups participants are presented as follows.

The majority of the participants thought that the quality of the outputs such as the created documents from cloud computing applications like Google Docs would not be high since they do not provide all the features that can be found in the conventional Office applications. This concern is clearly mentioned by participant A1, “the problem as I said before, the program will not give you all the features, which are available in the Microsoft Office, it means there are things you may want to do but you don’t find them here, so here is the problem”. Participant B3 felt that the quality of the output form Google Docs would not be high since the Google Docs applications such as Word are not like the Microsoft Word. In contrast, a few participants believed that quality of the outputs from cloud computing applications such as Google Docs would be high when compared with handwritten documents. One participant (C2) mentioned that, “the quality of the outputs such as solving the assignment in the notebook by using the computer will be clear and easy”.

There was disagreement among the students concerning the quality of the cloud applications output such as Google Docs. Majority of the participants thought that they would have some problems with the output quality of the cloud applications such as Google Docs since most of the features they may need are not available in the cloud applications. Participants A2 and B3 stated that they will have issues with the output of the cloud applications, since it may be different from the output of the applications they are familiar with. On the contrary, some of the participants argued that they would not have any problem with the output quality of the cloud applications such as Google Docs, since its quality is better than the paper work. As one participant (C4) commented that “there will be a difference if it was on paper it will be a low quality, but with Google Docs it will for sure be at a better level even if it is not of a high quality but still it will be better than paper work”.

There was disagreement among the students concerning how the results of the cloud applications such as Google Docs can be rated. Majority of the participants had some thought about rating the results of the cloud applications and they were not confident to say it is excellent as one participant (A2) commented that “I really can’t say it is excellent”. Participant A5 expressed that he would rather rate it as adequate. On the other hand, some of the participants agreed that the results from cloud applications such as Google Docs could be rated as excellent. One participant (C3) said the result would be excellent, “because the people who designed the Docs they have done this job after they have realized the problems of the people and considering their circumstances”.

The above responses described the role of output quality on the adoption of cloud computing applications. Although some participants agreed with the statements that suggest the influence of output quality on the adoption of cloud computing applications, majority of the participants disagreed with the statements. Hence, it can be concluded that output quality had a non-significant effect on the adoptionof cloud computing applications by students.

7.2.2.9 Result Demonstrability (RES)

Result demonstrability in this context is viewed as the extent to which the students believe that the result of using cloud computing applications is tangible, observable, and communicable. The following opinions are from the participants regarding the influence of result demonstrability factor.

Majority of the participants thought that it would be difficult for them to tell others about cloud computing applications results before knowing the applications very well. As one participant (B3) said that “first we must use and practice it in order to know it more”. Likewise, participant B4 said “anything in the beginning is difficult, you have to learn in order to know how to convey the information to the others”.

When the participants were asked if they could communicate to others the consequences of using cloud applications such as Google Docs there was a disagreement about this statement. Majority of the participants believed that they could communicate the consequences of using cloud computing applications such as Google Docs to others only when they have experience about the cloud application and they realize its benefits. As participant C3 said that “if I have the full experience and full background about this application I will tell other students why not”. Also, participant A1 commented that “yes, if it benefits me with high percentage I would like the others to utilize it, and hoping that they could take the advantages of it”.

When the participants were asked if they think the results of using cloud applications such as Google Docs would be apparent to them or not, majority of the participants believed that cloud computing applications results would not be clear to them since they do not have enough knowledge about them. As one participant (A2) argued that “for some students it is not clear for them since they do not know how to use the program itself and they don’t have a background about it”. Similarly participant B4 commented that “if I understand it perfectly, it would be clear, otherwise not”.

Regarding if the participants would have any difficulty explaining why using cloud applications such as Google Docs may or may not be beneficial; majority of the participants disagree with the statement and argued that first they need to have some experience with the cloud applications such as Google Docs before they can tell others about their benefits. As one participant (A1) said that “if I knew the application well and its benefits, I would tell others about it”.

The results of the focus groups above indicate the non-significant influence of result demonstrability on the adoption of cloud computing applications by students since majority of the participants did not agree with the statements.

7.2.2.10 Self-Efficacy (SE)

Self-efficacy in this research refers to students' confidence in their ability to use cloud computing applications for learning and other collaborative works.In order to assess the confidence of participants in their ability to use cloud computing applications, they were asked a series of questions related to self-efficacy.

The majority of the participants pointed out that students without background may find it difficult to use cloud applications without guiding. Participants B3 and B4 mentioned that students without the required background may not be able to use cloud applications alone. Participant C3 also further elaborated that "you may meet a student who has never touched a laptop before and he has never worked on a PC before, so how shall he be able to use it". Participants A2, B1 and C1 also further explained how the potential barriers to use cloud applications can be reduced or eliminated with help from those who have more experience. As participant B1 mentioned that "in the beginning we need someone to teach us".

The participants were asked if they had a lot of time to complete tasks using cloud computing applications. The majority of the participants expressed that, although time is an important thing and cloud applications save time, they need a lot of time especially when they begin using cloud computing applications such as Google Docs. Participant B4 mentioned that, they need time to complete learning and other collaborative tasks like assignments using cloud applications such as Google Docs because if the time is limited they may not be able to do the tasks correctly and completely. Participant C1 mentioned that time is important especially at the beginning when users have no experience, as he commented that "yes I need much time to know what the application contains in order to use it faster at the beginning".

When they were asked whether they could complete the tasks using cloud applications such as Google Docs if they had only the built-in help facility for support, majority of the participants disagreed with this statement and they preferred to have some training before using the cloud applications to assist them on how to use the cloud applications and the help tool itself. As participant B3 commented that "there are students who do not know how to use it, so there must be an introduction to Google Docs about the way of using, and the way of using the help tool itself, since there are some students who do not know how to use the help tool". In contrast, some of the participants agreed with the statement and they argued that, adding built-in help facility in cloud applications would be enough to assist them on how to use the cloud applications. As participant C5 mentioned that, “if the program itself has a help tool so I will know what to do, what steps I shall do after I log into the application, if that exists I will for sure be able to do everything from the first day”.

Majority of the participants agreed that they could easily complete learning and other collaborative tasks using cloud applications such as Google Docs if someone showed them how to use it. Participant A2 expressed that, “if someone came explain to me, it would be better, I mean I can finish it quickly, instead of completing the task in half an hour, I will complete it in 15 minutes”. Another participant (B3) said, “if someone came and explained the full system I will know how to use it”.

The participants were asked if prior experience with systems similar to cloud computing applications such as Google Docs would help them to accomplish learning and other collaborative tasks. Majority of the participants believed that, prior experience with systems similar to cloud computing applications would not be enough to use the cloud applications. Participants B3, C2, and C5 claimed that since there are specific features for every application so they could not use the cloud applications without a prior experience with it. Participant B3 said that “we did not use it before, so we are unable to use it”. In contrast, some of the participants argued that, they could use the cloud applications if they had prior experience with systems similar to cloud computing applications. Participant A1 revealed that, he used similar systems before, like Word, Excel and PowerPoint so this would make it easier for him to use cloud computing applications such as Google Docs.

The responses from the participants provided insight into the role of self-efficacy on the adoption of cloud computing applications.There was mixed reaction on this issue from the participants, some participants agreed with the statements that indicate the influence of self-efficacy, while majority of the participants expressed their disagreement with the statements, which implies that self-efficacy has a non-significant effect on the adoptionof cloud computing applications by students.

7.2.2.11 Perceptions of External Control (PEC)

In this study, perceptions of external control is the students’ perception of the presence of available resources in the university such as Internet, support, computer devices, and infrastructure that are necessary to use cloud computing services. The views of the participants are presented as follows.

The participants agreed that the control of activities such as editing and sharing of documents and files using cloud computing applications will be in the hand of the students. Participant B4 expressed that, “this is really important, because if there was no control you may send something that could go to many people while you want to send it to a specific person”. Another participant (C1) mentioned that, “it is possible that I have the control I can allow him to edit or not, so the control is in the sender’s hand”.

Concerning the availability of the necessary resources to use cloud computing applications, the majority of the participants argued that the availability of the necessary resources such as personal computers and Internet to use cloud computing applications is necessary to use cloud computing services. For example, participant A1 commented that, “the resources like computers and Internet are necessary for accessing the cloud applications”. It is clear the major concern for majority of the participants is the availability of Internet. Participant C4 confirmed that “Internet is the most important requirement than computer, because one can use his mobile device like Smartphone”.

All the participants confirmed that they would have the required knowledge to use cloud applications such as Google Docs because they believed that they could not use it if they do not have the knowledge required. According to participant B4, “if you do not have the required knowledge you may not be able to use Google Docs”. This is the view of the majority of the participants. Similarly, participant A1 supported the same argument and claimed “you must have the knowledge, if you don’t have the knowledge you can’t use this program”.

The participants agreed that using cloud applications would be easier when there are available resources, opportunities, and the students have the required knowledge. Participant B3 emphasized that, “for sure without them you will not be able to do anything”. Participant C1 further stressed that, “if there was no required knowledge and the needed resources do not exist how shall I use it?”.

Majority of the participants mentioned that cloud computing applications such as Google Docs would be compatible with other applications they used such as

Microsoft Office. However, one participant (A1) claimed that cloud computing applications such as Google Docs do not fully meet his needs since some features are not there. He commented that “the basic tools are available, but the additional complementary tools of Microsoft Office do not exist”.

The above conversations indicate that perceptions of external control positively do influence the adoption of cloud computing applications by students.

7.2.2.12 Anxiety (ANX)

Anxiety in this study is defined as the extent of students’ worry or fear when using cloud computing applications. The participants’ opinions regarding anxiety were presented as follows.

Majority of the participants strongly agreed that they would not feel apprehensive about using cloud computing applications. Participant A1 said, “I don’t think there is any fear in it, it’s the same as any regular applications”. Similarly, participant C2 supported the same argument and claimed that he does not feel apprehensive when using cloud computing applications, as he said “I am skilled in using Google Docs, I understand it very well, some people might feel scared because they do not understand the program”. On the other hand, participant C5 claimed that, “I will feel scared in the beginning since I store some information that I am afraid that they may be lost, my data for example, applications, assignments that I am afraid to lose”.

Regarding the scare of losing information by hitting wrong keys, majority of the participants indicated that they would not be scared when they think of losing information using cloud applications such as Google Docs by hitting wrong keys because they are used to programs that are similar to cloud computing applications such as Google Docs. Participant A1 argued that, if the students do not have the required skills they might feel scare otherwise not. He commented that “if you don’t have the skills, you will feel afraid”. Participant B3 supported the same argument and he explained further, how they could find a way to restore any file deleted wrongly. He commented that “you must find a way to restore the files that you have mistakenly deleted, like a recycling bin which is in Windows if you delete any file it will go automatically to the bin not permanently deleted, so the same feature should be in this system, to restore the file if it was mistakenly deleted”. In contrary to the above view participant C5 claimed that he would be scared of using cloud applications since one click may cost him the work of a few hours. He commented that "sure I am afraid that with one click I might delete information that I have worked on for two or three hours I mistakenly click a button and everything will disappear".

The majority of participants thought that they would not hesitate to use cloud applications such as Google Docs for fear of making mistake that they cannot correct because it is like Microsoft Office applications, which almost every student knows. They further stressed that, there will be hesitation only if a student does not have a background on how to use the cloud applications. Participant A1 mentioned that "yes, it may happen if they do not have a background about it".

Despite the fact that some participants mentioned that they would be somewhat intimidated by using cloud computing applications when they first start using them, majority of the participants expressed that they would not be intimidated. Participant C3 said, "there is no fear, since the way of using it is very easy so there is nothing to be scared about". Additionally, participant C1 said, "since the saving is automatic, and there is protection there is nothing to be scared of, these are the most important points auto save and protection". Another participant (A2) took the issue further and he elaborated how the fear will be eliminated by the time, he commented that, "at the beginning fear exists, but by the time it will be something normal".

The participants' responses shed light on the influence of anxiety on the adoption of cloud computing applications. There was a variety of responses among the participants. Some participants are with the opinion that anxiety has influence, while majority of the participants expressed their disagreement with the statements that suggest the influence of anxiety. Hence, this indicates that anxiety had a non-significant effect on the adoptionof cloud applications by students.

7.2.2.13 Playfulness (PLAY)

Playfulness in this study can be referred to as the extent to which the students feel spontaneous, creative and playful while using the cloud applications. The views of the participants related to playfulness are as follows.

The participants were asked if they can characterize themselves as spontaneous when using cloud computing applications. Most of the participants agreed that they would be spontaneous. Participant C2 expressed that, “I would be spontaneous because I use the computer very often”.

Majority of the participants agreed that they would be creative when using cloud computing applications because according to participants A2 and B3, creativity is essential. Participant A2 mentioned that he would be creative, “because sometimes you can’t find someone to ask him how to do this and that, so it is necessary to try things by yourself”. Similarly, participant C4 said, “I would use it more than I used paper work, for drawing, colours, beautiful shapes, so I will be more creative in comparison with paper work”.

Majority of the participants admit that they would be playful when they use cloud computing applications such as Google Docs. Participant C3 emphasized that he will surely be playful when using cloud applications especially if there is graphic output involved. He commented that “as long as there is graphics output it will be easy and attract any person, and I will be playful that I am using this application”. Similarly, participant (C2) noted that, “you will be playful if it saves you lots of time”.

The majority of participants further agreed that they would consider themselves original when they use cloud computing applications. For instance, participant A2 described how he would feel original when using cloud computing applications such as Google Docs. He commented that “if it is normal, I will use it like any other program”.

The above focus groups conversations provide evidence of the positive influence of playfulness on the adoption of cloud applications by students.

7.2.2.14 Perceived Enjoyment (ENJ)

In this study, perceived enjoyment is the degree to which the students perceive the use of the cloud computing applications as enjoyable and pleasant task without considering any consequences of performance as a result of system use. The following opinions reflect the views of the focus groups participants on perceived enjoyment.

Most of the participants thought that they would find using cloud applications enjoyable because they are easy to use and save lots of time and effort. For instance, participant A3 commented that, “I knew how to use the program and deal with it, it is enjoyable for me”. Similarly, participant B3 felt the same and further elaborated how cloud applications are enjoyable especially the display and user interface. He commented that “it is enjoyable in the way of displaying”. Furthermore, participant C2 argued that using cloud applications such as Google Docs is enjoyable since it helps him to save time and effort. He comment that, “enjoyable on the level of saving time and effort means that if you have something to do it will be finished quickly, sure you will be psychologically relieved”. Participant B4 also further elaborated that using cloud applications such as Google Docs would be enjoyable especially for those who are creative students.

The majority of participants strongly agreed that, the process of using cloud computing applications such as Google Docs would be pleasant. One of the participants (A2) mentioned that “it’s a beautiful thing frankly, fun practically in way of use to get the job done, I mean make me continue and go on until finish it”.

There was a total agreement among the participants regarding having fun by using cloud computing applications. For example, participant A2 commented that, “I would have fun with it when I have for example, completed the assignment and any work, but if I exit with no benefit there will not be fun or exciting”. Participants A5, C2, and C5 agreed that using cloud computing applications such as Google Docs would be fun since it is easy and saves time and effort.

Overall, the conversations above indicate that perceived enjoyment had a positive influence on the adoptionof cloud applications by students.

7.2.3 Summary of the Focus Groups Findings

The focus groups were conducted with the aim of validating the empirical findings. This would overcome the weakness of relying on one research method, and also allow the participants to express their views concerning the topic under study in a more detail. Based on the detailed analysis of the three focus groups, the results were consistent with the quantitative findings. Specifically, the focus groups analysis findings showed that job relevance, perceived usefulness, playfulness, perceived ease of use, perceptions of external control, trust, and perceived enjoyment had significant impact on the students' intention to adopt cloud computing applications, whereas self-efficacy, anxiety, image, subjective norm, result demonstrability and output quality had non-significant influence. In addition, the focus groups findings related to behavioural intention strongly supported that the participants were willing to adopt cloud computing applications.

The participants also mentioned several suggestions, as well as concerns and barriers that were not related to factors of the modified TAM3 model, which however are worth mentioning here so they can be considered by the universities decision makers particularly in Saudi Arabia context to make cloud computing applications implementation successful in universities and also to make the adoption of the cloud applications easier by the students. Furthermore, these suggestions, as well as concerns and barriers could be helpful for cloud applications providers for improving cloud applications in general. The suggestions, as well as concerns and barriers mentioned by the participants are reported in Sections 7.3.1 and 7.3.2 below.

7.3 Open-Ended Question Analysis

The questionnaire survey and focus groups included open-ended question that asked the respondents to provide additional information related to factors not considered in the proposed research model. The main objective of the open-ended question was to get more information from the respondents about the difficulties, barriers, concerns, and any other important factors that were not covered in the proposed model. It enables the respondents to feel free to express their opinions and make suggestions regarding the topic under study. The open-ended question was "in your opinion, are there any other factors or barriers that affect the adoption of cloud computing applications in your university which are not covered in this study, or any additional information which you think would be useful to this study".

Consequently, a total of 527 questionnaires were distributed to the respondents of the study. However, only 188 (36%) answered the open-ended question, whereas majority of the participants in the focus groups answered the open-ended question. The open-ended question responses from the questionnaire survey respondents and focus groups participants were analysed by grouping and combining them into related themes, which emerged during the analysis. The main themes are presented below, as barriers and concerns, and suggestions.

7.3.1 Barriers and Concerns

This section presents the findings from the open-ended question analysis which reveales the barriers and concerns that may prevent students from adopting and using cloud computing applications. These findings form an important and useful foundation for decision makers in Saudi Arabia universities and cloud applications providers to enable them to have a clear understanding on the barriers and concerns that students think are important to them. The following subsections present the identified barriers and concerns in detail.

7.3.1.1 Unavailability or Lack of High Speed Internet in the University

This concern was the most cited by students that may prevent them from using cloud computing applications. They thought that without Internet the cloud applications would not be accessible. Also with low speed Internet, use of these applications would become frustrating. According to most of the questionnaire respondents and focus groups participants, the Internet services in their universities are either slow, weak or very bad. One respondent said, “in my opinion the Internet services and the network in my university are not good enough, sometimes we have to go outside the campus to get a good quality network connection. I suggest that the campus should be supplied with high quality Internet connection, that will give us a chance to do our study activities like assignments or share documents while we are far from our houses”. Further, some questionnaire respondents also mentioned that Internet services in their universities are not available at all for students especially the Wi-Fi service. The same argument also mentioned by the focus groups participants. They claimed that the Internet is always slow which will make the cloud applications lagging. One of the focus groups participants mentioned that “lack of Internet inside the university is hindering the use of cloud computing applications”.

7.3.1.2 Lack of Knowledge and Experience to Use Cloud Applications

This concern was also identified from the open-ended question data as the key barrier that may affect the adoption of cloud computing applications. Some of the questionnaire respondents and the focus groups participants believed that some of their colleagues and lecturers may lack the knowledge required to use cloud computing applications. One of the questionnaire respondents commented that some lecturers especially those who are not in Faculty of Science or Computer Engineering may not have the necessary knowledge to use cloud computing applications. He commented that “not all the lecturers are well qualified to use such a service especially lecturers from outside the Faculties of Science and Computer Engineering”. Similarly, the focus groups participants felt the same and they commented that the lack of knowledge about the cloud computing applications between students and the lecturers is an issue that may prevent the adoption of this technology. As one participant mentioned that, “the students and the lecturers have no knowledge about the technology and how to use it”.

7.3.1.3 Lack of High Quality of Internet Services in Student’s City/Home

Absence of high quality of Internet services in students’ homes and city was another barrier that affects the adoption of cloud applications as mentioned by some questionnaire respondents and focus groups participants. According to one of the questionnaire respondents, “Internet in the city is very bad”. Another respondent commented that, “the Internet in the city is very bad, so are the land lines and the mobile networks”. Similarly, focus groups participants supported the same argument and claimed how the Internet providers do not take the needs of their clients into their account as one of the participants commented, “the telecommunication companies do not take their clients’ needs into account, and we wish that they will do that soon by setting up fibre optic lines in all over the kingdom because I think that the services of the cloud applications more depend on the Internet speed”.

7.3.1.4 Lack of Training on Cloud Computing Applications

Students claimed that lack of training on how to use cloud computing applications in their universities was one of the main factors that they think may prevent the use of this technology by students. One questionnaire respondent revealed that, “one of the reasons that affect the use of technology is the lack of training courses of this important service”. In the same way one of the focus groups participants said “introduction lecture about cloud computing applications is needed to help students use the cloud computing applications efficiently”.

7.3.1.5 Students’ Lack of Computer Related Knowledge

Lack of computer knowledge was another issue that affects the adoption of cloud computing applications by students. In this respect, some questionnaire respondents mentioned that they do not use computer and they do not even know how to use it. One respondent commented that, “we do not know about computer and how to use it and the university did not provide us with workshops on how to use computers”. Likewise, one of the focus groups participants revealed that, “some students in the literary departments or English language department do not even know how to turn on the computer, so this is a problem and there must be an introduction course about the applications usage, in order to make the process of dealing with Google Docs easy for them”.

7.3.1.6 University Restrictions to Download Files from the Websites

Another barrier that may affect the adoption of cloud applications by students was the university’s restrictions to download files from the websites in campus. The questionnaire respondents argued that the adoption of cloud computing applications will not be effectively used by students as a result of some restrictions in their universities. For example, one questionnaire respondent commented that, “using the cloud computing applications in the university would not be effective because the university forbids file downloading from all sites such as videos, images and documents”.

7.3.1.7 Storage Space

Another concern was related to the storage space that was allocated to each user from the cloud application providers. Some of the questionnaire respondents related that they were worried about the storage space that will be allocated to each student, which may not be enough for the students during the period of their study in the university. One questionnaire respondent specifically mentioned that “the saving space allocated for each student is not sufficient”.

7.3.1.8 High Price of Internet Services in Saudi Arabia

This was another barrier that may prevent some students from using cloud computing applications. Some of the questionnaire respondents admitted that Internet price was very expensive in Saudi Arabia. One of the questionnaire respondents said, “speed, quality and the price of the Internet service are the main reasons that influence the use of cloud applications”. Similarly, another questionnaire respondent commented that “the prices of the Internet services are very high and the speed does not match with what the service providers advertised”.

7.3.1.9 Concern Regarding Forgetting Username and Password

The study respondents also further elaborated their concern regarding forgetting username and password of cloud applications for user account as another barrier that may affect the adoption of cloud computing applications by students. Even though username and password provide security to files saved in all of the cloud based applications, one respondent expressed his fear that he may forget his username and password so he becomes unable to access his data.

7.3.1.10 Commitment of Lecturers

Commitment of lecturers to use cloud applications was another barrier that the students think will affect the adoption of the cloud applications. Some students mentioned that some lecturers may not have the desire to adopt and use cloud computing applications. One of the questionnaire respondents claimed that the adoption of cloud computing applications may be affected by “the lecturer’s way of thinking, they do not have any desire to learn a new thing”. In the same way, another respondent said, “there may be no encouragement by the lecturers to use this technology”.

7.3.1.11 Cultural Influence

Cultural influence was another barrier that may affect the adoption of cloud computing applications as mentioned by some of questionnaire respondents and focus groups participants. Some parents due to cultural influence do not support the idea of having Internet at home, which in turn will influence the adoption and use of cloud computing applications. As one of questionnaire respondents commented that, “some parents do not accept the idea of having Internet in the house”. Another questionnaire respondent, a female student related that some female students would not be able to use cloud computing applications to interact with their colleagues or lecturers since their parents don’t allow the female students and also male students to use Internet at home. Likewise, one of the focus groups participants argued that “parents don’t allow the use of Internet at home”.

7.3.1.12 Lack of Encouragement by the Lecturers to Share Files Using Cloud Applications

Another barrier that may affect the adoption of cloud computing application was the fear of lack of encouragement by the lecturers to share files using cloud applications as mentioned by the focus groups participants and the questionnaire respondents. As one of the questionnaire respondents expressed his worry over this issue because some lecturers may not like and use the idea of sharing files using cloud computing applications, he commented, “maybe the lecturers would not encourage the students to share files through Google Docs”.

7.3.1.13 Lack of Availability of Trainers in the University

The focus groups participants and the questionnaire respondents also mentioned that the lack of availability of trainers in the universities was another barrier that might affect the adoption of cloud computing applications. As one of the questionnaire respondents claimed that the adoption and use of cloud computing applications would be affected by the lack of availability of trainers in the university who can help the students learn how to use the cloud computing applications. He commented that “lack of trainers who can help and illustrate how to use the cloud computing applications will affect the use of the technology”. Similarly, one of the focus groups participants claimed that, “there are some of students who cannot use it, but if someone is there to explain to them, they will find something that they will benefit from it”.

7.3.1.14 Lack of Commitment and Interest in Using Cloud Applications by Students

Lack of students’ commitment and interest in using cloud applications was another barrier expected to affect the adoption of the technology as reported by some of the questionnaire respondents. One of the questionnaire respondents stated that there may be less commitment and interest in using cloud computing applications by students. Another questionnaire respondent related that, “some students may not have the desire to learn this technology perhaps because they may be unaware of the benefits of this technology”.

7.3.1.15 Financial Constrains

Financial constrain was another factor that may affect the adoption of cloud computing applications by students since some students may not have the financial strength to acquire computer and Internet service. One of the questionnaire respondents specifically said, “I do not have a computer”. Another questionnaire respondent on this issue also mentioned that, “lack of financial abilities to buy computers and Internet service may hinder the use of cloud computing applications”.

7.3.1.16 Lack of Awareness

Lack of awareness among the students about the cloud computing applications was another barrier that may affect the adoption of cloud computing applications as mentioned by the questionnaire respondents. One of the questionnaire respondents commented that, “I see this side is neglected in my study. Despite my specialization in Computer Science field, I did not know about having a cloud storage in Google”. Similarly, another respondent commented that “I could see that there is a lack of awareness among students and workers in the university about these applications”.

7.3.1.17 Unavailability of Computer Labs in the University

Unavailability of computer labs in the universities was another barrier that may affect the adoption of cloud applications by students as mentioned by questionnaire respondents and focus groups participants. Although there were some labs in the universities but they were only for Computer Science and Information Technology students which may affect the adoption of cloud applications by students in other different majors, as one questionnaire respondent mentioned that the adoption of cloud applications by students was affected by “monopolism in using the computer labs only by the Computer Science and Information Technology students”. One of the questionnaire respondents claimed that, “there are no labs that are opened all the times for the students to use them whenever they like”. Likewise, another respondent commented that “the lack of PC devices in the university may become as an obstacle for using the cloud applications”.

7.3.2 Suggestions

Various important suggestions for decision makers in universities and the cloud applications providers were mentioned by the questionnaire survey respondents and focus groups participants to increase the adoption rate of cloud computing applications by students as well as to improve the design of cloud applications. The suggestions are presented as follow.

A) Suggestions for the decision makers in universities:

- Universities should conduct an efficient awareness campaign to increase the knowledge about cloud computing applications.
- Training courses on how to use cloud computing applications should be provided to all students as part of their study.
- Universities should provide trainers to train and help students to use cloud applications easily and effectively since the participants acknowledged that some of students cannot use cloud applications.
- The students should be taught the basics of using cloud computing applications by adding it as a chapter in computer skills course or create a brochure to highlight its benefits in education.

- Universities decision makers should assign at least one hour per week within the study plan for each student in every semester to motivate the students and enable them to use cloud applications in university.
- Universities should provide IT support office for students who have some issues or queries about cloud computing applications.
- Computer labs with high speed Internet facilities should be provided and made them available to students to enable them use the cloud computing applications.
- The decision makers in universities should accelerate the implementation and use of cloud computing applications in order to derive its benefits for students.
- Another training courses on how to use computer devices are required for students who do not know how to use computer devices, because some students especially those Art majors are computer illiterates.
- Universities should encourage the lecturers to use cloud computing applications for interaction with students in order to guide and encourage them.
- The lecturers should motivate the students to use cloud computing applications.

B) Suggestions for cloud applications providers:

- The providers of cloud computing applications should provide concise, clear and understandable steps in the help menu of the cloud applications to facilitate their use by students.
- The cloud applications providers should develop cloud applications with all the features of the existing computer based applications or develop more features than the existing computer based applications; for instance, cloud applications that are used to create and edit documents should at least have all the features of Microsoft Word.
- The design of cloud applications should be made appealing to attract students to adopt and use cloud applications.
- Effective and fast online support services should be available in all cloud computing providers’ websites to ensure the quality of services provided.

- Automatic saving functionality should also be added to cloud computing applications so that if user forgets to save his work it will be automatically saved in case computer turned off or sudden electricity cut.
- Cloud computing applications should have support for chat in the form of text or video.
- Cloud applications providers should add notification or acknowledgment service in the cloud applications to notify the sender when the user received the file.
- Menus and links should be made simple so that students can easily understand the contents of the cloud computing applications and the steps required to use the cloud applications efficiently.
- Cloud computing applications should have restore functionality to recover deleted files.
- Cloud applications providers should ensure that users' data and login credentials are protected.
- Cloud applications providers should provide cloud applications that support software required by students in Arts and Sciences majors to make the cloud applications effectively and equally used by all university students.
- Cloud applications providers should make cloud applications run the processes and activities quickly without delay.
- Cloud applications providers should provide cloud applications that support Arabic language, to make students easily understand how to use the cloud applications.

7.4 Chapter Summary

This chapter presented the findings of the analysis of the qualitative data, which were collected using focus groups and open-ended question. The qualitative research was conducted to validate the quantitative findings, and to explore factors that were not covered by the proposed model. The findings from the focus groups were consistent with the quantitative findings. The participants in the focus groups and respondents in questionnaire have revealed important barriers and concerns that may impede the adoption of cloud applications by students. They also have mentioned a number of suggestions to improve the design of the cloud applications, and to increase the adoption rate among the students. Hence, it is expected that the adoption of cloud applications would be increased by students when the barriers and concerns are addressed by decision makers in Saudi universities and cloud applications providers.

Chapter 8: Discussion of Findings

8.1 Introduction

This chapter presents and summarizes the research findings of both quantitative and qualitative data. The discussion involves connecting together the findings of both the quantitative and qualitative studies with existing studies in relation to the research questions. This chapter provides discussions about the findings of the constructs of the original TAM3 model, findings related to the additional construct in the research model, which is trust, and findings related to the moderating factors defined in the proposed model. Finally, the chapter discusses the findings of the open-end question.

8.2 Discussion of Findings of the Study

This section presents discussion about the research findings which are related to each of the research questions.

8.2.1 Discussion Related to Research Question 1

This subsection discusses the findings related to the original TAM3 model constructs and their relationships with the dependent construct which is behavioural intention. The proposed model in this study was assessed using a quantitative approach and the results were later validated using a qualitative approach. The constructs from the original TAM3 model considered in this study are: perceived usefulness, perceived ease of use, behavioural intention, anxiety, self-efficacy, perceptions of external control, perceived enjoyment, output quality, subjective norm, job relevance, playfulness, image, and result demonstrability. The research question related to these constructs is as follows:

RQ1: What is the influence of the TAM3 based factors on the adoption of cloud computing applications by Saudi Arabian university students?

The following subsections discuss the findings related to the constructs.

8.2.1.1 Perceived Usefulness (PU)

Perceived usefulness is defined in this study as the extent of students’ belief that cloud applications will improve the performance of their learning activities. This factor was measured by the belief about enhancement of students’ productivity, performance and effectiveness of their learning and collaboration activities by using cloud computing applications. The factor was also measured by the ability of students to quickly and easily accomplish learning tasks using cloud computing applications. As hypothesized in TAM by Davis et al. (1989), this study postulated that perceived usefulness will positively affect behavioural intention of cloud computing applications adoption. The finding showed that perceived usefulness has a significant positive influence on behavioural intention, which supports the relevant hypothesis (H1). This finding is also supported by the focus groups results. This implies that the adoption of cloud applications by Saudi Arabian students will increase when they perceive the usefulness of cloud applications. Therefore, the universities can let their students realize the benefits of cloud applications, especially those that are related to the improvement of the productivity and effectiveness in their learning and collaboration activities in order to promote the adoption of cloud applications. The finding of this study is consistent with TAM3 study where perceived usefulness was found to have a positive impact on behavioural intention (Venkatesh & Bala, 2008). This finding is also supported by various existing studies in different fields like K. M. Faqih and Jaradat (2015) on mobile commerce adoption in Jordan, Al-Gahtani (2014) on e-Learning adoption in Saudi Arabia; Behrend et al. (2011) on cloud computing adoption in USA, and Li and Chang (2012) on cloud applications adoption in Taiwan. The positive impact of perceived usefulness on behavioural intention may be because of the desire of university students to carry out their learning and collaboration activities by adopting the cloud computing applications, especially because these activities are achievable by performing tasks such as creating, editing, formatting, and sharing documents or spreadsheets on cloud applications like Google Docs. Although, the perceived usefulness has significant impact on behavioural intention, the Saudi universities are recommended to conduct more specialized training courses and seminars to encourage the students’ adoption of cloud computing applications by spreading the knowledge and increasing the awareness of students about the effectiveness of using cloud applications for achieving their learning activities and collaboration tasks.

8.2.1.2 Perceived Ease of Use (PEOU)

In the context of this study, perceived ease of use is the perception of students on the ease of using, learning, and utilizing the cloud computing applications. This factor was measured by the perception of ease of learning, using and getting the cloud computing applications to do what the user wants it to do, perception about clarity and flexibility of user's interaction with cloud applications such as Google Docs, and also the effort required to practice, become skilful and interact with these applications. Perceived ease of use was hypothesized in this study to predict perceived usefulness as well as behavioural intention as in the original models that formed TAM3 by Venkatesh (2000) and Venkatesh and Davis (2000). The assumption on the influence of perceived ease of use on both behavioural intention and perceived usefulness is that the performance of students in learning activities will increase when they utilize cloud applications that are easy to use. The relationship between perceived ease of use and perceived usefulness on one hand, and the impact of perceived ease of use on behavioural intention, on the other hand, were found both significant as a strong positive effect was realized. Consequently, H2 and H3 hypotheses related to perceived ease of use were supported. The focus groups confirmed these findings. These findings confirmed the assumption that students would adopt cloud applications because they perceive it as easy to use, flexible, and easy to become proficient in using it. The great impact of perceived ease of use on the adoption of cloud applications was clearly seen from its strong positive effect on both perceived usefulness and behavioural intention. The significant effect of perceived ease of use on both perceived usefulness and behavioural intention was in line with various studies, not only TAM3 related studies but in many original TAM related studies (Al-Gahtani, 2014; K. M. Faqih & Jaradat, 2015; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000). The findings imply that the adoption of cloud computing applications by Saudi Arabian students would be increased when the students perceive the cloud applications are easy to use. Therefore, universities can promote the adoption of cloud applications by increasing the awareness among students about the flexibility and ease of use of cloud applications. Also universities should provide training courses to make the use of the cloud applications by students easier. Moreover, the providers of cloud applications are recommended to consider the flexibility and easiness issues so that the students can perceive the ease of use of cloud applications which will facilitate its adoption.

8.2.1.3 Subjective Norm (SN)

In this study, subjective norm is the perception of students that their instructors or peers think they should use the cloud computing applications. It was measured by the perception of the ability of important people such as instructors or peers to influence student's intention to use cloud computing applications. Similar to TAM2 assumption (Venkatesh & Davis, 2000), this study hypothesized that subjective norm influences perceived usefulness, image, and behavioural intention. The influence of subjective norm on the main TAM belief and behavioural factors (perceived usefulness and behavioural intention respectively) were both found to be insignificant which is consistent with the findings of the focus groups. This suggests rejection of hypotheses H6 and H7 which implies that the influence of people such as teachers and peers in the student's social group has no impact on students' belief and behaviour toward cloud applications adoption. Although these results contradict the findings of some existing studies that supported the impact of subjective norm on behavioural intention and perceived usefulness (Al-Gahtani, 2014; C. Anderson et al., 2008; Gottschalk & Kirn, 2013; Macharia & Nyakwende, 2010; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000), the results are in agreement with findings of other previous studies for subjective norm to perceived usefulness relationship and subjective norm to behavioural intention relationship (S. J. Chang & Im, 2014; Chih-Yang, Tsai-Chu, Ping-Teng, & Chih-Wei, 2011; Chismar & Wiley-Patton, 2003; Mathieson, 1991; Zafiropoulos, Karavasilis, & Vrana, 2012).

Similarly, Venkatesh et al. (2003) found subjective norm significant only in mandatory setting; and even in the mandatory setting, the influence is weakened as users gain experience with the system. Perhaps this is one of the reasons why the impact of subjective norm on behavioural intention and perceived usefulness is insignificant in this study, since the usage of cloud applications such as Google Docs was voluntary by university students. Another explanation of such results may be because of the fact that the cloud computing application used in this study is an Internet based application, and from the demographic profile of the respondents it is shown that majority (84.2%) of the respondents have a good Internet proficiency, where proficiency in using Internet increases the self-confidence that in turn may reduce the influence of others' thinking and opinion. Conversely, the findings show a strong positive effect of subjective norm on the other social influence factor (image).

This provides an evidence to support the hypothesis (H8) as reported in some studies (Al-Gahtani, 2014; K. M. Faqih & Jaradat, 2015). Hence, these findings indicate that the adoption of cloud computing applications by Saudi Arabian students is a matter of personal belief that cannot be affected by the influence of others such as instructors or peers. However, in order to promote the adoption of cloud applications, Saudi universities are recommended to encourage the participation of students in designing learning activities and collaborative tasks that depend on cloud applications, on one hand, and to conduct more specialized seminars and workshops to encourage the students' usage of cloud applications for different learning activities and collaborative works on other hand.

8.2.1.4 Image (IMG)

In this study, image is the extent of students' belief that using cloud applications will result in elevating their status in the academic environment. Image was measured by the belief about whether the status and profile of people such as teachers and students who use cloud computing applications in universities is higher than that of those who do not use the applications or not. Therefore, in this study it was postulated that perceived usefulness will be positively affected by image. However, results showed that image had a non-significant effect on perceived usefulness, which led to the rejection of hypothesis (H9) that assumed a positive influence of image on perceived usefulness existed. The focus groups results confirmed this finding. Although this finding was contrary to the expectation of the influence of image on perceived usefulness in both TAM2 and TAM3 (Venkatesh & Bala, 2008; Venkatesh & Davis, 2000), it was in line with existing studies that reported a non-significant relationship between image and perceived usefulness (S. J. Chang & Im, 2014; Chismar & Wiley-Patton, 2003; Zafiropoulos et al., 2012). One possible explanation of this finding is, since the adoption of cloud computing applications in this situation is solely due to personal beliefs so the students did not consider enhancement of status as part of the perceived usefulness. Thus, gaining recognition is not considered as a benefit expected from using the cloud applications. Therefore, Saudi universities are recommended to appreciate and consider students who use cloud applications, besides the continuous encouragement to students to the adoption of cloud computing applications, by establishing support groups and conducting specialized workshops and training courses to encourage the adoption of cloud applications by students.

8.2.1.5 Job Relevance (REL)

In the current study, job relevance which is denoted by study relevance, is the students' perception on the extent to which the cloud applications are relevant for learning related activities and collaborative works. This factor was measured by the belief of the students that using cloud computing applications like Google Docs would be important and relevant in their study. As postulated in TAM2 (Venkatesh & Davis, 2000), this study hypothesized that job relevance will have a positive influence on perceived usefulness. This implies that students in Saudi universities would adopt the cloud computing applications as they think that such applications are relevant to their studies. A significant positive influence of job relevance on perceived usefulness was revealed in this study, which supported H10 hypothesis. This finding was also supported by the focus groups results. This result confirms the relevance of cloud applications to students learning related activities and collaborative works. The demographic characteristics of the respondents also supports this finding since the cloud computing application used was computer/Internet based application; majority of the respondents have computers (87.1%), high Internet connection at home (75.4%), good Internet proficiency level (84.2%), and spend more than 3 hours using Internet daily (54.1%). This finding is consistent with various studies that reported similar finding (Agudo-Peregrina et al., 2014; Al-Gahtani, 2014; S. J. Chang & Im, 2014; Chih-Yang et al., 2011; Huang et al., 2012; Macharia & Nyakwende, 2010; Zafiropoulos et al., 2012). As there is a positive impact of job relevance on perceived usefulness of cloud computing applications, it is recommended that the designers of study-related tasks such as assignments, reports, and courses presentations; and cloud applications providers should consider the compatibility and relevance of these tasks and cloud applications to students' learning activities. Moreover, the Saudi universities are recommended to include students in the planning and implementation of cloud based learning activities.

8.2.1.6 Output Quality (OUT)

In the context of this study, output quality is the degree to which the students believe that the cloud applications are effective in performing the learning activities and other collaborative tasks better. In other words, the output quality in this context denotes the outcomes of using the cloud applications in performing the learning activities and other collaborative tasks. It is measured by the opinions of the respondents regarding the quality of cloud computing applications output. In this situation, the output is the documents created by using Google Docs application. Similar to TAM2 theory (Venkatesh & Davis, 2000), this study hypothesized that output quality positively affect perceived usefulness. The assumption on the influence of output quality on perceived usefulness is that students' productivity and effectiveness will be enhanced as they get a high quality and excellent output from the cloud computing applications. Nevertheless, the results of this study did not support this assumption, leading to the rejection of the relevant hypothesis (H11). This was similar to the findings of the focus groups. This result was in line with findings from earlier studies by Chismar and Wiley-Patton (2002), Venkatesh and Bala (2008), Jung et al. (2014), S. J. Chang and Im (2014) and Zafiropoulos et al. (2012). The findings of this study indicated that the adoption of cloud applications by students in Saudi universities was not affected by the quality of cloud computing applications' output, which means that the students did not perceive the cloud application used in this study provided high quality output. Therefore, the cloud applications' providers are recommended to design applications that have excellent and high quality output, in order to make it possible for the students to distinguish the output of cloud applications from the output of other non-cloud based applications. Moreover, Saudi universities should allow students to participate in determining the required specifications of high quality output expected from the cloud applications that will be adopted by students.

8.2.1.7 Result Demonstrability (RES)

Result demonstrability can be viewed as the extent of students' belief that the result of using cloud computing applications is tangible, observable, and communicable. Result demonstrability was measured by the perception of the respondents about the result of using cloud applications like Google Docs, and how they can explain the consequences and benefits of using it to others. In this study, result demonstrability was hypothesizedto positively affect perceived usefulness of cloud computing applications, as postulated in TAM2 (Venkatesh & Davis, 2000). This assumption implies that performance, productivity, and effectiveness of the students related to their study will increase if the results of the adopted cloud applications are apparent and they find no difficulty in explaining their experience with those applications. Hypothesis (H13) of this study, which was related to result demonstrability, was rejected as the finding showed a non-significant impact of result demonstrability on perceived usefulness. This was in line with focus groups findings. Although similar findings were reported in various studies (Al-Gahtani, 2014; S. J. Chang & Im, 2014; K. M. Faqih & Jaradat, 2015; Jung et al., 2014), other studies found positive relationship between result demonstrability and perceived usefulness (C. Anderson et al., 2008; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000). The insignificant effect of result demonstrability on perceived usefulness might indicate that the students did not believe that the results of using cloud computing applications such as Google Docs are observable, tangible, and communicable. Therefore, providers of cloud computing applications are recommended to pay more attention to the output of such applications to be more tangible. In addition, decision makers in universities are recommended to collaborate with students to design learning activities and collaboration tasks of tangible and observable results.

8.2.1.8 Self-Efficacy (SE)

Self-efficacy in this research refers to students’ confidence in their abilities to use cloud computing applications for learning and other collaborative tasks. This factor was measured by the ability of the students to use cloud computing applications without assistance from others. It was measured also by the belief about having enough time required to complete a task using cloud applications such as Google Docs by the students, as well as the belief about whether experience with similar systems will assist the students to complete tasks using cloud applications. Similarly, as hypothesized by Venkatesh (2000), this study assumed a positive impact of students’ self-efficacy on ease of using cloud computing applications for learning and other collaborative work activities. Contrary to this assumption, self-efficacy was found to have a non-significant effect on perceived ease of use so was also found in the focus groups results. As a result, the related hypothesis (H14) was rejected. The non-significant effect indicated that the students were unable to perform the required tasks independently without the help of anybody else. Although this finding contradicts some studies that established the existence of significant positive impact of self-efficacy and perceived ease of use relationship (C. Anderson et al., 2008; Venkatesh, 2000), it supports findings from other technology adoption studies where a non-significant relationship was reported (Agudo-Peregrina et al., 2014; Jung et al., 2014). This finding implies that Saudi universities should carry out training courses that enable students to adopt cloud computing applications easily by elevating their self-confidence to use the new technologies independently.

8.2.1.9 Perceptions of External Control (PEC)

In this study, perceptions of external control is viewed as the perceptions of students that facilities and resources such as Internet, computers devices, and technical support are provided by their universities to support the use of cloud computing applications. Perceptions of external control was measured by the belief of students that they would have resources, knowledge, and control over using cloud applications such as Google Docs, and that cloud applications would be compatible with other software that students use. As hypothesized in one of the models that formed TAM3 theory (Venkatesh, 2000), perceptions of external control is hypothesized to have a positive impact on perceived ease of use of cloud computing applications. This study revealed that perceptions of external control was a determinant of perceived ease of use, which supported the relevant hypothesis (H15). This finding was also supported by the focus groups results. Therefore, improving the adoption of cloud applications by universities students through perceived ease of use involve providing the resources in universities such as Internet and computer devices needed to use cloud applications. This finding was supported by various studies (Agudo-Peregrina et al., 2014; Al-Gahtani, 2014; S. J. Chang & Im, 2014; K. M. Faqih & Jaradat, 2015; Jung et al., 2014; Venkatesh, 2000; Venkatesh & Bala, 2008). However, this finding implies that Saudi universities should not only provide the facilities, technical resources, and equipment needed for cloud applications adoption by students, but also increase the awareness of availability of these resources and participation of students in the utilization of these resources to support the adoption of cloud applications.

8.2.1.10 Anxiety (ANX)

In this research, anxiety refers to the degree of students' worry or fear when they are faced with the possibility of using cloud computing applications. It was measured by the perception of students' nervous or negative reaction toward using a cloud technology. It was also measured by the belief about students' fear that they may lose information by hitting the wrong key, and the feeling that using cloud applications such as Google Docs would be intimidating. Therefore, similar to the model of predictors of perceived ease of use that was proposed by Venkatesh (2000), this study assumed a negative influence of anxiety on the perceived ease of use of cloud computing applications such that the presence of anxiety or horrible emotional conditions among students will lead to developing unfavourable perception toward the adoption and use of cloud applications. This is may be due to the lack of computer skills, or preference for other conventional ways of learning, sharing, or collaboration. However, the findings did not support the assumption of negative influence of anxiety on perceived ease of use of cloud computing applications, hence leading to the rejection of hypothesis (H16). This finding was consistent with focus groups findings. This is perhaps because the students have prior experience with computer and Internet as supported by the demographic profile of the respondents that 84.2% and 80.9% of the respondents have good Internet proficiency and computer knowledge respectively. This result was consistent with a study on cloud computing adoption and usage in a community college (Behrend et al., 2011), which was also supported in various studies (K. M. Faqih & Jaradat, 2015; Huang et al., 2012). Conversely, the negative influenceof anxiety on perceived ease of use was confirmed by TAM3 (Venkatesh & Bala, 2008) and other studies (C. Anderson et al., 2008; S. J. Chang & Im, 2014; Gottschalk & Kirn, 2013; Jung et al., 2014; Macharia & Nyakwende, 2010; Venkatesh, 2000). Therefore, the decision makers and cloud applications providers should not be concerned about students' anxiety towards using cloud applications when providing and implementing it because of its insignificant effect.

8.2.1.11 Playfulness (PLAY)

In the context of this study, playfulness can be referred to as the extent to which the students perceive themselves as spontaneous, creative, and playful when using cloud computing applications. This factor was measured by how the students characterized themselves as spontaneous, creative, playful, and original when using cloud applications such as Google Docs. As hypothesized in one of the models that formed TAM3 theory (Venkatesh, 2000), playfulness is theorized in this study to positively affect perceived ease of use of cloud applications. The results of this study confirmed the presence of intrinsic motivation of students to adopt cloud applications. Thus, hypothesis H17 was accepted since a significant impact of playfulness on perceived ease of use was found. This was in line with focus groups findings. This finding was also supported in various studies (Agudo-Peregrina et al., 2014; Gottschalk & Kirn, 2013; Venkatesh, 2000; Venkatesh & Bala, 2008). This significant impact of playfulness on perceived ease of use of cloud applications implies that the adoption of cloud applications by students would be increased when they feel spontaneous and playful while using cloud computing applications. Hence, decision makers in the universities and cloud applications providers should focus on designing cloud applications for students with playful attitude to adopt it easily.

8.2.1.12 Perceived Enjoyment (ENJ)

In this study, perceived enjoyment is regarded as the degree to which the university students perceive that using cloud computing applications is an enjoyable task unrelated to any performance consequences resulted from the use of such applications. Perceived enjoyment was measured by the belief of students about how using cloud applications such as Google Docs would be enjoyable and pleasant, and the fun the students are expected to get when using these applications. This study postulated that perceived enjoyment affects perceived ease of use positively, as hypothesized in the model of determinants of perceived ease of use (Venkatesh, 2000), such that the students' perception about ease of using cloud applications will increase when they find that using cloud application is a pleasurable task itself. A strong positive impact of perceived enjoyment on perceived ease of use was found in this research, which supported hypothesis H18. This result was supported by the focus groups findings and other empirical studies conducted in Saudi Arabia setting

(Al-Gahtani, 2014), and other different settings (C. Anderson et al., 2008; S. J. Chang & Im, 2014; Venkatesh, 2000). Therefore, providers of cloud computing applications are recommended to present more enjoyable cloud computing applications to increase its adoption by students through perceived ease of use, while universities are recommended to encourage students to participate in designing enjoyable learning activities and collaboration tasks to be carried out using cloud applications.

8.2.2 Discussion Related to Research Question 2

This subsection discusses the result regarding to the additional construct in the proposed model, which is trust. The question related to this construct is as follows:

RQ2: What is the influence of trust on the adoption of cloud computing applications by Saudi Arabian university students?

The following subsection discusses the findings related to trust construct.

8.2.2.1 Trust (TR)

Trust was added to the model of this study to examine cloud computing applications adoption by university students because there is uncertainty involved as a result of lack of standards, regulations, and complexity of the technology (Gefen et al., 2003; P. A. Pavlou, 2003; Quynh et al., 2014). Trust was measured by perception of students about trustworthiness and ability of cloud applications providers such as Google to protect the privacy of the students and keep its promises and commitments; and how secure the cloud applications would be. This study assumed a positive impact of trust on the intention of adoption of cloud computing applications as hypothesized in previous studies (Carter & Weerakkody, 2008; Gefen et al., 2003; P. A. Pavlou, 2003), and on perceived usefulness of cloud computing applications as hypothesized by Gefen et al. (2003), Chircu, Davis, and Kauffman (2000), Alsajjan and Dennis (2010), and Belanche, Casaló, and Flavián (2012). A positive significant impact of trust on perceived usefulness was found in this study that led to the acceptance of the hypothesis (H5). The focus groups results confirmed this finding. However, a non-significant relationship between trust and behavioural intention was found, which led to the rejection of hypothesis (H4). The non-significant impact of trust on behavioural intention perhaps may be as a result of the indirect effect of trust on behavioural intention via perceived usefulness.

Although some research found a significant influence of trust on behavioural intention (Carter & Weerakkody, 2008; Gefen et al., 2003; P. A. Pavlou, 2003), the finding that trust had a non-significant effect on behavioural intention in this study was consistent with finding from Zafiropoulos et al. (2012), while the finding related to the significant effect of trust on perceived usefulness was in line with findings from various studies (Belanche et al., 2012; Chircu et al., 2000; Gefen et al., 2003). This implies that students are highly relating the adoption of cloud applications with trust, such that if students trust such applications, their performance in learning activities and collaborative tasks will be enhanced. Therefore, the cloud applications providers are recommended to present more trustable and secure applications to promote its adoption by university students. In addition, the cloud applications providers and decision makers in universities should educate students on the possible threats related to the security and privacy, and solutions should be provided in order to increase students' confidence in cloud computing applications and build trust with students.

8.2.3 Discussion Related to Research Question 3

This subsection discusses the results related to the moderating constructs defined in the extended TAM3 model, which are output quality and Internet experience. The question related to the moderator constructs is as follows:

RQ3: What is the influence of the moderating factors (Internet experience and output quality) on the hypothesized relationships in the proposed model?

The following subsections discuss the effect of the moderator constructs on the hypothesized relationships in the proposed model.

8.2.3.1 Output Quality (OUT)

In this study, output quality is hypothesized to moderate the relationship between perceived usefulness and job relevance, as proposed by Venkatesh and Bala (2008).

This study found that, output quality did not moderate the relationship between job relevance and perceived usefulness, thus the related hypothesis (H12) was rejected. This implies that the effect of job relevance on perceived usefulness is not influenced by the output quality of cloud computing applications. This finding was contrary to the previous findings that found output quality as a factor that moderates job relevance and perceived usefulness relationship (Al-Gahtani, 2014; Huang et al., 2012; Venkatesh & Bala, 2008). The inability of output quality to positively moderate the relationship between job relevance and perceived usefulness of cloud computing applications implies that the providers of cloud applications should take into consideration that not only a high quality output is required, but also the output should be related and relevant to students' learning and collaborative tasks and activities.

8.2.3.2 Internet Experience (IE)

Internet experience in this study is viewed as the extent to which the students have Internet experience to use cloud computing applications. It was measured by the number of years the students spent using Internet. Although, TAM3 has included experience as a moderator factor that moderates the specified relationships between the hypothesized factors, it was changed to Internet experience in the proposed model because cloud computing applications are Internet-based services. It was expected that students with higher Internet experience are likely to be more skilful in using such applications. As hypothesized in TAM3, Internet experience was theorized to moderate between perceived ease of use and perceived usefulness relationship, between perceived ease of use and behavioural intention relationship, between subjective norm and perceived usefulness relationship, between subjective norm and behavioural intention relationship, between anxiety and perceived ease of use relationship, between playfulness and perceived ease of use relationship, and between perceived enjoyment and perceived ease of use relationship. This study found that Internet experience did not have the moderating effect on the hypothesized relationships in the proposed model. Therefore, the hypotheses (H19a, H19b, H19c, H19d, H19e, H19f, and H19g) were all rejected. This is perhaps because the Internet experience of the respondents was sufficient to use cloud applications as supported by the demographic profile of the respondents that 84.2%

of the respondents have good Internet experience. This insignificant moderating effect contradicted with the original TAM3 assumption that experience affected the hypothesized relationships in the model (Venkatesh & Bala, 2008). This result was partially supported in various studies. For instance, an insignificant moderating effect of experience on computer anxiety to perceived ease of use, computer playfulness to perceived ease of use, as well as perceived ease of use to perceived usefulness relationships were found in some studies such as K. M. Faqih and Jaradat (2015); Huang et al. (2012). In addition, a non-moderating effect of experience on computer anxiety and perceived ease of use relationship, and computer playfulness and perceived ease of use relationship were found by Al-Gahtani (2014). Therefore, the decision makers in Saudi universities should not pay more attention on students' Internet experience when implementing cloud applications, however they have to provide the students with relevant training on how to use the cloud applications, which in turn will increase its adoption.

8.2.4 Discussion Related to Research Question 4

This subsection discusses and presents a summary of the open-ended question findings. The open-ended question asked the respondents to identify other factors that were not considered in the proposed model which may affect the adoption of cloud computing applications by university students in Saudi Arabia. The research question related to open-ended question is presented as follows:

RQ4: What new factors that are not covered in the proposed research model can be identified using open-ended questions?

The questionnaire respondents and focus groups participants mentioned important concerns and barriers that impede the adoption of cloud applications by students in Saudi universities, and also they provided suggestions to improve the adoption rate of cloud applications by students as presented and explained in section 7.3. The identified barriers and concerns will help the decision makers in Saudi Arabia universities and cloud applications providers to focus on these highlighted issues that influence the adoption and use of cloud computing application by students. It is expected that when the decision makers in universities particularly in Saudi Arabia and cloud applications providers tackled the barriers and concerns, the cloud applications would be implemented successfully in Saudi Arabian universities, and adopted easily by students, which will lead to improvement in the rate of adoption of cloud applications by students.In addition, it is expected that when the suggestions are carefully followed by decision makers in Saudi Arabia universities and cloud applications providers; the cloud computing applications and its adoption rate by students would be improved.

8.3 Chapter Summary

This chapter discussed the findings of the study. The results of the hypotheses related to the proposed model constructs were discussed. Findings related to the primary TAM3 constructs showed that perceived ease of use had a strongest positive impact on perceived usefulness. Perceived usefulness and perceived ease of use both had a strong impact on behavioural intention. The social influence factor subjective norm had no significant influence on perceived usefulness and behavioural intention. Image had no significant impact on perceived usefulness. Subjective norm had a significant influence on image. Similarly, the influence of the three cognitive instrumental processes (output quality, job relevance, and result demonstrability) revealed that, only the path between job relevance and perceived usefulness was found significant. Additionally, playfulness and perceptions of external control were the only factors from the four anchors (self-efficacy, playfulness, anxiety, and perceptions of external control) that had a significant effect on perceived ease of use. Adjustment factor perceived enjoyment had a significant influence on perceived ease of use. Trust was also found to have a significant effect on perceived usefulness but not on behavioural intention. Finally, the moderating effect of two moderator factors (output quality and Internet experience) were both found to have a non-significant moderating effect on the hypothesized relationships in the extended TAM3 model.
Furthermore, the chapter discussed the results of open-ended question, which was added in the questionnaire and focus groups. The respondents mentioned important issues categorised as barriers and concerns that affect the successful implementation and adoption of cloud computing applications, and also they mentioned suggestions that should be considered to improve the cloud applications as well as its adoption rate by the students.

Chapter 9: Conclusion

9.1 Introduction

This chapter provides a summary of the study findings including both the quantitative and qualitative findings. The chapter also discusses the theoretical and methodological contributions. In addition, the chapter highlights the practical implications of the study. Finally, the chapter presentsthe limitations of the study and future research directions.

9.2 Overview of the Study

This research sought to investigate factors that influence cloud computing applications adoption by Saudi university students in order to increase its adoption rate. This will provide important implications and suggestions to decision makers in Saudi universities and cloud applications providers so that students can easily adopt and use cloud computing applications. One of the benefits of cloud computing applications in education is to make teaching, learning and research easier. This research was motivated by the fact that there was lack of studies that investigate factors affecting the adoption of cloud computing applications by university students in developing countries in general and Saudi Arabia in particular.

The study adopted TAM3 model as the theoretical framework, which was modified to suit our research context. The research model was empirically validated and qualitative data collected using focus groups were later used to validate the empirical findings. Furthermore, an open-ended question was also used in the survey questionnaire and focus groups in order to identify additional factors that may affect the adoption process which were not considered in the research model. The summary of the study findings is presented in the following section.

9.3 Summary of Study Findings

The proposed model in this study was assessed to find out the influence of the model constructs on the adoption of cloud computing applications by Saudi Arabian university students. The empirical findings related to the main constructs of the TAM model revealed that perceived ease of use had a positive significant influence on perceived usefulness; and both perceived usefulness and perceived ease of use had a positive direct significant effect on behavioural intention. These results supported the findings from a study on e-Learning in Saudi Arabia (Al-Gahtani, 2014) and previous studies by Venkatesh (2000), Venkatesh and Davis (2000), and Venkatesh and Bala (2008). This is evidence of suitability of using TAM to study cloud computing applications adoption that also supports the impact of perceived usefulness and perceived ease of use in determining the behavioural intention of Saudi university students on the adoption of cloud computing applications. Consistent with TAM3 and focus groups results, perceived usefulness and perceived ease of use were the main determinants of behavioural intention (Venkatesh & Bala, 2008). The finding implies that the adoption of cloud computing applications by Saudi Arabian students will increase when they perceive that they require less effort to use cloud applications and become proficient in using it; and cloud applications will help them to increase their productivity and effectiveness related to learning and other collaborative tasks. The behavioural intention in this study was the main dependent construct that measures the intention of the students to adopt cloud computing applications. Findings from the focus groups supported that behavioural intention was significant in determining the adoption of the cloud applications, which means that the students are willing to adopt the cloud computing applications once implemented in their university.

Furthermore, the quantitative findings related to the two social influence factors (subjective norm and image) found a direct positive influence of subjective norm on image. This supported similar hypothesis in prior studies (Al-Gahtani, 2014; K. M. Faqih & Jaradat, 2015). However, subjective norm had a non-significant influence on perceived usefulness and behavioural intention. In addition, image had a non-significant effect on perceived usefulness. Therefore, these results suggested that the influence of other people such as peers and teachers in the social group of the students only affect the formation of perception about enhancing the students' status, but has no role in the formation of the actual belief and behaviour about cloud computing applications adoption. The non-significant effect of image on perceived usefulness was supported by findings from the focus groups and findings from previous studies (S. J. Chang & Im, 2014; Chismar & Wiley-Patton, 2003;

Zafiropoulos et al., 2012). In addition, findings related to subjective norm was supported by the focus groups findings as well as findings from previous studies (S. J. Chang & Im, 2014; Chih-Yang et al., 2011; Chismar & Wiley-Patton, 2003; Mathieson, 1991; Zafiropoulos et al., 2012).

Additionally, quantitative findings related to the three cognitive instrumental processes (job relevance, result demonstrability, and output quality) show that only job relevance had a strong positive influence on perceived usefulness, whereas output quality and result demonstrability had a non-significant effect on perceived usefulness. This means that in spite of the fact that the students perceive cloud computing applications as relevant to their study and learning activities, they do not believe that the results obtained are tangible, and the cloud applications such as Google Docs can be used to perform learning and collaboration tasks effectively and provide high quality and excellent output. The qualitative findings and previous studies supported the empirical evidence of the influence of job relevance on perceived usefulness (Agudo-Peregrina et al., 2014; Al-Gahtani, 2014; S. J. Chang & Im, 2014; Chih-Yang et al., 2011; Huang et al., 2012; Macharia & Nyakwende, 2010; Zafiropoulos et al., 2012); and the non-significant effect of output quality on perceived usefulness (S. J. Chang & Im, 2014; Chismar & Wiley-Patton, 2002; Jung et al., 2014; Venkatesh & Bala, 2008; Zafiropoulos et al., 2012), and result demonstrability on perceived usefulness (Al-Gahtani, 2014; S. J. Chang & Im, 2014; K. M. Faqih & Jaradat, 2015; Jung et al., 2014).

Moreover, all the four anchors proposed in TAM3 (self-efficacy, playfulness, anxiety, and perceptions of external control) that are expected to predict perceived ease of use were adopted in this research. The empirical findings revealed that perceptions of external control and playfulness significantly predicted perceived ease of use. This means that the availability of resources in the university such as Internet and computer devices, and intrinsic motivation of the students such as they feel playful and spontaneous when using cloud applications play important roles in the formation of perception of perceived ease of using cloud applications (Venkatesh, 2000). The focus groups findings and findings from previous studies supported the significant influence of playfulness on perceived ease of use (Agudo-Peregrina et al., 2014; Gottschalk & Kirn, 2013; Venkatesh, 2000; Venkatesh & Bala, 2008), and perceptions of external control on perceived ease of use (Agudo-Peregrina et al., 2014; Al-Gahtani, 2014; S. J. Chang & Im, 2014; K. M. Faqih & Jaradat, 2015; Jung et al., 2014; Venkatesh, 2000; Venkatesh & Bala, 2008).

Also consistent with the focus groups and previous studies findings, the empirical findings showed that self-efficacy had a non-significant effect on perceived ease of use (Agudo-Peregrina et al., 2014; Jung et al., 2014), and also anxiety did not influence perceived ease of use (Behrend et al., 2011; K. M. Faqih & Jaradat, 2015; Huang et al., 2012). This means that the students are not confident of using cloud computing applications without assistance from others, and the students do not have any negative feelings toward using the cloud applications.

The only system characteristic factor related to adjustment that was adopted in this study is perceived enjoyment. Perceived enjoyment had a strong positive effect on perceived ease of use and this result was supported by Al-Gahtani (2014), and also supported by the qualitative findings. This finding implies that the students' belief about the ease of using cloud applications will increase when the students perceived that the applications are enjoyable.

Finally, trust which was the additional construct in the proposed model had a significant influence on perceived usefulness, but a non-significant effect was found on behavioural intention. This result was contrary to cloud computing applications adoption study in Saudi Arabia in which trust had a significant influence on behavioural intention and a non-significant influence on perceived usefulness (Alotaibi, 2014). This is perhaps because the students consider trust as part of the benefits expected from adopting cloud computing applications especially when used for leaning and collaboration tasks. This finding was supported by the focus groups results, since its effect on the adoption of cloud computing applications by students was found to be significant.

Moreover, the empirical findings showed that effect of the two moderating factors (output quality and Internet experience) were non-significant. The finding related to moderator factor output quality was contrary to the previous findings that found output quality moderates job relevance and perceived usefulness relationship (Al-Gahtani, 2014; Huang et al., 2012; Venkatesh & Bala, 2008). This implies that output quality will not influence the effect of job relevance on perceived usefulness. Therefore, based on the significant influence of job relevance on perceived usefulness, it can be established that the students consider the cloud applications relevant for learning and collaboration tasks regardless of the quality of its output.

Although various studies found that experience with a service or product moderated relationships between beliefs and behavioural intention (Lin, 2013), our study found that Internet experience had no moderating effect on the relationships between subjective norm and behavioural intention, subjective norm and perceived usefulness, anxiety and perceived ease of use, playfulness and perceived ease of use, perceived enjoyment and perceived ease of use, perceived ease of use and perceived usefulness, and perceived ease of use and behavioural intention. This was in conformity with prior studies that found an insignificant moderating effect of experience on computer playfulness and perceived ease of use relationship, computer anxiety and perceived ease of use relationship, as well as perceived ease of use and perceived usefulness relationship (K. M. Faqih & Jaradat, 2015; Huang et al., 2012). The insignificant moderating effect of Internet experience found in this study implies that the students have adequate Internet experience.

Furthermore, the open-ended question reported a number of important issues which were grouped into barriers and concerns that influence the respondents' intention to adopt cloud computing applications; and also the respondents mentioned important suggestions to increase the adoption rate of cloud applications by students and also to improve cloud applications as discussed in section 7.3. Therefore, it is anticipated that the adoption of cloud applications by students in Saudi Arabia universities would increase when the barriers and concerns are addressed, and the suggestions are carefully followed by decision makers in Saudi Arabia universities and cloud applications providers.

9.4 Research Contributions

This research provides important contributions that help understand the factors that affect the adoption of cloud computing applications by university students in Saudi Arabia. This research extended Technology Acceptance Model 3 (TAM3) to gather both quantitative and qualitative data for an in-depth understanding of the research problem. The research contributions are divided into theoretical and methodological contributions, which are explained in the following subsections.

9.4.1 Theoretical Contributions

This study contributes by providing a theoretical understanding of the factors affecting the adoption of cloud computing applications by university students in Saudi Arabia. This is an important contribution to knowledge that will guide researchers to understand the factors that affect the adoption of cloud applications by university students in Saudi Arabia, since Saudi Arabia is considered as one of the first Arab countries that show interest in cloud computing adoption (Alsanea & Wainwright, 2014; Ministry of Communications and Information Technology, 2014). This research is the first study that utilized TAM3 to examine and study factors that influence students' intention to adopt cloud computing applications in Saudi Arabian higher education context. The first theoretical contribution is the development and validation of the proposed TAM3 based model. The second theoretical contribution is the integration of trust into modified TAM3 model and suggestion of the relationship between trust and perceived usefulness, and another relationship between trust and behavioural intention. This is based on the influence of trust on technology acceptance and particularly cloud computing services (Zhou, Zhang, Xie, Qian, & Zhou, 2010). The third theoretical contribution is the conceptualization of experience moderator factor into Internet experience, and testing the moderating effect of Internet experience on the specified relationships as proposed in TAM3. This is important and relevant since cloud applications are Internet based applications and the influence of Internet experience on the adoption of online services has been established (Nysveen & Pedersen, 2004; Szymanski & Hise, 2000; Varma Citrin et al., 2000). Finally, the development and validation of TAM3 based Arabic instrument to collect data from Arabic speaking respondents is another theoretical contribution.

9.4.2 Methodological Contributions

The methodological contributions of this research centre on the research method that has been adopted in this study. As opposed to most studies in cloud computing adoption context which commonly used the single method approach, this research applied a mixed method approach that combined quantitative (questionnaire survey) and qualitative (focus group and open-ended question) approaches. The main reason for adopting mixed method approach in this research relates to the fact that studies that investigate the factors affecting cloud computing applications adoption by university students in Saudi Arabia are lacking. Therefore, understanding the important factors that affect adoption of cloud computing applications by university students requires more effort. In this regard, quantitative research was conducted to test the proposed model using a questionnaire survey. Moreover, qualitative research was conducted to validate the findings from the quantitative phase and to identify additional factors that were not covered in the proposed model using focus group and open-ended question techniques respectively. Therefore, this study contributes by bringing together both exploratory and empirical methods in Information Systems research to combine the strengths and overcome the weaknesses of the single method.

9.5 Practical Implications

This study has contributed to cloud computing applications adoption initiatives in higher education institutions by identifying and examining the critical factors that influence the students' intention to adopt cloud computing applications in Saudi Arabian universities using modified TAM3 model. The factors in the proposed TAM3 based model were assessed using data collected by survey questionnaire, and then the empirical findings were validated using data collected by conducting focus groups. The findings of this study provided a comprehensive and deep understanding of the factors that influence students' intention to adopt cloud computing applications in Saudi Arabia universities. Therefore, the results of this study will be used as a guideline for the decision makers in academic institutions in general, and in Saudi Arabia particularly to help ensure successful adoption of cloud applications among students. The findings also will help cloud applications providers better comprehend the factors that impact the intention of students to adopt cloud applications, and when these factors are considered they can develop cloud computing applications that would be effectively utilized by students.

In this study, the students were positively influenced mainly by their perception about the potential benefits of cloud computing applications such as Google Docs and its expected simplicity based on the significant influence of perceived usefulness on the adoption of cloud computing applications. Therefore, cloud applications providers and the university management should emphasize on the issues that would improve students' performance academically using cloud computing applications. In addition, based on the significant influence of job relevance on the adoption of cloud computing applications, the university management should ensure that the students realize the relevance of cloud computing applications to learning, research, and other academic activities. Cloud applications providers should focus on features that make cloud applications easy to use, and also various trust mechanisms should be employed in order to enhance the students' intention to adopt cloud computing applications. This is based on the positive influence of perceived ease of use and trust in the proposed model. Cloud applications need to be secured so that students can safely collaborate, share their work and store it in the cloud. Similarly, the positive influence of playfulness and perceived enjoyment in this study suggested that the cloud applications should be developed such that the students will feel playful, enjoyable and pleasurable when they use cloud applications. The significant influence of subjective norm on image suggests that the universities should organize specialized seminars and workshops to encourage the usage of cloud applications for different learning activities and collaborative works in order to increase the status of the students among their colleagues. Finally, the significant positive influence of perceptions of external control in this study suggests that the university should provide all the resources such as Internet, support, training courses, computer labs and other infrastructures the students require to use cloud applications.

Furthermore, the findings from the open-ended question provided important barriers and concerns that affect the adoption of cloud applications by students besides the significant factors found in this study. Hence, the decision makers in Saudi Arabia universities and cloud applications providers should focus on the barriers and concerns in order to increase the adoption rate of cloud computing applications by students.

9.6 Limitations and Future Research Directions

This study has some limitations like any other research. First, in this study Google Docs was used as the instance of cloud computing applications. Therefore, the outcome of the study may differ when cloud applications other than Google Docs are used. Hence, there is a need to examine the effect of the factors considered in this study on other cloud computing applications in order to generalize the results to cloud computing services. Similarly, more studies should be conducted to identify and examine other factors that affect the adoption of cloud computing applications by university students.

Second, during this study, the students used Google Docs in computer devices, since cloud applications can be accessed using mobile devices. In the future there is a need to examine the effect of mobile devices' specific characteristics such as screen size and mobile Internet speed on the adoption of cloud services.

Third, this research examined students' beliefs and behaviours about adoption of cloud computing applications by collecting data one time only (cross-sectionally) due to the limited allocated time for the study, despite the fact that a longitudinal design was used in the original TAM3 study (Venkatesh & Bala, 2008). Therefore, in the future there is a need to examine the behavioural intention and use at different points in time (longitudinal) in order to have an in-depth understanding of the phenomena and examine if there is any change in the behavioural intention or use by university students regarding the adoption of cloud applications.

Fourth, the usage construct was not included in the proposed model since the construct requires assessments of users' beliefs and attitudes in different time period and the empirical data in this study were collected cross-sectionally. Hence, studies should be conducted to include usage construct in their research models, which would increase the prediction capacity of the cloud applications adoption.

Fifth, the study was conducted in two universities in Saudi Arabia because it was difficult to study the whole population of undergraduate students in Saudi universities due to time and resources constraints. Therefore, in the future a more studies should be conducted to cover Saudi universities in order to generalize the findings.

Sixth, the focus groups were conducted only with male students from King Abdulaziz University, which may not reflect the view of all male and female students from Taibah University, and female students from King Abdulaziz University. The selection of only male students from King Abdulaziz University as the focus groups participants was due to time, budget and culture constraints. Therefore, in the future another focus groups should be conducted with female and male students from other Saudi universities for more generalized findings.

Seventh, objective usability construct was omitted in the proposed TAM3 based model even though it was part of the original TAM3. This is because objective usability construct cannot be measured using the cloud application utilized in this study since it requires a special research design to enable keystroke model to measure the novice-to-expert ratio of effort in order to compute time taken to carry out series of tasks with the cloud application. Hence, future research should add this construct and examine its effect to add more value to the results.

Finally, cloud computing applications adoption by students in Saudi universities is still at an early stage, and there is lack of studies conducted to identify the factors affecting the adoption of cloud applications by students in Saudi universities. Hence, in future research, interview and questionnaire survey should be conducted with students from various Saudi universities in order to explore and examine new factors that could influence the adoption of cloud computing applications; this may lead to generalization of the findings or find out other factors that occur only in some universities. In addition, the perception of teachers, decision makers in Saudi universities, administrative, IT and other relevant personnel should be studied since they are believed to play a significant role in the successful cloud computing applications implementation and use. Another future research direction is to replicate this study using the proposed TAM3 based model in other universities within Saudi Arabia and other Arabian Gulf countries to assess the validity of the proposed research model. Moreover, there is a need to investigate the rationale behind the insignificant effects of the factors which are subjective norm, self-efficacy, image, output quality, result demonstrability, and anxiety, as well as the moderator factors (Internet experience and output quality) found in this study.

9.7 Chapter Summary

This chapter summarized the findings of this study and presented the contributions categorized as theoretical and methodological contributions. The practical implications of the research were also presented. In addition, this chapter highlighted the limitations of the study and future research directions.

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Appendix A: Questionnaire - English Version

Brief Introduction:

This study is a part of a project entitled "Factors influencing the adoption and usage of cloud computing applications in Saudi universities". This project will investigate the factors influencing the adoption of cloud computing applications by university students in Saudi Arabia. Cloud computing applications such as Google Documents (Google Docs) allow you to create word documents, spreadsheets, and presentations in the cloud servers. They enable students and academic staff to share documents and collaborate with each other, as they allow anytime, anywhere access to the documents via the Internet. Microsoft and Google are among the reputable cloud computing service providers. For the purpose of this study, Google Docs will be used as an example of cloud applications.

Section (1): General Information

A. Please answer the following questions by ticking (√) the appropriate box:

1. Which university do you study at? ☐ King Abdulaziz University ☐ Taibah University

2. What is your academic major? ☐ Art ☐ Science

3. What is your gender? ☐ Male ☐ Female

4. Which age group are you in?

< 18 years	18-22 years	23-27years	28-32years	> 32 years

5. Please indicate your year of study:

First year	Second year	Third year	Fourth year	Other (please specify)

6. Do you have a computer? ☐ Yes ☐ No

7. Approximately, how many years have you been using the computer?

< 1 year	1-3 years	4-6 years	7-9 years	> 9 years

8. How would you rate your computer knowledge?

Poor	Fair	Good	Very good	Excellent

9. Do you have high-speed Internet connection at home? ☐ Yes ☐ No

10. Is the Internet available to you in your university? ☐ Yes ☐ No

11. Are computer labs available to you in your school? ☐ Yes ☐ No

12. Approximately, how long have you been using the Internet?

< 1 year	1-3 years	4-6 years	7-9 years	> 9 years

13. On average, how long do you spend on the Internet daily?

<1hour	1-3 hours	4-6 hours	7-9 hours	> 9 hours

14. How would you rate your proficiency with the Internet?

Poor	Fair	Good	Very good	Excellent

Section (2): Questions Related to Cloud Computing Applications Adoption Based on Modified TAM3 Model

Please select the most appropriate answer that indicate the level of your agreement or disagreement with each statement (Please circle one option only as in the example below).

Example:

Item number	Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	I would find Google Docs useful in my study	1	2	3	4	5

Please select the most appropriate answer that indicate the level of your agreement or disagreement with each statement (please circle one option only).

Item number	Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	Using Google Docs in my study would enable me to accomplish learning tasks more quickly.	1	2	3	4	5
2.	Using Google Docs would improve my performance in my study.	1	2	3	4	5
3.	Using Google Docs in my study would increase my productivity.	1	2	3	4	5
4.	Using Google Docs would enhance my effectiveness in my study.	1	2	3	4	5
5.	Using Google Docs would make it easier to do my learning tasks.	1	2	3	4	5
6.	I would find Google Docs useful in my study.	1	2	3	4	5
7.	Learning to use Google Docs would be easy for me.	1	2	3	4	5
8.	I would find it easy to get Google Docs to do what I want it to do.	1	2	3	4	5
9.	My interaction with Google Docs would be clear and understandable.	1	2	3	4	5
10.	I would find Google Docs to be flexible to interact with.	1	2	3	4	5

Item number	Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
11.	It would be easy for me to become skillful at using Google Docs.	1	2	3	4	5
12.	I would find Google Docs easy to use.	1	2	3	4	5
13.	Assuming I had access to Google Docs, I intend to use it.	1	2	3	4	5
14.	Given that I had access to Google Docs, I predict that I would use it.	1	2	3	4	5
15.	I plan to use Google Docs in the future.	1	2	3	4	5

Item number	Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	• I could complete the task using Google Docs…					
16.	….If there was no one around to tell me what to do.	1	2	3	4	5
17.	….If I had a lot of time to complete the task.	1	2	3	4	5
18.	….If I had just the built-in help facility for assistance.	1	2	3	4	5
19.	….If someone showed me how to do it first.	1	2	3	4	5
20.	….If I had used similar systems before this one to do the same task.	1	2	3	4	5

Item number	Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	• The following questions ask you how you would characterize yourself when you use Google Docs:					
21.	…spontaneous	1	2	3	4	5
22.	…creative	1	2	3	4	5
23.	…playful	1	2	3	4	5
24.	…original	1	2	3	4	5

Item number	Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
25.	I would have control over using Google Docs (e.g., editing, sharing documents with others, etc.)	1	2	3	4	5
26.	I would have the resources necessary (e.g., computer, Internet, etc.) to use Google Docs.	1	2	3	4	5
27.	I would have the knowledge necessary to use Google Docs.	1	2	3	4	5
28.	Given the resources, opportunities and knowledge it takes to use Google Docs, it would be easy for me to use Google Docs.	1	2	3	4	5
29.	Google Docs would be compatible with other software that I use (e.g., Microsoft office).	1	2	3	4	5
30.	I would feel apprehensive about using Google Docs.	1	2	3	4	5
31.	It would scare me to think that I could lose a lot of information using Google Docs by hitting the wrong key.	1	2	3	4	5
32.	I would hesitate to use Google Docs for fear of making mistakes that I cannot correct.	1	2	3	4	5
33.	Google Docs would be somewhat intimidating to me.	1	2	3	4	5
34.	I would find using Google Docs to be enjoyable.	1	2	3	4	5
35.	The actual process of using Google Docs would be pleasant.	1	2	3	4	5
36.	I would have fun using Google Docs.	1	2	3	4	5
37.	People (teachers/ friends) who influence my behaviour would think that I should use Google Docs.	1	2	3	4	5
38.	People who are important to me would think that I should use Google Docs.	1	2	3	4	5
39.	People whose opinions I value would prefer me to use Google Docs.	1	2	3	4	5
40.	People (teachers/ friends) in my university who use Google Docs would have more prestige than those who do not.	1	2	3	4	5
41.	People in my university who use Google Docs would have a high profile.	1	2	3	4	5
42.	Having Google Docs would be a status symbol in my university.	1	2	3	4	5

Item number	Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
43.	In my study, usage of Google Docs would be important.	1	2	3	4	5
44.	In my study, usage of Google Docs would be relevant.	1	2	3	4	5
45.	The use of Google Docs would be pertinent to my various study-related tasks.	1	2	3	4	5
46.	The quality of the output (e.g., the created documents) that I would get from using Google Docs would be high.	1	2	3	4	5
47.	I would have no problem with the quality of Google Docs' output.	1	2	3	4	5
48.	I would rate the results from Google Docs as excellent.	1	2	3	4	5
49.	I would have no difficulty telling others about the results of using Google Docs.	1	2	3	4	5
50.	I believe I could communicate to others the consequences of using Google Docs.	1	2	3	4	5
51.	The results of using Google Docs would be apparent to me.	1	2	3	4	5
52.	I would have no difficulty explaining why using Google Docs may or may not be beneficial.	1	2	3	4	5
53.	Using Google Docs would be secure.	1	2	3	4	5
54.	I trust the ability of Google (the provider of cloud applications) that would protect my privacy.	1	2	3	4	5
55.	Google (the provider of cloud applications) would be trustworthy.	1	2	3	4	5
56.	Google (the provider of cloud applications) would keep its promises and commitments (e.g., cloud services availability).	1	2	3	4	5
57.	I trust that Google (the provider of cloud applications) would keep my best interests in mind.	1	2	3	4	5

Section (3): General Question

In your opinion, are there any other factors or barriers that affect the adoption of cloud computing applications in your university which are not covered in this study, or any additional information which you think would be useful to this study?

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As part of my study, I will conduct focus groups with students if you are interested to volunteer to participate please contact me on +966 555069896 or by email (alma0138@flinders.edu.au), or provide us with your mobile number.

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Thank you very much for your participation.

Appendix B: Questionnaire - Arabic Version

استبيان

مقدمة موجزة:

هذه الدراسة هي جزء من مشروع بحثي بعنوان "العوامل المؤثرة على اعتماد تطبيقات الحوسبة السحابية واستخدامها في الجامعات السعودية". سوف يدرس هذا المشروع العوامل المؤثرة على اعتماد تطبيقات الحوسبة السحابية من قبل الطلاب الجامعيين في المملكة العربية السعودية. تمكنك تطبيقات الحوسبة السحابية مثل مستندات جوجل من إنشاء وتخزين المستندات (وثائق النصوص)، جداول البيانات الحسابية، والعروض التقديمية في الخوادم السحابية. وهي تمكن الطلاب وأعضاء هيئة التدريس من مشاركة المستندات والتعاون فيما بينهم، وكذلك تسمح بالوصول إلى المستندات من أي مكان وفي أي وقت عن طريق الإنترنت. وتعد شركتا مايكروسوفت وجوجل من بين أشهر مقدمي خدمات الحوسبة السحابية. ولتحقيق غرض هذه الدراسة، سوف يتم استخدام مستندات جوجل السحابية كمثال على التطبيقات السحابية.

الجزء الأول: معلومات عامة

أ. الرجاء اختيار الإجابة المناسبة بوضع علامة (√) في المربع المناسب للأسئلة التالية:

١. ما اسم الجامعة التي تدرس فيها؟ ☐ جامعة الملك عبدالعزيز ☐ جامعة طيبة

٢. ماهو تخصصك الأكاديمي؟ ☐ أدبي ☐ علمي

٣. الجنس؟ ☐ ذكر ☐ أنثى

٤. ماهي الفئة العمرية التي تنتمي إليها؟

أقل من 18 سنة	22-18 سنة	27-23 سنة	32-28 سنة	أكبر من 32 سنة

٥. ماهي سنتك الدراسية الحالية في الجامعة؟

السنة الأولى	السنة الثانية	السنة الثالثة	السنة الرابعة	أخرى (حدد من فضلك)

٦. هل لديك جهاز حاسب آلي ؟ نعم ☐ ☐ لا

٧. كم عدد سنوات استخدامك لجهاز الحاسب الآلي تقريبا؟

أقل من سنة	1-3 سنوات	4- 6 سنوات	7-9 سنوات	أكثر من 9 سنوات

٨. كيف تقيم مدى معرفتك في استخدام جهاز الحاسب الآلي؟

ضعيفة	مقبولة	جيدة	جيدة جدا	ممتازة

٩. هل لديك خدمة إنترنت عالي السرعة في المنزل ؟ ☐ نعم ☐ لا

10. هل يتاح لك استخدام الإنترنت في الجامعة؟ ☐نعم ☐ لا

11. هل يتاح لك استخدام معامل الحاسبالآلي في كليتك متى ما رغبت؟ ☐نعم ☐ لا

١٢. منذ متى تقريبا وأنت تستخدم الإنترنت؟

أقل من سنة	1-3 سنوات	4- 6 سنوات	7- 9 سنوات	أكثر من 9 سنوات

١٣. كم متوسط عدد الساعات التي تقضيها على الإنترنت كل يوم تقريبا؟

أقل من ساعة	1-3 ساعات	4-6 ساعات	7-9 ساعات	أكثر من 9 ساعات

١٤. كيف تقيم مدى اتقانك لاستخدام الإنترنت؟

ضعيف	مقبول	جيد	جيد جدا	ممتاز

الجزء الثاني: الأسئلة المتعلقة باعتماد تطبيقات الحوسبة السحابية بناء على نموذج قبول التقنية 3 المعدل

الرجاء اختيار الإجابة المناسبة التي تشير إلى مدى موافقتك أو عدم موافقتك على كل عبارة من العبارات التالية (ضع دائرة حول خيار واحد فقط كما في المثال التالي).

مثال:

رقم العبارة	العبارة	لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
	سوف أجد مستندات جوجل مفيدة في دراستي	1	2	3	4	5

الرجاء اختيار الإجابة المناسبة التي تشير إلى مدى موافقتك أو عدم موافقتك على كل عبارة من العبارات التالية (ضع دائرة حول خيار واحد فقط)						
رقم العبارة	العبارات	لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	سوف يمكنني استخدام مستندات جوجل في دراستي من إنجاز المهام التعليمية بشكل أسرع.	1	2	3	4	5
2	سوف يحسن استخدام مستندات جوجل من أدائي في الدراسة.	1	2	3	4	5
3	سوف يزيد استخدام مستندات جوجل في دراستي من محصلتي.	1	2	3	4	5
4	سوف يعزز استخدام مستندات جوجل من فعاليتي في الدراسة.	1	2	3	4	5
5	سوف يسهل لي استخدام مستندات جوجل عمل الواجبات التعليمية.	1	2	3	4	5
6	سوف أجد مستندات جوجل مفيدة في دراستي.	1	2	3	4	5
7	سوف يكون تعلم استخدام مستندات جوجل سهلًا بالنسبة لي.	1	2	3	4	5
8	سوف يمكنني استخدام مستندات جوجل من إنجاز ما أريد بسهولة.	1	2	3	4	5
9	سوف يكون تفاعلي مع مستندات جوجل واضحًا ومفهومًا.	1	2	3	4	5
10	سوف أجد مستندات جوجل مرنة (سهلة) في التفاعل معها.	1	2	3	4	5
11	سيكون من السهل بالنسبة لي أن أصبح ماهرا في استخدام مستندات جوجل.	1	2	3	4	5
12	سوف أجد مستندات جوجل سهلة الاستخدام.	1	2	3	4	5
13	أنوي استخدام مستندات جوجل إذا تمكنت من الوصول إليها.	1	2	3	4	5
14	أتوقع بأنني سوف استخدم مستندات جوجل في حال تمكني من الوصول إليها.	1	2	3	4	5
15	أخطط لاستخدام مستندات جوجل في المستقبل.	1	2	3	4	5

رقم العبارة	العبارات • **يمكنني إكمال التكليف الدراسي باستخدام مستندات جوجل...**	**لا أوافق بشدة**	**لا أوافق**	**محايد**	**أوافق**	**أوافق بشدة**
16	... إذا لم يكن هناك أحد بجانبي يعلمني ما يجب القيام به.	1	2	3	4	5
17	... إذا توفر لدي الكثير من الوقت لإنجاز التكليف.	1	2	3	4	5
18	... إذا توفرت لي فقط وسيلة المساعدة المدمجة داخل برنامج مستندات جوجل.	1	2	3	4	5
19	... إذا شرح لي شخص ما طريقة استخدام مستندات جوجل أولاً.	1	2	3	4	5
20	... إذا كنت قد استخدمت أنظمة مشابهة قبل هذا لعمل نفس التكليف.	1	2	3	4	5

رقم العبارة	العبارات **تطرح عليك الأسئلة التالية للسؤال عن الكيفية التي تصف بها نفسك عندما تستخدم مستندات جوجل:** • **عندما استخدم مستندات جوجل فإنني...**	**لا أوافق بشدة**	**لا أوافق**	**محايد**	**أوافق**	**أوافق بشدة**
21	...أكونُ عفويًا (أكون تلقائيا في الاستخدام).	1	2	3	4	5
22	...أكونُ مُبدعًا.	1	2	3	4	5
23	...أكونُ مَرِحاً.	1	2	3	4	5
24	...أكونُ على طبيعتي.	1	2	3	4	5

رقم العبارة	**العبارات**	**لا أوافق بشدة**	**لا أوافق**	**محايد**	**أوافق**	**أوافق بشدة**
25	سوف أتمكن من التحكم في استخدام مستندات جوجل (مثل التحرير، مشاركة المستندات مع الآخرين، إلخ).	1	2	3	4	5
26	ستتوفر لدي المصادر اللازمة (مثل الكمبيوتر، الإنترنت، إلخ) لاستخدام مستندات جوجل.	1	2	3	4	5
27	ستتوفر لدي المعرفة اللازمة لاستخدام مستندات جوجل.	1	2	3	4	5
28	سوف يكون من السهل بالنسبة لي استخدام مستندات جوجل متى ما توفرت لدي المصادر والفرص والمعرفة اللازمة.	1	2	3	4	5
29	سوف تكون مستندات جوجل متوافقة مع البرامج الأخرى التي استخدمها (مثل برامج مايكروسوفت المكتبية).	1	2	3	4	5
30	سوف أشعر بالخوف عند استخدام مستندات جوجل.	1	2	3	4	5

رقم العبارة	العبارات	لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
31	سيخيفني التفكير بأنني يمكن أن أفقد الكثير من المعلومات من خلال ضغط زر بالخطأ عند استخدام مستندات جوجل.	1	2	3	4	5
32	سوف أتردد في استخدام مستندات جوجل لخوفي من ارتكاب أخطاءٍ لا يمكن تصحيحها.	1	2	3	4	5
33	سوف تخيفني مستندات جوجل بعض الشيء.	1	2	3	4	5
34	سأجد استخدام مستندات جوجل ممتعًا.	1	2	3	4	5
35	سوف أجد الطريقة الحالية لاستخدام مستندات جوجل ممتعة.	1	2	3	4	5
36	سوف استمتع عند استخدام مستندات جوجل.	1	2	3	4	5
37	سوف يعتقد الأشخاص (المدرسون/ الزملاء) الذين يؤثرون على سلوكي بأنه يجب علي أن استخدم مستندات جوجل.	1	2	3	4	5
38	سوف يعتقد الأشخاص المهمون لدي بأنه يجب علي أن استخدم مستندات جوجل.	1	2	3	4	5
39	سيفضل الأشخاص الذين أقدر آراءهم بأن أستخدم مستندات جوجل.	1	2	3	4	5
40	سيكون لدى الأشخاص (المدرسون / الزملاء) في جامعتي الذين يستخدمون مستندات جوجل شهرة (تميز) أكثر من الأشخاص الذين لايستخدمونها.	1	2	3	4	5
41	سيكون لدى الأشخاص في جامعتي الذين يستخدمون مستندات جوجل مكانة عالية.	1	2	3	4	5
42	سيكون رمزًا للمكانة وجود مستندات جوجل في جامعتي.	1	2	3	4	5
43	سوف يكون استخدام مستندات جوجل مهمًا في دراستي.	1	2	3	4	5
44	سوف يكون استخدام مستندات جوجل مرتبطًا بدراستي.	1	2	3	4	5
45	سوف يكون استخدام مستندات جوجل ذا صلة وثيقة مع مهامي المختلفة المتعلقة بالدراسة.	1	2	3	4	5
46	سوف تكون النتائج التي سأحصل عليها من مستندات جوجل ذات جودة عالية (على سبيل المثال المستندات المنشئة).	1	2	3	4	5
47	لن يكون لدي أي مشكلة مع جودة نتائج مستندات جوجل.	1	2	3	4	5
48	سوف أقيم نتائج مستندات جوجل بأنها ممتازة.	1	2	3	4	5
49	لن أواجه أي صعوبة في إخبار الآخرين عن نتائج استخدام مستندات جوجل.	1	2	3	4	5
50	أعتقد بأنه سيمكنني أن أوْصِلَ للآخرين النتائج المترتبة على استخدام مستندات جوجل.	1	2	3	4	5
51	سوف تكون نتائج استخدام مستندات جوجل واضحة بالنسبة لي.	1	2	3	4	5
52	لن أواجه أي صعوبة في توضيح ما إذا كان استخدام مستندات جوجل مفيدًا أو غير مفيد.	1	2	3	4	5
53	سوف يكون استخدام مستندات جوجل آمنًا.	1	2	3	4	5
54	أثق في قدرة جوجل (المزود للتطبيقات السحابية) الذي سيحمي خصوصيتي.	1	2	3	4	5
55	سوف يكون جوجل (المزود للتطبيقات السحابية) جديرًا بالثقة.	1	2	3	4	5

56	سوف يفي جوجل (المزود للتطبيقات السحابية) بوعوده والتزاماته (على سبيل المثال توفر الخدمات السحابية).	1	2	3	4	5
57	أثق بأن جوجل (المزود للتطبيقات السحابية) سيضع في الاعتبار أهم اهتماماتي.	1	2	3	4	5

<u>الجزء الثالث: سؤال عام</u>

في رأيك الشخصي، هل يوجد هناك أي عوامل أوعوائق أخرى توثر على اعتماد تطبيقات الحوسبة السحابية في جامعتك لم تذكر في هذه الدراسة، أو أي معلومات إضافية تعتقد بأنها مفيدة لهذه الدراسة؟

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كجزء من دراستي سوف أجري مقابلات (مجموعات نقاش) مع بعض الطلاب فإذا كنت ترغب في التطوع بالمشاركة فضلاً قم بالاتصال بي على الجوال +966555069896 أو بواسطة البريد الالكتروني (alma0138@flinders.edu.au)، أو قم بتزويدنا برقم جوالك.

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شكرا جزيلا للمشاركة في هذه الدراسة

Appendix C: Practical Session Tasks Guide - English Version

Section I: Brief Introduction

Google Docs is a free cloud based application that allows users to create and edit documents, sheets, and slides online. It also enables multiple users to share and work on the same document. The application includes word, spreadsheet, and presentation editors. The documents stored in Google Docs can be accessed and edited from anywhere at any time using a web browser. This enables team members to collaborate and work on one document at the same time from anywhere. Google Docs is a simple to use application that requires the user to only have Gmail account to get started.

This practical session is designed to allow you to use cloud application (Google Docs) since you may not have prior experience with this cloud application. This will also enable you to answer the questionnaire more effectively. The practical session including the introduction and live demonstration on how to access and use Google Docs and completing the questionnaire will take not more than 2 hours of your time. Specifically, the introduction and live demonstration will take about 50 minutes, performing the giving tasks will take approximately 40 minutes, and completing the questionnaire after performing the designed tasks will take about 30 minutes.

Section II: Practical Session Tasks List

Please perform the following tasks in the given order.

Task No.	Task	Task description	Time to complete the task
1	Open a new browser window, type the following address, and press ENTER: https://www.google.com/intl/ar/docs/about/#start	To visit Google Docs web page to get additional information related to its advantages, features, and how you can start using it. Also, to know how it is useful in collaboration and sharing of files.	6-8 minutes
2	Click on “Go to Google Docs” at the top right hand side of the window.	To experiment, access and use Google Docs.	1 minute
3	Sign in using your Gmail account and password to use Google Docs, or go to “Create account” if you don’t have Gmail account.	To experiment, access and use Google Docs.	6-8 minutes
4	Create new document by clicking on “+” at the bottom left hand side of the window.	To create new cloud based document.	1 minute

5	Name the document “Cloud Computing” in the rename box at the top right hand side of the window by replacing the text “Untitled document” with “Cloud Computing”.	To familiarize you with cloud based documents, and to discover how to rename and use the documents.	1 minute
6	**<u>In the created document please type the following text:</u>** - Introduction to Cloud Computing - Google Docs is a free cloud based application that allows user to create and edit documents, sheets, and slides online.	To write on cloud based document.	4-6 minutes
7	• Make “Introduction to Cloud Computing” the title in the document. • Make the title blue and at the center.	To use the settings and menu bar in the document, and to enable you format the document.	3 minutes
8	Share your file with your friend. Press on “Share” button at the top left hand side of the window and then add your friend’s email in the new small window and click on “Send”.	To show you how to share documents with others.	3 minutes
9	Go to main menu by clicking on “Docs home” the first button at the top right hand side of the window.	To show you how to move from one page to another in Google Docs.	2 minutes
10	**<u>Open the shared document sent from your friend. Type under the previous text:</u>** Google Docs enables multiple users to share and work on the same document.	To show you how to access and open shared document, and also how you can write and add text in the same shared document.	4-6 minutes
11	Click on your email address at the top left hand side of the window, and then click on “Sign out”.	To show you how to exit from Google Docs.	2 minutes

Thank you for your time and participation

Appendix D: Practical Session Tasks Guide - Arabic Version

دليل المهام للتطبيق العملي

القسم الأول: مقدمة موجزة

مستندات جوجل هي تطبيقات سحابية مجانية تتيح للمستخدمين إنشاء وتحرير المستندات، أوراق الجداول، وشرائح العروض التقديمية على الانترنت. كما تمكن العديد من المستخدمين من المشاركة والعمل على نفس المستند. ويشمل التطبيق محرر المستندات النصية، جداول البيانات الحسابية، ومحرر العروض التقديمية. ويمكن الوصول إلى المستندات المخزنة في مستندات جوجل وتحريرها من أي مكان وفي أي وقت باستخدام متصفح ويب. وهذا يتيح لأعضاء الفريق التعاون والعمل على مستند واحد في نفس الوقت من أي مكان. مستندات جوجل هي تطبيقات سهلة الاستخدام، وكل ما يتطلبه من المستخدم للبدء في استخدامها أن يكون لديه حساب في بريد جوجل الالكتروني.

وقد تم تصميم هذا التطبيق العملي ليمكنك من استخدام تطبيق سحابي (مستندات جوجل) بما أنك قد لا تكون لديك خبرة سابقة مع هذا التطبيق السحابي. ايضا فسوف يمكنك هذا التطبيق العملي من الإجابة عن الاستبيان على نحو أكثر فعالية. ويتضمن التطبيق العملي مقدمةً وعرضًا مباشرًا حول كيفية الوصول لمستندات جوجل واستخدامها وكذلك استكمال الاستبيان، ولن يستغرق ذلك أكثر من ساعتين من وقتك. وعلى وجه التحديد، فإن المقدمة والعرض المباشر يستغرقان حوالي 50 دقيقة، وأداء المهام التي ستقدم إليك يستغرق حوالي 40 دقيقة، أما استكمال الاستبيان بعد أداء المهام المصممة يستغرق حوالي 30 دقيقة.

القسم الثاني: قائمة مهام التطبيق العملي

يرجى تنفيذ المهام التالية وفق الترتيب المحدد.

الوقت المحدد لإكمال المهمة	وصف المهمة	المهمة	رقم المهمة
8-6 دقائق	لزيارة صفحة ويب مستندات جوجل وذلك للحصول على معلومات إضافية تتعلق بفوائده، وميزاته، وإمكانية البدء في استخدامه. وكذلك لمعرفة مدى فائدته في التعاون ومشاركة الملفات.	افتح نافذة متصفح جديدة، اكتب العنوان التالي، ثم اضغط على مفتاح الإدخال ENTER: https://www.google.com/intl/ar/docs/about/#start	1
(1) دقيقة واحدة	لتجربة مستندات جوجل، والدخول لها واستخدامها.	انقر على "الانتقال إلى مستندات جوجل " في أعلى الجانب الأيمن من النافذة.	2
8-6 دقائق	لتجربة مستندات جوجل، والدخول لها واستخدامها.	قم بتسجيل الدخول بإدخال بريدك الالكتروني وكلمة المرور الخاصة بك في بريد جوجل الالكتروني لاستخدام مستندات جوجل، أو الانتقال إلى "إنشاء حساب" إذا لم يكن لديك حساب في بريد جوجل الالكتروني.	3
(1) دقيقة واحدة	لإنشاء مستند سحابي جديد.	أنشأ مستند جديد بالنقر على علامة "+" في أسفل الجانب الأيسر من النافذة.	4
(1) دقيقة واحدة	لتعريفك بالمستندات السحابية، ولاكتشاف كيفية إعادة تسمية المستندات واستخدامها.	قم بتسمية المستند "الحوسبة السحابية " في مربع إعادة التسمية في أعلى الجانب الأيمن من النافذة عن طريق استبدال النص "بلا اسم" بـ "الحوسبة السحابية".	5

6	**<u>في المستند الذي تم إنشاؤه اكتب النص التالي:</u>** - مقدمة إلى الحوسبة السحابية - مستندات جوجل هي تطبيقات سحابية مجانية تتيح للمستخدم إنشاء وتحرير المستندات النصية، أوراق الجداول، وشرائح العروض التقديمية على الانترنت.	للكتابة على المستند السحابي.	6-4 دقائق
7	• اجعل "مقدمة إلى الحوسبة السحابية" العنوان في المستند. • اجعل العنوان باللون الأزرق وفي المنتصف.	لاستخدام الإعدادات وشريط القوائم في المستند، ولتمكنك من تنسيق المستند.	3 دقائق
8	قم بمشاركة ملفك مع صديقك. اضغط على زر "مشاركة" في أعلى الجانب الأيسر من النافذة ومن ثم قم بإضافة البريد الإلكتروني الخاص بصديقك في النافذة الصغيرة الجديدة وانقر على "إرسال".	لتوضح لك كيفية مشاركة المستندات مع الآخرين.	3 دقائق
9	اذهب إلى القائمة الرئيسية للمستندات عن طريق النقرعلى زر "الصفحة الرئيسية للمستندات"، الزر الأول في أعلى الجانب الأيمن من النافذة.	لتوضح لك كيفية الانتقال من صفحة إلى أخرى في مستندات جوجل.	(2) دقيقتان
10	**<u>افتح المستند المشترك المرسل من صديقك. اكتب تحت النص السابق:</u>** تمكن مستندات جوجل العديد من المستخدمين من المشاركة والعمل على نفس المستند.	لتوضح لك كيفية الدخول إلى المستند المشترك وفتحه، وأيضا كيفية الكتابة وإضافة نص في نفس المستند المشترك.	6-4 دقائق
11	انقر على عنوان بريدك الإلكتروني في أعلى الجانب الأيسر من النافذة، ثم اضغط على "الخروج".	لتوضح لك كيفية الخروج من مستندات جوجل.	(2) دقيقتان

شكرًا على وقتك والمشاركة

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Appendix E: Letter of Introduction - English Version

Dear Participant,

This letter is to introduce Mr. Abdulwahab Almazroi who is a doctorate student in the School of Computer Science, Engineering and Mathematics at Flinders University in Australia. He will produce his student card, which carries a photograph, as proof of identity.

Abdulwahab is undertaking research leading to the production of a thesis entitled “Factors influencing the adoption and usage of cloud computing applications in Saudi universities”.

He would be most grateful if you would volunteer to assist in this project by participating in a practical session and then completing a questionnaire, and also later participate in focus group which covers certain aspects of this topic. The aims of the practical session, questionnaire, and focus group are presented as follows:

- The practical session is designed to allow you to use cloud application (Google Docs) since you may not have prior experience with this cloud application. This will also enable you to answer the questionnaire more effectively.
- The questionnaire aims to investigate the factors influencing the adoption of cloud computing applications by university students in Saudi Arabia. The factors may represent issues that need to be considered in order to improve adoption of cloud applications by university students.
- The focus group aims to investigate the factors that influence the adoption of cloud applications by university students in Saudi Arabia. This involves examining your perceptions and opinions regarding the factors in order to have successful adoption of cloud applications by university students.

No more than 2 hours of your time would be required for participation in the practical session as well as answering the questionnaire out of which90 minutes are reserved for the introduction and conducting the practical session, and 30 minutes for answering the questionnaire. You may also be asked to participate in the focus group which will also take about 2 hours. If you agree to participate in the practical session and focus group, please sign the consent form provided as an indication of your agreement.

Be assured that any provided information will be treated in the strictest confidence and none of the participants will be individually identifiable in the resulting thesis, report or other publications. To guarantee participants anonymity in the focus group, the researcher will provide assurance to participants that he will respect confidentiality and anonymity, and because he will have no control over other participants in the group he will remind group members of this limitation and gain verbal agreement between all participants that they will maintain anonymity of other members and the confidentiality of the discussion. You are, of course, entirely free to discontinue your participation at any time or to decline to answer particular questions.

Since Abdulwahab intends to make an audio recording for the focus group, he will seek your consent, on the attached form, to use the information from focus group recording (transcript) in preparing the thesis, report or other publications, on condition that your name or identity will not be revealed. The summary of the focus group will be given for confirmation about the accuracy of the information provided during the focus group.

Any enquiries you may have concerning this project should be directed to me at the address given above or by telephone on (+61 8 82013969) or by e-mail (haifeng.shen@flinders.edu.au). Abdulwahab can be contacted on (+61 8 82013969) or by email (alma0138@flinders.edu.au).

Thank you for your attention and assistance.

Yours sincerely

Dr. Haifeng Shen

Senior Lecturer

School of Computer Science, Engineering and Mathematics

Flinders University

This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 6379). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au

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Appendix F: Letter of Introduction - Arabic Version

خطاب تعريف

عزيزي المشارك،

هذا الخطاب لتقديم الأستاذ عبدالوهاب المزروعي وهو طالب دكتوراه في كلية علوم الحاسب الآلي، الهندسة والرياضيات في جامعة فلندرز في استراليا. وسوف يقدم بطاقته الجامعية وهي تحتوي على صورته الشخصية، كإثبات للهوية. يجري عبدالوهاب بحثا للوصول إلى تقديم أطروحة بعنوان "العوامل المؤثرة على اعتماد تطبيقات الحوسبة السحابية واستخدامها في الجامعات السعودية".وسوف يكون في غاية الامتنان لو تفضلتم بالتطوع للمساعدة في هذا المشروع من خلال الموافقة على المشاركة في التطبيق العملي واستكمال الاستبيان ومن ثم المشاركة في مجموعة النقاش والتي تغطي جوانب معينة من هذا الموضوع. أهداف التطبيق العملي، والاستبيان، ومجموعة النقاش كما يلي:

- تم تصميم التطبيق العملي لتمكينك من استخدام تطبيق سحابي (مستندات جوجل) وبما أنك قد لا تكون لديك خبرة سابقة مع استخدام هذا التطبيق السحابي. فسوف يمكنك هذا التطبيق العملي أيضا من الإجابة عن أسئلة الاستبيان على نحو أكثر فعالية.
- يهدف الاستبيان إلى الكشف عن العوامل المؤثرة على اعتماد تطبيقات الحوسبة السحابية من قبل الطلاب الجامعيين في المملكة العربية السعودية. وربما تمثل العوامل مشاكل ينبغي وضعها بالاعتبار من أجل تحسين اعتماد التطبيقات السحابية من قبل الطلاب الجامعيين.
- تهدف مقابلة مجموعة النقاش إلى الكشف عن العوامل التي تؤثر على اعتماد التطبيقات السحابية من قبل الطلاب الجامعيين في المملكة العربية السعودية. ويتضمن هذا اختبار تصوراتك وآرائك في ما يتعلق بالعوامل من أجل الحصول على اعتماد ناجح للتطبيقات السحابية من قبل الطلاب الجامعيين.

لن يتطلب الأمر أكثر من ساعتين من وقتك للمشاركة في التطبيق العملي وكذلك الإجابة على الاستبيان، وسيتم تخصيص 90 دقيقة للمقدمة التعريفية وإجراء التطبيق العملي، وأما 30 دقيقة ستكون للإجابة عن أسئلة الاستبيان. وربما يطلب منك المشاركة في مجموعة النقاش والتي ستستغرق أيضًا قرابة ساعتين. فضلًا يرجى التوقيع على استمارة الموافقة المقدمة كدليل على موافقتك، إذا كنت موافقًا على المشاركة في التطبيق العملي ومجموعة النقاش.

تأكد بأن أي من المعلومات المقدمة سيتم التعامل معها بسرية تامة ولن يتم تحديد هوية أي من المشاركين بشكل فردي في نتائج الأطروحة، أو التقارير أو غيرها من المنشورات. ومن أجل ضمان عدم الكشف عن هوية المشاركين في مجموعة النقاش؛ فسيقوم الباحث بتقديم ضمان للمشاركين بأنه سيحترم السرية ولن يفصح عن هوية المشاركين، وبما أنه ليس لديه سلطة على المشاركين الآخرين في مجموعة النقاش؛ فإنه سيقوم بتذكير أعضاء المجموعة بهذه الحدود ويحصل على اتفاق شفهي بين كل المشاركين على أن يحافظوا جميعهم على إبقاء المشاركين الآخرين غير معروفين وعلى الحفاظ على سرية النقاش. وبالطبع يحق للمشارك التوقف عن المشاركة في أي وقت أو عدم الإجابة على أي من الأسئلة.

وبما أن عبدالوهاب ينوي استخدام تسجيل صوتي لمجموعة النقاش، فإنه سيسعى للحصول على موافقتك، على الاستمارة المرفقة، وذلك لاستخدام المعلومات المسجلة (المدونة) من مجموعة النقاش في إعداد الأطروحة أو التقارير أو غيرها من المنشورات، شريطة ألا يتم الكشف عن اسمك أو الهوية الخاصة بك. وسيتم إعطائك ملخصًا لمجموعة النقاش للتأكد من دقة المعلومات المقدمة أثناء مجموعة النقاش.

أي استفسارات بشأن هذا المشروع ينبغي أن توجه إليّ على العنوان المذكور أعلاه أو عن طريق الهاتف رقم (82013969 8 61+) أو عن طريق البريد الإلكتروني (haifeng.shen@flinders.edu.au). ويمكن الاتصال بعبدالوهاب على الرقم (82013969 8 61+) أو عن طريق البريد الإلكتروني(alma0138@flinders.edu.au).
وأشكركم على اهتمامكم ومساعدتكم.

تفضلوا بقبول فائق الاحترام،،،

د. هايفنغ شين
أستاذ محاضر
كلية علوم الحاسب الآلي، الهندسة والرياضيات
جامعة فلندرز

تمت الموافقة على مشروع البحث هذا من قبل لجنة أخلاقيات البحوث الاجتماعية والسلوكية بجامعة فلندرز (رقم المشروع 6379). ولمزيد من المعلومات بشأن الموافقة الأخلاقية للمشروع يمكن الاتصال بالمدير التنفيذي للجنة عن طريق الهاتف رقم 8201 3116 أو الفاكس رقم 8201 2035 أو عبر البريد الالكتروني :human.researchethics@flinders.edu.au.

Abdulwahab Almazroi
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CRICOS Provider No. 00114A

Appendix G: Information Sheet for Participation in Practical Session - English Version

Title: "Factors influencing the adoption and usage of cloud computing applications in Saudi universities"

Investigators:

Mr Abdulwahab Almazroi
School of Computer Science, Engineering and Mathematics
Flinders University
Ph: +61 8 82013969

Supervisor (Principal Supervisor):

Dr Haifeng Shen
School of Computer Science, Engineering and Mathematics
Flinders University
Ph: +61 8 82013969

Description of the study:

This study is a part of a project entitled "Factors influencing the adoption and usage of cloud computing applications in Saudi universities". This project will investigate thefactors influencing the adoption of cloud computing applications by university students in Saudi Arabia. This project is supported by Flinders University, School of Computer Science, Engineering and Mathematics.

Purpose of the study:

This project aims to:

- identify the factors that influence university students' adoption of could computing applications in Saudi Arabia,
- develop and examine an adoption model of cloud computing applications by university students in Saudi Arabia,
- expose barriers that hinder the adoption of cloud computing applications by university students, and
- assist the Saudi universities and cloud application providers to overcome the barriers that hinder the students' adoption of cloud computing applications in order to effectively implement and use these applications in Saudi universities.

What will I be asked to do?

- ***Participation in the Practical Session***

You will be asked to voluntarily participate in the practical session and complete a questionnaire at the end of the session. In the practical session you will be given an introduction and live demonstration on how to access and use Google Docs which will take around 40-50 mins. You will then be asked to use Google Docs to perform certain tasks in cloud based word document designed by the researcher to familiarise and enable you have an experience with the cloud application that will be used in this study. This will also enable you to answer the questions in the questionnaire more effectively. It will take around 30-40 mins to perform the tasks, and 20-30 mins to complete the questionnaire.

- ***Participation in the Focus Group***

You will be invited to voluntarily participate in focus group with the researcher who will ask a set of questions about the factors that affect the adoption and use of cloud computing applications in Saudi universities. The focus group will take between 1.5– 2 hours. The focus group will be recorded using a digital voice recorder to help the researcher listen to the focus group conversations. Once recorded, the focus group will be transcribed (typed-up) and stored on a password protected computer. The audio files will then be destroyed once the analysis of the results is done.

What benefit will I gain from being involved in this study?

Sharing your experiences will help in overcoming the barriers and factors that affect the adoption of cloud computing applications by students in Saudi universities. We are very keen to identify the barriers and factors so that we can suggest solutions for overcoming the barriers. The results of the study will highly help Saudi universities and cloud applications providers to overcome the barriers so that the students will successfully adopt the cloud applications in the future.

Will I be identifiable by being involved in this study?

We do not need your name or any other personal information; thus, you will be anonymous. Any identifying information will be removed and the typed-up file will be stored on a password protected computer that only the researcher will have access to. Your comments will not be linked directly to you.

Are there any risks or discomforts if I am involved?

Other group members may be able to know your contributions in the focus group so group members should be aware of this limitation and I will gain verbal agreement between all participants that they will maintain anonymity of other members and the confidentiality of the discussion. The researcher anticipates few risks from your involvement in this study. If you have any concerns regarding anticipation or actual risks or discomforts, please raise them and inform the researcher. Participants can withdraw their information by contacting the researcher within two weeks after the data has been collected. The researcher can be contacted by phone or by email.

How do I agree to participate?

Participation is voluntary. You may answer ‘no comment’ or refuse to answer any questions and you are free to withdraw from the practical session and focus group at any time without effect or consequences. Consent forms for the participation in the practical session and focus group are provided. If you agree to participate please read and sign the consent forms.

How will I receive feedback?

Outcomes of the project will be summarised and given to you by the researcher if you would like to see them. If you have any concerns or questions regarding this research, please feel free to contact the researcher Mr. Abdulwahab by phone on +61 8 82013969 or by email (alma0138@flinders.edu.au) or the supervisor Dr. Haifeng Shen on +61 8 82013969 or by email (haifeng.shen@flinders.edu.au).

Thank you for taking the time to read this information sheet and we hope that you will accept our invitation to be involved.

This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 6379). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au

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Appendix H: Information Sheet for Participation in Practical Session - Arabic Version

عنوان البحث:

"العوامل المؤثرة على اعتماد تطبيقات الحوسبة السحابية واستخدامها في الجامعات السعودية"

الباحث:

عبدالوهاب علي المزروعي

كلية علوم الحاسب الآلي، الهندسة والرياضيات

جامعة فلندرز

هاتف: +61 8 82013969

المشرف الأكاديمي الرئيسي:

د. هايفنغ شين

كلية علوم الحاسب الآلي، الهندسة والرياضيات

جامعة فلندرز

هاتف: +61 8 82013969

وصف الدراسة:

إن هذه الدراسة جزء من مشروع بحثي بعنوان "العوامل المؤثرة على اعتماد تطبيقات الحوسبة السحابية واستخدامها في الجامعات السعودية". سوف يدرس هذا المشروع العوامل المؤثرة على اعتماد تطبيقات الحوسبة السحابية من قبل الطلاب الجامعيين في المملكة العربية السعودية. هذا المشروع مدعم من قبل كلية علوم الحاسب الآلي، الهندسة والرياضيات بجامعة فلندرز.

الغرض من الدراسة:

يهدف هذا المشروع إلى:

- تحديد العوامل التي تؤثر على اعتماد الطلاب الجامعيين لتطبيقات الحوسبة السحابية في المملكة العربية السعودية.

- تطوير واختبار نموذج اعتماد لتطبيقات الحوسبة السحابية من قبل الطلاب الجامعيين في المملكة العربية السعودية.
- الكشف عن العوائق التي تمنع اعتماد تطبيقات الحوسبة السحابية من قبل الطلاب الجامعيين.
- مساعدة الجامعات السعودية ومزودي التطبيقات السحابية على التغلب على العوائق التي تمنع الطلاب من اعتماد تطبيقات الحوسبة السحابية حتى يتم تنفيذها بفعالية واستخدام هذه التطبيقات في الجامعات السعودية.

ماذا سوف يطلب منك؟

- **المشاركة في التطبيق العملي**

ستكون مدعوًا للمشاركة الطوعية في التطبيق العملي واستكمال استبيان في نهايته. وخلال هذا التطبيق العملي سيتم إعطاؤك مقدمةً وعرضًا مباشرًا حول كيفية الدخول إلى مستندات جوجل وكيفية استخدامها وسيستغرق هذا حوالي 40-50 دقيقة. وسيطلب منك بعدها أن تستخدم مستندات جوجل لأداء مهام معينة في مستند سحابي صممت من قبل الباحث لتعرفك وتمكنك من الحصول على خبرة مع التطبيق السحابي الذي سوف يتم استخدامه في هذه الدراسة. وهذه ستمكنك أيضًا من الإجابة عن أسئلة الاستبيان على نحو أكثر فعالية، وسيستغرق ذلك حوالي 30-40 دقيقة لأداء المهام، و20-30 دقيقة لإكمال الاستبيان.

- **المشاركة في مجموعة النقاش**

ستكون مدعوًا للمشاركة الطوعية في مجموعة النقاش مع الباحث الذي سوف يوجه مجموعة من الأسئلة حول العوامل التي تؤثر على اعتماد واستخدام تطبيقات الحوسبة السحابية في الجامعات السعودية. وسوف تستغرق المقابلة مع مجموعة النقاش من ساعة ونصف إلى ساعتين (1.5-2). وسوف يتم تسجيل مجموعة النقاش باستخدام جهاز تسجيل الصوت الرقمي لمساعدة الباحث على الاستماع لمحادثات المجموعة. وبعد عملية التسجيل، سوف يتم تدوين مقابلة مجموعة النقاش وحفظها في ملف على جهاز حاسب آلي محمي بكلمة مرور، ومن ثم سيتم اتلاف الملفات الصوتية بمجرد الانتهاء من تحليل النتائج.

ماهي الفائدة التي سوف أكتسبها من مشاركتي في هذه الدراسة؟

سوف يساعد تبادل الخبرات فيما بينكم في التغلب على العوائق والعوامل التي تؤثر على اعتماد تطبيقات الحوسبة السحابية من قبل الطلاب في الجامعات السعودية. ونحن حريصون جدا على تحديد العوائق والعوامل حتى نتمكن من اقتراح حلول للتغلب على هذه العوائق. وسوف تساعد نتائج الدراسة الجامعات السعودية ومزودي التطبيقات السحابية للتغلب على العوائق بشكل كبير حتى يعتمد الطلاب تطبيقات الحوسبة السحابية بنجاح في المستقبل.

هل سوف أكون معروفًا من قبل مشاركتي في هذه الدراسة؟

إننا لا نحتاج إلى اسمك أو أي معلومات شخصية أخرى، لذلك فلن تكون معروفًا. وسيتم إزالة أية معلومات شخصية، وسوف يتم تخزين الملف النصي في جهاز حاسب آلي محمي بكلمة مرور، وسوف يطلع عليها الباحث فقط. كما أن تعليقاتك لن تكون مرتبطة بك مباشرة.

هل هناك أي مخاطر أو مضايقات تترتب على مشاركتي؟

ربما يكون الأعضاء الآخرون في المجموعة قادرين على معرفة مشاركاتك في مجموعة النقاش، وعليه فيجب أن يدرك أعضاء المجموعة هذه الحدود وسوف أحصل على موافقة شفهية من كل المشاركين بأن أعضاء المجموعة سوف يحافظون على بقاء الأعضاء الآخرين غير معروفين وعلى سرية النقاش. ويتوقع الباحث البعض من المخاطر المترتبة على مشاركتك في هذه الدراسة. فإذا كان لديك أي قلق بشأن المخاطر أو المضايقات المتوقعة أو الفعلية، فيرجى طرحها وتبليغ الباحث. ويمكن للمشاركين حذف معلوماتهم عن طريق الاتصال بالباحث خلال أسبوعين بعد جمع البيانات. ويمكن الاتصال بالباحث عن طريق الهاتف أو عن طريق البريد الإلكتروني.

كيف أوافق على المشاركة؟

إن المشاركة طوعية. وبإمكانك الإجابة بـ'لا تعليق' أو رفض الإجابة عن أي أسئلة، وبإمكانك الانسحاب من التطبيق العملي ومن مجموعة النقاش في أي وقت دون تأثير أو عواقب. وسيتم تزويدك بنماذج استمارة موافقة للمشاركة في التطبيق العملي ومجموعة النقاش. يرجى قراءة نماذج الموافقة والتوقيع عليها إذا كنت موافقًا على المشاركة.

كيف يمكنني الحصول على النتائج؟

سيقوم الباحث بتلخيص نتائج المشروع وإعطائها إياك، إذا كنت ترغب في رؤيتها . وإذا كان لديك أي اهتمامات أو أسئلة بخصوص هذا البحث، فلا تتردد في الاتصال بالباحث عبد الوهاب المزروعي عن طريق رقم الهاتف +61 8 82013969 أو عن طريق البريد الإلكتروني (alma0138@flinders.edu.au) أو الاتصال بالمشرف د. هايفنغ شين عن طريق الهاتف رقم +61 8 82013969 أو بواسطة البريد الإلكتروني (haifeng.shen@ flinders.edu.au).

شكراً على قضائك بعض الوقت لقراءة ورقة المعلومات هذه، ونأمل أن تقبل دعوتنا للمشاركة.

تمت الموافقة على مشروع البحث هذا من قبل لجنة أخلاقيات البحوث الاجتماعية والسلوكية بجامعة فلندرز (رقم المشروع 6379). ولمزيد من المعلومات بشأن الموافقة الأخلاقية للمشروع يمكن الاتصال بالمدير التنفيذي للجنة عن طريق الهاتف رقم8201 3116 أو الفاكس رقم 8201 2035 أو عبر البريد الالكتروني: human.researchethics@flinders.edu.au.

Appendix I: Consent Form for Participation in Research (by Practical Session) - English Version

Research Title: “Factors influencing the adoption and usage of cloud computing applications in Saudi universities”

I…..

being over the age of 18 years hereby consent to participate as requested in the Letter of Introduction for the research project on Factors Influencing the Adoption and Usage of Cloud Computing Applications in Saudi Universities.

1. I have read the information provided.
2. Details of procedures and any risks have been explained to my satisfaction.
3. I am aware that I should retain a copy of the Information Sheet and Consent Form for future reference.
4. I understand that:
   - I may not directly benefit from taking part in this research.
   - I am free to withdraw from the project at any time and am free to decline to answer particular questions.
   - While the information gained in this study will be published as explained, I will not be identified, and individual information will remain confidential.
   - Whether I participate or not, or withdraw after participating, will have no effect on my progress in my course of study, or results gained.

Participant’s signature……………………………………**Date**…………………...

I certify that I have explained the study to the volunteer and consider that she/he understands what is involved and freely consents to participation.

Researcher's name:

Researcher's signature…………………………………..**Date**…………………….

Appendix J: Consent Form for Participation in Research (by Practical Session) - Arabic Version

Flinders
UNIVERSITY

استمارة الموافقة على المشاركة في البحث

(عن طريق التطبيق العملي)

عنوان البحث: "العوامل المؤثرة على اعتماد تطبيقات الحوسبة السحابية واستخدامها في الجامعات السعودية"

أنا...

أبلغ من العمر أكبر من 18 سنة وأوافق بموجب هذه الاستمارة على المشاركة كما هو مطلوب في الخطاب التعريفي لمشروع البحث الذي بعنوان العوامل المؤثرة على اعتماد تطبيقات الحوسبة السحابية واستخدامها في الجامعات السعودية.

1. لقد قمت بقراءة المعلومات المقدمة.

2. وقد تم شرح تفاصيل الإجراءات وأية مخاطر قد تكون مترتبة على المشاركة بصورة مرضية.

3. أدرك بأنه يجب علي أن أحتفظ بنسخة من ورقة المعلومات واستمارة الموافقة كمرجع في المستقبل.

4. أفهم بأنني:

- قد لا أستفيد مباشرة من المشاركة في هذا البحث.
- لي مطلق الحرية في الانسحاب من المشروع في أي وقت، وكذلك رفض الإجابة عن أسئلة معينة.
- عندما سيتم نشر المعلومات المكتسبة في هذه الدراسة كما هو موضح، فلن أكون معروفًا، وستبقى المعلومات الشخصية سرية.
- سواءً أشاركت أم لم أشارك، أو انسحبت بعد المشاركة، فلن يكون لذلك أي تأثير على التقدم في دراستي، أو النتائج المكتسبة.

توقيع المشارك ....… **التاريخ**.........................

أشهد بأنني قد شرحت هذه الدراسة للمتطوع وأعتبربأنه هي/هو يفهم ماهية المشاركة ويوافق بحرية على المشاركة في البحث.

اسم الباحث:

توقيع الباحث ....**التاريخ**..........................

Appendix K: Focus Group Schedule - English Version

Section (1): Participants Demographics

Please answer the following questions:

1. Participant's Name:____

2. What is your academic major? ☐ Art ☐ Science

3. What is your age?___________

4. Please indicate your year of study:

First year	Second year	Third year	Fourth year	Other (please specify)

5. How would you rate your computer knowledge?

Poor	Fair	Good	Very good	Excellent

6. How would you rate your proficiency with the Internet?

Poor	Fair	Good	Very good	Excellent

Section (2): Proposed Model Questions:

Item NO.	Statements	Response and Comments
Perceived Usefulness (PU)		**Response and Comments**
PU1	Using Google Docs in my study would enable me to accomplish learning tasks more quickly.	
PU2	Using Google Docs would improve my performance in my study.	
PU3	Using Google Docs in my study would increase my productivity.	
PU4	Using Google Docs would enhance my effectiveness in my study.	
PU5	Using Google Docs would make it easier to do my learning tasks.	
PU6	I would find Google Docs useful in my study.	
Perceived Ease of Use (PEOU)		**Response and Comments**
PEOU1	Learning to use Google Docs would be easy for me.	
PEOU2	I would find it easy to get Google Docs to do what I want it to do.	
PEOU3	My interaction with Google Docs would be clear and understandable.	
PEOU4	I would find Google Docs to be flexible to interact with.	
PEOU5	It would be easy for me to become skillful at using Google Docs.	
PEOU6	I would find Google Docs easy to use.	

Self-Efficacy (SE)		Response and Comments
I could complete the task using Google Docs…		
SE1	….If there was no one around to tell me what to do.	
SE2	….If I had a lot of time to complete the task.	
SE3	….If I had just the built-in help facility for assistance.	
SE4	….If someone showed me how to do it first.	
SE5	….If I had used similar systems before this one to do the same task.	
Perceptions of External Control (PEC)		**Response and Comments**
PEC1	I would have control over using Google Docs (e.g., editing, sharing documents with others, etc.)	
PEC2	I would have the resources necessary (e.g., computer, Internet, etc.) to use Google Docs.	
PEC3	I would have the knowledge necessary to use Google Docs.	
PEC4	Given the resources, opportunities and knowledge it takes to use Google Docs, it would be easy for me to use Google Docs.	
PEC5	Google Docs would be compatible with other software that I use (e.g., Microsoft office).	
Playfulness (PLAY)		**Response and Comments**
The following questions ask you how you would characterize yourself when you use Google Docs:		
PLAY1	…spontaneous	
PLAY2	…creative	
PLAY3	…playful	
PLAY4	…original	

Anxiety (ANX)		Response and Comments
ANX1	I would feel apprehensive about using Google Docs.	
ANX2	It would scare me to think that I could lose a lot of information using Google Docs by hitting the wrong key.	
ANX3	I would hesitate to use Google Docs for fear of making mistakes that I cannot correct.	
ANX4	Google Docs would be somewhat intimidating to me.	
Perceived Enjoyment (ENJ)		**Response and Comments**
ENJ1	I would find using Google Docs to be enjoyable.	
ENJ2	The actual process of using Google Docs would be pleasant.	
ENJ3	I would have fun using Google Docs.	
Subjective Norm (SN)		**Response and Comments**
SN1	People (teachers/ friends) who influence my behaviour would think that I should use Google Docs.	
SN2	People who are important to me would think that I should use Google Docs.	
SN3	People whose opinions I value would prefer me to use Google Docs.	
Image (IMG)		**Response and Comments**
IMG1	People (teachers/ friends) in my university who use Google Docs would have more prestige than those who do not.	
IMG2	People in my university who use Google Docs would have a high profile.	
IMG3	Having Google Docs would be a status symbol in my university.	

Job Relevance (REL)		Response and Comments
REL1	In my study, usage of Google Docs would be important.	
REL2	In my study, usage of Google Docs would be relevant.	
REL3	The use of Google Docs would be pertinent to my various study-related tasks.	
Output Quality (OUT)		**Response and Comments**
OUT1	The quality of the output (e.g., the created documents) that I would get from using Google Docs would be high.	
OUT2	I would have no problem with the quality of Google Docs' output.	
OUT3	I would rate the results from Google Docs as excellent.	
Result Demonstrability (RES)		**Response and Comments**
RES1	I would have no difficulty telling others about the results of using Google Docs.	
RES2	I believe I could communicate to others the consequences of using Google Docs.	
RES3	The results of using Google Docs would be apparent to me.	
RES4	I would have no difficulty explaining why using Google Docs may or may not be beneficial.	
Trust (TR)		**Response and Comments**
TR1	Using Google Docs would be secure.	
TR2	I trust the ability of Google (the provider of cloud applications) that would protect my privacy.	
TR3	Google (the provider of cloud applications)would be trustworthy.	

TR4	Google (the provider of cloud applications)would keep its promises and commitments(e.g., cloud services availability).	
TR5	I trust that Google (the provider of cloud applications)would keep my best interests in mind.	
Behavioural Intention (BI)		**Response and Comments**
BI1	Assuming I had access to Google Docs, I intend to use it.	
BI2	Given that I had access to Google Docs, I predict that I would use it.	
BI3	I plan to use Google Docs in the future.	

<u>Section (3): General Question</u>

In your opinion, are there any other factors or barriers that affect the adoption of cloud computing applications in your university which are not covered in this study, or any additional information which you think would be useful to this study?

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Thank you for your time and participation.

Appendix L: Focus Group Schedule - Arabic Version

أسئلة مقابلة مجموعة النقاش

الجزء الأول: معلومات عامة

من فضلك قم بالإجابة عن الأسئلة التالية:

1. اسم الطالب:______________________________

2. ما هو تخصصك الأكاديمي؟ ☐ أدبي ☐ علمي

3. كم عمرك؟_______________

4. ماهي سنتك الدراسية الحالية في الجامعة؟

السنة الأولى	السنة الثانية	السنة الثالثة	السنة الرابعة	أخرى (حدد من فضلك)

5. كيف تقيم مدى معرفتك في استخدام جهاز الحاسب الآلي؟

ضعيفة	مقبولة	جيدة	جيدة جدا	ممتازة

6. كيف تقيم مدى اتقانك لاستخدام الإنترنت؟

ضعيف	مقبول	جيد	جيد جدا	ممتاز

الجزء الثاني: أسئلة النموذج المقترح

رقم العبارة	العبارات	
	الفائدة المدركة	**الإجابة والتعليقات**
1	سوف يمكنني استخدام مستندات جوجل في دراستي من إنجاز المهام التعليمية بشكل أسرع.	
2	سوف يحسن استخدام مستندات جوجل من أدائي في الدراسة.	
3	سوف يزيد استخدام مستندات جوجل في دراستي من محصلتي.	
4	سوف يعزز استخدام مستندات جوجل من فعاليتي في الدراسة.	
5	سوف يسهل لي استخدام مستندات جوجل عمل الواجبات التعليمية.	
6	سوف أجد مستندات جوجل مفيدة في دراستي.	
	سهولة الإستخدام المدركة	**الإجابة والتعليقات**
1	سوف يكون تعلم استخدام مستندات جوجل سهلًا بالنسبة لي.	
2	سوف يمكنني استخدام مستندات جوجل من إنجاز ما أريد بسهولة.	
3	سوف يكون تفاعلي مع مستندات جوجل واضحًا ومفهومًا.	
4	سوف أجد مستندات جوجل مرنة (سهلة) في التفاعل معها.	
5	سيكون من السهل بالنسبة لي أن أصبح ماهرا في استخدام مستندات جوجل.	
6	سوف أجد مستندات جوجل سهلة الاستخدام.	
	الكفاءة الذاتية	**الإجابة والتعليقات**
	• **يمكنني إكمال التكليف الدراسي باستخدام مستندات جوجل...**	
1	... إذا لم يكن هناك أحد بجانبي يعلمني ما يجب القيام به.	
2	... إذا توفر لدي الكثير من الوقت لإنجاز التكليف.	
3	... إذا توفرت لي فقط وسيلة المساعدة المدمجة داخل برنامج مستندات جوجل.	
4	... إذا شرح لي شخص ما طريقة استخدام مستندات جوجل أولاً.	
5	... إذا كنت قد استخدمت أنظمة مشابهة قبل هذا لعمل نفس التكليف.	
	تصورات السيطرة الخارجية	**الإجابة والتعليقات**
1	سوف أتمكن من التحكم في استخدام مستندات جوجل (مثل التحرير، مشاركة المستندات مع الآخرين، إلخ).	
2	ستتوفر لدي المصادر اللازمة (مثل الكمبيوتر، الإنترنت، إلخ) لاستخدام مستندات جوجل.	
3	ستتوفر لدي المعرفة اللازمة لاستخدام مستندات جوجل.	
4	سوف يكون من السهل بالنسبة لي استخدام مستندات جوجل متى ما توفرت لدي المصادر والفرص والمعرفة اللازمة.	
5	سوف تكون مستندات جوجل متوافقة مع البرامج الأخرى التي استخدمها (مثل برامج مايكروسوفت المكتبية).	

المرح		**الإجابة والتعليقات**
تطرح عليك الأسئلة التالية للسؤال عن الكيفية التي تصف بها نفسك عندما تستخدم مستندات جوجل:		
• **عندما استخدم مستندات جوجل فإنني...**		
1	...أكونُ عفويًا (أكون تلقائيا في الاستخدام).	
2	...أكونُ مُبدعًا.	
3	...أكونُ مَرِحـاً.	
4	...أكونُ على طبيعتي.	
القلق		**الإجابة والتعليقات**
1	سوف أشعر بالخوف عند استخدام مستندات جوجل.	
2	سيخيفني التفكير بأنني يمكن أن أفقد الكثير من المعلومات من خلال ضغط زر بالخطأ عند استخدام مستندات جوجل.	
3	سوف أتردد في استخدام مستندات جوجل لخوفي من ارتكاب أخطاءٍ لا يمكن تصحيحها.	
4	سوف تخيفني مستندات جوجل بعض الشيء.	
المتعة المدركة		**الإجابة والتعليقات**
1	سأجد استخدام مستندات جوجل ممتعًا.	
2	سوف أجد الطريقة الحالية لاستخدام مستندات جوجل ممتعة.	
3	سوف استمتع عند استخدام مستندات جوجل.	
المعيار شخصي		**الإجابة والتعليقات**
1	سوف يعتقد الأشخاص (المدرسون/ الزملاء) الذين يؤثرون على سلوكي بأنه يجب علي أن استخدم مستندات جوجل.	
2	سوف يعتقد الأشخاص المهمون لدي بأنه يجب علي أن استخدم مستندات جوجل.	
3	سيفضل الأشخاص الذين أقدر آراءهم بأن أستخدم مستندات جوجل.	
التصور		**الإجابة والتعليقات**
1	سيكون لدى الأشخاص (المدرسون / الزملاء) في جامعتي الذين يستخدمون مستندات جوجل شهرة (تميز) أكثر من الأشخاص الذين لايستخدمونها.	
2	سيكون لدى الأشخاص في جامعتي الذين يستخدمون مستندات جوجل مكانة عالية.	
3	سيكون رمزًا للمكانة وجود مستندات جوجل في جامعتي.	
الصلة في الدراسة		**الإجابة والتعليقات**
1	سوف يكون استخدام مستندات جوجل مهمًا في دراستي.	
2	سوف يكون استخدام مستندات جوجل مرتبطًا بدراستي.	
3	سوف يكون استخدام مستندات جوجل ذا صلة وثيقة مع مهامي المختلفة المتعلقة بالدراسة.	

جودة النتائج		**الإجابة والتعليقات**
1	سوف تكون النتائج التي سأحصل عليها من مستندات جوجل ذات جودة عالية (على سبيل المثال المستندات المنشئة).	
2	لن يكون لدي أي مشكلة مع جودة نتائج مستندات جوجل.	
3	سوف أقيم نتائج مستندات جوجل بأنها ممتازة.	
استعراض النتائج		**الإجابة والتعليقات**
1	لن أواجه أي صعوبة في إخبار الآخرين عن نتائج استخدام مستندات جوجل.	
2	أعتقد بأنه سيمكنني أن أوْصِلَ للآخرين النتائج المترتبة على استخدام مستندات جوجل.	
3	سوف تكون نتائج استخدام مستندات جوجل واضحة بالنسبة لي.	
4	لن أواجه أي صعوبة في توضيح ما إذا كان استخدام مستندات جوجل مفيدًا أو غير مفيد.	
الثقة		**الإجابة والتعليقات**
1	سوف يكون استخدام مستندات جوجل آمنًا.	
2	أثق في قدرة جوجل (المزود للتطبيقات السحابية) الذي سيحمي خصوصيتي.	
3	سوف يكون جوجل (المزود للتطبيقات السحابية) جديرًا بالثقة.	
4	سوف يفي جوجل (المزود للتطبيقات السحابية) بوعوده والتزاماته (على سبيل المثال توفر الخدمات السحابية).	
5	أثق بأن جوجل (المزود للتطبيقات السحابية) سيضع في الاعتبار أهم اهتماماتي.	
النية السلوكية		**الإجابة والتعليقات**
1	أنوي استخدام مستندات جوجل إذا تمكنت من الوصول إليها.	
2	أتوقع بأنني سوف استخدم مستندات جوجل في حال تمكني من الوصول إليها.	
3	أخطط لاستخدام مستندات جوجل في المستقبل.	

الجزء الثالث: سؤال عام

في رأيك الشخصي، هل يوجد هناك أي عوامل أوعوائق أخرى توثر على اعتماد تطبيقات الحوسبة السحابية في جامعتك لم تذكر في هذه الدراسة، أو أي معلومات إضافية تعتقد بأنها مفيدة لهذه الدراسة؟

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شكرًا جزيلا لوقتكم ومشاركتكم

Abdulwahab Almazroi
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Appendix M: Information Sheet for Participation in Focus Group- English Version

Title: "Factors influencing the adoption and usage of cloud computing applications in Saudi universities"

Investigators:

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School of Computer Science, Engineering and Mathematics
Flinders University
Ph: +61 8 82013969

Supervisor (Principal Supervisor):

Dr Haifeng Shen
School of Computer Science, Engineering and Mathematics
Flinders University
Ph: +61 8 82013969

Description of the study:

This study is a part of a project entitled "Factors influencing the adoption and usage of cloud computing applications in Saudi universities". This project will investigate thefactors influencing the adoption of cloud computing applications by university students in Saudi Arabia. This project is supported by Flinders University, School of Computer Science, Engineering and Mathematics.

Purpose of the study:

This project aims to:

- identify the factors that influence university students' adoption of could computing applications in Saudi Arabia,
- develop and examine an adoption model of cloud computing applications by university students in Saudi Arabia,
- expose barriers that hinder the adoption of cloud computing applications by university students, and
- assist the Saudi universities and cloud application providers to overcome the barriers that hinder the students' adoption of cloud computing applications in order to effectively implement and use these applications in Saudi universities.

What will I be asked to do?

- ***Participation in the Focus Group***

You will be invited to voluntarily participate in focus group with the researcher who will ask a set of questions about the factors that affect the adoption and use of cloud computing applications in Saudi universities. The focus group will take between 1.5– 2 hours. The focus group will be recorded using a digital voice recorder to help the researcher listen to the focus group conversations. Once recorded, the focus group will be transcribed (typed-up) and stored on a password protected computer. The audio files will then be destroyed once the analysis of the results is done.

What benefit will I gain from being involved in this study?

Sharing your experiences will help in overcoming the barriers and factors that affect the adoption of cloud computing applications by students in Saudi universities. We are very keen to identify the barriers and factors so that we can suggest solutions for overcoming the barriers. The results of the study will highly help Saudi universities and cloud applications providers to overcome the barriers so that the students will successfully adopt the cloud applications in the future.

Will I be identifiable by being involved in this study?

We do not need your name or any other personal information; thus, you will be anonymous. Any identifying information will be removed and the typed-up file will be stored on a password protected computer that only the researcher will have access to. Your comments will not be linked directly to you.

Are there any risks or discomforts if I am involved?

Other group members may be able to know your contributions in the focus group so group members should be aware of this limitation and I will gain verbal agreement between all participants that they will maintain anonymity of other members and the confidentiality of the discussion. The researcher anticipates few risks from your involvement in this study. If you have any concerns regarding anticipation or actual risks or discomforts, please raise them and inform the researcher. Participants can withdraw their information by contacting the researcher within two weeks after the data has been collected. The researcher can be contacted by phone or by email.

How do I agree to participate?

Participation is voluntary. You may answer ‘no comment’ or refuse to answer any questions and you are free to withdraw from the focus group at any time without effect or consequences. A consent form for the participation in the focus group is provided. If you agree to participate please read and sign the consent form.

How will I receive feedback?

Outcomes of the project will be summarised and given to you by the researcher if you would like to see them. If you have any concerns or questions regarding this research, please feel free to contact the researcher Mr. Abdulwahab by phone on +61 8 82013969 or by email (alma0138@flinders.edu.au) or the supervisor Dr. Haifeng Shen on +61 8 82013969 or by email (haifeng.shen@flinders.edu.au).

Thank you for taking the time to read this information sheet and we hope that you will accept our invitation to be involved.

This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 6379). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au

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Appendix N: Information Sheet for Participation in Focus Group - Arabic Version

ورقة معلومات البحث لمجموعة النقاش

عنوان البحث:

"العوامل المؤثرة على اعتماد تطبيقات الحوسبة السحابية واستخدامها في الجامعات السعودية"

الباحث:

عبدالوهاب علي المزروعي

كلية علوم الحاسب الآلي، الهندسة والرياضيات

جامعة فلندرز

هاتف: 82013969 8 61+

المشرف الأكاديمي الرئيسي:

د. هايفنغ شين

كلية علوم الحاسب الآلي، الهندسة والرياضيات

جامعة فلندرز

هاتف: 82013969 8 61+

وصف الدراسة:

إن هذه الدراسة جزء من مشروع بحثي بعنوان "العوامل المؤثرة على اعتماد تطبيقات الحوسبة السحابية واستخدامها في الجامعات السعودية". سوف يدرس هذا المشروع العوامل المؤثرة على اعتماد تطبيقات الحوسبة السحابية من قبل الطلاب الجامعيين في المملكة العربية السعودية. هذا المشروع مدعم من قبل كلية علوم الحاسب الآلي، الهندسة والرياضيات بجامعة فلندرز.

الغرض من الدراسة:

يهدف هذا المشروع إلى:

- تحديد العوامل التي تؤثر على اعتماد الطلاب الجامعيين لتطبيقات الحوسبة السحابية في المملكة العربية السعودية.

- تطوير واختبار نموذج اعتماد لتطبيقات الحوسبة السحابية من قبل الطلاب الجامعيين في المملكة العربية السعودية.
- الكشف عن العوائق التي تمنع اعتماد تطبيقات الحوسبة السحابية من قبل الطلاب الجامعيين.
- مساعدة الجامعات السعودية ومزودي التطبيقات السحابية على التغلب على العوائق التي تمنع الطلاب من اعتماد تطبيقات الحوسبة السحابية حتى يتم تنفيذها بفعالية واستخدام هذه التطبيقات في الجامعات السعودية.

ماذا سوف يطلب منك؟

- المشاركة في مجموعة النقاش

ستكون مدعوًا للمشاركة الطوعية في مجموعة النقاش مع الباحث الذي سوف يوجه مجموعة من الأسئلة حول العوامل التي تؤثر على اعتماد واستخدام تطبيقات الحوسبة السحابية في الجامعات السعودية. وسوف تستغرق المقابلة مع مجموعة النقاش من ساعة ونصف إلى ساعتين (1.5-2). وسوف يتم تسجيل مجموعة النقاش باستخدام جهاز تسجيل الصوت الرقمي لمساعدة الباحث على الاستماع لمحادثات المجموعة. وبعد عملية التسجيل، سوف يتم تدوين مقابلة مجموعة النقاش وحفظها في ملف على جهاز حاسب آلي محمي بكلمة مرور، ومن ثم سيتم اتلاف الملفات الصوتية بمجرد الانتهاء من تحليل النتائج.

ماهي الفائدة التي سوف أكتسبها من مشاركتي في هذه الدراسة؟

سوف يساعد تبادل الخبرات فيما بينكم في التغلب على العوائق والعوامل التي تؤثر على اعتماد تطبيقات الحوسبة السحابية من قبل الطلاب في الجامعات السعودية. ونحن حريصون جدا على تحديد العوائق والعوامل حتى نتمكن من اقتراح حلول للتغلب على هذه العوائق. وسوف تساعد نتائج الدراسة الجامعات السعودية ومزودي التطبيقات السحابية للتغلب على العوائق بشكل كبير حتى يعتمد الطلاب تطبيقات الحوسبة السحابية بنجاح في المستقبل.

هل سوف أكون معروفًا من قبل مشاركتي في هذه الدراسة؟

إننا لا نحتاج إلى اسمك أو أي معلومات شخصية أخرى، لذلك فلن تكون معروفًا. وسيتم إزالة أية معلومات شخصية، وسوف يتم تخزين الملف النصي في جهاز حاسب آلي محمي بكلمة مرور، وسوف يطلع عليها الباحث فقط. كما أن تعليقاتك لن تكون مرتبطة بك مباشرة.

هل هناك أي مخاطر أو مضايقات تترتب على مشاركتي؟

ربما يكون الأعضاء الآخرون في المجموعة قادرين على معرفة مشاركاتك في مجموعة النقاش، وعليه فيجب أن يدرك أعضاء المجموعة هذه الحدود وسوف أحصل على موافقة شفهية من كل المشاركين بأن أعضاء المجموعة سوف يحافظون على بقاء الأعضاء الآخرين غير معروفين وعلى سرية النقاش. ويتوقع الباحث البعض من المخاطر المترتبة على مشاركتك في هذه الدراسة. فإذا كان لديك أي قلق بشأن المخاطر أو المضايقات المتوقعة أو الفعلية، فيرجى طرحها وتبليغ الباحث. ويمكن للمشاركين حذف معلوماتهم عن طريق الاتصال بالباحث خلال أسبوعين بعد جمع البيانات. ويمكن الاتصال بالباحث عن طريق الهاتف أو عن طريق البريد الإلكتروني.

كيف أوافق على المشاركة؟

إن المشاركة طوعية. وبإمكانك الإجابة بـ'لا تعليق' أو رفض الإجابة عن أي أسئلة، وبإمكانك الانسحاب من مجموعة النقاش في أي وقت دون تأثير أو عواقب. وسيتم تزويدك باستمارة موافقة للمشاركة في مجموعة النقاش. يرجى قراءة استمارة الموافقة والتوقيع عليها إذا كنت موافقًا على المشاركة.

كيف يمكنني الحصول على النتائج؟

سيقوم الباحث بتلخيص نتائج المشروع وإعطائها إياك، إذا كنت ترغب في رؤيتها . وإذا كان لديك أي اهتمامات أو أسئلة بخصوص هذا البحث، فلا تتردد في الاتصال بالباحث عبد الوهاب المزروعي عن طريق رقم الهاتف +61 8 82013969 أو عن طريق البريد الإلكتروني (alma0138@flinders.edu.au) أو الاتصال بالمشرف د. هايفنغ شين عن طريق الهاتف رقم +61 8 82013969 أو بواسطة البريد الإلكتروني (haifeng.shen@ flinders.edu.au).

شكراً على قضائك بعض الوقت لقراءة ورقة المعلومات هذه، ونأمل أن تقبل دعوتنا للمشاركة.

تمت الموافقة على مشروع البحث هذا من قبل لجنة أخلاقيات البحوث الاجتماعية والسلوكية بجامعة فلندرز (رقم المشروع 6379). ولمزيد من المعلومات بشأن الموافقة الأخلاقية للمشروع يمكن الاتصال بالمدير التنفيذي للجنة عن طريق الهاتف رقم 8201 3116 أو الفاكس رقم 8201 2035 أو عبر البريد الالكتروني: human.researchethics@flinders.edu.au.

Appendix O: Consent Form for Participation in Research (by Focus Group) - English Version

Flinders
UNIVERSITY

Research Title: “Factors influencing the adoption and usage of cloud computing applications in Saudi universities”

I…..

being over the age of 18 years hereby consent to participate as requested in the Letter of Introduction for the research project on Factors Influencing the Adoption and Usage of Cloud Computing Applications in Saudi Universities.

1. I have read the information provided.
2. Details of procedures and any risks have been explained to my satisfaction.
3. I agree to audio recording of my information and participation.
4. I am aware that I should retain a copy of the Information Sheet and Consent Form for future reference.
5. I understand that:
    - I may not directly benefit from taking part in this research.
    - I am free to withdraw from the project at any time and am free to decline to answer particular questions.
    - I will provide the researcher with the verbal agreement to maintain the anonymity of other members and the confidentiality of the discussion.
    - Whether I participate or not, or withdraw after participating, will have no effect on my progress in my course of study, or results gained.
    - I may ask that the recording be stopped at any time, and that I may withdraw at any time from the session or the research without disadvantage.

Participant's signature……………………………………**Date**…………………...

I certify that I have explained the study to the volunteer and consider that he understands what is involved and freely consents to participation.

Researcher's name: Abdulwahab Almazroi

Researcher's signature…………………………………..**Date**…………………….

Appendix P: Consent Form for Participation in Research (by Focus Group) - Arabic Version

استمارة الموافقة على المشاركة في البحث

(عن طريق مجموعة النقاش)

عنوان البحث: "العوامل المؤثرة على اعتماد تطبيقات الحوسبة السحابية واستخدامها في الجامعات السعودية"

أنا..

أبلغ من العمرأكبرمن 18 سنة وأوافق بموجب هذه الاستمارة على المشاركة كما هو مطلوب في الخطاب التعريفي لمشروع البحث الذي بعنوان العوامل المؤثرة على اعتماد تطبيقات الحوسبة السحابية واستخدامها في الجامعات السعودية.

1. لقد قمت بقراءة المعلومات المقدمة.

2. وقد تم شرح تفاصيل الإجراءات وأية مخاطر قد تكون مترتبة على المشاركة بصورة مرضية.

3. أوافق على التسجيل الصوتي لمعلوماتي ومشاركتي.

4. أدرك بأنه يجب علي أن أحتفظ بنسخة من ورقة المعلومات واستمارة الموافقة كمرجع في المستقبل.

5.أفهم بأنني:

- قد لا أستفيد مباشرة من المشاركة في هذا البحث.
- لي مطلق الحرية في الانسحاب من المشروع في أي وقت، وكذلك رفض الإجابة عن أسئلة معينة.
- سوف أقوم بتزويد الباحث بموافقة شفهية على إبقاء الأعضاء الآخرين غير معروفين والحفاظ على سرية النقاش.
- سواءً أشاركت أم لم أشارك، أو انسحبت بعد المشاركة، فلن يكون لذلك أي تأثير على التقدم في دراستي، أو النتائج المكتسبة.
- يمكنني أن أطلب أن يتم إيقاف التسجيل في أي وقت، كما يمكنني الانسحاب من المقابلة أو البحث في أي وقت دون ضرر.

توقيع المشارك ....**التاريخ**.......................

أشهد بأنني قد شرحت هذه الدراسة للمتطوع، وأعتبر بأنه يفهم ماهية المشاركة ويوافق بحرية على المشاركة في البحث.

اسم الباحث : عبدالوهاب المزروعي

توقيع الباحث ....**التاريخ**..........................

Appendix Q: Univariate Outliers Test Results

Zscore Item	Minimum	Maximum
Zscore (PU1)	-3.56601-	1.11260
Zscore (PU2)	-3.75933-	1.36677
Zscore (PU3)	-3.70288-	1.39635
Zscore (PU4)	-3.67959-	1.37985
Zscore (PU5)	-3.80839-	1.02307
Zscore (PU6)	-3.69437-	1.15617
Zscore (PEOU1)	-3.78561-	1.17390
Zscore (PEOU2)	-3.70597-	1.20267
Zscore (PEOU3)	-3.98852-	1.40930
Zscore (PEOU4)	-3.90543-	1.31725
Zscore (PEOU5)	-3.59272-	1.12779
Zscore (PEOU6)	-3.90766-	1.21174
Zscore (BI1)	-3.94366-	1.09127
Zscore (BI2)	-3.92396-	1.11794
Zscore (BI3)	-3.74259-	.99208
Zscore (SE1)	-2.15531-	1.36978
Zscore (SE2)	-3.74404-	1.31532
Zscore (SE3)	-3.32448-	1.40158
Zscore (SE4)	-3.16439-	1.10848
Zscore (SE5)	-3.22778-	1.18687
Zscore (PLAY1)	-3.06678-	1.31711
Zscore (PLAY2)	-2.76685-	1.30776
Zscore (PLAY3)	-2.95181-	1.25108
Zscore (PLAY4)	-3.62976-	1.33091
Zscore (PEC1)	-3.78731-	1.62227
Zscore (PEC2)	-3.82820-	1.08715
Zscore (PEC3)	-2.49448-	1.55961
Zscore (PEC4)	-3.82285-	1.16732
Zscore (PEC5)	-3.57599-	1.34850
Zscore (ANX1)	-1.22083-	1.98963
Zscore (ANX2)	-1.64926-	1.50585
Zscore (ANX3)	-1.49838-	1.73884
Zscore (ANX4)	-1.44522-	1.79754
Zscore (ENJ1)	-3.44024-	1.43884
Zscore (ENJ2)	-3.55058-	1.51285
Zscore (ENJ3)	-3.34215-	1.48124
Zscore (SN1)	-2.32981-	1.60556
Zscore (SN2)	-2.51737-	1.58501
Zscore (SN3)	-2.78301-	1.50074
Zscore (IMG1)	-2.44911-	1.34008

Zscore Item	Minimum	Maximum
Zscore (IMG2)	-2.15950-	1.49847
Zscore (IMG3)	-2.68508-	1.26589
Zscore (REL1)	-3.66200-	1.30510
Zscore (REL2)	-3.62611-	1.41745
Zscore (REL3)	-3.68087-	1.43098
Zscore (OUT1)	-2.12442-	1.35331
Zscore (OUT2)	-2.67113-	1.38162
Zscore (OUT3)	-3.17943-	1.39084
Zscore (RES1)	-2.82235-	1.29035
Zscore (RES2)	-3.27418-	1.26937
Zscore (RES3)	-2.91496-	1.34300
Zscore (RES4)	-2.68650-	1.38615
Zscore (TR1)	-2.73557-	1.31613
Zscore (TR2)	-2.57401-	1.28915
Zscore (TR3)	-3.08152-	1.31300
Zscore (TR4)	-3.84719-	1.37896
Zscore (TR5)	-3.41978-	1.31126

Appendix R: Correlation Matrix Coefficients for all Items

- **Perceived Usefulness (PU):**

Correlation Matrix

		PU1	PU2	PU3	PU4	PU5	PU6
Correlation	PU1	1.000	.678	.564	.612	.514	.574
	PU2	.678	1.000	.625	.621	.429	.547
	PU3	.564	.625	1.000	.602	.464	.577
	PU4	.612	.621	.602	1.000	.524	.531
	PU5	.514	.429	.464	.524	1.000	.595
	PU6	.574	.547	.577	.531	.595	1.000

- **Perceived Ease of Use (PEOU):**

Correlation Matrix

		PEOU1	PEOU2	PEOU3	PEOU4	PEOU5	PEOU6
Correlation	PEOU1	1.000	.543	.517	.526	.491	.482
	PEOU2	.543	1.000	.583	.538	.507	.452
	PEOU3	.517	.583	1.000	.626	.545	.495
	PEOU4	.526	.538	.626	1.000	.538	.625
	PEOU5	.491	.507	.545	.538	1.000	.550
	PEOU6	.482	.452	.495	.625	.550	1.000

- **Behavioural Intention (BI):**

Correlation Matrix

		BI1	BI2	BI3
Correlation	BI1	1.000	.709	.620
	BI2	.709	1.000	.636
	BI3	.620	.636	1.000

- **Self-Efficacy (SE):**

Correlation Matrix

		SE2	SE3	SE4	SE5
Correlation	SE2	1.000	.543	.508	.486
	SE3	.543	1.000	.504	.428
	SE4	.508	.504	1.000	.583
	SE5	.486	.428	.583	1.000

- **Playfulness (PLAY):**

Correlation Matrix

		PLAY1	PLAY2	PLAY3	PLAY4
Correlation	PLAY1	1.000	.482	.501	.521
	PLAY2	.482	1.000	.579	.485
	PLAY3	.501	.579	1.000	.483
	PLAY4	.521	.485	.483	1.000

- **Perceptions of External Control (PEC):**

Correlation Matrix

		PEC1	PEC2	PEC4	PEC5
Correlation	PEC1	1.000	.452	.479	.497
	PEC2	.452	1.000	.534	.501
	PEC4	.479	.534	1.000	.614
	PEC5	.497	.501	.614	1.000

- **Anxiety (ANX):**

Correlation Matrix

		ANX1	ANX2	ANX3	ANX4
Correlation	ANX1	1.000	.465	.564	.597
	ANX2	.465	1.000	.671	.611
	ANX3	.564	.671	1.000	.700
	ANX4	.597	.611	.700	1.000

- **Perceived Enjoyment (ENJ):**

Correlation Matrix

		ENJ1	ENJ2	ENJ3
Correlation	ENJ1	1.000	.714	.691
	ENJ2	.714	1.000	.736
	ENJ3	.691	.736	1.000

- **Subjective Norm (SN):**

Correlation Matrix

		SN1	SN2	SN3
Correlation	SN1	1.000	.649	.549
	SN2	.649	1.000	.645
	SN3	.549	.645	1.000

- **Image (IMG):**

Correlation Matrix

		IMG1	IMG2	IMG3
Correlation	IMG1	1.000	.573	.444
	IMG2	.573	1.000	.604
	IMG3	.444	.604	1.000

- **Job Relevance (REL):**

Correlation Matrix

		REL1	REL2	REL3
Correlation	REL1	1.000	.648	.614
	REL2	.648	1.000	.664
	REL3	.614	.664	1.000

- **Output Quality (OUT):**

Correlation Matrix

		OUT1	OUT2	OUT3
Correlation	OUT1	1.000	.563	.458
	OUT2	.563	1.000	.515
	OUT3	.458	.515	1.000

- **Result Demonstrability (RES):**

Correlation Matrix

		RES1	RES2	RES3	RES4
Correlation	RES1	1.000	.710	.695	.620
	RES2	.710	1.000	.672	.552
	RES3	.695	.672	1.000	.678
	RES4	.620	.552	.678	1.000

- **Trust (TR):**

Correlation Matrix

		TR1	TR2	TR3	TR4	TR5
Correlation	TR1	1.000	.704	.595	.525	.467
	TR2	.704	1.000	.770	.535	.547
	TR3	.595	.770	1.000	.600	.613
	TR4	.525	.535	.600	1.000	.550
	TR5	.467	.547	.613	.550	1.000