ADOPTION MODEL FOR CLOUD-BASED E-LEARNINGIN OMANI HIGHER EDUCATION INSTITUTIONS

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DOCTOR OF PHILOSOPHY

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ABSTRAK

Hari ini, terdapat peningkatan corak berkenaan dengan penggunaan pendekatan e-pembelajaran di Institusi Pengajian Tinggi (IPT).Rangka kerja e-pembelajaran memerlukan prasarana dengan pelbagai penubuhan yang sukar untuk diurus. Pengkomputeran awan dilengkapi dengan platform pembangunan baru untuk mengatasi masalah-masalah e-pembelajaran dengan cara yang mudah dan cekap. Hari ini, IPT menghadapi pelbagai cabaran seiring dengan perubahan pesat yang penting untuk globalisasi dan penggunaan teknologi baru. Berdasarkan kajian literatur, halangan-halangan yang paling penting adalah kos prasarana, penyelenggaraan, peningkatan dan kecekapan staf Sistem Maklumat (IS) yang berupaya mengawal sokongan teknikal harian. Oleh itu, kaedah e-pembelajaran tradisional tidak lagi mencukupi kerana halangan dan cabaran yang disebutkan di atas. Manakala, E-Pembelajaran berasaskan Awan (CBEL) adalah platform e-pembelajaran menarik yang menyediakan rangka kerja e-pembelajaran yang fleksibel dan boleh skala yang boleh diakses di mana-mana, pada bila-bila masa oleh mana-mana peranti. Kajian ini menyelidik faktor-faktor yang paling penting yang mempengaruhi pengambilan CBEL oleh IPT di seluruh dunia dan di Oman sebagai kajian kes. Rangka kerja konsep kajian ini dibina berdasarkan tiga dimensi; Penilaian teknologi, Penilaian kesediaan, dan faktor-faktor budaya maklumat. Dimensi-dimensi ini diekstrak daripada dua teori penggunaan teknologi terkenal, Model penyuaian-dayamaju (FVM) dan penyebarluasan pembaharuan (DOI). Satu lagi dimensi yang dipertimbangkan adalah faktor-faktor budaya maklumat (IC) yang dipilih berdasarkan pengaruh pentingnya terhadap penggunaan teknologi dan ianya relevan dengan objektif kajian ini. Dalam kajian ini, teori pengambilalihan yang terkenal ini diintegrasikan dan diperluaskan dengan menambah lebih banyak faktor selepas menganalisis beberapa faktor utama yang diterima pakai dalam konteks IPT. Secara keseluruhannya, hipotesis yang dicadangkan keempat belas telah dibangunkan untuk mengkaji pengaruh pentingnya terhadap penggunaan dan pemeriksaan untuk menguji kecergasan model yang dibangunkan untuk CBEL ke IPT di Oman dan daya majunya juga. Soal selidik yang berstruktur yang terdiri daripada soalan-soalan piawai dengan skala tetap, ia Soal selidik berstruktur digunakan untuk pengumpulan data primer dari sampel ahli-ahli akademik dan kakitangan profesional IT dari 32 IPT di Oman. Penduduk kajian ini berpengetahuan tentang perkhidmatan pengkomputeran awan serta ciri-ciri dan model-modelnya. Pakej Statistik untuk Sains Sosial (SPSS v. 25) dan Partial Least Squares (SmartPLS v.3) digunakan sebagai alat analisis bagi menilai faktor-faktor model CBEL yang dibangunkan dan mengkaji hubungan di antara mereka. Model akhir disediakan berdasarkan hasil penemuan yang membuktikan bahawa penyuaian, dayamaju dan faktor-faktor budaya maklumat sangat mempengaruhi keputusan dalam pengambilan CBEL oleh IPT di Oman. Tugas, kelebihan relatif, kompleksiti dan keserasian mempengaruhi kepadanan sebagai faktor-faktor teknikal. Model terakhir menunjukkan bahawa 68.2% daripada faktor penting untuk penggunaan CBEL dilindungi, dan dengan menggunakan model ini, 56.1% peningkatan dapat dicapai dalam kualiti perkhidmatan akademik. Tahap yang dicadangkan nilai pekali Laluan (β) yang signifikan ialah 0.1, manakala dalam kajian ini, terdapat pada t-statistik 1.217 dan 16.967.Pentingnya kajian ini adalah, IPT boleh mengamalkan CBEL dengan lebih yakin, mengurangkan kos yayasan, dan mengurangkan masa menunggu untuk menyampaikan perkhidmatan e-pembelajaran kepada pelajar mereka.

ABSTRACT

Today, there is a developing pattern with respect to the utilization of e-learning approach in the Higher Education Institutions (HEIs). E-learning framework requires immense up-front infrastructure with numerous establishment which is not easy to be managed. Cloud computing comes with a new development platform to overcome e-learning issues in an easy and cost-efficient way. Today, HEIs are facing numerous challenges to be in line with the rapid transformation which is essential to globalization and new technology adoption. Based on the literature, most significant obstacles were the cost of up-front infrastructure, maintenance, upgrading and competent of Information Systems (IS) staff to handle daily technical support. Thus, the conventional e-learning method is no longer enough due to the above-mentioned obstacles and barriers. In the other end, Cloud-Based E-Learning (CBEL) is an attractive e-learning platform that provides a flexible and scalable e-learning framework which can be accessed anywhere, anytime and by any device. This research investigated the most significant factors influencing CBEL adoption by HEIs globally and in Oman as a case study. The conceptual framework of this study has been built based on three dimensions; Technological evaluation, Readiness evaluation, and Information culture factors. These dimensions were extracted from two renowned technology adoption theories, Fit-Viability Model (FVM) and Diffusion of Innovation (DOI). Another dimension considered is Information culture (IC) factors which were selected based on its significant influence on any technology adoption and this is relevant to the objectives of this study. In all, fourteenth proposed hypotheses were developed to examine its significant influence on the adoption and examined to test the fitness of the developed model for CBEL to the HEIs in Oman and its viability as well. Structured questionnaires which consists of standardized questions with fixed scale, it were used for the primary data collection from a sample of academics and IT professional staff from 32 HEIs in Oman. The population for this study was knowledgeable about cloud computing services and its features and models. Statistical Package for Social Science (SPSS v. 25) and Partial Least Squares (SmartPLS v.3) we reused as analysis tools to evaluate the developed CBEL model factors and to examine the relationship among them. The final model was provided based on the result of the findings which proved that Fit, Viability, and Information culture factors significantly influenced the decision for CBEL adoption by HEIs in Oman. Task, Relative Advantages, Complexity, and Compatibility influenced the fitness as technical factors. The final model showed that 68.2% of the significant factors for the adoption of CBEL was covered, and by adopting this model, 56.1% of improvement can be achieved in the quality of academic services. The suggested level of significant Path coefficient (β) value is 0.1, while in this study, were at t-statistics 1.217 and 16.967. The key significant of this study is that, HEIs can adopt CBEL with more confidence, reducing the foundation cost, and decreasing the waiting time to deliver e-learning services to their students with quality consideration.

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LIST OF ABBREVIATIONS

CBEL	Cloud-Based E-Learning
CBT	Computer-Based Training
CMS	Course Management System
DOI	Diffusion of Innovation
DE	Distance Education
ENISA	European Network and Information Security Agency
HEIs	Higher Education Institutions
H	Hypothesis
IaaS	Infrastructure as a Service
IC	Information Culture
IP	Internal Protocol
IT	Information Technology
ICT	Information and Communication Technology
IBT	Internet-Based Training
MoE	Ministry of Education
MoHE	Ministry of Higher Education
NaaS	Network as a Service
NIST	National Institute of Standards and Technology
NAQF	National Academic Qualification Framework
OAAA	Oman Academic Accreditation Authority
OAC	Oman Accreditation Council
PaaS	Platform as a Service
PLS	Partial Least Squares
QAS	Quality of Academic Services
SDN	Software Defined Network
SLA	Service Level Agreement
SPSS	Statistical Package for the Social Science
SaaS	Software as a Service
UTUAT	Unified Theory of Acceptance and Use of Technology
TAM	Technology Acceptance Model
WBT	Web-Based Training

CHAPTER 1

INTRODUCTION

1.1 Introduction

Cloud computing refers to ‘‘sharing computing technology services that provide accessible resources such as storage, computing control, and application delivered through the Internet as service’’ (Arpaci, 2016; Batista et al., 2017).Cloud computing is also defined as a technology or computing model that relied on the Internet and remote servers to help preserve and maintain data and applications (Riahi, 2015). Various applications of cloud computing, such as Google Apps, G-Drive, Dropbox, Sky Drive, and I-Cloud can be easily integrated with education platform(P. Y. Thomas, 2011). It brings new technological advancement where the technology services it provides become computing resources (Chengyun, 2010). Cloud computing has been attributed to the use of computing resources, specifically hardware and software, where they are delivered as a service in a network. It is considered highly scalable and with a possibility of creating virtualized resources that can be made available to users. The users do not need any special knowledge on cloud computing to interact with; they can easily communicate via the Internet with remote servers. The servers are able to exchange computing slots by themselves (Alsaadi, 2012). Cloud computing is considered to be one of the emerging technologies that have a significant impact on the learning environment in HEIs (Alharthia et al., 2017; Ercan, 2010).

E-learning makes use of the Internet and different digital information on learning and teaching activities as key components in the implementation of modern educational technology. This learning process is implemented by ICT systems inside and outside classroom educational experiences on technology (Almazroi et al., 2016). A common platform such as Computer-Based Training (CBT), Web-Based Training

(WBT) or Internet-Based Training (IBT) is the most terminologies associated with E-learning. E-learning enables the transfer of skills and knowledge to learners in less time compared to what they spend on traditional learning (Riahi, 2015). E-Learning allows learners to access a broader view of materials in accordance with personal competence devices with no limitation of time and space. By using any of E-learning applications such as Web-based learning, virtual education opportunities, computer-based learning, and digital collaboration, all types of information can be transferred in media such as text, image, audio, animation and video (Hemanth & Mahammad, 2016). In conclusion, the Cloud Computing (CC) and E-Learning can be combined together to have a Cloud Based E-Learning (CBEL) where the higher education institutions can be benefited from for having a modern form of E-Learning.

1.2 Background and Motivation

European Network and Information Security Agency (ENISA) defined cloud computing as "On-Demand service model for IT provision, often based on virtualization and distributed computing technologies"(Catteddu & Hogben, 2009).The National Institute of Standards and Technology(NIST) defined cloud computing as "a computing model that enables convenient, ubiquitous, and on-demand network access to a shared pool of computing resources, including networks, servers, applications, storage, and services"(Mell & Grance, 2011)that can be released with little management effort or service provider interaction. NIST have listed the five best characteristics of cloud computing asbroad network access, on-demand self-service, rapid elasticity or expansion, resource pooling, and measured service. Further, it has listed three of the most essential service models as a platform, software, and infrastructure. These are coupled with four deployment models- private, public, community, and hybrid which can in delivering computing services(Taylor et al., 2014). Cloud services can be grouped into the following categories: Infrastructure as a Service (IaaS); Software as a Service (SaaS); and Platform as a Service (PaaS). Consequently, the cloud computing can be defined as a technology offered a virtual service to be adopted and pay as you use without need to worry about the up-front infrastructure or any other operational expenditure.

1.2.1 Cloud Computing

The transformative advancements in digital technology that have arisen in the last part of the 20th century have typically seen higher and more rapid rates of adoption in the developed world than the developing world. Typical factors impeding technology services adoption include knowledge, infrastructure, cost, government policy, education, user resistance, and security challenges (Svantesson & Clarke, 2010).Many of these factors are particularly salient in the developing world. Whereas this trend has continued in the early years of cloud computing, more recently, there has been considerable attention given to cloud computing in developing countries from global IT players such as IBM, Microsoft, VM ware and Amazon and from national governments, international agencies, and IT firms (Pett et al., 2010).

Cloud computing is a good alternative to running own-managed systems that HEIs should consider due to the relative lack of in-house IT expertise(S. K. Sharma et al., 2016), in addition to hardware upgrades and software updates issues. Political instability and the potentials of irreparable damage to property during the war are other reasons why embarking on cloud computing is a viable option. Given the lower upfront cost of cloud computing services compared to the traditional method on the premise of IT infrastructure models, it has been asserted that the cloud model will not only provide significant development opportunities for the developing world but will go as far to lessen the development gap with the West (Pett et al., 2010), as geographical factors will no longer dominate in determining who can and who cannot have access to leading-edge technologies.

1.2.2 E-Learning

According to (Mayer et al., 2009),e-learning is referred to the use of ICT and network in learning and teaching. The growth of e-learning is attributed to the increased access to ICT and the decreasing cost of maintenance(Jain et al., 2012). Furthermore, ICT's capacity to support multi-media resource-based learning is dependent on e-learning. Currently, most conventional education systems are becoming less practical to be used for development as they are not able to catch up with the new changes of the learning demand (Almazroi et al., 2016). For this reason, computer networks have

presented opportunities for it. Furthermore, HEIs are in search of an effective method to implement ICT services without much cost of upgrading and maintenance.

Traditional web-based e-learning mode is found in the interior of most HEIs, which results in problems such as additional investment to maintain the system(Lian, 2015). Traditional e-learning network consists of six parts, including content creation, Internal Protocol(IP), content management, utilization and curriculum development, learning management, delivery, and development (Aung & Khaing, 2015), and this takes much time of the HEIs. Cloud computing platform provides an appropriate variety of computing resources with its attractive technology that is more reliable because of its scalability and effective usage in terms of resources (Bahrami & Singhal, 2015). It can also be used under different circumstances with limited resources. The resources used can be applications, network servers, platforms and infrastructure segment, and services. Based on the discussion on the issues of traditional e-learning, cloud computing delivers its services based on the level of demand for sufficient access to the network, effective flexibility, and data resource (Elgelany & Alghabban, 2017).

1.2.3 Cloud-Based E-Learning (CBEL)

Cloud-Based E-learning (CBEL) provides the feature of virtualization with managed, expensed, migrated and backup of services through the virtualization phenomena. Enabling the feature of virtualization in the e-learning platform provides the pooling of resources with distributed computing and on-demand services(Hemanth & Mahammad, 2016). CBEL educational system capitalizes on the server, storage, and network equipment of cloud infrastructure. CBEL models allocate and assign teaching staff and deliver regular lectures through the internet. The quality of teaching content is enhanced by integrating multimedia in online content. CBEL also facilitates learning by providing a platform for cooperative learning that helps in completing group-based projects (Aruna & Prakasam, 2013). CBEL architecture provides a powerful computing and storage capacity due to distributed computing. It provides the service of large data storage space and continuous availability of service to students through the Internet. Cloud computing facilitates the continuous delivery of quality service availability by integrating the service of mass storage with efficiently performing computing and processing power (Anshari et al., 2016).

CBEL provides flexibility in all educational institutions, especially HEIs, and delivers an effective deployment model to fulfill the dynamic demands (Subashini & Kavitha, 2011). It can support a lot of educational institutions and help resolve some of the most common challenges, including quick and effective communication, cost reduction, privacy, security, flexibility, and accessibility (Koch et al., 2012). Moreover, CBEL is termed as the next new invention to help sustain the current information technology services and products that are on demand, and this is exactly what HEIs need -moving the processing task from a local device to the data-center facilities.Many researchers have indicated that cloud computing plays a significant role in changing the nature of learning and business, hence (Priyadarshinee et al., 2017), one of these researches have examined the relationship between cloud-based-eLearning (CBEL) adoption factors theoretically and empirically, and its influence on the quality of academic services (QAS) in Higher Education Institutions (HEIs). Moreover, this study aims to present an extended model of adoption in the context of HEI in Oman by integrating well-known adoption theories.

In spite of various existing adoption models for isolated cloud computing adoption, isolated e-learning adoption, and very few for CBEL adoption, still, the HEIs context has not been investigated empirically by a model which its main contribution includes information culture (IC) factors, along with Fit-Viability Model (FVM) (Tjan, 2001). This study focused on three dimensions; First dimension is a technical evaluation, consisting of four factors (Task, Relative advantage, Complexity, and compatibility) originally extracted from the Diffusion of innovation theory (DOI) (Rogers, 2003), and Task construct which was extracted from the Fit construct of FVM. The second dimension is Readiness evaluation which consists of three factors (Decision makers, Cost reduction and IT readiness) extracted from Viability construct of FVM. Finally, the third dimension is Information culture factors which consist of four factors (Information integrity, Information formality, Information control, and Information pro-activeness).

1.3 Problem Statement

The current process of implementing e-Learning system requires a high budget, financial investment, and human resources to build an e-Learning system with updated infrastructure in terms of hardware and software. Centralizing the computing assets and

efforts is the strategic option for the HEIs towards reducing the cost and workforce, and this option is offered by CBEL services. Cloud computing is the hot area nowadays due to its capability of attracting HEIs, but the level of reluctance is very high (Abbas et al., 2015). The concept and potential application of CBEL in higher educational institutions (HEIs)in Oman are new (Al-Balushi et al., 2016). Few studies have explored and examined the feasibility of CBEL at HEIs in Oman in view of the rising student population of graduates qualified for HEIs (Al-Samarraie & Saeed, 2018). CBEL is seen to have the potential of "minimizing" the challenges of rising admission demands at HEIs(Al Musawi & Abdelraheem, 2004). CBEL can be very effective in providing better academic services. CBEL adoption can help in overcoming the HEIs challenges explained earlier during the implementation of their e-learning ecosystem. Oman has 29 HEIs; SQU is the first and only public university in the country which opened in 1986.

In addition, the infrastructural concept associated with traditional e-Learning model is based on self-built/self-maintained environments. Aspects of cloud computing are yet not available, thus, the sort of barriers/factors to CBEL entry that are frequently highlighted pertained to investment costs, lack of IT personnel, competence availabilities, and lack of computing equipment (Al-Senaidi et al., 2009); (Saleem & Al-Suqri, 2015). Oman, like other developing countries, without getting the advantages of cloud computing to migrate their e-Learning system to cloud-based model, will continue struggling with many challenges that we have highlighted in the previous section, such as lack of open-budget, lack of infrastructure, lack of experts, and cost of maintenances and upgrading. Decision makers in HEIs need to evaluate this CBEL in term of its effectiveness.

Based on the above discussion, we have noticed that the conventional e-Learning systems are not sufficient any more to catch up the demands of the market in the HEI context (with maintaining the QAS) due to the high up-front cost of the traditional e-learning system in terms of software updates, hardware upgrade, and maintenance. In another hand, HEIs in developing countries like Oman are very reluctant to migrate their e-learning system to the cloud-based model. Furthermore, there is a lack of literature investigating the CBEL adoption factors. This loophole has encouraged the author to investigate the factors that influence the adoption of Cloud-Based E-Learning in Oman. Furthermore, this research developed a CBEL adoption

model consisting of the factors influencing CBEL adoption in HEIs in Oman by attempting to highlight the most significant factors influencing CBEL adoption. This model was developed after reviewing the relevant literature and examined the relationship of these factors with the develop adoption model based on the result of the empirical study. This study attempts to identify the significant factors that would lead to a successful implementation of CBEL adoption in HEIs, practically Oman. These factors are grouped into three dimensions - Technological evaluation factors (TE), Readiness evaluation (RE) factors, and Information culture (IC) factors as per the factor's nature wise, this will offer a comprehensive model. These factors were built based on the renowned IS adoption theories - DOI and FVM which formed the adoption model of this study.

1.4 Research Questions

This study will focus on the factors that affect the adoption of CBEL in HEIs for the quality of its academic services. As per the above discussion, this research problem is broken down to form the research questions. Hence, the main question of this research is: How can the CBEL adoption model be successfully adopted and validated in the HEIs in Oman? Towards answering this research question, the following sub-questions are to be addressed:

RQ1: What are the most significant factors that affect the adoption decision of CBEL in Higher Education Institutions (HEIs)?

RQ2: How to develop adoption model that can be used for CBEL and QAS in HEIs in Oman?

RQ3: What is the relationship between these factors, CBEL adoption, and the Quality of Academic Services (QAS) in HEIs in Oman?

RQ4: How can this model be validated to assess adoptability of CBEL towards successful implementation for HEIs in Oman?

This research developed an extended model of combined features; e-learning, and cloud computing named "Cloud-Based E-Learning (CBEL)". A key research objective of the study is to investigate/examine the factors affecting the adoption of CBEL in Higher Education Institutions (HEIs) in Oman.

1.5 Research Objectives

The main aim of this research is to identify and validate the significant factors affecting the adoption of CBEL for HEIs decision makers in Oman. In order to address this research problem, and to answer the above research questions, the following objectives are to be achieved:

(1) To determine the factors that significantly affect the adoption of CBEL in Higher Education Institutions (HEIs).

(2) To develop an adoption model of the relationship between the factors, CBEL adoption, and quality of academic services (QAS).

(3) To investigate the effect of these factors on CBEL adoption as well as CBEL on the QAS in HEIs in Oman.

(4) To validate a CBEL adoption model for HEIs' successful implementation in Oman.

1.6 Scope of the Study

This study is limited to the HEI context, particularly in Oman as a case study. The study population consists of Academics and IT professionals who are knowledgeable about cloud computing and e-Learning. The scope of this research covers the area of CBEL in HEIs in Oman as a case study. Omani HEIs are in use of the traditional e-learning and cloud computing services for email and storage services, but reluctant to use CBEL. In specific, this research investigates the adoption factors of CBEL in HEIs in Oman.

The following adoption theories were studied: Diffusion of Innovation (DOI) (Rogers, 2003), Technology Acceptance Model (TAM)(Davis, 1989), Unified Theory of Acceptance and Use of Technology (UTUAT) (Venkatesh et al., 2003), Information Culture factors(IC) (Choo et al., 2008), and Fit Viability Model(FVM) (Liang et al., 2007).This research was conducted by an online survey-based method using a questionnaire that targets the knowledgeable entities on cloud computing and e-learning in HEIs, especially the decision makers for CBEL adoption.

1.7 Significance of the Study

Cloud computing adoption is a hot research area for the past few years (Alharthia et al., 2017);e-learning has not been considered to be transferred to cloud-based in HEIs in Oman (Almazroi et al., 2016); the role of CBEL for HEIs has received little attention(Ahmed, 2015);it is hard to find literature that investigated the factors affecting CBEL adoption in HEIs in Oman. Therefore, this research will augment the lack of literature on CBEL in the field of education institutions in Oman. Policy makers and academic researchers in the future may find some significant values from the outcomes of the study, particularly concerning ideas on e-learning initiatives of HEIs.

Oman has one public university (Sultan Qaboos University(SQU)), 10 public colleges (Applied& Technical colleges), and 29 private universities and colleges under the umbrella of Ministry of Higher Education (MoHE)(MOHE, 2018). These HEIs are located in different geographical location, mainly located in Muscat governance. Cloud-computing services and models can help in improving the learning and quality of academic services (QAS). Therefore, it is significant to develop a model for Omani HEIs context based on the above-mentioned theories.

This study will make an original contribution to the study of e-learning adoption in general. In a more specific area, and based on the context of HEIs, future studies can be directed towards refining or furthering the inquiries that have been made and presented, towards producing a more robust finding. Lastly, in view of the dynamic nature of ICT advancements, this study presents fresh perspectives on CBEL by which no study identical to or of similar context is known to exist prior to the completion of this research. This research contribution is explained in detail in the conclusion chapter (6.2.2). The importance of this research can be summarized as follows:

- HEIs can adopt CBEL with more confidence, reducing the foundation cost, and decreasing the waiting time to deliver e-learning services to their students. This would influence the HEI image among the competitors and for competitive advantage.

- Omani HEIs with CBEL adoption can open more co-operation with other universities locally and internationally; this would give several opportunities to upgrade the level of benchmarking to international standards.

- The developed model is a unique model in terms of its dimensions and context as it is one of the recent and new models that focused on technological and non-technological factors.

- This study will expand the body of knowledge with consolidate literature to the researchers and decision makers, in addition to other theoretical and practical implementation which are discussed in chapter 6.

1.8 Organisation of Research

This study consists of six chapters, including (1) Introduction, (2) Literature Review, (3) Research Methodology, (4) Research Model Development, (5) Data Analysis and Result, and (6) Conclusion, as shown below.

Chapter One- Introduction to the research. Introduces the background of this research problem which leads to the problem statement. Next, this problem statement is broken down into the main question with four sub-questions. Four objectives are formed to answer the four sub-questions. These are to be achieved through this research. The significance of this study is explained at the end of this chapter.

Chapter Two- discusses the literature review, provides a detailed survey into the background to cloud computing and e-learning. It investigates the current state of the factors affecting the adoption of new technology in general and CBEL in particular in the developed and developing countries. In addition, renowned adoption theories are critically discussed in order to select a theory to be adjusted to become the research model.

Chapter Three- outlines the research methodology employed in this study and the research hypothesis derived. It includes data collection, sampling techniques, and analysis procedures. It begins with reviewing the philosophical paradigm in information systems research, then, discuss the various research approaches, methods, and data collection inputs. A justification is highlighted for the selected methodology and its suitability. The roadmap/framework for this research help in highlighting the actions to be taken for each step- in order to get answers to the research questions. Finally, the proposed Cloud-Based E-Learning adoption model is presented; the model's constructs are defined, the hypotheses are discussed.

Chapter Four- presents the research model development for the proposed model for the context of this study. The initial factors of the model and the hypotheses are discussed and explained in term of definitions and originality. In addition, the definitions of the proposed model are provided.

Chapter Five- discusses data analysis and the recent literature about the achieved results. The chapter also presents how all the research questions are answered, leading to the building of the final model. The implications of the research and the practice are also discussed in this chapter. It presents the research contribution, limitations, and recommendations for future practice and research. Full statistical analysis is also discussed.

Chapter Six –This chapter mainly focuses on the conclusion of the result of the study on the factors that affect CBEL adoption by HEIs. The summary of the research objectives and achievements are also discussed. This chapter includes the implications of this research, consisting of theoretical and practical implications. Also, the limitations of this research and the suggestions for further research are included in this chapter. The final section of this chapter is the summary.

1.9 Summary

This chapter elaborated on the subject of this study, and introduced the related background and problem. Also, presented the problem statement based on the background of E-Learning and cloud computing adoption in HEIs context in developing countries and Oman in particular. Therefore, the problem was broken to main question and sub-questions and the related objectives for the study. However, the scope and the significance of the study were identified. Finally, the organisation of the thesis was presented along with the structured phases with clear road map.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed the current theoretical concept in the literature which will act as a guide for this research. The review is focused on cloud computing adoption for e-learning in HEIs. The aim is to investigate the significant factors that affect the decision of Cloud-Based E-Learning adoption; to answer the research questions, then, interpret the results and make recommendations. The next discussion is on the status of CBEL in Oman as a case for the developing countries, as well as a review of the literature on the challenges of CBEL. Firstly, the author looked at the actual setting of cloud-computing infrastructure for e-learning purpose; secondly, the author assessed the impact of e-learning on the adoption of cloud computing; thirdly, the author discussed the leading theories of technology adoption and uptake, namely the Diffusion of Innovation (DOI) (Rogers, 2003), Technology Acceptance Model (TAM)(Davis, 1989), Unified Theory of Acceptance and Use of Technology (UTUAT) (Venkatesh et al., 2003), and Fit Viability Model (FVM) (Liang et al., 2007). Each of these adoption theories was discussed and analyzed thoroughly in the coming sections in term of their suitability in understanding the factors that affect the adoption of CBEL in HEIs in Oman.

The keywords of this research are Cloud Computing, E-learning, Cloud-Based E-Learning, and the Quality of Academic Services as shown in Figure 2-1. These keywords were discussed thoroughly in term of definition, architecture, and related issues based on the literature. Then, the author narrowed down to the HEIs context where the successful implementation, challenges, concerns and advantages of CBEL were discussed for the HEIs context. Finally, the renowned IS adoption theory and its

constructs were discussed, compared and justified, leading to the building of the conceptual model for CBEL.

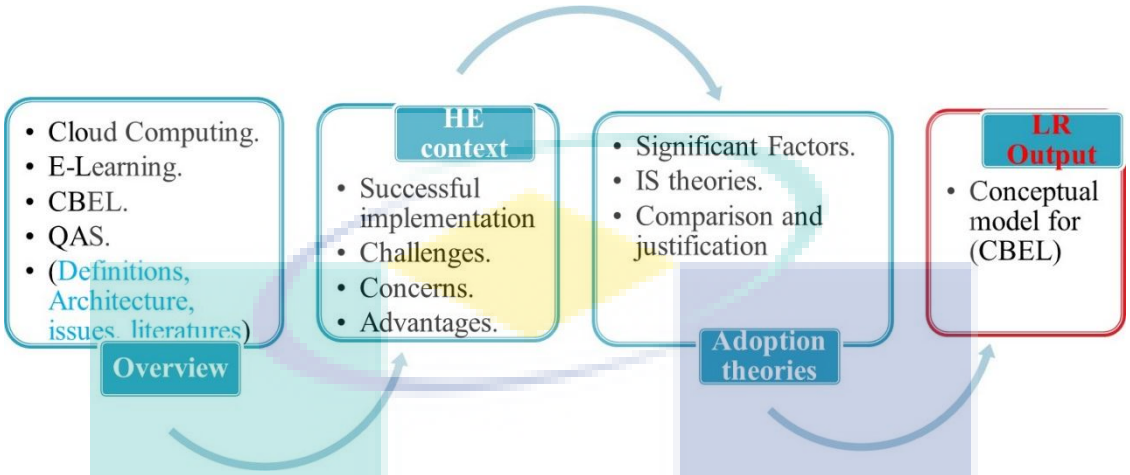

Figure 2-1 Literature Review Roadmap

2.2 E-Learning

E-learning has found its place in many platforms today, including the higher education sector. Learners are often the main group involved in e-learning systems. Students benefit by using online courses, writing exams, sending feedbacks, sending projects and interaction (Almazroi et al., 2016). On the other hand, learners interact with the content, prepare tests, assess the tests, homework, and projects, and communicate the final feedback to the students. The standard e-learning system was developed as distributed applications (Sarrab et al., 2012). The learner in the HEIs may use a mobile device or a desktop computer to access an application which can be a simplified web browser or a dedicated one. However, none of these applications would run without technical requirement in the likes of servers and other physical hardware that comprise the whole systems architecture, and these technical requirements are very costly (Abbas et al., 2015), Figure 2-2illustrates an overview of the architecture of an e-learning system based on Cloud computing (Menzel et al., 2015). Any Higher educational institution may develop its own e-learning system without having to worry much about up-front entry-cost that traditionally used to be huge. Adoption of CBEL will handle the e-learning for the HEIs without worrying about any technical requirements.

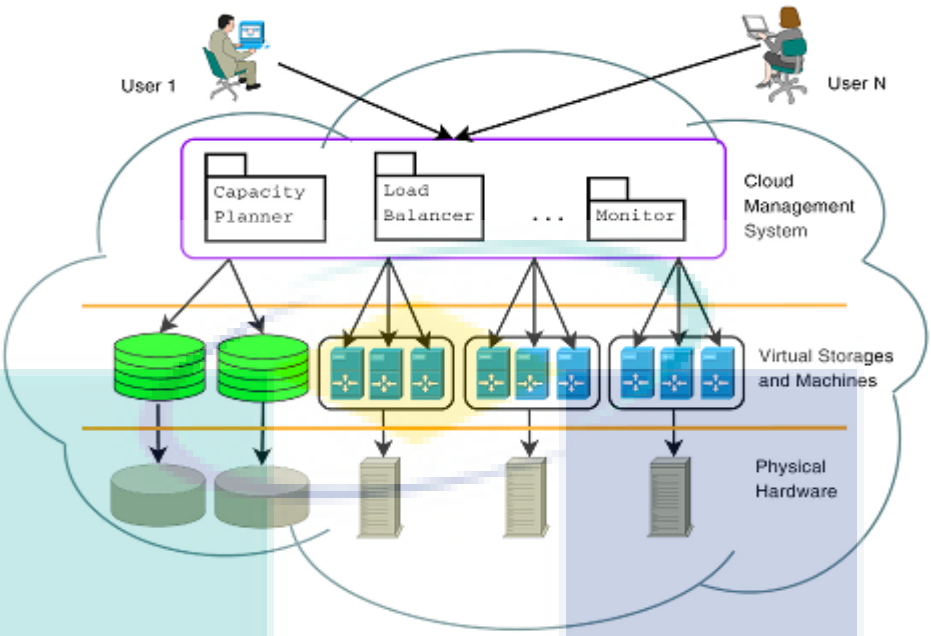

Figure 2-2 Overview of an E-learning Platform based on CC Infrastructure

2.3 E-Learning Approach and their Impact on Learning

The impact and effectiveness of e-learning also vary with different types and nature of learning models deployed with technology (Al-Samarraie & Saeed, 2018). Every model contributes differently and uniquely to augment the learning experience and learning outcomes of the students. The deployment of e-learning is a medium to facilitate and manage learning. It involves the efficient utilization of all the tools of a virtual learning environment like Moodle, web communication technology, and the Internet for accessing the online learning environment(Al Musawi & Abdelraheem, 2004).

Electronic framework is also used to support and provide feedback to the students on their projects and assignments. It also facilitates the two-way communication between students and teachers which is essential for the learning process. The deployment model in which the e-learning platform is used as a medium does not directly contribute in the learning process., but by providing easy and convenient access to the learning material and content, it influences the learning process of students in e-learning platforms(Finlayson et al., 2006).

The use of e-learning as a presentation model is developed to manage and control the face-to-face interactions of teachers and students. In this deployment model of e-learning, content is used for the presentation, including powerpoint presentations, online worksheets, and interactive whiteboards (Aljenaa et al., 2011). The proper use of these tools is possible only by developing the technical capabilities of users involved in the learning process. Different software applications on the e-learning platform demand different technical expertise.

Besides technical knowledge, the teaching expertise of the instructor facilitates interactive presentations and allows learners to communicate and learn in a friendly and interactive learning environment(Guan et al., 2014). The use of e-learning as a problem-solving learning tool deploys the technology to manage the controlled and uncontrolled student sessions with interactive whiteboards and distributed computers. It employs sophisticated software for performing calculations and predictions, designing and controlling online data collections and modeling which enhances group and individual learning (Finlayson et al., 2006).

Web-enhanced mode of e-learning augments face-to-face interaction in the learning environment and efficiently uses the services of the web for the management of online courses (O. Ali et al., 2016). In the mixed mode, basic teaching methodologies are redesigned and face-to-face interaction teaching practice is exchanged with online instruction and teaching methods. In this deployment of e-learning, classroom conventional teaching practices are integrated with technologically supported learning opportunities. Web-based learning benefits the users and organizations by reducing the cost as the use of the internet; the web has limited the use of the physical environment (Britt, 2015). This feature adds to the convenience, suitability, and accessibility to the student in the e-learning environment. The easy upgrading feature and the teacher's feasibility to enrich the quality of learning content through the addition of multimedia content has made it easily understandable and comprehensible to the students.

The complete online instruction mode eliminates the face-to-face interaction feature and replaces it with a completeonline teaching service. Complete online presence has limited the use and demand for on-campus facilities (Al-Ghaith et al., 2010). After evaluating the effectiveness of all e-learning teaching modes, it could be inferred that mixed mode is considered more efficient and effective in the learning

environment. It has combined the important and effective features of traditional classroom learning with technology to produce profound learning outcomes (Bourlova & Bullen, 2005).

The learning approach provided by e-learning is considered a learner's centric approach as it provides the opportunity to evaluate and reuse the common and diverse areas of knowledge. The benefits of cloud computing, like on-demand access and utilization of network resources with transparent allocation in collaboration with the academicenvironment has effectively deployed the infrastructure resources to deliver effective learning environment to the users (P. Sharma, 2014).

2.4 Cloud Computing

Cloud computing is a utility computing approach for managing and delivering computer-related functions and services using the Internet(Akande & Van Belle, 2014). The computing functions are operated and maintained in a data-center, and it extends its resources, capabilities, and services to clients based on subscription basis or size of data use. For example, information-sharing may conveniently occur by connecting people in the network as cloud computing allows users to store and retrieve digital data on-demand from a remote server, otherwise known as cloud storage. There are cloud computing services (hosting and managing) by third-party providers that HEIs may eventually avail for their own e-learning systems (Rovai et al., 2007). Figure 2-3 showed the most common features of cloud computing.

The concept of cloud computing was barely mentioned in any of the extant articles (Al Musawi & Abdelraheem, 2004); (Saleem & Al-Suqri, 2015). Therefore, to fill the gap in the literature, this study added several information on cloud computing adoption in Oman which combined cloud computing services and e-learning platform to form a CBEL in HEIs in Oman.

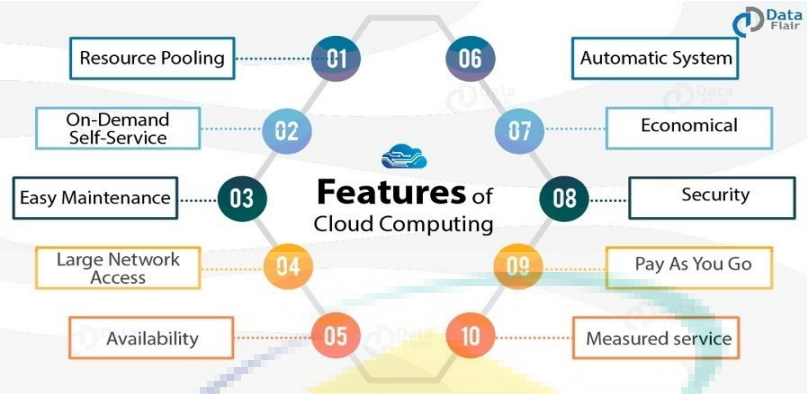

Figure 2-3 Cloud Computing Features

Source: Almajalid, (2017)

2.5 Cloud Computing Models and their Impact on Learning

The three deployments models of cloud computing services (SaaS, PaaS, and IaaS) can be adopted for the e-Learning purpose as each of them delivers specific need and solution (Rovai et al., 2007). There are public, private, community, and hybrid cloud computing models as shown in Figure 2-4. (Alrousan & Jones, 2016).

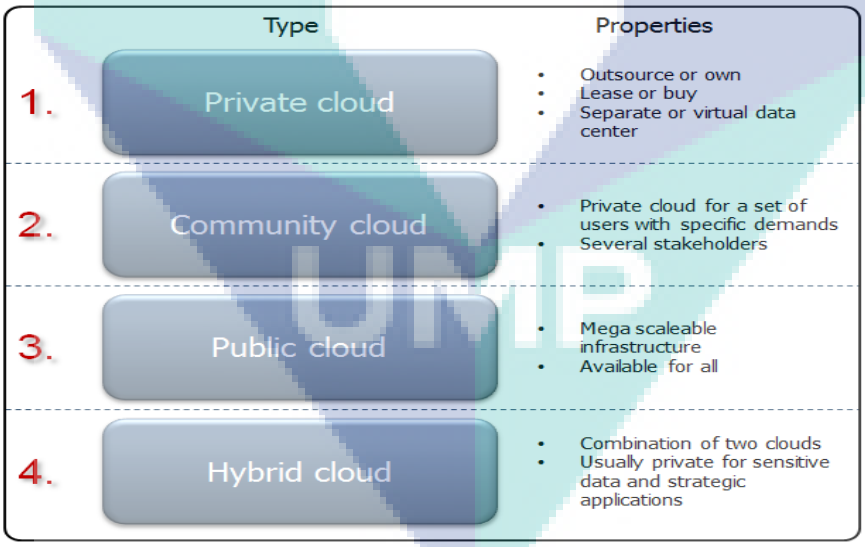

Figure 2-4 Cloud computing deployment models

Source: VISMA, (2017)

The deployment of cloud-computing models may vary depending on the terms. There are four deployment models that have been identified(Mell & Grance, 2011)and each of them contains specific characteristics that support the requirements of the users of cloud computing in specific ways. A private cloud is a cloud-computing

infrastructure deployed, operated, and maintained by an organization. The operation processes are done in-doors or on premises with a third party (Akande & Van Belle, 2014). A public cloud is a cloud model which can be accessed by the public with the help of a cloud service provider. As a result, the consumer is able to develop and deploy a particular service in the cloud infrastructure given a little financial budget compared to the huge capital expenditures that are associated with extra deployment models (Batista et al., 2017).A community cloud is a cloud model which can be shared by several organizations with the same requirements and interests. This allows the organization to cut the expenditure to allow for its establishment (Almajalid, 2017). The operation processes are done in-doors or on premises with a third party.

A hybrid cloud is a cloud model that comprises of a number of clouds, with the ability to allow data and applications to be transferred from one cloud to another(Chandran & Kempegowda, 2010). The cloud can be a combination of both public and private clouds that retain the data in an organization. Internet computing is made up of different forms of computation. The software and hardware need the Internet to perform this process. Internet computing can be referred to as a model that enables convenient and on-demand network access to a huge pool of other configurable computing resources such as servers, services, networks, storage, and applications. These resources can be provided with little effort and service provision interaction (Mell&Grance, 2011).

According to (Koch et al., 2012), the most common approaches to cloud computing in institutions are private and public cloud models. For instance, the private cloud model provides the institution with a chance to have full control of data security, services, identity management, resources, and applications (Vujin, 2011). For example, any student taking a course in computer science can benefit from this model since they are provided with a platform for application development, as well as complex software tools. According to literature, there is an increase in the number of private cloud solutions incorporated in the e-learning systems for HEI use (Radenković et al., 2014).

The processes involved in designing a private e-learning cloud differs from the one used in the business field. In the business sector, the design focuses on costs and security of the system, while the e-learning systems look for other aspects to fulfill the need(Durairaj & Manimaran, 2015). In reference to the emerging trends in IT, to

achieve flexibility in any design, the IT infrastructure needs to be flexible and expandable to support different teaching courses in this field. When it comes to e-learning, there must be an efficient use of resources and provision of effective e-learning services as per demand(Ashtari & Eydgahi, 2017). Teachers should be able to define cloud computing services that ought to be offered to their students according to the courses they are taking. Further, the cloud computing model should be simplified to allow users to access any information and applications at any time and place.

There are several steps involved in designing and implementing the cloud computing infrastructure based on e-learning; conceptual design on educational needs: these include (i) defining educational aspects, e-learning services, and anticipated workloads(Alrousan & Jones, 2016);(ii) designing network and cloud infrastructure: some of the main components to be designed include cloud infrastructure, network infrastructure, and management services(Chang et al., 2017); (iii) designing and executing cloud services: this involves deployment of e-learning systems on the cloud computing infrastructure together with the learning management system(Fernandes et al., 2014); (iv) testing and evaluation: this involves testing the computing infrastructure and evaluation of the performance of teachers and students to get their results(Hemanth & Mahammad, 2016).

2.6 Deployment of Cloud Services' Architecture

Any service that is implemented on the cloud model is divided into two major categories: services for learners and services for teachers. Both teachers and students sometimes use some of these services. They include the Moodle learning system, which is a platform that provides various services that help in the learning process of the student (O. Ali et al., 2016) for activities management system and course management resources. This offers a brief description of the most frequently used services for students and teachers that are found in the cloud infrastructure. For the teachers, there are services that are involved in teaching and administrative processes(Abbas et al., 2015). The Intranet portal is an example of a single access point service for all teachers that was designed with the help of the Word press content management system. Its authentication is Lightweight Directory Access Protocol(LDAP)-based which means that it is created by the user's requirements(Gujar et al., 2013). The portal works together with LDAP servers to provide the users with good service and enough

information needed to conduct their activities. It enables easier development, tracking, and broadcasting of projects.

This service provides services such as time tracking, reporting services, role management etc. Most staff take part in several projects that take place at the same time. Therefore, there is a need for a good project management solution (Braglia & Frosolini, 2014).Such a service is implemented by different software such as Redmine. In addition, teachers are provided with a Pydio tool that helps in file management which can be done from any place. Pydio tool (originally Ajaxplorer) is software that enables any server, NAS, PaaS or IaaS, to be converted into a usable file sharing platform(Guan et al., 2014). Simply, it can be used in place of SaaS Boxes and Drives, but it has more control, privacy and safety features.

Teachers also require a visual tool that can be used to manage events in teaching and other business processes within the system. The management service is personalized and adjusted according to the teacher's needs. In addition, the content on the calendar is provided on the user's mobile device. A notification in the form of an SMS or email is sent to the user as a reminder (Chandramouli et al., 2014).The element used for managing different activities associated with students contains all the information about every student, additional comments, and contact details. The main aim is to retain a good management system between students and the HEI by using high availability and immediate exchange of crucial information. The cloud computing infrastructure allows users to develop unique designs and e-learning services (Hemanth & Mahammad, 2016). Within the model, there are various services that are designed and evaluated for students, including adaptive e-learning services, mobile learning services, mobile language services, event simulation services, social network learning services, continuous simulation learning services, and visualization services (Radenković et al., 2014).

The incorporation of grid computing reduces the management effort to manage, monitor and control the use of computing resource within any organisation(Kesan et al., 2012). The concept of cloud computing has put life in the virtualisation of technology in which the host computer also known as hypervisor develops more virtual machines which would enable the end user to run and simulate software applications from any operating system (Naone, 2009). Hardware integration involves the placement of hard

drives, processors and network devices within a data-centre, which should not be located near the end user or its geographic location(Al-Balushi et al., 2016). This centre was set to process and store information for multiple users from different locations. Cloud computing has incorporated all characteristics of virtual technology that include no geographic restriction, pooling of network resources and elasticity (Zissis & Lekkas, 2012).

The architecture of cloud computing is available in three different service models of infrastructure, platform, and software(M. Ali et al., 2015). The model of Infrastructure as a Service (IaaS) offers customers limited control over network information by easing the processing, storage and management of the client's operating system. The consumer can simulate and run any software applications. In this service model, the consumer has limited amount of control on the network resources and infrastructure.

Platform as a Service (PaaS) model only allows consumers to deploy and run software applications on the platform provided by the company(Menzel et al., 2015). These software applications include consumer-generated application, programming languages and software tools provided by the network provider. PaaS model does not facilitate user control over the infrastructure like IaaS, which involve network resources and storage space. The user access in this model is limited to the deployment of the application and configuration of the host. Diverse client devices could easily access the software applications with the help of thin user interface. According to (Zissis & Lekkas, 2012), a client or user is not allowed to access, manage and control the cloud infrastructure. Moreover, cloud architecture serves the consumers in the form of four deployment models(Fernandes et al., 2014). The deployment of private cloud is mostly used in private organisations with the management of a third party in the loop. The location of cloud infrastructure would be within or outside the geographic boundary of the company.

In the deployment of community cloud, the infrastructure of the cloud is shared by numerous organisations and meets the specific company's needs in the community. The organisational requirements in community cloud are security demands, policy formation and adherence of the organisational policy(Kshetri, 2013). The services of public cloud are provided to the public or group of large industries. The infrastructure

and placement of cloud computing is the property of the organisation offering cloud the services. The deployment of hybrid cloud integrates two or more clouds to provide a unique and organisational specific technological infrastructure. By the application of standardised technology, hybrid cloud facilitates the balancing of load between the integrated cloud infrastructures. In this way, it ensures the portability of applications simulated in the hybrid cloud (Mell & Grance, 2011).

2.7 Cloud-Based E-Learning (CBEL)

An e-learning cloud-based architecture is divided into two main layers/parts: infrastructure layers and application layer (Pulier et al., 2015). Further, four other modules, including policy module, provision module, the monitoring module, and arbitration module accompany it. These are discussed further in the next section which elaborated all these layers and their benefit to e-learning. Figure 2-5 showes the abstract model of CBEL.

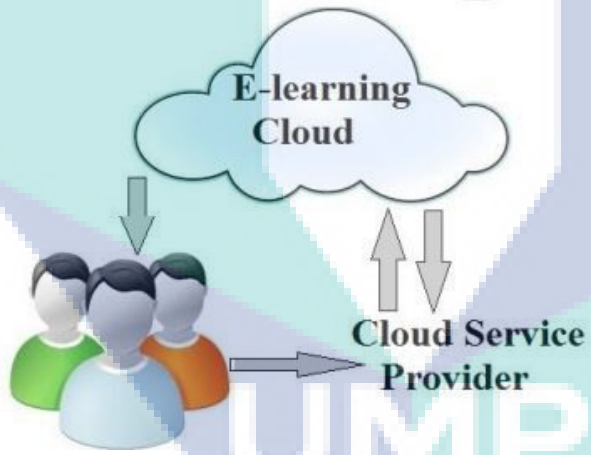

Figure 2-5 Abstract Model of CBEL.

Source: O. Ali et al., (2016)

2.7.1 Infrastructure Layer

It is described as the most resourceful layer of an e-learning system. Being the base layer, it shares the infrastructure resources and connects the entire system together to provide suitable services. The cloud computing system contains both a hardware and software virtualization system that is used to maintain the reliability and stability of the

infrastructure (Dinh et al., 2013). The infrastructure further consists of the system software, Internet, information management system and so on. The resources are accumulated in the teaching model and later distributed to other different departments and domains in the HEIs. The virtualization group is made up of the physical server, storage, and network. This group separates the operating hardware from the operating system, which makes up the storage capacity of the physical server(Hemanth & Mahammad, 2016). This helps to improve the utilization and flexibility of technological resources. Also, it can provide a common interface in case an organization requires large scale cloud integration (Na & Huh, 2015).

2.7.2 Application Resource Layer

These applications used in the integration of the teaching resources that are used in cloud computing. They include interactive courses and sharing teaching resources. Interactive programs are made for the teachers. They are modified to fit the needs of the learners(Tashkandi & Al-Jabri, 2015). The content of the course and its progress may be adjusted according to the teacher's feedback. Sharing teaching resources comprises of teaching information resources, material resources, and sharing of human resources.

The main features of this layer include educative objectives, content production, content delivery, and the management component (Haddad & Draxler, 2002). The applications software is to be provided by the institution involved, and the students have to pay for the service according to the calculated amount. E-learning-based cloud computing offers additional user-oriented hardware resources and software services. With the cloud, users can obtain necessary computing services and networks at anytime from anywhere. The computing capability will help with the integration of the information space as well as the physical space (Na & Huh, 2015).

According to Hrastinski (2008), e-learning systems can be categorized depending on the way people see them. All these categories have several common characteristics accompanied by their differences. Most of these systems are used to describe the distance education(Arkorful & Abaidoo, 2015). The traditional class concept is extended to represent the virtual classroom, which is characterized by freedom of space and time. In virtual classrooms, the learning processes take place simultaneously for different learners(Alsaadi, 2012). This is facilitated by

communication technologies, including video conferencing, and so on without all the learners and teachers being in the same room. Such systems are known as synchronous e-learning systems. The following sections explain the most important issues about e-learning and its benefits for the HEIs which can be enhanced by using CBEL.

2.8 Advantages of Cloud-Based E-Learning:

CBEL as discussed in the literature considered to be the solution to the HEIs challenges due to the following advantages;

2.8.1 Enhanced Learning of Students

Web-based learning and the use of the Internet for e-learning have eliminated the geographic boundaries, and learners can easily access the teaching sessions by simply gaining access to the Internet(Alshwaier et al., 2012). The content and services of e-learning are fully accessible to the students at any time. The introduction of online education facility provided by e-learning has enhanced the time efficiency and provides continuous access to the online learning content. The services of instructor support and feedback could be easily deployed at any time with the feasibility of both, the student and the instructor(Hamburg, 2015). Feedback from the instructor on each lesson and student activity improves the student's learning ability. Teacher's feedback on every lesson would enable the student to adapt and adjust his work and implement the given feedback in the next assignment or student work(Almazroi et al., 2016). It assists in developing and polishing the student's knowledge and skills. The learning pace of students is not dependent on the geographic location, restriction of time, and conventional learning structure (Dargham et al., 2013).

The role of students in the e-learning platform is highly active with great responsibility and interest to learn. Online learning environment trains and educates the students' skills of time management, planning, and organization(Al-Sharafi et al., 2017). In a self-paced learning environment provided by e-learning, the organization of content and sequential completion of educational objectives is necessary. Course material and content is developed with predefined assignments for every course, which helps in highlighting the problems related to every course(Méndez & Gonzalez, 2011). In this way, content and material of the whole course are elaborated and explained to the students. There is an exchange of course-related issues between the instructor and

organizer on a continuous basis that enhances their coordination. The use of e-learning management systems enables the facilitator and instructor to monitor, manage and control the progress of students through an online forum (Dargham et al., 2013).

2.8.2 Economic Benefits

Implementation of e-learning through improved education yields economic benefits for the economy (Gangwar et al., 2015). It advances to a strong technological workforce with improved job skills that yield huge economic returns of e-learning. This workforce contributes to creating an economically healthy society with good citizenship. The collaborative effect of technology and learning provides a technologically efficient workforce which is the foundation of developed economies.

E-learning facilitates the delivery of lectures, conducts assessments and keeps track of the student's progress. All these initiatives are integrated with different stages of the educational process in the learning environment. Employment opportunities developed by the national economy after the introduction of e-learning system in education shows a huge increase in economic activity due to web-based learning (Olson urt deMaagd et al., 2011).

The economic effect of e-learning could be easily investigated by evaluating the increase in the level of GDP with the educated workforce. The model of human capital revealed that education increases the national level of GDP. Positive changes in the educational system, like the integration of technology, results in driving positive economic growth which is reflected in the form of a bigger GDP level and increased the income of workers in the country (Hannum & Buchmann, 2005).

2.8.3 Social Benefits

Information and communication technology (ICT) plays a paramount role as a change agent in society(Arpaci, 2016). Easy and convenient access of the user to information and communication technology deployed in the educational system allows social and economic development by creating employment opportunities and by growing economic output. The use of e-learning and distance learning facilitates in reducing this gender gap and provides equal access to the learning content and educational courses to the girls as well as boys. This gender difference in the education

system is also reflected in providing access to internet services and communication technologies (Mercer, 2006).

Education helps to eliminate poverty and promotes self-esteem in decision-making processes. The success(Alshwaier et al., 2012) of e-learning is determined by societal factors and equal access to education and information and communication technology is possible only with the establishment of complete infrastructure and ensured network connectivity at every place. The delivery of e-learning services, especially in rural areas, call for significant planning and efficient resource management (Al-Zoube et al., 2010). The systematic and modernized process of implementing e-learning platform in rural and distant areas would help in achieving the true essence of distance learning and web-based learning (Olson urt deMaagd et al., 2011). E-learning provides an educational facility to large participants with a range of learning styles, preferences and student needs. It assists in communicating expert knowledge with efficient e-learning and knowledge management system (Pandey, 2013).

2.9 Successful Implementation of CBEL

E-learning is the product of information and communication technology coordinated with well-structured new techniques of learning and education. It has deployed Internet technology as a driving force, representing the integration of e-teaching and e-learning (Arpaci, 2016). It requires strategic and administrative procedures and plans that would help in supporting and executing the learning and teaching processes that are facilitated by an online environment.

In fact, it is not just the delivery of conservative teaching and learning content through the Internet, rather, it involves the addition of features like live chats, online assignments, discussion boards, recording of online material and lectures with communication support in the form of an email. E-learning enables the students to learn and educate themselves with self-defined pace by accessing large knowledge resources (Odunaike et al., 2013). Furthermore, by analyzing the benefits derived from e-learning and its impact on the quality of educational outcomes, it is highly recommended that the e-learning implementation process should come first among the stakeholders. Nevertheless, the system lacks enough support from leaders and students which is an important requirement in the successful implementation of e-learning(Attaran et al.,

2017). Before e-learning implementation occurs in an educational setting, its requirements and benefits should be fully elaborated in the form of teaching and learning pedagogy. According to (Odunaike et al., 2013), the process of identification of critical success factors could be helpful in successfully integration of e-learning practices in the teaching and learning of the educational system. The following sections will elaborate on the important issues for successful implementation.

2.9.1 Adequate planning

Insufficient planning, lack of proper budgeting, and human errors are some of the determinants which lead to the failure of executing most of the communication technologies (Christensen, 2013). E-learning implementation process in an organization requires a lot of capital to start with. Before introducing the implementation process, the e-learning management should evaluate and monitor the organizational readiness in term of IT infrastructure and other factors and inclination to ensure the success of the implementation process.

Moreover, organizational goals, needs, objectives, constraints, and resources should also be properly assessed in an attempt to introduce an e-learning (Traditional or Cloud-based) system within the organization(Colbrunn & Tiem, 2000). A systematic process of planning, monitoring and the evaluation of the implementation process would ensure the magnificent implementation of e-learning in an educational system.

2.9.2 Use of Sustainability Plans

Technological developments are largely influencing the field of education and conventional teaching practices, teaching, and learning pedagogy (Ghobakhloo & Hong Tang, 2013). The use of sustainability plans would help to ensure that organizations and students derive persistent benefits from e-learning. Sustainable plans in the organization would develop their internal capabilities to meet the current and future challenges of e-learning. Any disturbance or failure in the successful implementation of e-learning would deteriorate all the financial resources and investments of management and organization undertaken to incorporate e-learning. Organizational sustainability plans would help to save the organization from the problems of e-learning failure (Cisler, 2002).

2.9.3 E-learning Collaboration

The development of e-learning is possible by the integration of education and technological development with sufficient capital and technology to successfully implement it (kasi Viswanath et al., 2012). It is not possible for one organization to develop the complete implementation of the e-learning mechanism in the house due to the deployment of expensive infrastructure requirement. Educational institutes and organizations mostly have a limited supply of resources and financial funds available, which hamper the successful implementation of e-learning. Several organizations and institutes can pool available resources and share benefits of resources equally by capitalizing on the economies of scale. E-learning demands strategic partnerships and collaborations that would facilitate the sharing of resources. It would help to share ideas on research, standardized practices, knowledge, technological resources and fundamental attributes that would facilitate organizations and institutes in implementing e-learning at a reduced cost (Govindasamy, 2001).

Most of the educational institutes use LMS to support and complement the conventional learning and teaching practices that have no impact on the implementation of e-learning practices and the introduction into the learning system(Al-Samarraie & Saeed, 2018). The current use of LMS is restricted for the purpose of student management, offering easy access to the course material, evaluate and assess their performance, and deliver feedback on their performance in the course. Technology has changed the learning system and we are not fully deploying and using all the available technological resources to increase the education outcome(Akande & Van Belle, 2014). Fully utilizing the service of the learning management system (LMS) would enable the successful implementation and execution of e-learning with increased return on investment. All these factors would foster the ultimate objective of online education and increase the education outcome of students.

Development of new technology, evolution in the teaching techniques, and practices and the introduction of new teaching and learning aids have overloaded the traditional classroom. All these developments in the learning and educational environment have increased the challenge to design and develop new content and curriculum for e-learning. According to Odunaike et al. (2013), the expertise of professionals and curriculum practitioners with deep knowledge and experience should

be consulted to provide guidelines that would help the teachers and teaching staff to design and develop online content and curriculum designed to the needs of e-learning.

2.10 Challenges/Issues Related to Cloud-Based E-Learning

One of the major problems which HEIs face is the lack of proper infrastructure which hampers the successful adoption and implementation of e-learning platforms (Hemanth & Mahammad, 2016). E-learning requires new rich content which is different from the traditional learning platforms(Akande & Van Belle, 2014). Development of this attractive content demands a well-structured, accessible and modern infrastructure which complements and facilitates the development and implementation of CBEL in the organization(Aung & Khaing, 2015). Moreover, it demands large resource utilization, like storage space and bandwidth, which would offer continuous services to the clients. The development of advanced and technical infrastructure has a high implementation and maintenance cost(Koch et al., 2012). It requires frequent hardware and software updates, along with regular maintenance, and this is no longer an issue with the adoption of Cloud-Based E-Learning in HEIs.

Granting that a strong infrastructure is already built in place, the next issue organizations confront is the deficient amount and quality of content, which could be easily imported on the CBEL platform(Batista et al., 2017). The quality and content of the e-learning curriculum are different from traditional learning practices which make it challenging for large organizations to implement (Tashkandi & Al-Jabri, 2015)Nonetheless, the implementation of cloud computing is overcoming this challenge by providing access to content produced by other organizations which limit the operational cost of e-learning(Alkhater et al., 2014). The implementation of e-learning platform demands changes in the educational process of the organizations.

To manage this change at such a big level, it requires a proper planning and effective change management process which would cater the issues of students, teachers, content developers, systems support and decision makers(Tashkandi & Al-Jabri, 2015). Cloud computing is facilitating this organizational change by increasing the pace of the change process. Cloud computing mitigates the predicaments in organizational change by providing easy access to all the stakeholders and enlightening

them with the value of change and its benefits by implementing e-learning at the organizational level (Karim & Goodwin, 2013). Most of these challenges related to Cloud-Based E-Learning are explained in the next sections.

Security and privacy are the major issues HEIs face when they integrate cloud computing with the e-learning platform. Security threats comprise software attacks in the form of viruses, worms, and denial of services(Fernandes et al., 2014). Technical and human errors that are accidentally exposing students' personal data have raised serious privacy and legal issues. Distribution of user data to virtual data centers augments data exposure. However, this concern decreased due to SLA. A new model of cloud computing has overcome these concerns with service level agreement (SLA).

Moreover, unauthorized access to the central cloud servers would cause serious damage to the content and personal information of learners. Destruction of the information system, equipment failure, acts of theft is some of the security issues which have raised questions about the quality of services delivered by e-learning platforms with the help of cloud computing(Abbas et al., 2015). HEIs are trying to overcome the security and privacy issues by adopting numerous technological solutions like SMS information security mechanism, biometrics information security system, access control list mechanism and digital signature information security mechanism. All these technical attempts struggle to provide control access to the cloud and prevent any malicious activity which would increase security and privacy concerns (El-Sofany et al., 2013).

Another predicament which reduces the adoption of cloud computing models is the thought of complexity of designing and managing the cloud-computing infrastructure. Its implementation involves numerous processes which make it difficult for institutions to adopt the services of cloud (Madan et al., 2012). It deploys disruptive technologies into multi-tenancy layers of virtualized clusters. It depicts that implementation and deployment of e-learning with cloud computing is a multifaceted phenomenon with complex infrastructure and technological requirements. This study aims to investigate these significant factors.

The complexity of infrastructure attracts hackers and intruders that raise security concerns for the management. To overcome the infrastructure complexity, it should start with a systematic process of designing conceptual designs specific to the educational needs of the organisation(Alharthia et al., 2017). After devising the conceptual design, organized processes like the effective design of network deployments, multiple testing, tuning, and evaluations should lessen the network complexity (Radenković et al., 2014).These steps could help in the efficient utilization of the available resources.

E-learning is a powerful system and comprehensive for education(Ashtari & Eydgahi, 2017). While it is said to be an updated form of technology with concepts and tools that provide new content and methods for education, it can never completely replace teachers and the value of human-to-human interactions (Sultana, 2015). Thus, teachers will continue to play a leading role and take part in developing and making use of the Cloud-Based E-Learning. The main objective of e-learning is to improve the nature of the educational system. With such interactive content and virtual collaboration, there is enough guarantee of a high retention factor.

E-learning cloud system, on the other hand, refers to the migration from self-built/self-maintained infrastructure to cloud computing technology(Attaran et al., 2017). It is termed as the future e-learning infrastructure that includes all the necessary hardware and software resources that are used to make e-learning a success(Riahi, 2015). These computing resources are virtualized and are available to inform of services for users such as educational institutions, students, and business that may desire to rent the computing resources (Riahi, 2015). In the following sections, the major e-learning issues and concerns from HEIs prospective are highlighted.

Inadequate infrastructure: Most of the educational institutions lack the proper infrastructure that is needed for adopting an e-Learning platform (Gai & Steenkamp, 2014). Reliable and scalable infrastructure is essential to facilitate the creation of new content that contains details on multimedia, high resource requirements for bandwidth and storage (Guoli & Wanjun, 2010).Cloud computing is known to offer solutions to overcome these challenges as since the centralized infrastructure of a clouding system minimizes the possibility of having repeated tasks in every institute which have such a system deployed. This helps to reduce the total cost and time needed to build the

infrastructure. Also, when Cloud-Based E-Learning is adopted in running a certain institution, the process of deployment is swift across the institution as of inadequate technical work to deploy the services in institutes(Fernandes et al., 2014). Finally, the cloud has a lower cost when it comes to hardware infrastructure in institutions. As usual, computers with low specifications can be used in this case.

Lack of curriculum: Most educational institutions lack the required content on the e-Learning system (Abbas et al., 2015). This is a serious problem which needs prior planning with consideration of the infrastructure needed (Aljenaa et al., 2011).Cloud computing can assist in ensuring readiness in two main ways; first, it provides a simple to use platform for all the teachers and students so that they can gain access from anywhere provided with an Internet connection; second, it helps in lowering the costs of operation since the HEIs can redirect the funds toward the development of more useful content or purchase content that has been developing by other institutions (Dong et al., 2009).

Lack of proper maintenance and technical support: When the e-learning system is established, the storage data should be updated, which means that the tools involved in data storage (hardware and software) require routine maintenance(Sivakumaran et al., 2011). Most institutions lack the needed know-how to maintain their infrastructure and respond to emerging issues such as network outages or security threats (Arpaci, 2016). With a cloud-based system, the time taken in technical support is reduced since the cloud technology uses a centralized infrastructure approach that helps to reduce the need to spend a lot of time on various issues such as service availability, and compatibility of the application in service delivery of the browser.

Change management: This is considered the main challenge facing traditional e-learning systems. This problem occurs when the user attempts to move to an online platform, therefore, it becomes arduous to manage the change process within the education system(Britt, 2015). This change affects all users. Hence, it is vital to do prior planning during the implementation stage of such a huge change when moving to an online platform. The change (Aljenaa et al., 2011) to the Cloud-Based E-Learning system provides the best management process for a quicker deployment process. With the new technology, the e-learning system can be easily deployed and spread across the

users in an institution more quickly. In many HEIs, e-learning systems are developed as distributed applications, which include an application from the client application, an application server accompanied by a reliable database server(Al-Balushi et al., 2016).

In the developing countries, they are facing many challenges while trying to catch up with the demands to change in their HEIs. Cloud-Based E-Learning can be considered as a solution to improve the quality of academic services in HEIs. The recent United Nation (UN) report shows that a lot of developing countries have low indices linked with ICT infrastructure (Ajzen & Fishbein, 1980; Arpaci, 2016). The Sultanate of Oman as a developing country is not out of these challenges in ICT adoption and the higher education is almost new, although the government has announced to its intention to be an electronic government to overcome the financial resources to build an infrastructure and lack of qualified human resources. Omani ministry of higher education planned the nation's technology infrastructure of the educational system in two platforms: a self-learning and a virtual classroom system(Latif et al., 2014). HEIs are the most significant sectors in any country and should adopt cloud services for easy implementation of Cloud-Based E-Learning. Moreover, there are fewer studies investigating the influencing factors on cloud computing adoption in HEIs (Alkhater et al., 2014).Many studies discussed this problem to understand ICT integration into Omani HE (Al-Senaidi, 2015). These studies did not consider the readiness of HEIs in developing countries and their fitness. There are three categories studied with this regard; institutional implementation of E-Learning, the relationship between faculties and various aspect of ICT, and the impact of e-learning on their instructional practices. The present study focused on factors driving the implementation of CBEL.

2.11 CBEL Services Providers for Higher Education Institution

Many leading IT companies like Google Apps education, Microsoft, Amazon Web Service(AWS) and IBM cloud academy have adopted cloud computing for educational purpose(Alshwaier et al., 2012).The following section provides more detail about educational services as shown in Table 2-1.

Table 2-1 Higher education cloud services providers

Edu. Cloud Providers	Services	Features
Microsoft Education Cloud (microsoft, 2017)	Live@edu, Azure Services Platform (ASP).	Website Creation, File sharing, Word processing ,presentation, Desktop sharing, Resource ,scheduling, VOIP.
Google Education Cloud(Google, 2017)	Google sites, Google videos, Google Calendar, Google Talk, Google Doc.	Phone support; 24 hours, Resource scheduling, 3rd party applications, free of cost, NO limit users.
Amazon Web Service (AWS) Cloud(Amazon, 2017)	Amazon Cloud Front, (Amazon EC2), (VCL).	Flexible, Elastic, Completely controlled, Inexpensive, Secure, Reliable.
Salesforce.com Education Cloud Platform(Salesforce, 2017)	Alumni Advancement, Student Recruiting, Knowledge Management, Alumni and Applicant Portals, Student Retention, Faculty Collaboration, Student Tracking, and Study Abroad.	Instant scalability, ease of configuration and support for multiple functional roles.
IBM Cloud Academy(IBM, 2017)	IBM Lotus Live collaboration, Virtual Computing Lab (VCL) education solution, IBM Smart Analytics system, IBM Smart Business desktop cloud.	Collaborate with peers and developers-work, Participate cloud services and technologies for IBM faculty, researchers, developers, Implement IBM cloud technologies solutions.

2.12 Cloud Computing Implementation in E-learning: Related Works

Using of cloud computing technique to deliver e-learning services in the educational system would not only save financial resources and funds required for updating and upgrading educational labs and their hardware, but it also saves the cost of purchasing licensed software and maintenance cost(Alharthia et al., 2017). The integration of cloud computing with e-learning should follow a systematic process of defining organizational objectives and listing the type and nature of services required to implement e-learning in the educational system (Al-Balushi et al., 2016). Identifying the list of cloud services required for successfully integrating e-learning into the educational setting would enable the management and organization to select the most suitable cloud services and save operational cost. Service providers would ensure the continuous supply of service by taking care of maintenance and upgrading. Cloud would provide

the service of efficient and complete infrastructure, which would fulfill the hardware need of storage devices, servers, and communication network. It would also provide easy and convenient access to virtual resources like management of all the services provided by service providers (El-Ala et al., 2012).

Moreover, a web-based e-learning system facilitated by the cloud presents several tools like social, smart agents and the use of web 2.0 techniques to provide interactive environments to users (Abbas et al., 2015). Web-based Course Management System (CMS) manages and controls the student registration process online and controls the user access to the course material. Another aspect of cloud computing is PLE that provides tools to organizations that would help them in developing their own learning environment specific to the organizational needs (El-Ala et al., 2012). Cloud computing technology provides hardware and software resources to successfully implement an e-learning mechanism.

E-learning implementation on a cloud computing platform enables the development of a software application that is user-friendly and controls user access to online content (Hussein et al., 2012). The integration of cloud computing technology in the field of e-learning has evolved the term e-learning cloud. Cloud provides enough infrastructure with hardware and software resources which could be efficiently be deployed in e-learning to enhance the effectiveness of learning outcome(Sarrab et al., 2016). Cloud provides the facility of the virtual machine and leases the computing resources for continuous delivery of e-learning content and services (Riahi, 2015).

Higher Education institutions (HEIs) are very enthusiastic to implement e-learning in cloud-based architecture. The integration of two important technologies requires significant planning, implementation, execution, and management as mentioned earlier. The use of cloud services in the educational system has transformed capital expenses into the operational cost of organizations(Koch et al., 2012). E-learning would capitalize on cloud services like the infrastructure of the service provider to establish its infrastructure. It explains that cloud architecture helps in implementing e-learning in the learning system and enhances the educational effectiveness and outcome of students.

The feature of service providers interface provided by the cloud would enable teaching staff to use and develop contents for e-learning system. The user of e-learning should not change the structure of e-learning applications running on the user machines. Cloud facilitates the execution of the application on the personal computer, mobile phones and tablet PCs with an internet connection without stimulating complex configuration settings (Akande & Van Belle, 2014). Data generated on the cloud could be easily accessed by paying to access the service of the service provider. Cloud provides a large storage space for e-learning with minimal cost and provides sufficient space for storing course content and studying material at economical rates (Riahi, 2015).

The processing and management of application provided by e-learning are managed by the cloud and results in improved performance of applications with the increased process and computing power. The performance of e-learning applications is run by the computing power of the cloud systems (Dinh et al., 2013). The e-learning applications are automatically updated and execute the applications on the processing power of the cloud. Deployment of the cloud improves the compatibility of the software and document formats.

E-learning applications developed in the cloud would facilitate the compatibility of any file format and document stored in the cloud(Li et al., 2012). The educational outcome of cloud-based e-learning is more effective and pronounced for students. Cloud provides efficient service by providing access to online courses, taking online exams; provide feedbacks and online coaching, and post online projects and assignments. Students benefit from cloud-based e-learning due to increased computing and processing power (Riahi, 2015).

2.13 Concerns on Cloud-Based E-Learning: Summary

The educational field is changing rapidly. This shift in education has attracted a lot of attention among academics, especially the technological aspect. To maintain an effective educational model in a certain region, all institutions rely on using the latest technologies for the development of University e-services whenever they are needed. The integration of cloud computing services involves integrating all e-services together and ensuring that they communicate with each other (Arpaci, 2016).

The idea behind the integration of all services in clouds is to preserve the stability of the system, increase its portability and reduce complexity. The modeling language used in the system should have an independent platform where there are enough details that allow it to succeed in that particular environment. The integration process that needs to be implemented first is ensuring that e-services are functioning(Fernandes et al., 2014). The integration of these services is done through a service or agent-oriented approach. Cloud infrastructure contains several types of integration models. Application integration; this process is used to describe those interfaces that are driven by events and that impact business operations. Data integration; it involves the transfer of large amounts of data in batches depending on the frequency of the data integration.

Although Cloud-based E-learning architecture provides a range of storage space, processing power, and infrastructure benefits, negative and confrontational factors of cloud computing are translated into the e-learning system(Ercan, 2010). Security and privacy are the two most important drawbacks of cloud computing which migrate to e-learning due to the integration of these two complementary technologies into one cloud-based learning (M. Ali et al., 2015). The factors of multiple tenancies, reusability of hardware and software resources provided by the cloud, redundancy, and development of virtual machines enhance the data exposure and possible risks. Data exposure to the service of e-learning would lead to security attacks, deletion of important data and denial of service because of intrusive network attacks, although service providers of the cloud have deployed several encryption technologies to prevent any network intrusion and protection of storage data and for continuous network transmission (Fernández et al., 2014).

Cloud computing has provided significant advantages of cost, flexibility, processing power and infrastructure but it poses serious and unavoidable security threats to the user data and other valuable data stored in the storage space provided by the cloud. Security is a major problem that has reduced the growth and effectiveness of the cloud in the learning system(Fleisher & Gordon, 2010). The issues of data privacy, confidentiality, integrity, and data protection have limited the market for cloud-based e-learning(Masud & Huang, 2012). The service of cloud-based e-learning is dependent on the Internet and all the application data of the learning system should be transported

to an isolated network. Access to the application and course content depending on the bandwidth that drives the traffic to the network. The successful implementation of cloud-based E-learning demands broadband network and fiber optic network for efficient communication mechanism(Masud & Huang, 2012).

Educational institutes prioritize the performance of services on data security and security measures used by service providers to decrease the performance of e-learning (García-Peñalvo et al., 2014). There should be security protocols placed on the accessibility of cloud services without impacting the performance. E-learning or cloud education is rather different from conventional education techniques that have given birth to numerous management issues for teachers and teaching staff. Teaching staff should be trained to handle different management requirements of e-learning (Masud & Huang, 2012)

The content of cloud-based e-learning is rather different from the conventional teaching methodology that demands quality content with an effective e-learning programme. The development of quality content demands several human resources, material resources, the expertise of educational and technical professionals and experts who would contribute to developing interesting, meaningful and scientific learning resources (Khan et al., 2014). Although cloud computing provides the service of sharing the learning content developed by different organizations from the cloud. It reduces the cost of developing content but it raises security and privacy concerns due to unregulated access to the learning content (Masud & Huang, 2012).

While deploying the services of the cloud server; there is an infringement of security laws that lead to the suspension of cloud services. Incompatibility of services from one service provider with other cloud vendors is another problem faced by HEIs in case of e-learning. It makes the transfer of services and data sources difficult from one service provider to another. In the case of cloud-based e-learning, it is of great importance that which party would control the security and authentication procedures of cloud services. Cloud would only provide the encryption of data, supplementary and additional security measures that should be arranged and managed by education institutes to keep their data safe and secure. Another problem faced by the cloud base e-learning is the integrity of data that is compromised. The service provider should be held liable for executing authorized transactions for transferring, storing, and retrieving

user data. The service provider should also have transparent privacy laws and explain the usage of the user's personal information (Kumar & Chelikani, 2011).

2.14 Motivates for Cloud-Based E-Learning: Summary

A Learning Management Systems (LMS) is a simple software that is used to plan, implement and support the learning process. The learning components, in this case, are divided into two categories; the first category includes the people involved, that is the teachers and learners with their different roles (F. Mohammed et al., 2017);the second category falls under the learning objects and educational materials.

Today, e-learning is widely applied in various educational levels, including company training, continuous education events, academic courses, and more. Many benefits can be achieved during the implementation of the e-learning systems, especially in cloud computing in HEIs. According to Pocatilu (2010), there are two main entities that are involved in the e-learning system, the trainers and the student. As seen before, e-learning systems can benefit from cloud computing in the following ways:

2.14.1 Reduced Cost and Improved Learning

Cloud computing can help cut the cost of building an educational system (Fernández et al., 2014). Also, the cost of licensing the software is reduced since it is offered as a service by the providers who will also deliver some maintenance to the software (Haddad & Draxler, 2002). In an e-learning environment, students do not need to have a large memory to run applications or store data; they can do this from the cloud from their electronic gadgets such as mobile, iPad and tablets. Therefore, the cost will be more economical since the company will pay per use.

In this case, all applications are on the cloud. With the system in place, the learning process will be affected in a positive way since the IT team will divert their focus from maintenance issues to providing better support to the learners (Jansen, 2011). With the cloud, students will have no predicaments opening files from different devices including mobile, iPad, tablet, computer etc., due to the available format compatibility offered in this system. They do not have to worry about running into problems with PCs or mobile supported file formats.

2.14.2 Benefits to Students and Teachers

The cloud-based e-learning system will have a positive impact on direct personal feedback, with the student taking online courses, exams, and getting feedback about their courses from their teachers, and uploading assignments and projects online (Alajmi, 2016; Hew & Kadir, 2016). They will also be able to share resources and course details online using the cloud. Similarly, they will have access to recent resources required to achieve their academic goals. The resources can be collaborated and shared over the cloud. Using cloud, teachers can prepare different online tests, create content resources to be used by their students, analyze tests done by students, and communicate the results and feedback to students (Aruna & Prakasam, 2013).

2.14.3 Improved Management of Learning Resources and Data Security

The integration of cloud computing in e-learning offers improved management of learning resources and enhanced integration models. This is conducted by providing automated deployment of the necessary resources (Bilal et al., 2014). The system also incorporates the use of multimedia learning contents in a mobile format and allows a student to build a mobile educational library. There is an enormous demand for data security as the data and the software are located on a remote server which can crash without any warning (Hashizume et al., 2013). Cloud computing offers some major security advantages for any individual or company interested in using e-learning solutions.

2.15 ICT Adoption in Oman

The Sultanate of Oman is gradually trying to improve its services under the 2020 strategic plan. The vital aim of this plan is the creation of knowledge with more focus on developing the ICT sector(Authority(ITA), 2006).Due to lots of challenges, this goal could not be achieved, and the strategic plan has been extended to 2040. One of the significant aims was "E-Oman". The Oman vision is to transfer its service to online services via one Portal called "OmanunaPortal" under the umbrella of Information Technology Authority(ITA) which was set up by the Royal Decree 52/2006 declared on the 31st May 2006(Authority(ITA), 2006) and its board of directors formed from the very senior decision makers. ITA is the apex body vested with the responsibility to implement this strategy. ITA's CEO stated that "Access to ICTs is viewed as a

fundamental factor for the advancement and the change of the prosperity of society" (Authority(ITA), 2006).

There were many key initiatives taken by ITA; setting up a bound together e-Government engineering, profiting broadband correspondences, making an ICT framework, improving and streamlining all administration forms, empowering client driven e-Government administrations, empowering simple access to auspicious and pertinent open data available, creating plans and strategies for preparing and advancing HR in IT, enabling purchasers with IT abilities and information through mindfulness and preparing efforts, conveying ICT instruction and preparing programs appropriate for different portions of the general public, and creating formal and casual correspondence channels. The electronic investment was embraced by 93% of government substances (Authority(ITA), 2006).

However, even most of the governmental entities have already adopted IS, somehow, the ununified standards for each was the problems in integrating e-services. HEIs are not isolated from this problem; each institution has its own education system. The related literature shows that HEIs in Oman face many barriers which can be overcome easily with cloud computing, such as lack of IT skills, lack of IT budget, and less support from top management. An empirical study by (Sarrab, 2015) proved that the infrastructure and the ability to adopt a new technology exists. There are the differentplatforms of cloud computing adoption, such as Mobile-Learning(M-Learning), where the learners can access to the content as needed and any time from any location(Sarrab et al., 2016).

Oman is like the other Gulf Countries Cooperation (GCC) in terms of academic relations with western universities. Most of the public and private HEIs in Oman have an academic affiliation with one or more of western universities, and one of the main utilization of this academic affiliation is delivering the materials and sharing systems. This has restricted the HEI from obtaining and adopting their own e-Learning systems, as this will make redundancy and doubling the efforts. However, in the coming years, all theses HEIs in Oman will have to adopt their own systems as this is a demand of the regulators in the country and the society, because this option was only allowed for infant HEIs and soon, some of these HEIs will be 20 years old. The adoption of Cloud-

Based E-Learning will be the strategic option to build up their e-learning systems quickly and cost-effectively.

2.16 The Quality of Academic Services in HEIs in Oman

The quality and performance of the HEIs are linked in the literature as an output of cloud computing adoption' result. The adoption of cloud computing platforms enhancesorganization performance (Priyadarshinee et al., 2017). (Batista et al., 2017) founded that the cloud environment helped a lot on the performance of the services in the organization. Moreover, (Arpaci, 2016)indicated that there is a relationship between cloud computing adoption and student academic performance.(Chang et al., 2017) also indicated that student performance in Taiwan was significantly influenced by Cloud-Based m-Learning. One of the outputs of this study is to develop a model that will help in enhancing the quality of academic services performance via cloud computing by applying an adoption model.

The Sultanate of Oman is at the early stage with regard to quality assurance for its HEIs. In 2010, his majesty (Sultan Qaboos Bin Said, Sultan of Oman) issued a royal decree No. (54/2010) to establish Oman Academic Accreditation Authority (OAAA)(OAAA, 2010) to replace the Oman Accreditation Council (OAC) which was founded in 2001. The main responsibility of OAAA is to regulate the quality of higher education in Oman to meet the international standard and to encourage these HEIs to improve the quality of their services internally. This responsibility was divided into two ways; Institutional Accreditation and Program Accreditation with responsibilities as follows: establish a system that includes the standards and procedures for institutional accreditation as Figure and program accreditation as Figure 2-7, accreditation against establish standard for both institutional and program, develop and update the National Academic Qualification Framework (NAQF), and publication of the accreditation result(OAAA, 2010).

In summing up, these two ways of accreditation are towards qualifying the internal services to meet the international standards. Cloud-Based E-Learned can have an impact on maintaining the HEIs' quality in line with international standards. The quality needs continued improvement, and this requires high budget, hence, Cloud-Based E-Learning is considered the right choice towards achieving the desired quality,

but still, there are some factors influencing the adoption of this Cloud-Based model. Therefore, this study investigated these factors and their relationships empirically.

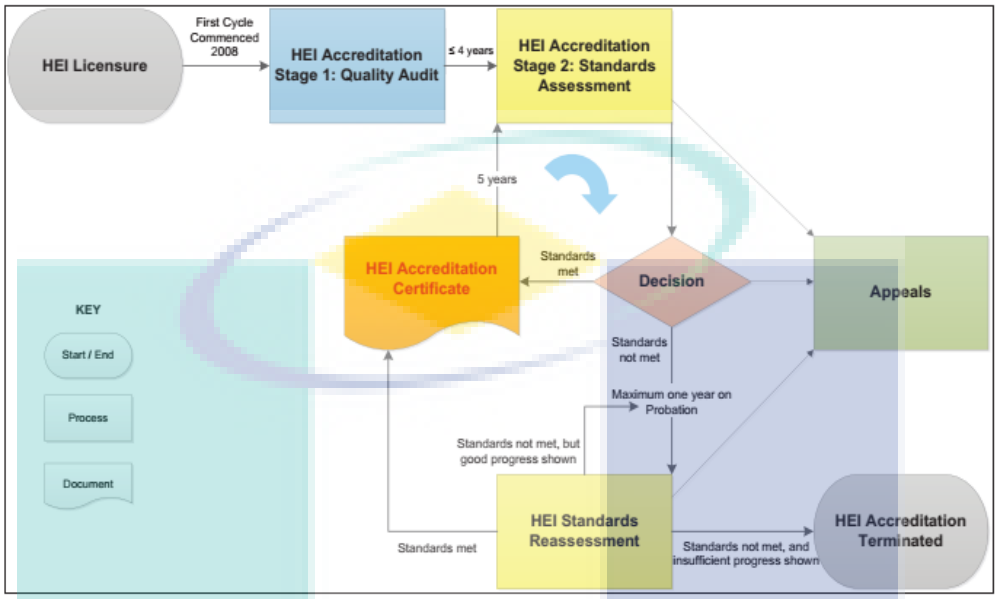

Figure 2-6 Institutional Accreditation System.

Source: OAAA, (2010)

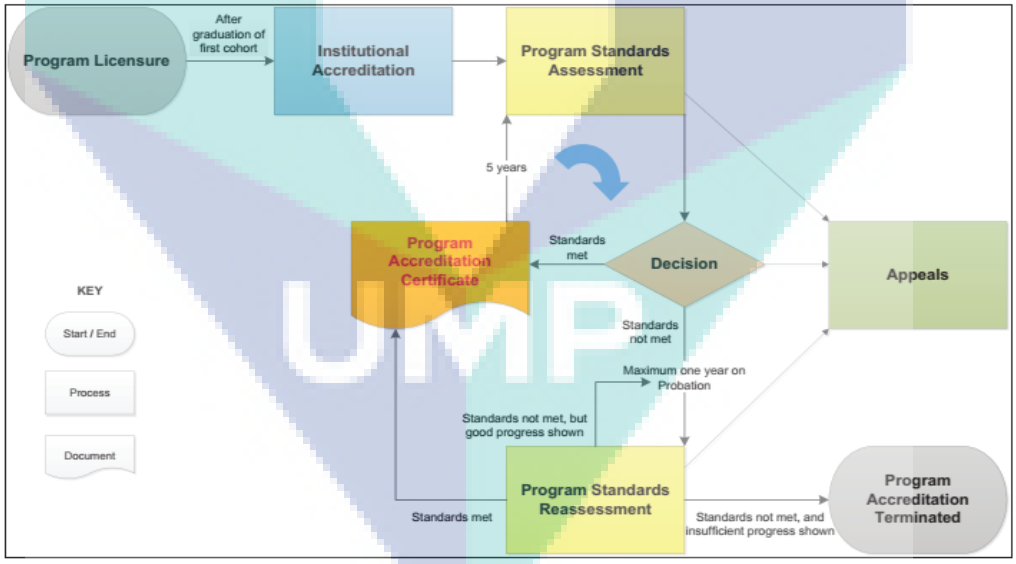

Figure 2-7 Program Accreditation System.

Source: OAAA, (2010)

2.17 Adoption Factors to be considered for Cloud-Based E-Learning Adoption

There are many influencing factors to be considered before the adoption of Cloud Computing, these are as follows:

2.17.1 Reliability

Reliability refers to the capability of cloud computing to facilitate the organization of businesses without any significant failure, thereby allowing higher utilization to be achieved(B.-N. Hwang et al., 2016), (Alharthia et al., 2017). Therefore, the Service Level Agreement (SLA) should highlight the percentage of availability and should not be less than 99% to avoid service outage and to compensate clients in case of an outage. Amazon and Google could not achieve 100 % of service availability (Na & Huh, 2015). This factor is critical which required more attention while selecting the type of cloud computing and the service provider.

2.17.2 Security

Security refers to the level of security procedures in place to protect information or the system from unauthorized access or any other security events (Nunes et al., 2017), (Oliveira et al., 2014), (Odeh et al., 2016). Cloud computing users allow the cloud provider full control on their sensitive data and information to protect and back them up. This is part of the contract of SLA (Benlian & Hess, 2011). This factor receives the biggest reworks doubt among users when they think of adopting cloud computing; it is a risk and an opportunity at the same time.

2.17.3 Performance

Performance refers to a set of metrics for any organization to measure how well cloud computing carries out computation work, which includes response time, channel capacity, latency, bandwidth, throughput, etc… (B.-N. Hwang et al., 2016). The doubt about the performance comes from the quality of the connection between the user and cloud computing (Benlian & Hess, 2011). This factorare important when deciding to adopt cloud computing. The organization can compare between their current and future bandwidth and the performances(Marston et al., 2011).

2.17.4 Scalability

Scalability refers to the extent to which provisioned computing resources can dynamically adjust to variable loads, such as changes in the number of users, required storage capacity, and processing power (Sila (2013). It should be considered as important factors in terms of performance, as the adopters of cloud computing increased their requirement by the time and the cloud provider should be very fixable to do so. Furthermore, this option is a strong point when it comes to selecting the cloud provider (Benlian & Hess, 2011).

2.17.5 Compliance and Physical Location

Compliance refers to an influential factor that can make the organization reluctant to migrate to cloud computing(Alharthia et al., 2017). This comes from the fact that there are no governmental regulations or rules that can support the firm in the event of a data breach (Alkhater et al., 2014). Physical location refers to a critical factor that affects an organization's decision to adopt cloud computing for several reasons. There are no international policies or regulations for data protection in the cloud and some of the cloud providers store the data in another country without disclosing this to the end users (Marston et al., 2011).

2.17.6 Cost

It refers to the amount of financial and human resources invested to implement and manage cloud computing (Ghobakhloo and Tang (2013), (Nunes et al., 2017), (Hassan et al., 2017). The cost is a very critical factor; "Cost advantages are the strongest driver affecting IT executives' perceptions of SaaS opportunities" (Benlian & Hess, 2011). It reduces the entry cost of small organization and investment cost for the bigorganization(Marston et al., 2011). In spite of this, some researchers pointed to some possible risks when the additional cost would be required than anticipated (Benlian & Hess, 2011). However, cloud computing is a cost-effective approach for its adaptors, but still, there are possible risks.

From the above factors, we can notice that for the adoption of any new technology, there will be a list of factors which can increase the resistance towards the adoption even though the prospective adopters may be willing to adopt the new

technology. It should be noted that these factors are common among most of the adopters, and its influence degree would vary from one to another.

2.17.7 Most frequent Factors for CBEL Adoption: HEIs Context

In concluding, the previous sections highlighted the factors that may affect the decision for Cloud-Based E-Learning. Several studies -100 article-have empirically investigated these factors as explained in the next sections. Due to various theoretical background, previous studies investigated the factors affecting cloud-computing adoption more than one time; few of them investigated it three to four times in different context. IT readiness, decision makers, complexity, compatibility and cost reduction were the most frequent factors found to have more influence in the past five years as shown in Table 2-2. The following table presents these factors while the full details of each study and its output are in Appendix F.

Table 2-2 Most frequent factors on CBELAdoption in Education Context

Factors	Definition	Frequent
Complexity	"The degree to which advancement is seen as being hard to utilize or get it".	(Al-Ghaith et al., 2010; Alkhater et al., 2014; Borgman et al., 2013; Charlebois et al., 2016; Chong et al., 2009; Gangwar et al., 2015; Hussein et al., 2012; Ibrahim, 2014; Low et al., 2011; Makoza, 2015; Morgan & Conboy, 2013; Oliveira et al., 2014; Humphrey M Sabi et al., 2016; Sabi et al., 2017; Sila, 2013; Stieninger et al., 2014; Tashkandi & Al-Jabri, 2015).
Compatibility	"The degree to which a development is seen steady with the current values, needs and encounters of potential adopters" Oliveira et al. (2014).	(Alkhater et al., 2014; Charlebois et al., 2016; Gangwar et al., 2015; Hussein et al., 2012; Ibrahim, 2014; Low et al., 2011; Makoza, 2015; Morgan & Conboy, 2013; Oliveira et al., 2014; Humphrey M Sabi et al., 2016; Sabi et al., 2017; Stieninger et al., 2014; Tashkandi & Al-Jabri, 2015).
Security Privacy	"Refers to the level of security procedures in place to protect information or the system from unauthorized access or any other security events"(Nunes et al., 2017).	(Al-Balushi et al., 2016; Alharthia et al., 2017; O. Ali et al., 2016; Alkhater et al., 2014; B.-N. Hwang et al., 2016; Kayali et al., 2016; Morgan & Conboy, 2013; Nunes et al., 2017; Odeh et al., 2016; Oliveira et al., 2014; Humphrey M Sabi et al., 2016; Sabi et al., 2017; Saya et al., 2010; Stieninger et al., 2014).

Table 2-2 Continued

Factors	Definition	Frequent
Cost reduction	"Referring to the amount of financial and human resources an S&T institution invests to implement and manage cloud computing"(Nunes et al., 2017).	(Al-Balushi et al., 2016; O. Ali et al., 2016; Arvanitis et al., 2016; Hassan et al., 2017; B.-N. Hwang et al., 2016; Nunes et al., 2017; Odeh et al., 2016; Oliveira et al., 2014; Humphrey M Sabi et al., 2016; Saya et al., 2010).
Decision makers	"Refers to the attitude of management toward the relevant technology and the level of support devoted for the adoption"(Alharthia et al., 2017).	(Alharthia et al., 2017; Alkhater et al., 2014; Borgman et al., 2013; Chong et al., 2009; Gangwar et al., 2015; Hassan et al., 2017; Ibrahim, 2014; Kayali et al., 2016; Low et al., 2011; Makoza, 2015; Oliveira et al., 2014; Sila, 2013; Tashkandi & Al-Jabri, 2015).
Relative Advantage	"The degree to which a development is seen as better than its ancestor"(Sabi et al., 2017).	(Alkhater et al., 2014; Borgman et al., 2013; Chong et al., 2009; Gangwar et al., 2015; Hussein et al., 2012; B.-N. Hwang et al., 2016; Ibrahim, 2014; Low et al., 2011; Makoza, 2015; Morgan & Conboy, 2013; Oliveira et al., 2014; Humphrey M Sabi et al., 2016; Sabi et al., 2017; Stieninger et al., 2014; Tashkandi & Al-Jabri, 2015).
IT readiness	"Relates to the readiness of an organization to adopt IT infrastructure in three perspectives: IT Technical infrastructure, IT human capability and IT managerial capability"(Kayali et al., 2016).	(Alkhater et al., 2014; Borgman et al., 2013; Chong et al., 2009; Kayali et al., 2016; Makoza, 2015; Nunes et al., 2017; Odeh et al., 2016; Oliveira et al., 2014).

2.18 Theoretical Background: IS adoption Theories

A number of theories have been postulated over the years to explain differential rates of adoption of new innovations, and particularly technological innovations, through time and space (Sabi et al., 2017). Much work in this field stems from the 1962 book Diffusion of Innovations by Everett M. Rogers(Rogers, 2003), which popularised the theory and energized a new field of study in social sciences. He has updated through a total of five editions in the four decades through to 2003(Rogers, 2003), seeking to enumerate, understand, and explain the factors that increase or decrease the likelihood

and the rate that a new innovation (idea, product or practice) will be adopted by a given culture. Rogers' theory centers on a bell curve normal distribution showing a split of five categories which he used to define the "innovativeness" of an individual within a population. That is the degree to which they will be early in adopting a new idea. These categories are as follows: innovators themselves, early adopters, early majority, late majority, and laggards. Rogers then hypothesized that the split between these categories and thus, the extent and the rate of spread of the innovation would be influenced by four key elements; these being the innovation itself, communication channels, time, and the social system into which the innovation has been launched(Rogers, 2003).

In meeting the research objectives of this study, an understanding of the factors influencing the adoption of Cloud-Based E-Learning in Omani HEIs is central. Therefore, in this literature review, it is necessary to interrogate some of the leading theories before arriving at the model to be used in the study and to explain and validate that decision. As per the scope section, we have selected four leading theories, based on their prevalence in the literature. The work of Rogers has been used here to illustrate theories of technology adoption, next, we will explore it alongside others in order to inform the process of arriving at an efficient model for e-learning-based cloud adoption in the context of HEIs in Oman.

2.18.1 Diffusion of Innovation theory (DOI)

Figure 2-8provides a bell curve representation of a standard deviation derived from Rogers' Diffusion of Innovation (DOI) theory discussed above. As we have said, DOI focuses on the spread of innovation governed by the communication channels that disseminate it and the social system that receives it, and how the innovativeness of the members of this social system drives the rate of adoption. What DOI does not consider, at least to an extent, is how behavioral factors impact upon the willingness or otherwise, of individuals to adopt any given innovation(Crespo & del Bosque, 2008). To put it in another way, DOI does not consider the behavioral factors in the context of a given innovation and social system that will result in their being, for example, a high proportion of early adopters as opposed to a high proportion of laggards. The following table shows the DOI factors by Rogers.

If we take a familiar and recent example – the adoption of smartphone technology – we can immediately postulate some determinants relating to rates of adoption: price of device, price of usage package, availability of network infrastructure to permit use of functionality, availability, price and relevance of mobile apps, penetration of marketing, and so on. DOI theory will not discuss these in any detail.

Table 2-3 DOI Factors

Factors	Definition
Relative advantage	How an innovation is improved compared to that of the previous generation
Compatibility	The level of compatibility that an innovation has to be assimilated into an individual's life
Complexity	If the innovation is too difficult to use an individual will not likely adopt it
Trialability	How easily an innovation may be experimented with as it is being adopted
Observability	The extent to which an innovation is visible to others. An innovation that is more visible will drive communication among the individual's peers and personal networks and will in turn create more positive or negative reactions

Source: Rogers (2003)

Therefore, it is for cloud computing adoption for e-learning in Omani HEIs. Whereas the selected model will be heavily informed by DOI, particularly when it comes to understanding the influence of early adopters in driving diffusion - in this case- thought leaders and expert users in the university system and government (H. M. Sabi et al., 2016), it is evident that we will need to look elsewhere in order to build a complete model for the purpose of the study.

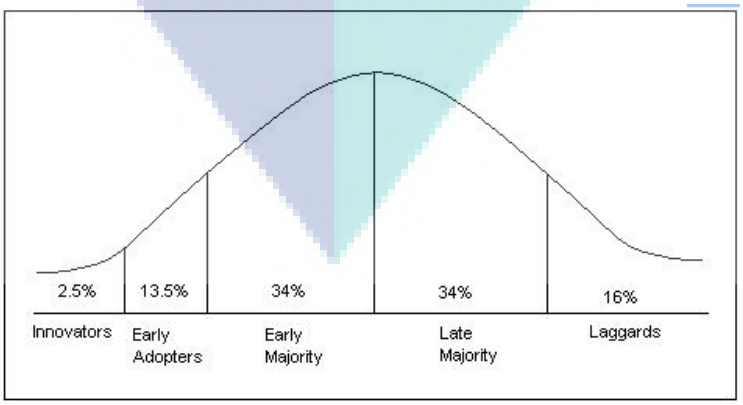

Figure 2-8 Standard deviation of innovation

Source: Rogers, (2003)

2.18.2 Technology-Organisation-Environment framework (TOE)

TOE is a construct which seeks to understand the process by which a firm adopts and implements technological innovations in terms of these three contexts (Tornatzky et al., 1990). TOE has been criticised as being limited to a categorisation of variables affecting technology adoption (compatibility, complexity, management support etc.) as shown, and has been considered to represent little more than a taxonomy of these variables, without a conceptual framework for analysis or even basic consistency on the use of variables across different studies (Wahsh & Dhillon, 2015).

Despite these apparent limitations, TOE has been found to be the most common framework in explaining the variation in cloud computing adoption in a wide-ranging review of the literature on the matter (Wahsh & Dhillon, 2015). We reference TOE here primarily because of this prevalence in the literature and its continuing influence in the field; however, it does not form part of the central thrust of this research.

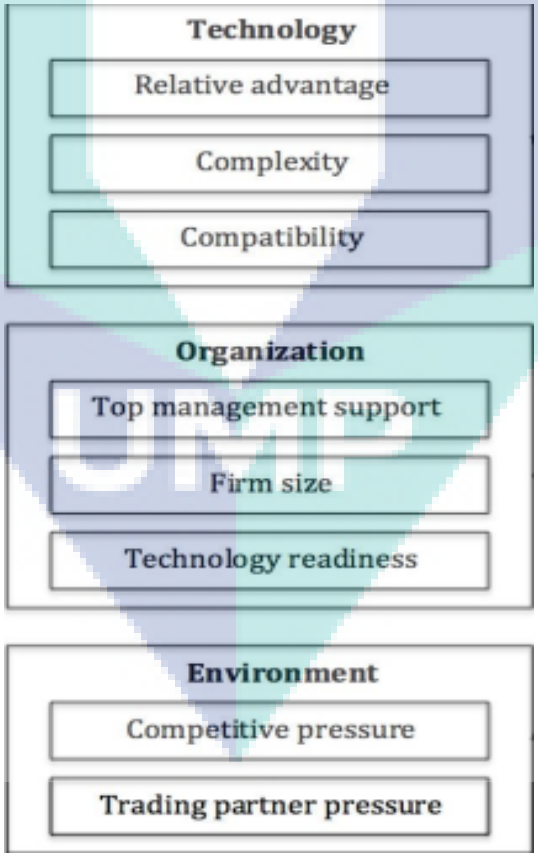

Figure 2-9 TOE Factors.

Source Tornatzky et al., (1990)

2.18.3 Unified Theory of Acceptance and Use of Technology (UTUAT)

UTUAT was derived by Venkatesh et al. in 2003(Venkatesh et al., 2003) as an attempt to bring different models of technology adoption in one overarching theory. In their validation of UTUAT, the authors sought to show how 70% in variance in usage intention to adopt new technology can be derived from eight IS usage models (Venkatesh et al., 2003) as shown in Figure 2-10, including those discussed in this section and further informed by demographic characteristics including age, gender, experience and voluntariness of use.

UTUAT is probably the most sophisticated model of technology acceptance in general use, however, it is precisely sophisticated and complex and that is the source of its most vocal critics. It has been said that UTUAT, with its 41 independent variables for intention prediction, and eight variable for behavior prediction, has led to the study of technology adoption reaching "a state of chaos" (Bagozzi, 2007). In assessing the suitability of the model as a basis for the research, we would concur with this view: there are simply too many variables to be accounted for in achieving the high coefficient of determination promised by the theory, and accordingly, the level of analysis required to justify the outcome of application of the model is liable to dominate the research to the detriment of its core purpose (Lian, 2015).

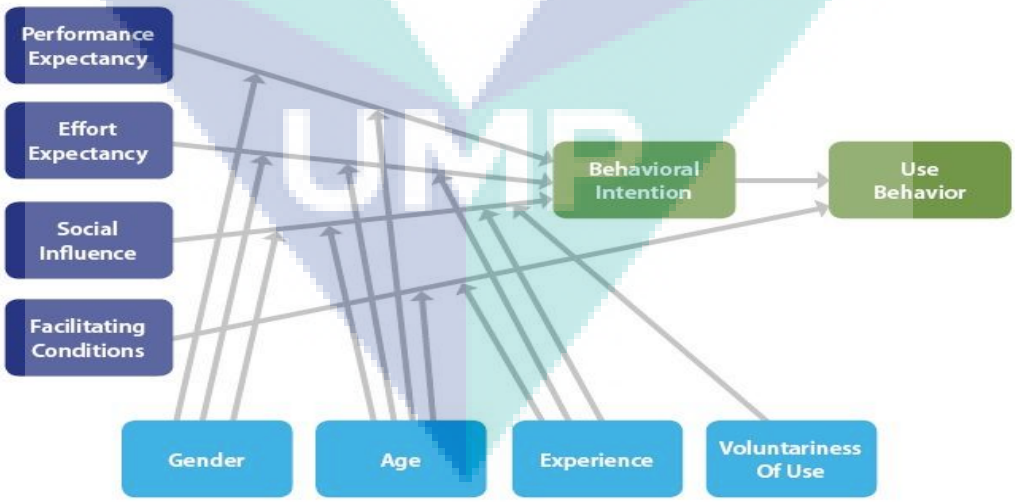

Figure 2-10 (UTUAT)

Source: Venkatesh et al., (2003)

2.18.4 Technology Acceptance Model (TAM)

With the developing innovation needs in the 1970s and the expanding disappointments of framework appropriation in associations, foreseeing framework utilization turned into a territory of enthusiasm for some analysts. In any case, the greater part of the examinations did neglect to deliver solid measures that could clarify framework acknowledgment or dismissal(Davis, 1989). Davis suggested that framework utilization is a reaction that can be clarified or anticipated by client inspiration, which, thus, is straightforwardly affected by an outside boost comprising of the genuine framework's highlights and abilities.

TAM is an adaptation of the theory of reason action (TRA) to the field of Software Engineering. TAM expresses the value and convenience that decide the reason for a man (client) to utilize a framework before the real face to work apparent framework. According to Jan and Contreras (2011), TAM determines the causal connections between framework configuration highlights, saw convenience, saw usability, mentality toward utilizing, and genuine utilization conduct.

TAM was created to pick up understanding into how people evaluate the value and estimate another innovation in connection to their endeavors to embrace it. In this model, the apparent esteem is described as how much an individual acknowledged that the utilization of a structure will improve his or her viability (Abdollahzadegan et al., 2013). TAM is a theory of information systems modeling how clients come to acknowledge and utilize innovation. It expresses those variables about how and when clients will utilize the innovation and how it will impact their choice when another innovation is exhibited to them. Specifically:

1. Perceived Usefulness (PU) was defined as the degree to which a person believes that using a particular system improves job performance(Davis, 1989).

2. Perceived Ease-Of-Use (PEOU) specifically is the degree to which a person believes that using a particular system may reduce the effort needed to do a job(Davis, 1989).

Overall, TAM provides an informative illustration of the mechanisms that style decisions influence user acceptance, and may thus be useful in applied contexts for prognostication and evaluating user acceptance of data technology. (Almazroi et al., 2016)believed that TAM postulates that the utilization of associated data system is set

by the activity intention, however, on the other hand, that the activity intention is set by the person's perspective towards the utilization of the system, and additionally by his perception of its utility.

In their theoretical model, Ajzen and Fishbein (1980) suggested that a person's actual behavior may well be determined by considering his or her previous intention, alongside the beliefs that the person would have for the given behavior. They cited the intention that an individual has before Associate in Nursing actual behavior because the activity intention of that person, and outlined it as a life of one's intention to perform a behavior.Ajzen and Fishbein (1980)also proposed that behavioral intention could be determined by considering both the attitude that a person has towards the actual behavior, and the subjective norm associated with the behavior in question (Thorpe & Gordon, 2012). They outlined the perspective towards a given behaviour as a person's positive or negative feelings regarding playing the particular behaviour, suggesting that the perspective of an individual towards a behavior may be measured by considering the total of the merchandise of all salient beliefs regarding consequences of playing that behavior, and an analysis of these consequences(Nistor et al., 2014).

As can be seen, TAM focuses on "use" when it comes to adoption of technology, usefulness, ease of use, attitude towards use and behavioral usage as shown in Figure 2-11. Although criticized in some quarters as being out of date, limited and of questionable practical or predictive value, TAM and its subsequent versions (TAM2 and TAM3) remain a popular information system theory for predicting user behavioral intention to adoption and use of new information technologies(Almazroi et al., 2016).

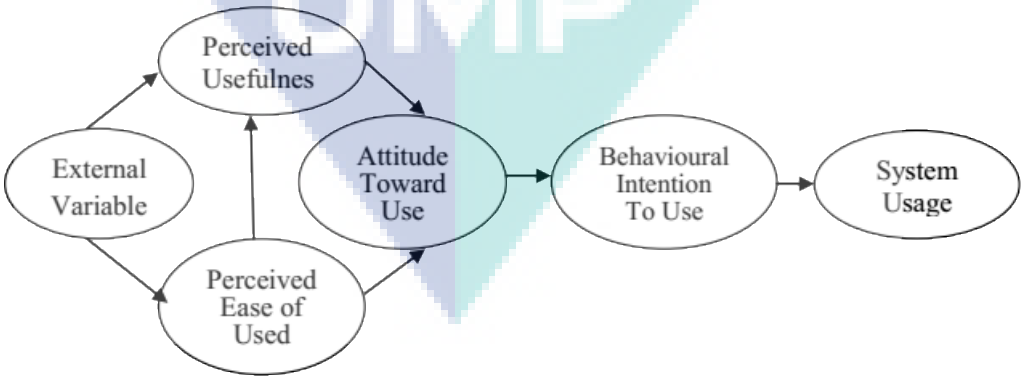

Figure 2-11 Technology Acceptance Model by Davis (1998)

2.18.5 Fit-Viability Model (FVM)

FVM is used to highlight the adoption of new technology.Specifically, it was used by (Tjan, 2001) to evaluate the organizational adoption of Internet initiatives(M-Commerce). Tjan derived FVM from the task-technology fit (TTF) model proposed by Goodhue and Thompson (Goodhue & Thompson, 1995) to include two dimensions; fitness and viability. "Fit measures the extent that new technology is in step with the core competency, structure, value, and culture of the organization". "Viability measures the extent of the added potential of recent applications, needs of human resource, capital desires and then on". The basis of measurement for fit criteria is technology characteristics adopted from DOI theory, while organization, economic and IT infrastructure criteria are the various basic measures for viability as shown in Figure 2-12.(Liang & Wei, 2014)investigated the factors that affect the output of m-commerce applications and addressed the criteria to evaluate the suitability of these applications.

The fit was identified based on task-technology fit theory and viability based on financial and managerial criteria measurement. FVM was used also to investigate the organizational adoption of mobile technology in business(Liang & Wei, 2014), ERP adoption(Turban et al., 2011), social software adoption(Muhammad & Wickramasinghe, 2013), and in e-government(Larosiliere & Carter, 2013).

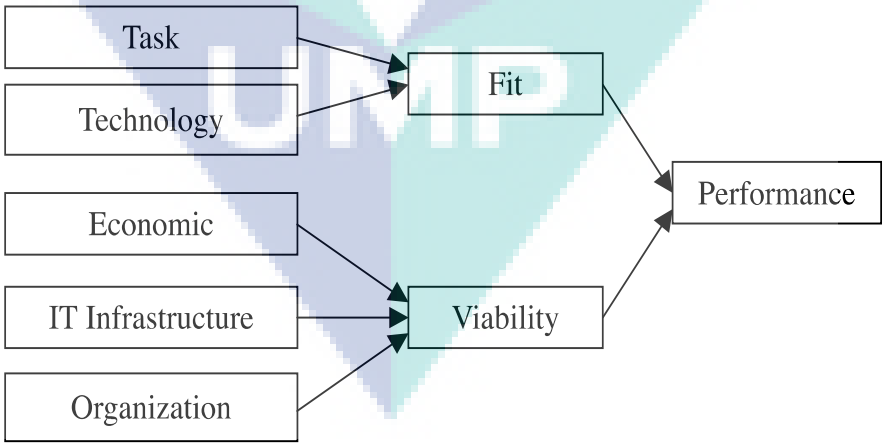

Figure 2-12 Fit-Viability Model by: Liang (2002)

From Figure 2-12 (Liang et al., 2007), we can notice that the Fit-Viability Model was used to examine the influence performance on the organization.

2.18.6 Information Culture factors

Information culture (IC)is defined as a culture in which intellectual resources are converted in line with physical resources (Choo et al., 2008). It's considered as a part of an organisational culture which focuses on information and technology as per(Travica, 2008). Organizational culture is considered to be a factor that influences significantly on the acceptance and adoption of new technology by SMEs in developing countries(Alrousan & Jones, 2016). Culture is related to people's beliefs, ethics, habits, norms, traditions, language, and religions. Information culture is about information systems, common knowledge, and attitudes of an individual towards the information and technology(Travica, 2008). Information culture is grouped as fields such as computer science, sociology, and psychology (Zimoch, 2013); it is about the process of IT construction (Yan, 2009). According to (Foscarini & Oliver, 2012)Information culture emerged in the mid-1980s in the context of the failure of IS projects.

Information culture consists of four constructs factors- information integrity, information formality, information control, and information pro-activeness as shown in Table 2-4. Information integrity refers to data integrity that assures the reliability and trustworthiness of knowledge (Mustofa et al., 2013).It deals with the errors or problems for the protection of knowledge of scholars and workers used for cloud computing technology. Information formality refers to the intentional dependence on regulated information, as opposed to casual sources, and it shows the formal management and pro-activeness of information with the adoption of cloud computing technology at higher academic establishments.

Information control refers to data management that characterizes a particular approach of the employment of information that will either hinder or support sure practices (Mustofa et al., 2013). Information pro-activeness refers to a state of mind to settle on and apply new information quickly within a business domain as a result of quick changes and vacillations within the earth resulting in advanced development in options and administration(Al-Sharafi et al., 2017; Marchand et al., 2002). Pro-activeness is paying special attention to indications of progress within the earth and suspecting sure foretold conditions that embody knowledge shifting forward and backward. Additionally, standing and capability of comprehension, and reacting to what

has been learned is another part of pro-activeness. As indicated by(Furness, 2010), data pro-activeness could be influenced by data trustworthiness.

(Widen & Hansen, 2012) founded that every organization has its own information culture. Consequently, each organization has to comprehend this concept to informationbehavior management(Davenport & Prusak, 1997). Therefore, IT and information shape a major portion of the culture concept in any organization(Travica, 2008). Then, information culture can be considered as a platform in which the organization decision rely on, and IT will enable IS development(Kivinen & Lammintakanen, 2013).

Table 2-4 Information Culture in the literature

Previous Studies	Context	Information Culture Factors
(Lauri et al., 2016)	Information Management	Information integrity, information pro-activeness, and information informality.
(Sinitsyna, 2014)	Information Quality	Information integrity, formality, control, and pro-activeness.
(Yang, 2012)	Safety management	Individual and group values, attitudes, perceptions, competencies, and patterns of behaviour.
(Collins, 2010)	Information knowledge & Information sharing	Information behaviour of knowledge sharing, attitudes towards sharing, and attitudes towards shared knowledge.
(Riyaz, 2009)	Information provision and access	Indigenous knowledge, information literacy, research – development and publishing, mass media and information policies.
(Foscarini & Oliver, 2012)	Information management	Recognition and acceptance of societal and organizational requirements for managing information, attitudes to sharing information, utilization of IT, preference for low or high context communication, and trust in written documentation.
(Choo et al., 2008)	Information use	Information integrity, formality, control, sharing, transparency, and pro-activeness.
(Katopol, 2007)	Decision-Making	Information retrieval, information creation, information storage, information transfer, information exchange, and information dissemination.
(Travica, 2008)	Information politics	Communication channel, information-sharing practices, background knowledge, accomplishing performance goals, and match between technological infrastructure and process efficiency needs.

From the table above, we can notice that there are no contexts of cloud computing adoption or Cloud-Based E-Learning adoption. Therefore, for this study, the author adopted four factors of information culture (Marchand et al., 2002) as an innovation to the proposed model. The selected factors from information culture factors (Information integrity, information formality, information control, and information pro-activeness) are crucial in bringing information quality(Sinitsyna, 2014). (Cullen & Taylor, 2009)has proved the existence of a strong relationship between information quality and technology adoption. Therefore, four factors are grouped under the information culture dimension beside Fit and Viability dimensions for the purpose of this study. This is also one of the research contributions which is to integrate information culture as an influence in CBEL adoption.

2.19 Comparison of selected adoption theories with justifications

After deep investigation, it was found that there is a lack of empirical studies on factors that affect the decisions on e-learning cloud-based adoption by HEIs. For more understanding about IS/IT adoption in the institutional level, many researchers used TOE combined with other IS/IT adoption theories. Technological and organizational factors were used more in the context of education.

FVM is most frequently used to investigate new technology adoption. While the aim of this study is to investigate Cloud-Based E-Learning in HEIs, and FVM consists of technology, economic, organization,and infrastructure dimensions, then, FVM is more suitable to be combined with T & O of TOE theory. In addition to this, FVM is to be used to evaluate cloud computing adoption and task characteristics of E-learning in order to answer the research questions. On the other hand, DOI theory consists of significant technology-related factors for technology adoption. DOI is to be integrated with previous models (TOE and FVM). Table 2-5shows most of the important information about these selected theories.

Table 2-5 Selected Theories Comparison

Theory	Recently used (Education Context)	Justification
DOI (Rogers, 2003)	(O. Ali et al., 2016; Arvanitis et al., 2016; Charlebois et al., 2016; Hussein et al., 2012; Odeh et al., 2016; Sabi et al., 2017).	Organisational level. Focus on non-technological factors as well. Usually joint with other IT/IS adoption theory to investigate the influence of technological factors.
FVM (Tjan, 2001)	(Goodhue & Thompson, 1995; Liang & Wei, 2014; Fathey Mohammed et al., 2016; F. Mohammed et al., 2017)	Specifically used to assess the technology adoption for specific task and this is very suitable for this research. It consists of technological, economical, organisational and infrastructure factors.
TOE (Tornatzky et al., 1990)	(Al-Balushi et al., 2016; Alharthia et al., 2017; Alkhater et al., 2014; Ibrahim, 2014; Kayali et al., 2016; Makoza, 2015; Saya et al., 2010; Tashkandi & Al-Jabri, 2015)	It ignores the economic factors, which is having a critical impact for cloud computing adoption. It consists from technological, organisational and environment factors.

2.20 Gap Analysis

From the previous sections about IS adoption theories, we can conclude that there is a lack of study on factors that influence the adoption of Cloud-Based E-Learning in HEIs in Oman from all the reviewed literature. Therefore, such study to identify the significant factors affecting Cloud-Based E-Learning adoption by HEIs is crucial due to what has been stated at the problem statement section. In addition, little empirical results were provided on the relationships between factors influencing Cloud-Based E-Learning intention and the important factors in the developing countries. Therefore, this study will fill this gap.

Few studies have explored and examined the feasibility of Cloud-Based E-learning at HEIs in Oman in view of the rising student population of graduates qualified for HEIs(Almazroi et al., 2016). Oman has 29 HEIs, SQU is the first university in the country which opened in 1986.These 29 HEIs have about 65,000 students during the academic year of 2017-2018 compare to 42,000 during the 2016-2017academic year (MOHE, 2018).This gradual increase will drive the need for offering the online course via CBEL.

This research will fill the gap by validating the CBEL model for HEIs in Oman. This validated model will consist of three dimensions; Technological Evaluation, Readiness evaluation, and Information culture factors. These dimensions were built based on two renown adoption theories- DOI and VFM, in addition to the information factors.

2.21 Summary

This chapter covered the literature relevant to this study. Overview of e-learning ecosystem, physical machines, and other resources organized and assigned for some specific tasks were discussed. Then, we have explored the challenges in developing countries with regard to cloud computing adoption. Next, it covered the statues of cloud computing adoption in Oman. In the next section, we have looked at the leading acceptance models from the literature that we can use to achieve the research objectives. ICT adoption theories were discussed, finally, the selected theories were reviewed.

From the previous literature review, it was found that HEIs in developing countries like Oman still have less level of Cloud computing adoption and Cloud-Based E-Learning adoption compared to the developed countries. In addition, most of the previous studies have examined lots of internal and external factors and their effects on Cloud computing adoption by HEIs without paying attention to the information culture factors. Based on the discussion on information culture, it is considered as a significant factor in IS adoption. Consequently, this will add to the body of knowledge new factors that have an influence on Cloud-Based E-Learning adoption. This is one of the contributions of this research.

The first question of this research is: what are the most significant factors that affect the adoption of Cloud-Based E-Learning in Higher Education Institutions (HEIs)? This question has been answered in subsection 2.12. Then, the author moved to the second question: what is the relationship between these factors, Cloud-Based E-Learning adoption, and the quality of academic services in HEIs in Oman? This was answered in section 5.6. The third question is: what is the efficient adoption model that can be developed for Cloud-Based E-Learning in HEIs in Oman? This question was answered in chapter 4. In order to answer the fourth question which is how the developed E-learningbased cloud computing model be validated among HEIs in Oman, the researcher had to test the relationship between each of the selected factors and the result of this test are discussed in chapter 5. The non -significant factors were removed, and the final model was presented.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The methodology involved a suitable research design, appropriate data collection procedures, and conducting an analysis to determine the results presented in the form of a written report. Chapters 1 and 2 covered the research problem questions and a detailed literature review. This research methodology demonstrates how to achieve the objectives of this study. This study investigated the factors that affect the adoption of CBEL in HEIs in Oman. The researcher also included the sampling design, sampling technique, target population, and the sample size. Sarantakos (2005) indicates that the term 'methodology' can be used to describe a research decision used in a certain project, including the knowledge, skills, and framework used. The focus of the research is to develop a suitable model for the adoption of CBEL by HEIs in Oman. In examining this topic, the research method was used to collect vital information that was applied in the study. It also included a detailed study of relevant information obtained from the respondents. The researcher ensured that the methodology used is strong based on empirical literature to reduce the possibility of errors that may occur during data collection and data analysis. The study evaluated surveys to collect data. The chapter also discussed the design and approaches used, including the sampling methods and a detailed review of the data collection instruments used. Table 3-1 displayed the road map followed to achieve the research objectives.

Table 3-1 Road-map for the research

Phases	Activities	Objectives	Instrument	Outcomes
1. Preliminary Study and Literature Review	1.1 Problem definition	To investigated factors affecting the adoption of Cloud-Based E-Learning in HEIs	Digital Databases.	Problem statement
	1.2 Formulating of RQ and RO	To formulate measurable research questions and objectives	-	Research questions and objectives
	1.3 Literature review	To review the literature covering IS adoption theories and cloud computing adoption.	Digital Databases.	Related-Work Table
	1.4 Expert interviews	To identify the most important factors that affect cloud-computing adoption and to propose a model for it derived from Literature Review.	closed-ended questions	Revised factors affecting adoption Of Cloud-Based E-Learning
2. Model Development	2.1 Propose the research model	To propose the research model for identifying the most important factors influencing the adoption of Cloud-Based E-Learning in HEIs in Oman, and for building a model for adoption based upon these and for validation and evaluation of this model	-	Research model
	2.2 Derive the research hypothesis	To derive the research hypothesis based upon 2.1	-	Research hypothesis
3. Methodology Selection	3.1 Questionnaire Development	To develop a tentative questionnaire based on the outputs of Section 2.	Questionnaire	an initial research instrument (questionnaire)
	3.2 Define study population and sample size	To define study population and sample size.	-	Sample size
	3.3 Experts feedback collection.	To validate the content of the questionnaire and it is fit to the research objectives.	Content Validity Letter	Validated Questionnaire
	3.4 Pilot Study	To validate and verify the questionnaire and to revise the questions	SPSS v.23	Reliability & Validity of collected data
	3.5Questionnaire Refinement	To necessary changes and refine the tentative questionnaire based on pilot test	-	A validate and reliable questionnaire
4. Data Analysis	4.1 Actual Survey-Data Collection	To conduct the survey	Questionnaire	Quantitative data collected.
	4.2 Data Analysis	To analyze the quantitative data using SPSS and (PLS), a variance-based (SEM) tool in order to test the research model in view of PLS's ability to operationalize a latent construct	SPSS v.23 and Smart PLS 3.0	A set of revised factors, tested hypothesis; a refined theoretical framework.
	4.3 Model Validation	To validate the research model empirically	Smart PLS 3.0	Validated research model by using Mixed approach.
	4.4 Hypothesis testing	To test the research hypothesis	Smart PLS 3.0	Hypothesis results
	Thesis writing	To write up the thesis and finalize the document	MS word	A PhD dissertation

3.2 Research Design

Creswell (2013)indicates that research design is a research structure that is used to answer the research questions. Further, the research design also explains the research problem, the link that exists between the research variables, and the structure applied to determine the evidence that exists on those relationships. The research approach is significant since it helps to determine whether certain research will be successful or not. It is a guideline used in data collection and analysis to help the researcher make informed conclusions.(De Vos & Fouche, 1998) adds that research design is a detailed plan that outlines how the research will be carried out by selecting the representative samples for the study, appropriate variables, data collection methods, and analyses of the findings.

In the current study, the researcher opted to use the descriptive research design. This design is suitable for this study since the author used the respondents/individual as unit analyses. In addition, the research design deemed fit to collect data from a large group of people. This allows the author to get the exact results and report things as they are. Descriptive research design involves a list of definite questions that need to be answered from a given scale(Cooper & Schindler, 2003). The research design applied a small sample population and it has statistical differences when it comes to results and outcomes. The researcher used this research method to obtain valuable findings and quality recommendations from the study. When it comes to the quality of the research,(Leedy & Ormrod, 2005)posits that the author should determine whether the research findings represent the actual structure they are intended to describe and the research objectives are achieved.

To accomplish the intended objectives of this study, the researcher collected information using three-staged processes that include, theoretical triangulation and method. Data triangulation process allows the researcher to collect vital information from different participants. The method was also applied to obtain primary and secondary data. The researcher interviewed knowledgeable people to obtain written evaluations on the topic, research questions and objectives. To ensure the technique is successful, the researcher required to include structured questions (which consists of standardized questions with fixed scale) to get various responses from the participants.

The researcher used a descriptive report by including an introductory section in the questionnaire for each sub-section.

The research aims to answer the research sub-questions using a quantitativemethod research model towards answering the main question of the research. This method is beneficial for this study as it includes several other research perspectives that are used to address the research problems (Lindblad-Toh et al., 2005) with different contexts and more focus on the context of this study. In addition, the quantitative method is suitable for this study since the main aim of the research is to evaluate the problem both practically and theoretically. Since the data is analyzed at the same time, the study examined using numerical data to understand the main aim of the study. To achieve this, the researcher conducted in-person interviews with the senior shareholders in higher education institutions in Oman to facilitate the research.

The stakeholders within higher education institutions in Oman included top, middle and operational level, policymakers and regulators among others. The study opted for the quantitative research that includes findings from statistical and content analysis to examine the relationship between the factors that affect the adoption of Cloud-Based E-Learning in Oman.

3.2.1 Phase 1: Preliminary study and Literature Review

This study formulated the general research question by determining the problem towards the research gap. From the literature review about traditional e-learning implementation challenges in most developing countries, and by studying the cases of Oman as a case, then, the main problem was determined. E-learning and cloud computing advantages and challenges were investigated in HEIs context. Then, the most significant factors were identified by studying the current statue of the existing challenges in many countries. Finally, the proposed model for CBEL adoption was clarified for the scope of this study.

3.2.2 Phase 2: Model Development

To answer the general research question, which is how the CBEL adoption model can be adopted and validated in the HEIs in Oman successfully, the model of factors affecting the adoption of CBEL was proposed and validated. Towards

developing the model, the significant factors were determined as per relevant literature. Then, to select the suitable IS theories to be used as the basis for this research model, the internal organizational level theories were selected, justified, compared and reviewed in order to be integrated to develop the model. This research model was based on the integration of the technological factors of DOI theory and Fit Viability Model (FVM) with Information culture factors as discussed in chapter 2. Figure 3-1shows the research model' constructs and its sources. The complete details are provided in section 2.18 of chapter2, where the author discussed thoroughly the renowned IS adoption theories in addition to Technology Acceptance Model (TAM)(Davis, 1989) and Unified Theory of Acceptance and Use of Technology (UTUAT) (Venkatesh et al., 2003).

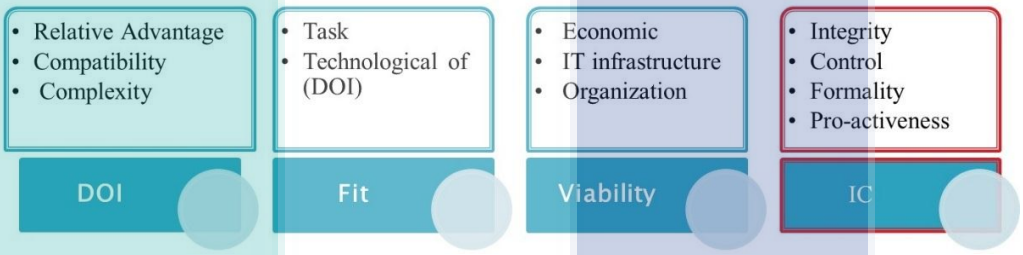

Figure 3-1 Model Constructs

3.2.3 Phase 3: Methodology Selection

For the empirical examination, the appropriate methods were selected to examine the relationship between the dependent and independent constructs of the proposed model. The research paradigm, approach, methods, and techniques were discussed considering the context of the study; a quantitative approach was selected based on the author' assumption, literature, problem statement and the research objectives.

To determine the significant factors influencing CBEL adoption in Oman, a questionnaire was developed. The dimension of the constructs was built based on the literature and the definition of each. The items for measuring each construct were extracted and adapted from the previous studies except QAS items which were extracted from the Oman Academic Accreditation Authority (OAAA) manual. Then, the questionnaire was sent to the experts for content validity for pre-testing. Then after

the validated questionnaire was sent to 40 respondents to check its clarity from the respondents' point of view then for validity and reliability.

3.2.4 Phase 4: Data Analysis

After collecting the data, the preparation process was followed. Tabulation and verification were done for missing data and data normality after data entering and editing and coding. Next, the data was statistically analyzed; a set of criteria were defined for the model reliability and validity. Composite reliability and Cronbach's Alpha were tested for reliability, Convergent and Discriminant validity were tested for validity. Then, the relationship between the factors was examined based on the tested hypothesis. Finally, the model was developed with findings and linked with the literature.

3.3 Research Methodology Overview

This is an overview of the research methodologies, including the research paradigms, research approach, research strategies, and data collection methods.

3.3.1 Research Paradigms

This section described the different methodological approaches used in the study. Different researchers have used several research methodologies, including quantitative, qualitative, action research, literature review and a mixed method to conduct researches. According to (Punch, 2013), quantitative research uses structured or controlled observations to analyze results. Qualitative research, on the other hand, applies an all-inclusive approach. As per (Phillips & Davidson, 2009), action research uses a structure that is more practitioner-based. This study used a quantitative approach where respondents were required to provide information depending on the questions asked. Using the questionnaire enabled the researcher to ask follow-up questions and make clarifications to avoid getting biased information. According to Will M. Bertrand and Fransoo (2002), sample surveys are applied because they take less time and information can be gathered easily from a target population and conclusions drawn to get the expected results. The researcher provided the respondents with the questionnaires via the Survey Monkey website with clear instructions.

The questionnaire included a brief explanatory paragraph containing information regarding the purpose of the study and the respondent's demographic information. The questions used were based on the factors affecting the adoption of Cloud-Based E-Learning. After extracting most of the frequent factors based on the literature and expert feedback, the items of the questionnaire were reviewed by the experts in the same field of study. The study outlined that the researcher issued the questionnaires to participants that volunteered to take part in the exercise via Survey Monkey website (either web link or mobile link as per their conveniences). The author received permission from the competent authority and the respective ministry of higher education in Oman; Directorate of applied colleges (Appendix A1), Directorate of private universities and colleges (Appendix A2),Sultan Qaboos University (Appendix A3), with a supporting letter from UMP (Appendix A4).

3.3.2 Research Design

The questionnaire approach is appropriate for the study since it is less prone to misleading results as the data is collected from a primary source(Leon, 2003). Furthermore, the quantitative method used also includes hypothesis testing. In this study, the researcher had to identify which of the proposed 14 hypotheses is significant or not significant and to which level of significance. Using the questionnaires also assisted in maintaining the anonymity of the respondents and confidentiality of the information they provide to gain accurate information. This study used a five-point Likert scale format in the questionnaires. According to Collis and Hussey (2013), a Likert scale allows the researcher to analyze the responses from the respondents easily and make informed conclusions.

Denzin (2010) believed that the outcome of research depends on the paradigm of the study. With regard to this study, as mentioned earlier, the researcher used a quantitative method to collect the primary data. The primary data was collected from the participants from all the higher education institutions in Oman (experienced in cloud computing and its models) through structured questions. On the other hand, the secondary data was gathered from different reviews of the previous literature on the topic discussed, including books, institution reports, and scholarly articles.

3.3.3 Research Methods

There were few research method was applied in order to collect the secondary data in this study along with the questionnaire which used to collect primary data.

3.3.3.1 Documentation Review

Document review is a data collection method where specific documents are used for a certain purpose (Robson, 2002). According to Bryman(Bryman, 2015), different institutions and government entities keep several documents on different researches conducted. The information in these documents is useful in obtaining both qualitative and quantitative data. In this study, the researcher sorted for permission from the management to access to the documents that are relevant to the study. The information accessed includes strategic planning documents, annual survey reports, and other significant documents that provided valuable information for the study. The relevant documents that could be useful for the study through the personal interview. The documents collected contained the relevant information and the data collected was adequate to proceed with the interview of the top management individuals.

3.3.3.2 Secondary Data

Most of the research carried out nowadays requires a lot of data collection and most researchers have proved this (Andrews et al., 2012). Secondary data is a method used in research where someone else collects specific data for the primary purpose. The secondary data collection method is flexible and can be used in various ways. According to Doolan and Foroelicher(Doolan & Froelicher, 2009), it is an empirical process that involves different procedures and steps in data collection. The secondary analysis involves research work that covers vital information that is already known (Hanson et al., 2005). It includes any literature related to the topic under study; however, it focuses more on previous data collected on the topic of study (Doolan & Froelicher, 2009). In this research, a detailed literature review was carried out to examine the previous and current work done by other researchers in the same field for the past recent years. Based on the findings, the researcher analyzed the previous studies in the related field as presented in the work table (Appendix F). Relevant information was also gathered to identify the gab and extend the work with a new model of CBEL adoption in HEIs in Oman. For the purpose of this study, the researcher was guided by

the research questions, focusing on the adoption of CBEL in HEIs in Oman. The use of secondary data ensures that the information collected will address the research questions. The researcher decided to apply this method to ensure that the questionnaireestablished the needed answers to the research questions.

3.3.3.3 Personal Interview Method

The study utilized a personal interview method to interview the regulators in the ministry of Higher Education (MoHE) in Oman. This allows the author and the interviewee to interact freely. The approach is less stressful since it allows both parties to carry out the exercise without interruptions. (Leon, 2003) suggests that the interviewing method involves conducting one-on-one interviews to achieve the main objectives of the study. This is a perfect way to maintain communication and get honest answers to the questions asked.

3.3.4 Research Instruments

The tools for the data collection were divided into the following: document review, in-person interview, and survey questionnaires. The researcher used a questionnaire as an instrument to collect primary data from higher education institutions and the targeted stakeholder in Oman.

3.4 The Questionnaire

The questionnaire was used to collect the quantitative data; to do so, a survey method was applied to identify the population and sampling technique, develop and validate the instrument, and select the data analysis method as explained in the following:

3.4.1 Questionnaire Design

As per (Churchill & Iacobucci, 2006), there are different stage and guidelines to build a questionnaire. For the purpose of this study, the researcher followed these guidelines to identify the factors towards the successful adoption of CLED and its influence on the HEIs in Oman. More details are explained in the next chapter. Whenever possible, validated measures were used from previous studies with the related context in cloud adoption and e-learning context. A cover letter which contains

the necessary information about the study, the researcher, demographic details, affiliation, and objectives of the study was provided to encourage the participants in the survey (Appendix B). This questionnaire was built in two parts (demographic details part and questions part), with a set of questions and guidelines on how to answer them. The items of the questionnaire were extracted from the literature, then, contextualized and sent to the experts.

Specifically, the second part of the questionnaire was divided into five sections (A,B,C,D,E), addressing the Technological Factors, Viability Factors, Information Culture Factors, Adoption of E-Learning Based Cloud Computing, and Quality of Academic Services(See Appendix B). The respondents were requested to select their responses using the 5-Point Liker scale based on their knowledge. More specifically, the first part covered the respondent's demographic information such as age, level of education, position, cloud computing awareness. The second part consists the items related to the technical factors which related to the relative advantage, complexity, and compatibility; Viability factors that include decision makers, IT readiness and cost reduction; and Information factors which related to information integrity, information formality, information pro-activeness and information control.

3.4.2 Content Validity

Further, we moved to the content validity stage where we contacted six experts from the field of study as the appendix D. They were selected from Computer science and Information system department from various HEIs.They were given a content validity letter consisting of the research introduction and the aim of this research, objectives of this content validity, and the evaluation rates (1= "The item is not a representative", 2= "The item needs revision to be representative" and 3= "The item is representative").

3.4.3 The Population

A population in research includes individuals, objects and events that qualify to be a sample in a study (Burns & Grove, 1993). Further, (Ngechu, 2004) adds that a research population comprises of certain specific set items, individuals or items used by the researcher to carry out certain research. This research aims to investigate significant factors to CBEL adoption in HEIs in Oman. It means that the subject under

investigation is a technology adoption (Cloud-Based) for a specific purpose (e-learning). For the scope of this study, the whole HEIs in Oman will be the population. Accordingly, the 33 HEIs in Oman were targeted, the total targeted respondents were 1005 individuals. The targeted population was the top, middle, low management with IT basic knowledge at least, and cloud computing awareness. The study also includes technicians in the population.

3.4.4 Sampling Design

(Orodho, 2009) indicates that a sampling design is a plan used by a researcher as a way to select a survey sample. For the purpose of this study, the researcher used a descriptive survey design. The author asked a set of questions based on factors influencing the adoption of CBEL decision. These questions helped the researcher to obtain answers and draw a conclusion with reference to the research problem. This way of the research assured that the information collected follows a credible research process. According to (Evans et al., 2000), sample size is the total number of observations made in the sample. The researcher used the sample size to increase the chances of gathering the opinion of many concerning the research. The method is preferred as it is less time consuming and free from bias since each unit will be included in the sample.

There are two main types of sampling: probability and non-probability. On-probability sampling is used when the entities of the population do not have an equal chance to be chosen, and this can be in four different forms: quota, availability, judgemental, and purposive sampling (Grinnell & Williams, 1990). Probability sampling is more suitable when all people or unit have the same chances to be selected, and this can be in four different forms: random, stratified, cluster and systematic (Creswell & Clark, 2007).This study adopted a different technique called census to select a sample size from the targeted population (Oliver & Jupp, 2006).As we had the complete list of targeted respondents for this study sample, individuals were selected based on the following criteria- their level of computer use and type of awareness of online applications, their knowledge about e-learning requirements, and their understanding of cloud computing services(Foscarini & Oliver, 2012). Due to this, census is a more suitable way as the author does not have to apply any sampling since

the full list of respondents was collected and gathered from the management of each HEIs after getting permission from the relevant authority.

This targeted population was selected from different HEIs in the higher education institutions in Oman; those who have experience and relevant information about CBEL. According to (Kothari, 2004), it is vital to use a sampling frame when selecting a sample size. The researcher got permission from the respective department of the institutions to facilitate easier collaboration with the participants (Appendixes A1, A2, and A3). Having identified the sampling method and the respondents size to be used in the study, the study preceded the data analysis method. However, a pilot study was conducted beforehand. The total participants were N=312. As long as the sampling method used is census, it means 312 of 1005 is valid and representative.

3.5 Pilot Study

The main aim of conducting a pilot study is to check for clarity of the research instruments, the validity and reliability of each item in the questionnaire using Cronbach's Alpha via SPSS statistical tool to assess the internal consistency of the scores among the items of a measurement scale. According to (Bryman, 2015); Mulusa (1988), pilot testing helps to establish whether the data used in the research instruments will perform the desired purpose or not. For this exercise, the researcher issued a total of 40questionnaires to top management individuals working as per the criteria been identified earlier in the higher education institutions in Oman to verify their feasibility based on the objectives of this study. Then this respondent was excluded from the final study respondents.

The author developed the questions based on the literature review, then, reviewed by experts from the same field of study. The questionnaires were issued to the senior individuals and their feedbacks were used to make necessary adjustments to the questions. The researcher conducted the pilot analysis and generated frequency tables to represent all the responses obtained from the respondents. This provides an impression of the expected outcome. Conducting the analysis ensures that the entire survey process is done smoothly and fulfilled the aims of the research. Lastly, the researcher made the necessary changes and adjustments to enable the respondents to make an exactjudgment based on their responses to the questions. Any ambiguous or unclear questions were

revised and rephrased to ensure that the respondents do not experience any difficulty answering them. The information collected from the pilot study was used to improve the results of the questionnaires.

3.6 Validity and Reliability

According to Wallen and Fraenkel (2001), a research instrument is said to be valid if it can measure the exact elements it is designed for. Further, validity used to refer to a certain degree by which the items in a sample test are applied to represent the content they are meant to measure. Validity can also be defined as "the degree to which a certain test accurately measures what it is designed to measure "(R. M. Thomas, 2003). Validity takes other different forms, including criterion validity, construct validity, and content validity.

The researcher used content validity to determine whether the content used represented a particular concept. The main aim of using content validity is to utilize a certain level of professionalism in a field of study (Mugenda & Mugenda, 2003). The research is considered valid if the data collected is accurate and relevant to the study. According to (R. M. Thomas, 2003), having strict plans and strategies is a good way to strengthen the validity of the research and ensure that the researcher avoids the misinterpretation of data.

The validity and reliability of the data collected can be influenced by the nature of the questions. For instance, the presence of biased questions may lead to biased and unreliable information. (Kara et al., 2012) suggests that the researcher should check the questions to ensure that they are easy to understand. A clear set of questions warrants that the responses are geared toward the topic of study. According to R. M. Thomas (2003), validity is more vital as opposed to reliability. Nevertheless, previous research indicates that the research should look at the reliability of the study. A perfect way to measure the reliability of the questions applied in research is by the use of a structured questionnaire. To begin with, the researcher created a receptive environment by including an introductory section with instructions to guide the respondents on how to answer questions.

The author used Cronbach's coefficient alpha to test for reliability of the research instruments as per the literature. In order to determine the consistency of the

results, the researcher conducted additional trials and verify the data. The researcher tested the reliability of the data to ensure that the outcome of the research can be used in a larger group and not limited to only the participants taking part in the research. Carrying out the two tests will ensure that the researcher obtains first-hand information and the data collected will be reliable. Table 3-2showed the Reliability and Validity assessment criteria as per the literature which washighlighted in chapter 5.

Table 3-2 Reliability and Validity Assessment Criteria

Criteria	**Measurement**	**Value**
Internal consistency	Cronbach's alpha	≥ 0.7 Satisfactory
	Composite reliability	0.6–0.7 Acceptable 0.7–0.9 Satisfactory >0.95 Redundancy
Indicator reliability	Outer loading	≥ 0.7
Convergent validity	Average Variance Extracted (*AVE*)	≥ 0.50 Desirable
Discriminant validity	Cross loading	An indicator's outer loading on the associated construct should be greater than all its loadings on other constructs.
	Fornell-Larker	$\sqrt{AVE}$> highest correlation with any other constructs
	HTMT criterion	< 0.90

3.7 Data Collection Technique

Bryman (2015) suggests that a sample is a group of individuals selected to represent a larger group. Quantitative research uses standardized questions to limit their responses to a certain category of study. The researcher conducted an actual survey using Survey Monkey website. Doing this allowed the author to gather relevant information before the actual date of the exercise; the information gathered was used to conduct a pilot study to test the validity and reliability of research instruments using SPSS statistical tool. Once the questionnaires were answered, the researcher analyzed the data collected.

The researcher got an approval letter from MoHE to access to all targeted staff' email IDs, then sent them an invitation via Survey Monkey website. The researcher provides a brief explanation of the research problem and the objectives of the study. The researcher also clarified to the respondents that the information provided will be confidential and will be used for academic purposes only.

In the study, the researcher opted to use one type of response format, which included closed-ended questions. Further, the researcher used Likert scales to determine the indicators used to measure responses. According to Hayes et al. (1998), Likert scales are imperative in a study as they yield high-reliability coefficients. Further, (Burns & Grove, 1993)stressed that they have a high likelihood of getting responses that describe the opinion of the respondents.

During the study, the researcher was fully in charge of following the responses from the respondents to ensure the credibility of all the information gathered. Clarification of the questionnaire was provided, and the researcher sent the questionnaires to the respondents and provided a deadline. After the time allocated elapses, the researcher closed access to the questionnaires for data analyses. To fasten the data analysis procedure, the researcher coded all the data in SPSS v. 23 for the pilot testing and Smart PLS V. 3.0 statistical coding system for advance analysis for the objectives of the study.

3.8 Appropriateness of the Research

A quantitative method is deemed fit for this study since it includes the analyses of quantitative in line with research aims and objectives. The researcher required to use all the research tools to conduct the analyses. When conducting research, primary and secondary data sources are the two main sources of data that are commonly used to collect data for any study. Primary data involves collecting data from groups of respondents directly. For the purpose of this study, the primary data was collected from a chosen sample of respondents. This approach is appropriate for this research to allow for a holistic understanding of the topic under study. It also provides detailed results to deliver some rigor to the research.

Each study contains some data collection tips that facilitate easier understanding of how the research should be conducted. Similarly, these tips are important in

maintaining the quality of information collected for the research study. These tips help to reduce the chances of mistakes, negative effects, and biases. During the research, it is common to encounter mistakes, which may affect the legitimacy and consistency of the results thus affecting the conclusions of the study. Such mistakes are reduced by using a predetermined process to collect data. In every area of research where quantifiable information is involved, it is common to have errors and negative results during the data collection process. These cases can be reduced by conducting a series of interviews with the help of unspecified questionnaires. Another source of biases in data collection is the poor recording of the information collected. The problem is eliminated by recording the data accurately.

The mistakes made in the process of carrying out research can be reduced by making prior preparation of the materials needed in the research, identifying the purpose of the research. Collection of data helped to gather vital information useful in the study and the methods used depend on the size of the respondents, the quantity of the information available and the resources available.

3.9 Data Analysis Procedure

Data analysis procedure begins with editing the data to identify errors and omissions in the questionnaires and make the necessary corrections. This involves analyzing the questionnaires to confirm that all the data provided are accurate. When it comes to statistical analysis, the researcher classified the data into smaller classes to facilitate the coding process. The process involves classifying the data based on how similar the responses were. After coding, the researcher classified the data according to the common attributes and characteristics. The data were assembled into raw data, tabulated into statistical tables for further analysis using Smart PLS 3. Quantitative analysis is focused on the philosophical nature of a model, while the qualitative one is focused on how compatible the research methods are (Neuman, 2002).

3.10 Ethical Considerations

Ethical considerations are a vital part of any study. When dealing with people, it is common to cause social, psychological, or financial harm. According to (Neuman, 2002), failing to maintain privacy and confidentiality of the information provided by the respondent is likely to cause harm. The researcher indicates that such a breach of

confidentiality may cause serious ethical problems in the area of study. Polit and Beck (2004) indicated that the researcher should take into account the principle of autonomy that deals with matters related to full disclosure and self-determination. The idea of self-determination suggests that the respondents have the freedom to decide whether they want to be part of the study or not. Therefore, the researcher got consent from respective parties before commencing the research process.

The field of quantitative research is faced with many new changes, and different experts believe that the consent to conduct the research is a continuous process and it must be taken into consideration. The researcher communicated with the respondents beforehand about the possible findings of the research before the whole exercise was completed. The researcher kept on reminding the respondents that participating in the exercise was voluntary. Further, the author provided an authorization letter to accompany the research together with the author's contact number and address. The researcher ensured that the confidentiality principles were fully implemented.

Speziale et al. (2011) indicated that the interpretation of data and reporting of the results require a certain ethical guideline that must be followed. Incidences of information biasness on the data were separated from the original data. During the process, the researcher faced other ethical issues, including information accuracy and legal issues to conduct the exercise. Such factors had a negative impact on the process. To ensure that the process is safe and consistent, the author formulated useful measures that were applied during the study.

During the process, there were hindrances that made the respondents be suspicious and lack trust, especially if they believe that the researcher is working closely with the senior stakeholders in the higher education institutions in Oman as a case. Some of them refused to respond to the questionnaires, indicating that the exercise will not benefit them at any cost. The researcher got consent from the relevant departments to carry out the research. They obtained relevant documentation to demonstrate that the exercise is legal. Further, the researcher ensured that the information collected from the study would be used for the study only.

3.11 Summary

This chapter contained a detailed description of the research philosophy, paradigm, and methodology. The main aim of the study was to determine the factors that affect the adoption of Cloud-Based E-Learning in HEIs in Oman and to develop a model for this adoption, and then evaluate and validate the proposed model. The researcher has conducted a detailed review of the research methodology that takes into account data collection approaches, research design, sampling, research instruments, the data collection procedure, pilot study, and data analysis. In the next chapter, the researcher will cover the research model development, analysis of the data, and interpretation of the results of the research.

CHAPTER 4

ADOPTION MODEL DEVELOPMENT

4.1 Introduction

The model development process is one of the significant steps towards building a new model, covering structural model and measurement model. The structural model focused on the key dimensions of the proposed model, the constructs and its relationship by proposing hypothesis. The model constructs have their original definition and customized definition based on the context and the scope of the study. The measurement model focused on the items used to measure each construct; this study instrument was built based on these items and the research objectives. Next to structural model and measurement model verification, the reliability and validity were verified through content validity and pilot study. Finally, validated questionnaire was distributed to the targeted sample in order to verify the whole proposed model.

4.2 A proposed Model based on DOI, FVM and IC

Based on the previous studies, relying on a single theory cannot be applicable to various types of innovations because of its different types (Zmud, 1982). In addition, an integrated model of theories needs to be applied to identify the adoption process of a specific type of innovations. Therefore, new technology adoption decision would involve risk. Technology or system applicability should consider issues than just technology characteristics, like readiness of the context (Tjan, 2001). In addition, any organization intending to adopt a new technology should have evaluated the technical characteristics, whetherit will satisfy the organisation requirement or not in term of functionality.

From the other side, the organization must assess the economic, organizational and technical readiness to use the intended new technology for adoption. FVM is one of the selected models for this study; it considers technological characteristics, under (Fit) dimension, and organizational readiness, under (Viability) dimension. This is been extended from TTF, where the factors are used to predict the technology usage and performance (Baas, 2010; Goodhue & Thompson, 1995; Teo & Men, 2008). Due to FVM capabilities, the author selected it as a base for an integrated model for the decision to adopt e-learning cloud-based in HEIs.

Figure 2-12represents the FVM which was proposed by (Liang et al., 2007); they studied M-Technology in business using FVM. Based on their model, fit to measure the extent of the advantage of a technology matches the needs of the task, and viability to measure the extent of organizational infrastructure is prepared for new technology adoption. Their result provides very useful guidelines for any organization to take a decision on adopting M-Technology. This is supportive for our study. Another FVM implementation for social software applied by (Turban et al., 2011) to the tasks of the decision making process, also on organizational factors to make social software more effective. Turban's model was developed to assess the fitness of social software to the tasks for group decision making and how it could be applied.

Moreover, in 2013, Muhammad used FVM to examine the success or failure of implementing ERP software (Muhammad & Wickramasinghe, 2013). Theories proposed framework used to identify the fit and viability of ERP implementation and increasing the possibility of success. The result of their study provides valuable principles and guidelines to any organization intending to take a decision on adoption and deployment of ERP. The fitis measured by identifying the organizations' requirements from ERP while viability depends on organizational factors such as political, economic, social, environmental infrastructure and technology readiness. The following table presents more studies on FVM and its adoption.

Summing up, the previous researchers measure the fitness of any new technology to any organization by identifying the specific tasks/requirements, then, selecting the suitable technology. Moreover, previous studies also used DOI factors in order to measure the effect of technology characteristics on adoption decision (Al-Ghaith et al. (2010); (Charlebois et al., 2016; Odeh et al., 2016); Oliveira et al. (2014);

(Sabi et al., 2017; Stieninger et al., 2014). These studies showed a relationship between DOI factors; relative advantage, computability and complexity and the construct of the fit in FVM. Therefore, the author proposes DOI factors to assess the fitness of CBEL in HEIs in Oman. This study model was proposed based on FVM integrated with DOI innovation factors that would affect the fitness of Cloud-Based E-Learning on HEIs tasks, in addition to the information culture towards the quality of academic services.

4.3 Research Model Constructs and Hypothesis in Phases:

The proposed model was built based on selected theories explained in chapter 2 which consists of three dimensions; Technology Evaluation, Readiness Evaluation, and Information culture factors. Technology Evaluation and Readiness Evaluation were examined by Fit-Viability Model (FVM) and DOI model after excluding Environmental factors to focus on factors which are essential components of Cloud-Based E-Learning. The following phases were followed in order to build this research model:

4.3.1 Step 1: Factors identifications & Hypothesis proposed:

As mentioned earlier, this initially proposed model consists of three dimensions as per their nature; Technology evaluation, Readiness evaluation and Information culture factors as shown in Figure 4-1. Technological evaluation concept concerns the factors that evaluate the technological applicability of Cloud-Based E-Learning to the functionality of HEIs, while readiness evaluation concerns the factors that focus on HEIs readiness to use Cloud-Based E-Learning in term of infrastructure and skilled staff. For this study, FVM model is selected to determine whether Cloud-Based E-Learning is a viable option for HEIs in Oman. Fit construct represents the technological evaluation dimension in order to measure the extent to which Cloud-Based E-Learning is consistent with the specific requirement of HEIs task characteristics. Furthermore, viability construct represents the readiness evaluation dimension in order to measure the extent to which the HEIs environment is ready to adopt Cloud-Based E-Learning. Lastly, information culture factors tested whether the effect on the adoption of Cloud-Based E-Learning is significant or not. Furthermore, this research mainly proposed the following two main hypotheses:

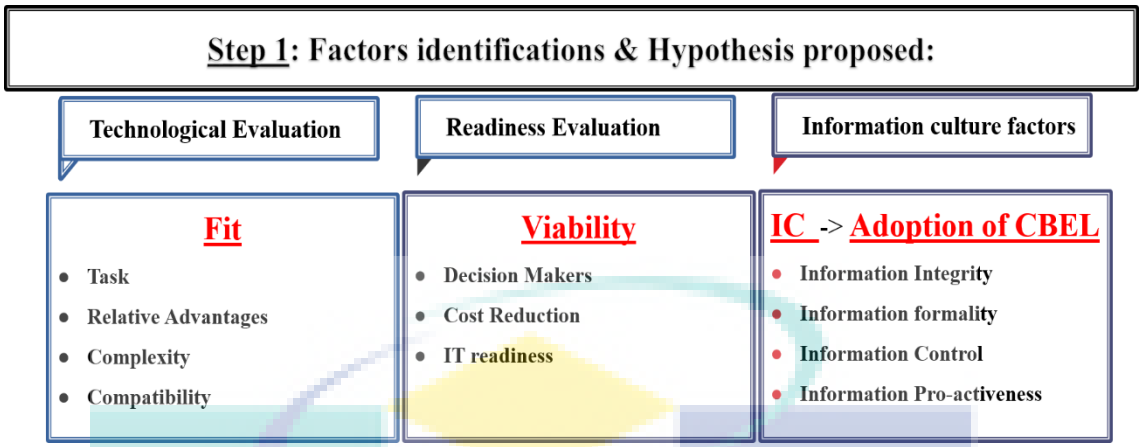

Figure 4-1 Factors identification

H1: The fit of Cloud-Based E-Learning to the HEIs task characteristics positively influences HEIs' decision for adoption.

H2: The viability of Cloud-Based E-Learning has a positive influence on HEIs' decision for adoption.

4.3.2 First Dimension: Technological Evaluation:

The concept of technology evaluation, in general, refers to the investigation to determine the fitness of any technology to the task of the intendedorganization. For the context of this study, is to decide the fitness to adopt Cloud-Based E-Learning by HEIs in Oman. In addition to what was explained in Chapter 2, (Liang & Wei, 2014; Tjan, 2001)investigated the fitness and task characteristics of mobile technology and the internet. (Turban et al., 2011) also investigated the fitness of social networking to the tasks like information sharing, knowledge, and communication. All of these studies and others have used the FVM model to measure the fitness of technology and the task requirements of the adopter. The following are the full details of the technical evaluation (Fit, Viability, and IC) which are also to examine the constructs of each variable with its independent variables.

4.3.2.1 Fit

Fit as defined earlier is to measure the extent to which technology functionality fulfill task requirements for the adopter (Goodhue & Thompson, 1995). Another definition from (Lippert & Forman, 2006) defined fit as a measure of the extent a technology offer features and fit the needs of the task. (Liang & Wei, 2014)defined fitness as the extent

to which the advantages of technology are in line with the needs of the task of the adopter. In this study context, the fitis defined as the extent to which Cloud-Based E-Learning is consistent with the specific requirements of HEIs needs. Accordingly, for this study, fit measures the fitness of Cloud-Based E-Learning (an innovation) for HEIs task requirements and is measured by investigating thetechnology characteristics using DOI technological factors (relative advantage, complexity, and compatibility) for the justifications given in chapter 2. These factors are the most frequent factors used to investigate cloud computing adoption in term of technological perspective (Alkhater et al., 2014; Borgman et al., 2013; Chong et al., 2009; Gangwar et al., 2015; Hussein et al., 2012; B.-N. Hwang et al., 2016; Ibrahim, 2014; Low et al., 2011; Makoza, 2015; Morgan & Conboy, 2013; Oliveira et al., 2014; Humphrey M Sabi et al., 2016; Sabi et al., 2017; Stieninger et al., 2014; Tashkandi & Al-Jabri, 2015). As shown in Figure 4-2, the proposed construction of the fit variable consists of the independent variables (Task and Technological characteristics); the following section will elaborate each with the proposed hypothesis. Firstly, the task will be discussed, then, the effect of the above factors on the fitness of Cloud-Based E-Learning for HEIs tasks.

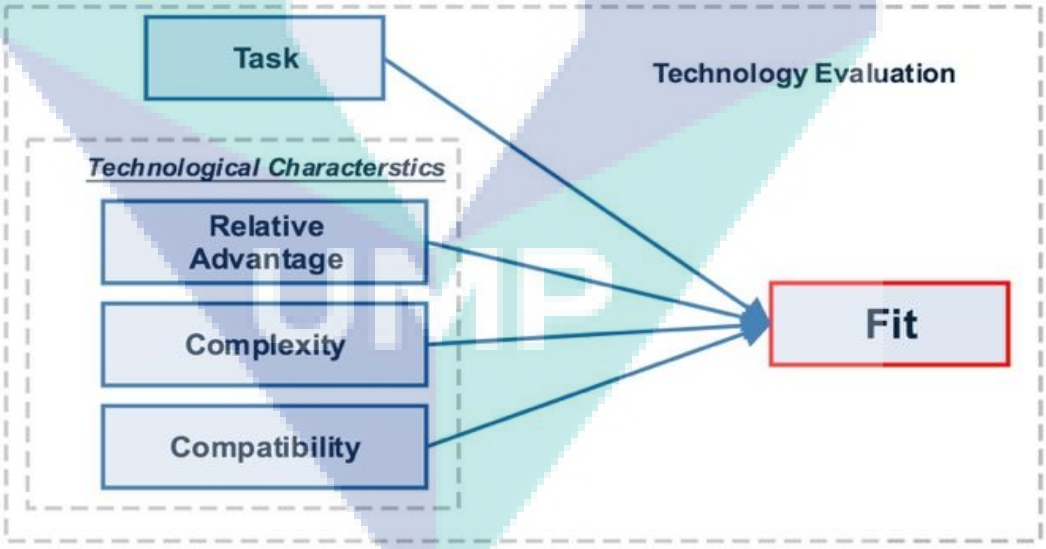

Figure 4-2 Technological Factors

A. Task

Task characteristic, in general, refers to the specific task requirements within the organization/institution(Liang et al., 2007). The task of the institution should be clearly defined to measure the technology fitness accurately; it is different from one context to another. When it fits the Xorganization, it does not mean it will fit the Yorganization. For example, recalling the previous studies on mobile technology adoption, again, the task was that the organization needs to perform functions in timely and remotely manner (Liang et al., 2007).In addition, in (Turban et al., 2011), the task was that the organizationsneed to perform using social networking. In this study, the task is to assess the HEIs' related requirements and actions to be taken toward Cloud-Based E-Learning adoption. Therefore, the author proposes the following hypothesis:

H3: The HEIs' related tasks requirements positively influence Cloud-Based E-Learning fitness on adoption' decision.

B. Technological characteristics:

As per the initially proposed model in Figure 4-3, the technical characteristics are tested using DOI theory factors for the justifications given in chapter 2. Accordingly, these factors are investigated as technology factors influencing the fitness of Cloud-Based E-Learning for the tasks of HEIs adoption. In the following sections, each construct of these technological characteristics (Relative advantage, Complexity, and compatibility) will be elaborated.

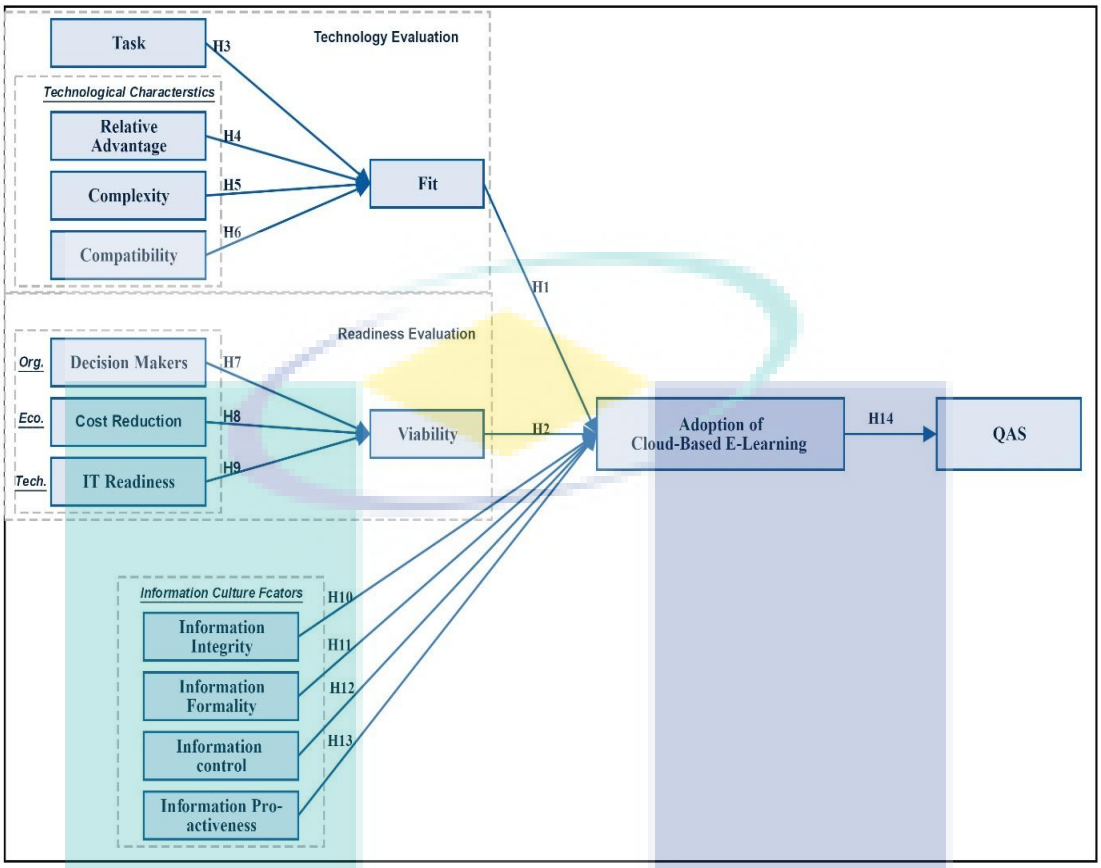

Figure 4-3 Proposed Model Cloud-Based E-Learning Adoption in Omani HEIs.

1. Technological characteristics: Relative Advantage

Relative advantage, in general, refers to "the degree to which development is seen as better than its ancestor" (Ibrahim, 2014). Most of the previous studies that used DOI to study cloud computing adoption hypothesized and examined relative advantage as a positive influences factor in cloud computing adopters with different and various context (Alkhater et al., 2014; Gangwar et al., 2015; Hussein et al., 2012; Low et al., 2011; Morgan & Conboy, 2013; Oliveira et al., 2014; Humphrey M Sabi et al., 2016; Sabi et al., 2017; Stieninger et al., 2014; Tashkandi & Al-Jabri, 2015).. It was defined in the context of cloud computing as the degree to which top management perceive the cloud as a better technology than the other existing computing applications for the same purpose. In the context of this study, it can be as one of the significant factors that influences Cloud-Based E-Learning fitness to the HEIs adoption. Therefore, the researcher hypothesis the following:

H4: Relative advantage positively influences the fitness of Cloud-Based E-Learning to the HEIs' computing needs for adoption.

2. Technological characteristics: Complexity

Complexity, in general, refers to "the degree to which development is seen steady with the current values, needs and encounters of potential adopters" (Sabi et al., 2017). It was mostly used in the previous studies to investigate the diffusion of cloud computing, and considered as a factor that negatively affects cloud computing adoption(Alkhater et al., 2014; Borgman et al., 2013; Charlebois et al., 2016; Chong et al., 2009; Gangwar et al., 2015; Hussein et al., 2012; Ibrahim, 2014; Low et al., 2011; Makoza, 2015; Morgan & Conboy, 2013; Oliveira et al., 2014; Humphrey M Sabi et al., 2016; Sabi et al., 2017; Sila, 2013; Stieninger et al., 2014; Tashkandi & Al-Jabri, 2015). Complexity, with respect to the context of this study, refers to which cloud computing is perceived to be relatively difficult to use (Morgan & Conboy, 2013). For this research, the researcher examined the effect of IT staff and end-user perception of complexity on the fitness of Cloud-Based E-Learning to the HEIs context. Therefore, the following hypothesis is proposed:

H5: Complexity negatively influences the fitness of Cloud-Based E-Learning to HEIs' computing needs for adoption.

3. Technological characteristics: Compatibility

Compatibility refers to how much advancement fits with the potential adopter's current esteems, past practices and current needs (Rogers, 2003). Compatibility has been viewed as a basic element for advancement reception(Cooper & Schindler, 2003). At the point when innovation is seen as fundamentally inconsistent, significant changes in forms that include impressive learning are required. In the context of cloud, computing is defined as the extent cloud computing is perceived to be in line with the existing system and applications. It was mostly used previously for diffusion of any innovation (Alkhater et al., 2014; Borgman et al., 2013; Charlebois et al., 2016; Chong et al., 2009; Gangwar et al., 2015; Hussein et al., 2012; Low et al., 2011; Makoza, 2015; Morgan & Conboy, 2013; Nunes et al., 2017; Oliveira et al., 2014; Humphrey M Sabi et al., 2016; Sabi et al., 2017; Stieninger et al., 2014; Tashkandi & Al-Jabri, 2015). For this study, compatibility is defined as the degree Cloud-Based E-Learning seems to be in line with the needs of HEIs, as was examined to measure task-technology fit(Chengyun, 2010; Teo & Men, 2008). Therefore, the researcher hypothesized as follows:

H6: Compatibility has a positive influence on the fitness of Cloud-Based E-Learning to HEIs' computing needs for adoption.

4.3.3 Second dimension: Readiness Evaluation:

Readiness refers to the extent an organization is ready to adopt new technology and implement it. Successful deployment of new technology is critical to any organization(Tjan, 2001). The organization can't guarantee its benefit from the adoption of any technology without adequate organizational readiness.(Turban et al., 2011)figured out that IT infrastructure maturity is measured by the readiness of hardware and software, in addition to the competence of IS/IT staff. Therefore, the decision makers to decide to adopt or not need to evaluate their organizations' readiness. The viability of a technology is measured by FVM model. As shown in Figure 4-4, the viability can be tested by three independent variables (Decision makers, Cost reduction and IT readiness) as justified in chapter 2.

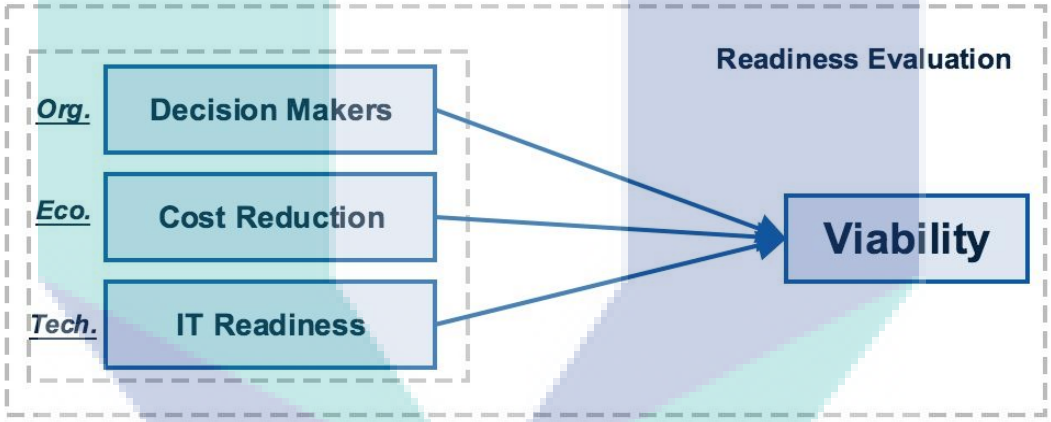

Figure 4-4 Readiness Evaluation

4.3.3.1 Viability

In the FVM model, viability, as per its founder, is the extent to which any organizational infrastructure is well-ready for adoption of a technology (Goodhue & Thompson, 1995; F. Mohammed et al., 2017), (Fathey Mohammed et al., 2016),(Liang & Wei, 2014). There are many factors that influence viability, such as time to positive, personal requirement, value potential and cash flow(Tjan, 2001). Factors that influence cloud computing adoption refers to the viability of the HEIs for Cloud-Based E-Learning by analyzing its economic feasibility and evaluating the technology readiness. In the next sections, the viability constructs (Decision makers, Cost reduction and IT

readiness) with their hypotheses will be elaborated in order to examine the viability empirically.

1.Organisational Factors (Decision Makers):

As discussed earlier in the previous sections and chapter 2 in details, organizational factors are very significant to measure the readiness of any organization to implement technology for the first time. Previous studies have examined top management support(Alkhater et al., 2014; Ashtari & Eydgahi, 2017; Borgman et al., 2013; Chong et al., 2009; Gangwar et al., 2015; Hassan et al., 2017; Kayali et al., 2016; Low et al., 2011; Masud & Huang, 2012; Oliveira et al., 2014; Sila, 2013; Tashkandi & Al-Jabri, 2015).In the cloud computing context, researchers have examined top management decision, innovativeness and cloud knowledge and firm size as influencers of cloud computing adoption (Turban et al., 2011). For the purpose of this research, we have selected and justified in chapter 2, the most frequent investigated factors in the previous studies, which is top management, and will be entitled in this study "Decision makers"(Alharthia et al., 2017; Alkhater et al., 2014; Borgman et al., 2013; Chong et al., 2009; Gangwar et al., 2015; Hassan et al., 2017; Ibrahim, 2014; Kayali et al., 2016; Low et al., 2011; Makoza, 2015; Oliveira et al., 2014; Sila, 2013; Tashkandi & Al-Jabri, 2015).

Decision makers refer to the attitude of management toward the relevant technology and the level of support devoted to the adoption(Ibrahim, 2014). The decision makers have very critical power and positive impact on staff' behavior within any organization toward adoption and use of new technology. (Liang & Wei, 2014)defined the decision makers support (extracted from the definition for this study), as for whether or not the executives in HEIs understand the functions and nature of Cloud-Based E-Learning technology in Oman. Also, this factor was examined by FVM model in order to check the viability of mobile devices (Liang et al., 2007). Therefore, the researcher hypothesized as follows to examine it in different contexts:

H7: Decision maker's supports have a positive influence on the viability of Cloud-Based E-Learning adoption in HEIs.

2. Economical Factors (Cost Reduction):

Economic feasibility means the degree to which the benefits of adopting a technology to be achieved and made more than economic cost which derived from various sources(Al-Balushi et al., 2016; O. Ali et al., 2016; Arvanitis et al., 2016; Hassan et al., 2017; B.-N. Hwang et al., 2016; Nunes et al., 2017; Odeh et al., 2016; Oliveira et al., 2014; Humphrey M Sabi et al., 2016; Saya et al., 2010). In another word, it will determine if the new technology or service/application will save cost or not in term of return on investment(ROI) which assess the cost vs. benefit, and transaction cost such as training cost, software maintenance cost and compatibility cost(Liang & Wei, 2014).Therefore, the author hypothesized the following;

H8: Economical factors have a positive influence on the viability of Cloud-Based E-Learning for HEIs adoption.

3.Technological Readiness (IT readiness):

Relates to the readiness of an organization to adopt IT infrastructure in three perspectives: ICT Technical infrastructure, IT human capability, IT policies and IT managerial capability(Alkhater et al., 2014; Ashtari & Eydgahi, 2017; Makoza, 2015; Masud & Huang, 2012; Humphrey M Sabi et al., 2016). IT infrastructure is defined by (Liang & Wei, 2014)as thetechnical readiness of any organization in terms of hardware/software, IT/security policy, data management and IT staff competent. Regarding the influence of technology readiness on cloud computing adoption, (Low et al., 2011)have studied IT infrastructure and IT human resources.(Saedi & Iahad, 2013) examined the volume of IT resources as an organizational factor affecting adopting cloud computing in SMEs. (Lian, 2015) also studied the influence of organizational readiness on cloud computing decision for adoption in terms of staff competent. This research investigated the technological readiness on the viability of Cloud-Based E-Learning in the HEIs in terms of previous concepts. Therefore, the researcher hypothesized the following:

H9: IT readiness has a positive influence on the viability of Cloud-Based E-Learning adoption in HEIs.

4.3.4 Third Dimension: Information culture factors:

Kroeber and Kluckhohn (1952) defined culture as the behaviors, beliefs, values, and symbols which the people think and communicate. Also, culture means "experience, attitudes, meanings, hierarchies, religion, roles, special relations, ideas of the universe, and material objects furthered as possessions or heritage within the course of generations through individual and group endeavor" (Hofstede, 1991). Therefore, Information culture combines various fields like psychology, computer science and sociology (Zimoch, 2013). It refers to the culture shaped in the process of IT construction (Yan, 2009). Information culture concerns data systems, general knowledge, and perspective of a person towards the data system (Widén-Wulff, 2000).Previous studies discussed that each organization has its information culture which it deals with, so, it's significant to understand the information culture of any organization to manage information behavior(Davenport & Prusak, 1997). As shown in Figure 4-5, information culture can be examined by (Info. Integrity, Info. Formality, Info. Control and Info. Pro-activeness).

Figure 4-5 Information Culture Factors

(Choo et al., 2008)identified six information culture factors (; Information integrity, Information formality, Information control, Information transparency, Information sharing, and Information pro-activeness);however, only four were selected for this study as they have been found in most studies as the most significant factors.

Information integrity is defined as "the use of knowledge in a trusted and principled manner at the individual and structure level"(Abrahamson & Goodman-Delahunty, 2013). Information formality is defined as "the temperament to use and trust institutionalized info over informal sources"(Foscarini & Oliver, 2012). Information control is defined as "the extent data regarding performance is ceaselessly given to folks to manage and monitor their performance"(Jackson, 2011). Information transparency is defined as "openness in coverage and presentation of knowledge on errors and failures, so permitting members to find out from mistakes". Information sharing is defined as "willingness to supply others with data in associate applicable and cooperative fashion". Information pro-activeness is defined as "active concern to place confidence in a way to get and apply new data so as to retort quickly to business changes and to push innovation in merchandise and services". The researcher selected the most used factors which focus on factors only as follows:

1. Information culture factors: Information integrity

Data integrity is the reliability, trustworthiness, and dependability of information. It is the precision, consistency, and quality of the information procedures. Data integrity is essential for information management activity. Lacking information integrity in an organization will affect its business activities(Marchand et al., 2002). (Choo et al., 2008)revealed that 650 staff from different organizations had information integrity, emphasizing that it is a desired trait for managers in decision-making positions. Then, again, if these qualities are sure, data will be straightforward, portraying reality and what is truly happening, promoting trust in the data stream and basic leadership realizing that the basis behind the choice is worthy, both ethically and basically (Marchand et al., 2002).

Regarding cloud computing adoption, previous studies in information integrity prove that it has an effect on technology adoption. Hence, this study expected that information integrity would decidedly influence the adoption of Cloud-Based E-Learning in the HEIs in Oman. Furthermore, the author hypothesized the following:

H10: Information integrity has a positive influence on Cloud-Based E-Learning adoption by HEIs in Oman.

2. Information culture factors: Information formality

Information formality refers to the willingness to use and trust institutionalized information over informal sources. It also refers to intentionally depending on regulated information as opposed to on casual sources(Marchand et al., 2002). (Sinitsyna, 2014)stressed that information formality has a positive influence on information quality, and the perception of information and value perception are interrelated once are associated with information formality. As per(Ke, 2011)organizations should try to supplement formal information for basic leadership utilizing formal contacts and correspondences with individuals inside and outside the organization to check the dependability of formal information, or to supplement the formal information accessible. (Ke, 2011) has figured out that the organizationis in need for formal information to support them for taking a decision.

Therefore, for this study, the researcher proposed the following hypothesis:

H11: Information formality has a positive influence on Cloud-Based E-Learning adoption by HEIs in Oman.

3. Information culture factors: Information control

Information control refers to the extent to which information about performance is continuously presented to people to manage and monitor their performance. It is characterized as the utilization of information specifically to either hinder or support certain practices (Marchand et al., 2002). Recently, there has been a huge increment in administrative endeavors to create money-related and non-monetary measurements, for example, economic value added. These are planned to manufacture mindfulness among representatives of the connections between their employment or work unit execution and the association's general execution (Ke, 2011). The utilization of information by decision makers enables them to nearly screen and control operations, exercises, and decide. Those capacities are vital for key arrangements and business execution argumentation to end up noticeably better. However, information control can be affected by information integrity and information formality(Furness, 2010).

Essentially, those control systems are identified with the person's execution which is associated with the association's execution (Furness, 2010). (Simons, 1994) set certain principles to negative data controls; it defines limits for circumstances looking

for conduct. It additionally gives an instrument to remunerate craved conduct and individual performance. He additionally recommended that positive data control would incorporate moving representatives to perform better utilizing information assets to support a conviction framework. For the purpose of this study, the researcher expected that information control will significantly affect the decision to adopt Cloud-Based E-Learning by HEIs in Oman; therefore, the following hypothesis was formed;

H12: Information control has a positive influence on Cloud-Based E-Learning adoption by HEIs in Oman.

4. Information culture factors: Information pro-activeness

Information pro-activeness refers to active concern to suppose the way to get and apply new data so as to reply quickly to business changes and to market innovation in product and services. Its characterized as a state of mind to pick up and apply new information picked up quickly in a business domain because of fast changes; in this manner, advancing development in both items and administrations (Marchand et al., 2002).As indicated by (Furness, 2010)information pro-activeness could be influenced by information trustworthiness, hence, the researcher expected that information responsiveness would empirically influence the adoption of Cloud-Based E-Learning as expressed in the following hypothesis:

H13: Information pro-activeness has a positive influence on Cloud-Based E-Learning adoption by HEIs in Oman.

4.3.5 Adoption of Cloud-Based E-Learning (CBEL) and QAS:

The author proposed that the explained dimensions in the previous sections will affect the adoption of CDEL. Quality refers to delivering something as measured against other things of the same type; for academic services, we can refer to the level of delivered academic services in HEI compared to others. Finally, with the support of the previous hypothesis, the researcher hypothesized the outcome as follows:

H14: Cloud-Based E-Learning has a positive influence on the quality of academic services in HEIs in Oman.

Table 4-1 highlighted the definitions of constructs used in the proposed model.

Table 4-1 Constructs' definition for the Proposed Model

Construct	Definition	Sources
Fit	Refers to the extent to which a Cloud-Based E-Learning provides features that match the requirements of the task of HEIs.	(Goodhue & Thompson, 1995; Liang & Wei, 2014; Fathey Mohammed et al., 2016; F. Mohammed et al., 2017).
Viability	Refers to the extent to which the infrastructure of the HEIs is ready for Cloud-Based E-Learning considering general economic feasibility, technical infrastructure and the social readiness.	(Goodhue & Thompson, 1995; Liang & Wei, 2014; Fathey Mohammed et al., 2016; F. Mohammed et al., 2017).
Task	Refers to the HEIs requirements and actions to be performed by Cloud-Based E-Learning.	(Goodhue & Thompson, 1995; Liang & Wei, 2014; Fathey Mohammed et al., 2016; F. Mohammed et al., 2017).
Relative Advantage	Refers to the degree to which Cloud-Based E-Learning is perceived as providing greater useful for HEIs rather existing system.	(B.-N. Hwang et al., 2016; Ibrahim, 2014; Low et al., 2011; Makoza, 2015; Oliveira et al., 2014; Sabi et al., 2017).
Complexity	Refers to the degree to which Cloud-Based E-Learning is seen as being hard to utilize or get it by HEIs.	(Alkhater et al., 2014; Gangwar et al., 2015; Low et al., 2011; Oliveira et al., 2014; Sabi et al., 2017).
Compatibility	Refers to the degree to which Cloud-Based E-Learning is seen steady with the current values, needs and encounters of HEIs.	(Alkhater et al., 2014; Low et al., 2011; Nunes et al., 2017; Oliveira et al., 2014; Sabi et al., 2017)
Cost Reduction	Refers to the amount of financial and human resources an HEIs need to invests to implement and manage Cloud-Based E-Learning.	(O. Ali et al., 2016; Arvanitis et al., 2016; Hassan et al., 2017; Nunes et al., 2017)
Decision Makers	Refers to the attitude of management in HEIs toward the Cloud-Based E-Learning and the level of support devoted for the adoption.	(Alharthia et al., 2017; Kayali et al., 2016; Makoza, 2015; Oliveira et al., 2014).
IT readiness	Refers to the readiness of HEIs in terms of IT Technical infrastructure, IT human capability and IT managerial capability for Cloud-Based E-Learning.	(Alharthia et al., 2017; Alkhater et al., 2014; Makoza, 2015; Nunes et al., 2017; Oliveira et al., 2014)
Information Integrity	Refers to the use of information of Cloud-Based E-Learning in a trustful and principled manner at the individual and organizational level in HEIs.	(Abrahamson & Goodman-Delahunty, 2013; Choo et al., 2008; Sinitsyna, 2014)
Information Formality	Refers to the willingness to use and trust institutionalized information over Cloud-Based E-Learning.	(Abrahamson & Goodman-Delahunty, 2013; Choo et al., 2008; Hwang, 2011; Sinitsyna, 2014)

Table 4-1 Continued

Construct	Definition	Sources
Information Control	Refers to the extent to which information in Cloud-Based E-Learning performance is continuously presented to staff in HEIs to manage and monitor their performance.	(Choo et al., 2008; Sinitsyna, 2014) (Abrahamson & Goodman-Delahunty, 2013;
Information Pro-activeness	Refers to the active concern to think about how to obtain and apply new information by Cloud-Based E-Learning in order to respond quickly to business changes in HEIs.	(Abrahamson & Goodman-Delahunty, 2013; Choo et al., 2008; Hwang, 2011; Sinitsyna, 2014)
Adoption of CBEL	Refers to the acceptance and the initial use of Cloud-Based E-Learning as a new technology among HEIs.	(Deering et al., 2012)

4.3.6 Step 2: Items validations:

After all the factors have been identified, and all the related hypotheses proposed, the author had to search for the proper items for each factor to examine the relevant hypotheses. Based on the related-work table (Appendix F) which was built in the literature review chapter, the items from the previous studies were reviewed and listed for contextualization and customization for the purpose of the study as shown in Figure 4-6. The minimum items for each factor were 3 items in order to represent the factors thoroughly. Table 4-2, shows the items validity result as per the expert feedback. The output of this validation is that the selected items are validated and proven to measure what was built for.

Table 4-2 Items validity be experts

Items	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	mean	SD
RA 1	3	2	3	3	3	3	2.833333	0.408248
RA 2	3	3	2	3	3	2	2.666667	0.516398
RA 3	3	3	2	3	3	3	2.833333	0.408248
RA 4	3	2	2	3	3	3	2.666667	0.516398
RA 5	3	2	2	3	3	3	2.666667	0.516398
RA 6	2	2	3	3	3	3	2.666667	0.516398
Com1	3	2	2	3	3	2	2.5	0.547723
Com2	3	1	2	3	3	2	2.333333	0.816497
Com3	3	3	2	3	3	1	2.5	0.83666
Com4	2	3	2	3	3	1	2.333333	0.816497
Com5	3	2	2	3	3	2	2.5	0.547723
Comt1	3	2	3	3	3	3	2.833333	0.408248
Comt2	3	3	3	2	3	2	2.666667	0.516398
Comt3	3	3	2	3	3	3	2.833333	0.408248
Comt4	3	2	3	3	3	2	2.666667	0.516398

Table 4-2 Continued

Items	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	mean	SD
Comt5	3	3	2	3	3	3	2.833333	0.408248
Fit1	3	3	2	3	3	3	2.833333	0.408248
Fit2	3	2	3	2	3	3	2.666667	0.516398
Fit3	3	2	3	3	3	3	2.833333	0.408248
Fit4	3	3	2	3	3	3	2.833333	0.408248
Fit5	3	3	2	3	3	3	2.833333	0.408248
DM1	3	1	2	3	3	3	2.5	0.83666
DM2	3	3	2	2	3	3	2.666667	0.516398
DM3	3	3	2	2	3	3	2.666667	0.516398
DM4	3	3	2	3	3	3	2.833333	0.408248
DM5	3	3	2	3	3	3	2.833333	0.408248
DM6	3	2	3	3	3	3	2.833333	0.408248
CR1	3	3	3	3	3	3	3	0
CR2	3	2	3	3	3	3	2.833333	0.408248
CR3	3	3	3	3	3	3	3	0
CR4	3	3	2	2	3	3	2.666667	0.516398
CR5	3	1	2	3	3	3	2.5	0.83666
IT1	2	3	3	3	3	3	2.833333	0.408248
IT2	3	2	2	2	3	2	2.333333	0.516398
IT3	3	3	2	2	3	3	2.666667	0.516398
IT4	2	3	2	2	3	3	2.5	0.547723
IT5	3	2	2	3	3	3	2.666667	0.516398
IT6	3	1	2	3	3	3	2.5	0.83666
Info.Integ1	3	2	2	3	3	3	2.666667	0.516398
Info.Integ2	3	3	2	3	2	3	2.666667	0.516398
Info.Integ3	3	2	2	3	3	3	2.666667	0.516398
Info.Integ4	3	3	2	3	3	3	2.833333	0.408248
Info.Integ5	3	3	2	3	3	3	2.833333	0.408248
InfoForm1	3	3	3	2	3	3	2.833333	0.408248
InfoForm2	3	3	3	3	2	3	2.833333	0.408248
InfoForm3	3	1	2	3	3	3	2.5	0.83666
InfoForm4	3	2	2	3	2	3	2.5	0.547723
InfoForm5	3	2	2	3	3	3	2.666667	0.516398
InfoCont.1	3	3	2	3	3	3	2.833333	0.408248
InfoCont.2	3	3	2	3	3	3	2.833333	0.408248
InfoCont.3	3	3	2	3	3	3	2.833333	0.408248
InfoCont.4	3	3	2	3	3	3	2.833333	0.408248
InfoCont.5	3	3	2	3	2	3	2.666667	0.516398
Info. Pro.1	3	3	2	3	3	3	2.833333	0.408248
Info. Pro.2	3	2	2	3	3	3	2.666667	0.516398
Info. Pro.3	3	2	3	3	3	3	2.833333	0.408248
Info. Pro.4	3	1	2	3	3	3	2.5	0.83666
Info. Pro.5	3	2	2	3	3	3	2.666667	0.516398

Table 4-3 Experts' statistics

	Expert1	Expert2	Expert3	Expert4	Expert5	Expert6
Mean	2.93	2.43	2.26	2.84	2.93	2.81
Median	3.00	3.00	2.00	3.00	3.00	3.00
Mode	3	3	2	3	3	3
Std. Deviation	.256	.678	.442	.365	.256	.476

Table 4-3showed the statistical measurement for all the 6 experts as pre-testing. In addition to the above experts' evaluation, they have shared their general feedback against some of the items such as Language issue, some items have to be simplified, they have comments against some vague statements, leading questions to be removed, and the overall format of the questionnaire.

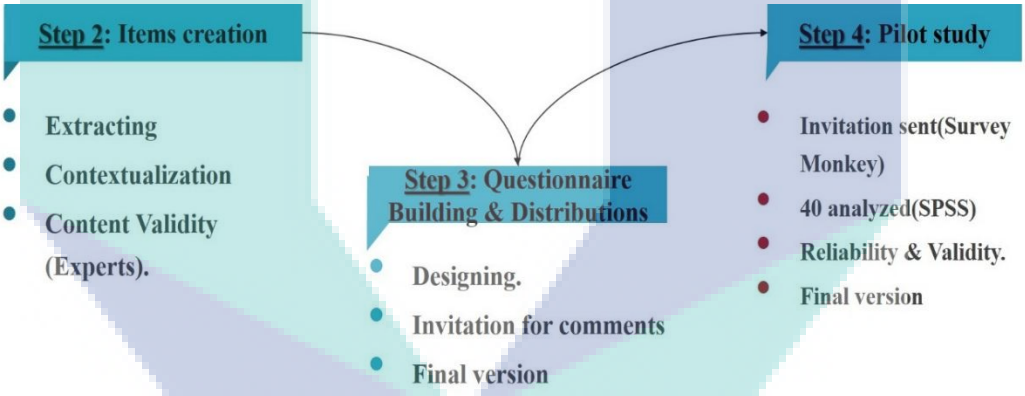

Figure 4-6 RM Development

Table 4-4 showed the number of items for each factor used for this research. Next, these items were sent to the experts for validation purpose before designing the final version of the questionnaire. These experts are from the field of information systems with interest in cloud computing adoption.

Table 4-4 Items against each factor

The Construct	No. Items
Fit	5
Viability	3
InfoCont	5
InfoForm	4
InfoInt	5
InfoPro	5
RA	6
COMX	5
COMT	6
Task	4
Org	6
IT	6
Econ	5
Adoption	5
AQS	4

4.3.7 Step 3: Questionnaire Organisation& Distributions

After factors identifications and items validation, the questionnaire designing was headed and consists of the introductory part where the author introduced his research details and purpose, along with the affiliation. Then, the respondents' demographic section which lists the required details of the respondents as per the identified variables. Finally, the factorpart with items for each using a 5-point Likert scale (Strongly Disagree=1, Strongly Agree= 5) is finalized.

The author approached content validity exercise for the questionnaire in order to make sure the questionnaire was designed in a friendly manner, ensure the instructions are useful, and nothing is missing or to be amended. For the language purpose, the service of an English language professor was sorted. Next, the feedback was incorporated, and the final version of the questionnaire was ready for distribution.

Furthermore, the final version of the questionnaire was offset on the Survey Monkey website, and then, an invitation for comments was sent to a few experts for more confirmation. The final soft survey was sent to five of the academics from the

targeted population; their response was monitored in term of accessibility, ease of use, no logical errors, and the response is saved without any problem. Finally, the original questionnaire was sent to 40 respondents for the pilot purpose. These 40 were invited via Survey Monkey with a special request to contact the author in case of any doubt.

4.3.8 Step 4: Pilot study

For reliability and validity, the first 40 respondents were analyzed using SPSS (full details mentioned in the next chapter). However, once the result of the pilot study was validated and significantly based on the literature, the author headed to the complete population. This phase is a grateful step as it builds the confidence of the researcher about his research, his questioner and its content. Finally, the full data was extracted from the Survey Monkey website in both Excel and PDF formats for analysis.

4.4 Summary

This chapter has covered the model development process starting from the factors identifications to building the initial model. The dimensions of the model were justified and explained thoroughly. The items were used also discussed, the questionnaire building process was also discussed. The final stage was pre-testing the questionnaire and pilot the collected data for the reliability and validity.

CHAPTER 5

DATA ANALYSIS AND DISCUSSION

5.1 Introduction

In order to achieve the research objectives, the collected data should be analyzed to get the findings and verify the hypotheses. However, before collecting the main data, the instrument should be tested through a pilot study. As we have mentioned earlier, by ensuring the reliability of the measures used in the instrument, the collected data is to be analyzed for the validation of the proposed model. The analyzing process includes verifying the reliability and the validity of the measurement model and examining the relationships between the constructs and testing the hypotheses. However, as suggested by Hair et al. (2010), the researcher should examine the data for completeness and consistency prior to analyzing the data.

5.2 Pilot Study

To detect the possible problems in the earlier phases of the study, identify the errors in the current instrument design format, and enhance the validity and reach reliability requirements, a pilot study was conducted. To save the time of collecting sample responses, the author decided to use the Survey Monkey service to reach the targeted population easily and quickly via different platforms (Email, Mobile link, and a web link); this helped in getting the summary of the result in a click. This method required getting emails IDs for the targeted responses, which required their institutions permission. With the supporting letter from the Ministry of Higher Education, the author was able to get the list of targeted samples' Email Ids in three weeks with personal involvement. The first group of the invitationwas sent to 250participants, however, 40 responses were received. The reliability test was conducted to assess the

internal consistency between each scale measures. Cronbach's Alpha's reliability coefficient test in SPSS was used to test the reliability. According to (Hair et al., 2010), 0.7 is the satisfactory cut-off for Cronbach's Alpha criterion. Table 5-1showed that all the constructs hada satisfactory value (above 0.7) of Cronbach's Alpha, indicating that all the measurements are reliable and confirming the reliability of the instrument measures.

Table 5-1 Reliability Test (Pilot Study)

The Construct	No. Items	Cronbach's Alpha
Fit	5	0.927
Viability	3	0.888
InfoCont	5	0.896
InfoForm	4	0.880
InfoInt	5	0.942
InfoPro	5	0.931
RA	6	0.922
COMX	5	0.914
COMT	6	0.822
Task	4	0.883
Org	6	0.949
IT	6	0.936
Econ	5	0.960
Adoption	5	0.916
AQS	4	0.969

5.3 Data Preparation

To analyze the collected data, a pre-processing step was involved so that the data is cleaned and transformed to improve its quality in a process called data preparation. Data preparation is a process in which the raw data is converted to a usable and ready for analysis format. This includes data entry, coding, tabulation and validation(Hair et al., 2014). Accordingly, data preparation involves screening the data, data normality, and common method bias assessment as detailed below.

5.3.1 Data Screening

Data screening (or “data screaming") is the process of ensuring that the data is clean and ready for conducting further analyses (B. Tabachnick & Fidell, 2001). According to F. Hair et al. (2014), data should be screened so as to make sure the information is reliable, valid and useable for testing. The most problems that require being self-addressed once identified are missing data and outliers. Missing information happens once the respondents could not answer one or a lot of questions within the survey, which ends up in potential issues within the analysis method(B. Tabachnick & Fidell, 2001).Missing observations are problematic in the analysis, and a few time, measures cannot be computed if there are missing values within the responses. With the help of Survey Monkey features, missing data can be easily found as “partial-completed” with the option to remind these respondents. Multivariate strategies need the knowledge to be complete; so, once using SEM as a data analysis technique, missing knowledge becomes a vital issue (Hair et al., 2010).

The most popular methodology for handling missing knowledge is understood as case deletion; typically referred to as list wise deletion (LD) and complete-case analysis (Schafer & Graham, 2002). LD is considered the simplest technique for addressing missing knowledge(Carter, 2006). This technique involved removing incomplete cases (record with missing information on any variable) from the dataset and this is easy to recognize by one click using Survey Monkey feature. If a missing-data downside will be resolved by discarding solely a tiny low a part of the sample, then, the way will be quite effective (Schafer & Graham, 2002). Considering the big sample size obtained for this study, there was no drawback removing the records that were missing on any variable, and there was no hurt of deleting incomplete cases from the collected information(Hair et al., 2010).By screening the data, missing values were observed, so, the LD technique was applied. According to (Hair et al., 2006), criterion cases with 10 % or more incomplete responses should be dropped. Accordingly, three cases were omitted because of the high percentage of missing data.

Another issue is dealing with the outliers to ensure that respondents paid attention to the questions, and that information was entered properly. This kind of outlier is known as an unengaged respondent(Hair et al., 2014). The responses were

reviewed to discover the illogical patterns. Consequently, if a respondent replied to most of every construct paradoxically, it is assumed that he or she failed to browse the things fastidiously. In addition, if the respondents chose constant to declare all the things, it is assumed that he or she failed to browse or listen to the questions. Other patterns indicative of unengaged respondents are '1, 2, 3, 4, 5; 1, 2, ...' or '2, 2, 2, 2,2; 5, 5, 5, 5; 1, 1, ...'. These respondents were clearly not engaged, and their responses were deleted from the results. Consequently, during this study, twenty questionnaires were discarded because of unengaged responses. Being that the sample size during this study is 332; the author did not bother about the discarded cases.

In addition, another type of outliers is the cases representing values that are substantially different (lower or higher) from all others (Kline, 2011). According to Hair et al. (2006), problematic outliers are not representative of the population, and may seriously distort applied mathematics tests. Usually, with outsized sample size, like the one used for this study (N=312),cases with outliers might occur(B. G. Tabachnick & Fidell, 2007). Mahalanobis distances D2 measure the distance of cases from the means of the predictor variables. As a result, to deduct the outliers, Mahalanobis distances D2was computed via SPSS with the regression procedure for the variables. As a rule of thumb, Hair et al. (2010) suggested identifying any case in which the D2/df value exceeds three or four in large samples (where the sample size is >=200) as an outlier. D follows a chi-square distribution with degrees of freedom equal to the number of variables included in the calculation (Hair et al., 2010; B. G. Tabachnick & Fidell, 2007). The result of the study analysis indicated that there are no outliers in the collected data (Appendix E).

5.3.2 Data Normality

Normality refers to the form of data distribution for a private metric variable and its correspondence with a statistical distribution. In the Structural Equation Modelling(SEM), a normality test is not obligatory, especially when the sample size is huge as with this study (Hair et al., 2010; Kline, 2011). In addition, bootstrapping is used in PLS to avoid any type of non-normal distribution. However, univariate normality has been conducted as a procedure of pre-processing to validate the data by determining the normal distribution of the data. The shape of any disruption is delineated bytwo measures; kurtosis and Skewness(Hair et al., 2010). Skewness and

kurtosis square measure two ways in which distribution may be non-normal. They will occur either on an individual basis or along in an exceedingly single variable (Kline, 2011). Consequently, the distribution of the items was assessed for normality via their Skewness and kurtosis values. Kurtosis refers to the peakedness or flatness of the distribution compared to the normal distribution. Skewness, in contrast, is used to describe the balance of the distribution. If the distribution is unbalanced and shifted to one side, it is skewed. Appendix F demonstrates skewness and kurtosis for all measures. According to Hair et al. (2010), the most commonly-used important worth of kurtosis and asymmetry is [± 2.58]. The asymmetry and kurtosis values within the table in the Appendix F within the appropriate limits. As a result, the data is normally distributed.

5.3.3 Common Method Bias

Common Method Bias (CMB) is a measurement error (Podsakoff et al., 2003; Podsakoff et al., 2012)that threatens the validity of a conclusion drawn upon the applied mathematics results. This bias is determined via the presence of a scientific variance (Bagozzi & Yi, 1990)that can inflate or deflate a given relationship between variables, resulting in unsound conclusions (Doty & Glick, 1998).Harman's single factor is the most widely used in the literature to test whether CMB is of concern (Podsakoff et al., 2003).By loading all the variables into the factor analysis (in SPSS), and set the number of factor to "1", if the first component of "Total Variance Explained" accounts for less than 50% of all the variables in the model, the instrument is free from significant common method bias effects (Podsakoff & Organ, 1986).For the current study, the results showed that the first factor accounted for only 32 % of the overall variance, which indicates that CMB does not affect the results. In addition, as suggested by Kock (2015), the Variance Inflation Factor (VIF) can be used to check the CMB. Applying the PLS algorithm showed that the VIF for all the constructs (See Table 5-2) was less than the threshold used in common method bias tests, which is 3.3(Kock, 2015). This indicates that the instrument in this study is free of common method bias.

Table 5-2 Common method bias Using Factor Analysis

Dependent Variable	Independent Variables	VIF
Adoption	Fit	1.643
	Viability	1.686
	InfoCont	3.282
	InfoForm	2.456
	InfoInt	3.174
	InfoPro	1.972
FIT	RA	1.627
	COMX	1.48
	COMT	2.114
VIABILITY	Task	1.145
	Org	1.555
	IT	1.452
	Econ	1.782

*Threshold; <3.3

5.3.4 Descriptive Statistic of the Data

To describe the basic features of the data, descriptive statistics are reported. Descriptive analysis was performed using Statistical Package for Social Sciences (SPSS) v.25. The demographic information of respondents was described by frequency distribution and percentage. In addition, a summary of the main features of all the measures was provided. This includes reporting the mean, means, standard deviations and variance in order to make sure that the responses did not deviate from the mean.

5.3.5 Respondents' Profile

The sample frame was this study is restricted to all computer knowledgeable staff in Omani HEIs. Table 5-3provided a detailed descriptive statistic of the respondents' profiles, including gender, age, degree, academic title, position, and experience.

Table 5-3 Respondents Profiles

Variable	Data	Respondents	Percent
	Male	202	64.7
Gender	Female	109	34.9
	Missing	1	.3
	Total	312	100.0
	18 -25 years	6	1.9
	26 - 33 years	73	23.4
	34 – 40 years	113	36.2
Age	41 – 50 years	87	27.9
	51 years or older	32	10.3
	Missing	1	.3
	Total	312	100.0
	High School or less	3	1.0
	College diploma	8	2.6
	Bachelor degree	53	17.0
Degree	Master Degree	127	40.7
	PhD	120	38.5
	Missing	1	.3
	Total	312	100.0
	Prof	5	1.6
	Associate Prof	24	7.7
Academic	Assistant Prof	78	25.0
	Lecturer	113	36.2
Title	Technician	49	15.7
	Other	41	13.1
	Missing	2	.6
	Total	312	100.0
	Owner	4	1.3
	Dean	24	7.7
Position	IT Manager	182	58.3
	Other	101	32.4
	Missing	1	.3
	Total	312	100.0
	Less than 3 years	55	17.6
	3-5 years	69	22.1
Experience	5-10 years	106	34.0
	Over 10 years	81	26.0
	Missing	1	.3
	Total	312	100.0

Concerning the gender of the respondents, the results showed that the men are almost twice the women, 65% and 35% respectively. The results also depicted that 113 of the respondents are aged 34 – 40(36%), 87 are 41 – 50 years (28%),76 are 26 - 33 years (23%), 32 are 51 years or older (10%), and only 6 are in range of 18 – 25 years (2%).Relating to the educational degree of the respondents, Table5-3 showed that 40.7 % of the respondents have Master of Science degree, 38.5 % have Ph.D. degree, 17 % have bachelor's degree, 8 have Diploma, and only 3 respondents have High school or less. In addition, 113 of the respondents are lecturers, 78 are Assistant Prof., 24 are Associate Prof. and 5 Professors, while 49 are Technician. Table 4.3 also showed that most of the respondents (182) are IT, managers, while 24 are deans,4 are owners, and the rest have different roles (101) under various positions (Faculty, Heads). Furthermore, 106(44 %) of the respondents have 5 - 10 years of experience, 81 have over 10 years of experience, 69 have more than 3 - 5 years of experience, while 55 respondents have been in their institution for less than three years.

5.3.6 Institution Information

Institution's information related to cloud adoption and usage can be described using the status of adopting cloud computing, types and models of clouds already adopted. As shown in Table 5-4, the targeted institutions are varied based on the stage of cloud computing adoption; from not considered cloud computing yet (26.3 %), evaluated the technology but still did not plan to adopt (with 6.1%), currently are evaluating cloud computing (18.6 %), have evaluated and planning to adopt cloud computing (with 15.1), and institutions that already adopted the technology (with 34 %). 43.6 % of the respondents do not know the types of cloud computing their institutions use or plan to use, while 24 % adopt or plan to adopt private cloud. 22.4 % adopt or plan to adopt public cloud and 9.9 % adopt or plan to adopt a hybrid cloud. Further, 61.2 % of the respondents do not know which model of cloud computing their institution use or plan to use, while 23.7 % stated that SaaS model is used, and 8 % stated that their institution use IaaS model and 8.1 know that PaaS model is used in their institution.

Table 5-4 Cloud Computing Adoption in the Institutions of the Study Sample

Variable	Data	Frq.	%
Status in Adopting CC	Not considering	82	26.3
	Have evaluated, but not planning to adopt cloud computing	19	6.1
	Currently evaluating cloud computing	58	18.6
	Have evaluated and planning to adopt cloud computing	47	15.1
	Have already adopted cloud computing	106	34.0
	Missing	0	0
	Total	312	100.0
CC types	Public cloud	70	22.4
	Private cloud	75	24.0
	Hybrid cloud	31	9.9
	Do not know	136	43.6
	Missing	0	0
	Total	312	100.0
CC model usage	IaaS	25	8.0
	PaaS	22	7.1
	SaaS	74	23.7
	Do not know	191	61.2
	Missing	0	0
	Total	312	100.0

5.3.7 Descriptive Statistics of Instrument

The statistics results of the measurement items are shown in Table 5-5. As can be seen, all the items have mean values above 3.5 and Std. Deviation of minimum 0.665 (for InfoCont5) and maximum 1.018 (for IT5). This indicates that the responses did not deviate from the mean.

Table 5-5 Results of the measurement items

Item	N	Mean	Std. Deviation	Item	N	Mean	Std. Deviation
Task1	312	3.60	.775	IT1	312	3.96	.842
Task2	312	3.60	.815	IT2	312	3.67	.994
Task3	312	3.66	.786	IT3	312	3.71	.929
Task4	312	3.77	.773	IT4	312	3.67	.905
RA1	312	3.83	.967	IT5	312	3.61	1.018
RA2	312	3.82	.924	IT6	312	3.81	.876
RA3	312	3.91	.869	Vi1	312	3.75	.700
RA4	312	3.90	.849	Vi2	312	3.77	.772
RA5	312	3.91	.875	Vi3	312	3.82	.719
RA6	312	3.90	.843	InfoInt1	312	3.89	.731
ComX1	312	3.73	.784	InfoInt2	312	3.65	.835
ComX2	312	3.68	.904	InfoInt3	312	3.74	.793
ComX3	312	3.65	.872	InfoInt4	312	3.79	.722
ComX4	312	3.79	.883	InfoInt5	312	3.89	.722
ComX5	312	3.74	.915	InfoForm1	312	3.82	.711
ComT1	312	3.58	.826	InfoForm2	312	3.86	.696
ComT2	312	3.69	.736	InfoForm3	312	3.61	.790
ComT3	312	3.68	.802	InfoForm4	312	3.83	.708
ComT4	312	3.77	.734	InfoCont1	312	3.70	.776
ComT5	312	3.73	.758	InfoCont2	312	3.82	.698
ComT6	312	3.74	.731	InfoCont3	312	3.80	.749
Fi1	312	4.02	.732	InfoCont4	312	3.90	.694
Fi2	312	3.71	.762	InfoCont5	312	3.88	.665
Fi3	312	3.84	.725	InfoPro1	312	3.90	.705
Fi4	312	3.68	.790	InfoPro2	312	3.78	.792
Fi5	312	3.85	.697	InfoPro3	312	3.83	.772
Org1	312	3.71	.787	InfoPro4	312	3.79	.796
Org2	312	3.65	.799	InfoPro5	312	3.84	.801
Org3	312	3.55	.840	Adopt1	312	4.15	.804
Org4	312	3.86	.804	Adopt2	312	4.10	.766
Org5	312	3.88	.795	Adopt3	312	3.90	.784
Org6	312	3.78	.809	Adopt4	312	3.78	.842
Eco1	312	3.74	.823	Adopt5	312	3.83	.822
Eco2	312	3.70	.832	ASQ1	312	4.04	.716
Eco3	312	3.75	.770	ASQ2	312	4.03	.743
Eco4	312	3.66	.752	ASQ3	312	3.98	.706
Eco5	312	3.77	.772	ASQ4	312	4.00	.748

5.4 Research Model Assessment using SMART PLS

Partial Least Squares (PLS) has become the technique of alternative for several MIS researchers owing to its relative simplicity in modeling difficult relationships. In addition, past analysis has documented many benefits of using PLS over Maximum Likelihood (ML) based SEM techniques. On reviewing the use of PLS in MIS Quarterly over the past 20 year period, Ringle et al. (2012) found that almost all authors justified the use of PLS because of little sample sizes, non-normal information and also the use of formative indicators. Furthermore, Chin (1998) suggested that PLS is appropriate for finding out phenomena that are comparatively new; also, the theoretical model is not well shaped and/or in things wherever the model is comparatively advanced with a sizable amount of indicators and LVs. Gefen et al. (2011) also prompt that the superior convergence rates of PLS over ML mean that PLS will be helpful for preliminary analysis objectives. Because PLS largely avoids inadmissible solutions and factor indeterminacy (Fornell & Bookstein, 1982), it becomes a beautiful technique to be employed in modeling complicated relationships. In addition, PLS is widely used in information systems research (Marcoulides & Saunders, 2006). Further, applying PLS should be considered when the theory is less developed and the main objective of structural modeling is the prediction and explanation of target constructs (Hair et al., 2014). It is a promising method particularly for new technology research and information systems research (Henseler et al., 2016). This study proposed extending a theoretical model by integrating factors from different theory and from the context. Therefore, PLS is an appropriate approach to analyze the data and verify the research model in the current study. According to (Hair et al., 2014), validating a model using PLS involves two main phases; Measurement Model Assessment and Structural Model Assessment.

5.4.1 Measurement Model Assessment (MMA)

In this phase of the research, the measurement model was evaluated by evaluating the reliability and validity of the model by testing its indicator reliability, internal consistency, convergent validity, and discriminant validity. Indicator reliability tests the extent to which a variable or a set of variables is consistent with what it intends to measure. The measurement used for assessing this criterion is the outer loading of each indicator with a threshold value of ≥ 0.7. Internal consistency is a measure based

on the correlations between different items on the same scale. It measures whether or not many things that propose to live identical general construct turn out similar scores. Construct reliability measures the internal consistency of constructs using Composite Reliability (with a value of 0.7–0.9) and Cronbach's Alpha (with a value of ≥ 0.7). Convergent validity is the extent to which a measure correlates positively with alternative measures of the same construct. Average variance extracted (AVE) is used to measure the convergent validity with the threshold of ≥ 0.50. On the other hand, discriminant validity illustrates the extent to which a construct is truly distinct from other constructs by empirical standards. It is assessed by items cross loading, Fornell-Larker test and the heterotrait-monotrait ratio of correlations (HTMT).Table 5-6illustrates the measurement model criteria, measurements, and threshold values. The measurement model is estimated using the PLS algorithm in SmartPLS 3. Findings for each of the analysis used to value the dependability and validity of the measurement model are conferred within the following subsections.

Table 5-5showed the measurement model. The items were coded as follows: Quality of Academic Service (QAS), Adoption of Cloud-Based E-Learning(Adoption), Fitness(Fit), Viability (Viability), Task(Task), Relative Advantage(RA), Complexity (ComX), Compatibility (ComT), Organisational factor(Org), Economical Factors(Eco), Technological Factors (IT), Information integrity (InfoInt), Information Formality (InfoForm), Information Pro-activeness (InfoPro), Information control (InfoCont).

Table 5-6 Measurement Model Criteria

Criteria	**Measurement**	**Value**
Internal consistency	Cronbach's alpha	≥ 0.7 Satisfactory
	Composite reliability	0.6–0.7 Acceptable 0.7–0.9 Satisfactory >0.95 Redundancy
Indicator reliability	Outer loading	≥ 0.7
Convergent validity	Average Variance Extracted (AVE)	≥ 0.50 Desirable
Discriminant validity	Cross loading	An indicator's outer loading on the associated construct should be greater than all its loadings on other constructs.
	Fornell-Larker	$\sqrt{AVE}$> highest correlation with any other constructs
	HTMT criterion	< 0.90

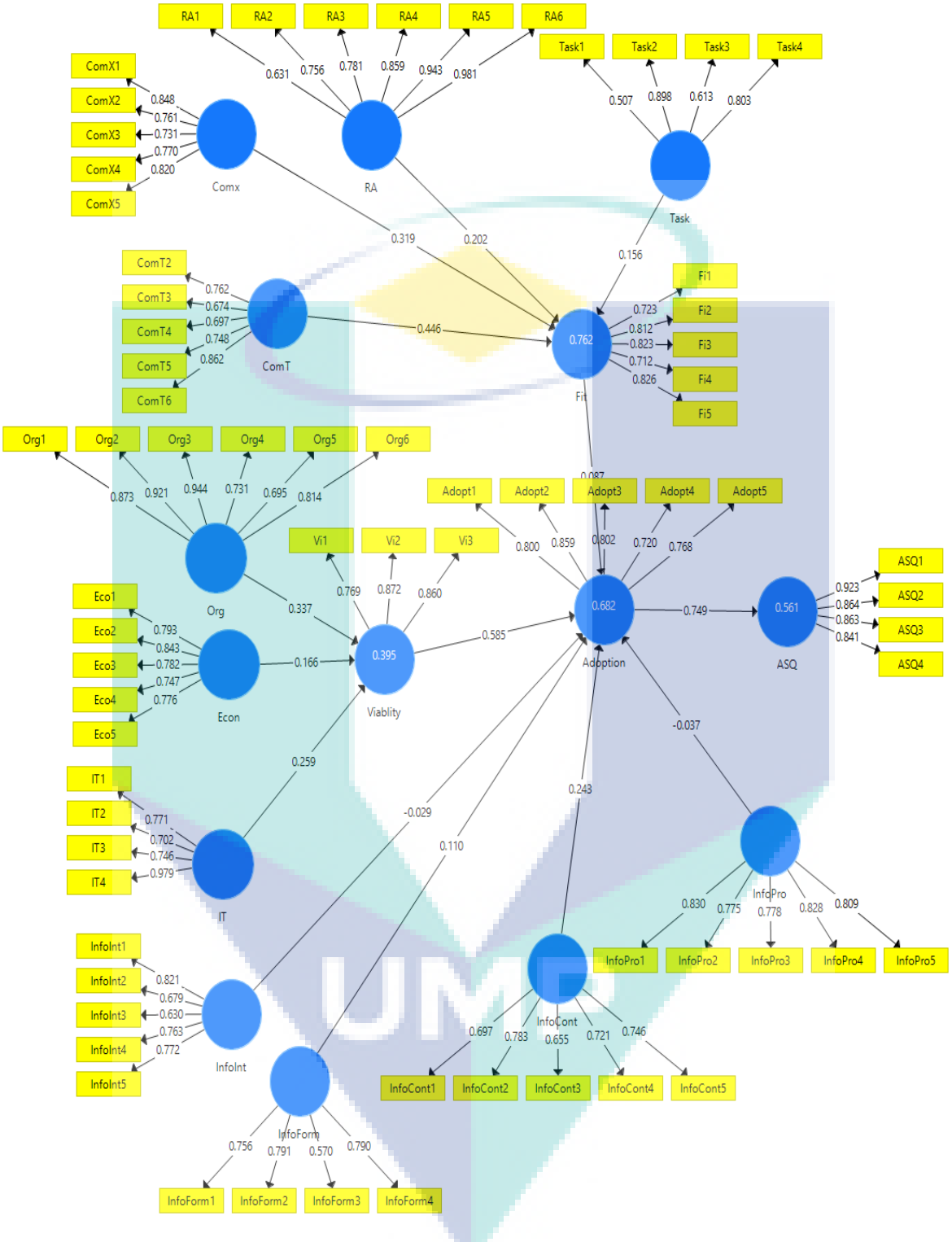

Figure 5 1 The Research Measurement Model

5.4.1.1 MMA: Internal Consistency

The internal consistency (reliability of constructs) is assessed against the criteria of composite reliability (ρ_c) and Cronbach's Alpha. Table 5-7showed that Cronbach's Alpha for the constructs in the measurement model ranges from 0.812 to 0.932 and ρ_c values ranges from 0.874 to 0.949. This indicated that internal reliability is established, and the items used to represent the constructs were reliable.

Table 5-7 Internal Consistency Measurement

The Construct	Cronbach's Alpha	Composite Reliability (ρ_c)
ASQ	0.928	0.928
Adoption	0.892	0.893
ComT	0.866	0.866
Comx	0.891	0.89
Econ	0.892	0.891
Fit	0.886	0.886
IT	0.881	0.880
InfoCont	0.844	0.844
InfoForm	0.819	0.82
InfoInt	0.855	0.854
InfoPro	0.902	0.901
Org	0.934	0.932
RA	0.932	0.931
Task	0.812	0.806
Viability	0.872	0.873

5.4.1.2 MMA: Indicator Reliability

The reliability of indicators is measured by examining the items loadings. Satisfactory indicator reliability is achieved when each item loading at least has a value of 0.70 (Hair Jr et al., 2016). However, indicators with outer loadings between 0.40 and 0.70 should be removed only if deleting them will lead to an increase in the composite reliability or the AVE above the suggested threshold value. Indicators with outer loading values below 0.4 should be deleted. Table 5-8illustrated the analysis results of the indicators' loadings. The results showed that most of the outer loadings values were above the threshold value (0.7). Few items had loading values > 0.4< 0.7; however, since all the constructs have an accepted value of AVE, there is no need deleting any of them. This indicates that there is no issue for the indicator reliability of the measurement model.

Table 5-8 Indicator Reliability Measurement

Construct	Items	Outer Loading	Construct	Items	Outer Loading	Construct	Items	Outer Loading
ASQ	ASQ1	0.923	Comx	ComX1	0.848	IT	IT1	0.771
	ASQ2	0.864		ComX2	0.761		IT2	0.702
	ASQ3	0.863		ComX3	0.731		IT3	0.746
	ASQ4	0.841		ComX4	0.770		IT4	0.979
Adoption	Adopt1	0.800		ComX5	0.820	InfoCont	InfoCont1	0.697
	Adopt2	0.859	Econ	Eco1	0.793		InfoCont2	0.783
	Adopt3	0.802		Eco2	0.843		InfoCont3	0.655
	Adopt4	0.720		Eco3	0.782		InfoCont4	0.721
	Adopt5	0.768		Eco4	0.747		InfoCont5	0.746
ComT	ComT2	0.762		Eco5	0.776	InfoForm	InfoForm1	0.756
	ComT3	0.674	Fit	Fi1	0.723		InfoForm2	0.791
	ComT4	0.697		Fi2	0.812		InfoForm3	0.570
	ComT5	0.748		Fi3	0.823		InfoForm4	0.790
	ComT6	0.862		Fi4	0.712	Org	Org1	0.873
InfoInt	InfoInt1	0.821		Fi5	0.826		Org2	0.921
	InfoInt2	0.679	RA	RA1	0.631		Org3	0.944
	InfoInt3	0.630		RA2	0.756		Org4	0.731
	InfoInt4	0.763		RA3	0.781		Org5	0.695
	InfoInt5	0.772		RA4	0.859		Org6	0.814
InfoPro	InfoPro1	0.830		RA5	0.943	Viability	Vi1	0.769
	InfoPro2	0.775		RA6	0.981		Vi2	0.872
	InfoPro3	0.778	Task	Task1	0.507		Vi3	0.860
	InfoPro4	0.828		Task2	0.898			
	InfoPro5	0.809		Task3	0.613			
				Task4	0.803			

*Threshold: >0.4<0.7

*Threshold:>0.7

5.4.1.3 Convergent Validity

Convergent validity is assessed by examining the Average Variance Extracted (AVE). Convergent validity is established if all constructs have AVE greater than 0.5. Table 5-9indicated that all the constructs have AVE ranging from 0.521to 0.763, which exceeded the recommended threshold value of 0.5. Thus, the measurement model has no issues regarding its convergent validity.

Table 5-9 Average Variance Extracted (AVE)

The Construct	Average Variance Extracted (AVE)
ASQ	0.763
Adoption	0.626
ComT	0.565
Comx	0.620
Econ	0.622
Fit	0.610
IT	0.651
InfoCont	0.521
InfoForm	0.536
InfoInt	0.542
InfoPro	0.647
Org	0.697
RA	0.695
Task	0.521
Viability	0.697

*Threshold: 0.5

5.4.1.4 MMA: Discriminant Validity

Following the recommendation of Hair et al. (2013), discriminant validity is assessed by three measures; cross-loadings, Fornell-Larker criterion and HTMT. Cross loading assesses discriminant validity at the item level. By this criterion, the indicators' loadings values should be higher against their respective construct compared to other constructs. On the other hand, in the Fornell-Larker criterion, the square root of each construct's AVE should be greater than its highest correlation with any other construct. However, according to Henseler et al. (2015), these two measures may not be reliable enough to detectthe lack of discriminant validity. Accordingly, they proposed a new measure to ensure the discriminant validity of the constructs, which is the heterotrait-monotrait ratio of correlations (HTMT). The HTMT is a new method for assessing discriminant validity in PLS-SEM which is one of the key building blocks of measurement models. The HTMT criterion clearly outperforms classic approaches to discriminant validity assessment(Henseler et al., 2015).

By running the consistent PLS algorithm in Smart PLS 3, the report includes all the discriminant validity results. Appendix H, Table 5-10and Table 5-11exhibited the results of cross-loadings, Fornell-Larker criterion assessment, andHTMT, respectively. As illustrated in Appendix H, the measures' outer loading on each construct was greater than all of its loadings on the other constructs, indicating that the measurement model has discriminant validity at the item level.

On the other hand, Table 5-15showed that the square root of the AVEs for each construct was greater than the correlations of the construct with the other constructs and satisfied the criterion of the construct level discriminant validity.

Table 5-10 Discriminant Validity by Fornell-Larker criterion

	ASQ	Adoption	ComT	Comx	Econ	Fit	IT	InfoCont	InfoForm	InfoInt	InfoPro	Org	RA	Task	Viability
ASQ	0.873														
Adoption	0.749	0.791													
ComT	0.458	0.551	0.751												
Comx	0.325	0.410	0.55	0.787											
Econ	0.471	0.532	0.623	0.39	0.789										
Fit	0.550	0.557	0.795	0.682	0.609	0.781									
IT	0.316	0.339	0.473	0.238	0.538	0.347	0.807								
InfoCont	0.589	0.616	0.53	0.374	0.512	0.517	0.544	0.722							
InfoForm	0.539	0.560	0.49	0.347	0.514	0.481	0.469	0.688	0.732						
InfoInt	0.542	0.538	0.499	0.205	0.541	0.463	0.58	0.775	0.734	0.736					
InfoPro	0.446	0.474	0.372	0.261	0.295	0.443	0.569	0.667	0.546	0.614	0.804				
Org	0.512	0.554	0.582	0.365	0.58	0.579	0.432	0.513	0.450	0.478	0.454	0.835			
RA	0.476	0.500	0.620	0.343	0.484	0.613	0.226	0.483	0.338	0.395	0.289	0.461	0.834		
Task	0.257	0.258	0.310	0.312	0.250	0.425	0.119	0.182	0.246	0.154	0.132	0.133	0.158	0.722	
Viability	0.582	0.778	0.572	0.314	0.501	0.543	0.494	0.511	0.481	0.479	0.472	0.545	0.411	0.176	0.835

Table 5-11represents the HTMT measurement results. The results showed that all the HTMT values were below 0.90, which according to (Henseler et al., 2015), established the discriminant validity of all the reflective constructs.

Table 5-11 Discriminant Validity Assessment by HTMT

	ASQ	Adoption	ComT	Comx	Econ	Fit	IT	InfoCont	InfoForm	InfoInt	InfoPro	Org	RA	Task	Viability
ASQ															
Adoption	0.747														
ComT	0.456	0.549													
Comx	0.323	0.409	0.546												
Econ	0.472	0.531	0.62	0.391											
Fit	0.55	0.555	0.792	0.681	0.607										
IT	0.317	0.338	0.479	0.238	0.539	0.348									
InfoCont	0.587	0.615	0.53	0.374	0.511	0.517	0.546								
InfoForm	0.539	0.557	0.492	0.347	0.518	0.479	0.467	0.684							
InfoInt	0.54	0.536	0.498	0.245	0.543	0.457	0.579	0.77	0.774						
InfoPro	0.446	0.474	0.377	0.26	0.294	0.345	0.568	0.669	0.543	0.608					
Org	0.514	0.555	0.58	0.365	0.578	0.578	0.431	0.516	0.445	0.478	0.458				
RA	0.476	0.496	0.613	0.336	0.479	0.606	0.226	0.484	0.338	0.389	0.29	0.456			
Task	0.257	0.263	0.316	0.302	0.253	0.402	0.119	0.187	0.247	0.149	0.134	0.138	0.154		
Viability	0.582	0.78	0.573	0.313	0.603	0.541	0.493	0.511	0.481	0.473	0.471	0.574	0.409	0.183	

*Threshold: <0.90

5.4.2 Structural Model Assessment (SMA)

By establishing the reliability and validity of the model through assessing the measurement model, the structural model (inner model) is ready to be assessed. The structural model was tested by estimating the paths between the constructs. To report the assessment of a structural model, there are several criteria as suggested by F. Hair Jr et al. (2014). Firstly, the structural model should be checked for collinearity issues by examining the value of VIF. Secondly, the significance of the structural model should be assessed by means of path coefficients (ß) and standard errors (*t* values) which are obtained by means of bootstrapping in SmartPLS 3. Thirdly, the level of Rsquare (R^2)

for the dependent variable needs to be assessed. Then, the effect sizes (f^2) of different constructs on the dependent construct need to be measured. Finally, predictive relevance (Q^2) and effect sizes (q^2) need to be reported. Table 5-13 summarized all the steps in assessing the structural model, their tests and the criteria based on Hair Jr et al. (2016) and Chin (1998). The techniques and criteria used to assess the structural model were explained in the following subsections.

Table 5-12 Criteria for Structural Model Assessment

Step	Analysis	Test	Criteria
1	Collinearly Issues	Tolerance	> 0.20 Acceptable
		VIF	5< Acceptable
2	Path Relationships	Path coefficients	Ranges from -1 to +1 Values closer to zero are less significant.
		p value	* <0.10 ** <0.05 *** <0.01
		t value	>1.65 Significance level 10% >1.96 Significance level 5% >2.57 Significance level 1%
3	Coefficients of Determination	R^2	0.19 Weak 0.33 Medium 0.67 Substantial
4	f^2Effect Size	f^2	0.02 Small 0.15 Medium 0.35 Large
5	Predictive Relevance	Q^2	> 0 Having predictive irrelevance
	q^2Effect Sizes	q^2	0.02 Small 0.15 Medium 0.35 Large

5.4.2.1 SMA: Collinearity Issue Assessment

Collinearity issue should be treated prior to the analysis of the relationships between the constructs. The estimation of path coefficients in the structural models is based on OLS regressions of each endogenous latent variable on its corresponding predecessor constructs. Accordingly, path coefficients might be biased if the estimation involves significant levels of collinearity among the predictor constructs. A collinearity issue arises when two constructs are highly correlated, which means that the two constructs are predictors of the same dependent construct (Hair et al., 2014). Therefore,

each set of predictor constructs should be examined separately. To evaluate the collinearity, two measures are applied: tolerance and Variance Inflation Factor (VIF). The tolerance represents the amount of variance of one predictor not explained by the others in the same subpart block, while the VIF is defined as the reciprocal of the tolerance. A tolerance value of 0.20 or lower and a VIF value of 5 and higher indicate a potential collinearity problem (Hair et al., 2014). Constructs with collinearity issues should be eliminated, merged or reconstructed in the higher order construct.

In the case of this study model, three subparts can be identified. Fit, Viability, Information Control, Information Integrity, Information Formality, and Information Pro-activeness are the predictors of adoption. Task, Relative Advantage, Complexity and Compatibility variables predict the fit construct, and the factors of the Organisation, Cost Redaction, and IT Readiness are predictors of the viability. The collinearity among each subpart constructs should be assessed. Running the PLS algorithm in SmartPLS 3 results in collinearity statistics. As presented in Table 5-13, the values of VIF of all constructs were less than 5 and tolerance values were more than 0.20; hence, it can be concluded that there was no collinearity among the constructs.

Table 5-13 Collinearity Assessment for the Structural Model

Dependent Variable	**Independent Variables**	**Collinearity Statistics**	
		Tolerance	VIF
Adoption	Fit	0.609	1.643
	Viability	0.593	1.686
	InfoCont	0.305	3.282
	InfoForm	0.407	2.456
	InfoInt	0.315	3.174
	InfoPro	0.507	1.972
FIT	RA	0.615	1.627
	COMX	0.676	1.48
	COMT	0.473	2.114
	Task	0.873	1.145
VIABILITY	Org	0.643	1.555
	IT	0.689	1.452
	Econ	0.561	1.782

*Tolerance threshold: >0.2

*VIF threshold: <5

5.4.2.2 Path Coefficient and Hypotheses Testing

To analyse the hypothesised relationships among the constructs, path coefficients were examined. Path coefficient (β) aims to examine the significance of the path relations in a structural model (Chin, 1998). In other words, Path coefficients represent the relationships between the latent variables in the structural model (Hair Jr et al., 2016). Path coefficient values range between +1 and -1; values close to +1 and -1 indicate strong positive and negative relationships, respectively. In general, β values different from zero indicate that the represented relations are significant, while values close to zero represent weak relationships and subsequently not significant relations. In addition, the significance of a coefficient relies on its standard error that is obtained by means of bootstrapping. Bootstrapping is a resampling technique that draws a large number of subsamples from the original data (with replacement). It determines the standard errors of coefficient and *P*valueto assess the statistical significance and level of significance between dependent and independent constructs. Using the SmartPLS 3 algorithm output, the relationships between the independent and dependent variables were examined. However, in SmartPLS 3, in order to test the significant level of relations, t-statistics and *P* value for all paths are generated using the SmartPLS3 bootstrapping function with 5000 re-samples, test type one-tailed and significance level 0.05.There are two critical *t* values, 1.65 and 2.33. If *t* value is larger than a critical value, the coefficient is significant at a certain level. Accordingly, there are two levels of significance;5% (*t*>1.65) and 1% (*t* > 2.33).Table 5-14 presented the results of the relationships and accordingly, the hypotheses testing. The results showed that hypotheses H5, H10, H11, andH13 were not supported, while the rest were supported.

Table 5-14 Hypotheses Testing Results

Relations	β	T Statistics	P Values	Result
Adoption -> ASQ	0.749	16.967	0.000***	Supported
ComT -> Fit	0.446	5.176	0.000***	Supported
Comx -> Fit	0.319	4.515	0.000***	Supported
Econ ->Viability	0.166	1.904	0.029**	Supported
Fit -> Adoption	0.087	1.217	0.112	Not Supported
IT ->Viability	0.259	3.262	0.001***	Supported
InfoCont -> Adoption	0.243	2.286	0.011**	Supported
InfoForm -> Adoption	0.11	1.364	0.086	Not Supported
InfoInt -> Adoption	-0.029	0.279	0.390	Not Supported
InfoPro -> Adoption	-0.037	0.509	0.305	Not Supported
Org ->Viability	0.337	3.749	0.000***	Supported
RA -> Fit	0.202	3.203	0.001***	Supported
Task -> Fit	0.156	3.282	0.001***	Supported
Viability -> Adoption	0.585	7.290	0.000***	Supported

*** P < 0.01, ** P < 0.05

5.4.2.3 SMA: Coefficient of Determination (R^2)

R^2 represents the amount of variance in an endogenous construct which is explained by its all predictors (Hair Jr et al., 2016). It is the squared correlation between the actual and the predicted values of a specific endogenous construct (Everitt, 2002), and it's the most common measure used to assess the model's predictive accuracy. The R^2 values range from 0 to 1;values closed to 1 indicate higher levels of predictive accuracy (Hair et al., 2014). There are no rules of thumb for R^2 values(Hair et al., 2014); however, according to Chin (1998), R^2 with 0.67, 0.33, and 0.19 are considered as substantial, moderate, and weak, respectively.

In this research, Smart PLS algorithm function was applied to calculate the R^2 for all endogenous constructs. The results show that the R^2 values ranged from 0.395 for Viability construct, (which means almost 40 % of the viability variance was explained by its predictors) to 0.762 of the Fit construct (76% of the Fit variance was explained by its predictors).This indicates that endogenous constructs for Adoption and Fit have a substantial level of predictive accuracy, while QAS and Viability have a medium level of predictive accuracy. Table 5-15represents the R^2 for all endogenous constructs.

Table 5-15 R^2Results

Endogenous Construct	R Square	Level of Predictive Accuracy
ASQ	0.561	Moderate
Adoption	0.682	Substantial
Fit	0.762	Substantial
Viability	0.395	Moderate

5.4.2.4 SMA: Effect Size (f^2)

In addition to measuring the model's predictive accuracy through the $\mathbf{R^2}$ values of all endogenous constructs, the effect size (f^2) for the exogenous constructs was assessed. f^2 is a criterion to measure the relative impact of an independent construct on its dependent construct using Cohen's f^2(Jacob Cohen, 1992). The f^2 is the change in the $\mathbf{R^2}$ value when a specified independent construct is omitted from the model (Hair et al., 2014). The f^2 values are calculated using the following formula.

$$f^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}} \quad 5.1$$

R^2included and R^2excluded are the R^2 values of the dependent construct when a selected independent construct is included or excluded from the model. As guided by Cohen, (1988), f^2 values of 0.02, 0.15, and 0.35 represent small, medium, and large effect, respectively.

In this research, the f^2 values obtained from the running of the PLS algorithm in SmartPLS 3 were presented in Table 5-17. The results showed that the effect of the size of Adoption on ASQ construct was the highest since it was the only dependent variable of QAS.On the other hand, the results showed a very small effect (f^2 = 0.001 and f^2 = 0.001) on Adoption from InfoInt and InfoPro, respectively. Further, Viability has a large effect on adoption based on Cohen role of thumb, while all the rest independent constructs of Adoption had small effects. Compatibility has a large effect on the Fit dependent construct, while complexity has medium-sizedeffect; Relative Advantage and

Task have small effects. For the Viability dependent construct, the results showed that all the predictors had small effects.

Table 5-16 Effect Size Results

Dependent variable	Independent variable	f^2	Level of Effect
ASQ	Adoption	1.276	Large
Adoption	Fit	0.014	Small
	InfoCont	0.057	Small
	InfoForm	0.016	Small
	InfoInt	0.001	Small
	InfoPro	0.002	Small
	Viablity	0.638	Large
Fit	ComT	0.395	Large
	Comx	0.290	Meduim
	RA	0.106	Small
	Task	0.089	Small
Viability	Econ	0.025	Small
	IT	0.077	Small
	Org	0.120	Small

5.4.2.5 SMA: Assessment of Predictive Relevance

Related to the model prediction capability assessment, besides evaluating the model predictive accuracy, the model's predictive relevance should be reported. The criterion of Stone-Geissers' $\mathbf{Q^2}$ value is used to assess the predictive relevance of independent constructs on the dependent construct. $\mathbf{Q^2}$ values represent a measure of how well the path model can predict the originally observed values. $\mathbf{Q^2}$ values larger than zero indicate the path model's predictive relevance for the particular construct (Hair et al., 2014). In PLS-SEM, the blindfolding approach is used to assess and calculate $\mathbf{Q^2}$ values. The blindfolding approach is a resembling technique that systematically deletes and predicts data points in the indicators of the reflective endogenous constructs (Chin, 1998; Henseler et al., 2009). Data points are omitted based on a certain omission distance (D) and endogenous construct scores are predicted by using the available information for the structural model. The predicted scores are used to predict systematically omitted data points (Hair et al., 2014). To run the blindfolding algorithm, two considerations must be considered; firstly, the blindfolding procedure is only applicable for reflective or single item constructs, secondly, omission distance (*D*) should be set such that the number of observations divided by D is not an integer (Hair et al., 2014).

In the current study, blindfolding algorithm in Smart PLS 3 was run by setting the D value to be equal to 7 because the number of valid observations was 312. As recommended by Hair *et al.*(2014), to obtain $\mathbf{Q^2}$values, the cross-validated redundancy, which includes the key element of the structural model to predict eliminated data points, is used. The results showed that the Q^2value was 0.356, 0.366, 0.402and 0.245, reflecting a good predictive relevance for ASQ, Adoption, Fit and Viability, respectively (See Table 5-17).

In addition, similar to the f^2 effect size approach for assessing $\mathbf{R^2}$ values, the relative impact of predictive relevance can be evaluated by the q^2 effect size measure. To determine the q^2effect size, each individual independent construct, the results of the predictive relevance $\mathbf{Q^2}$ including with the predictor ($\mathbf{Q^2}_{\text{Included}}$) and without the predictor ($\mathbf{Q^2}_{\text{excluded}}$), should be computed. The q^2 values are calculated using the following formula.

$$q2 = \frac{Q^2_{included} - Q^2_{excluded}}{1 - Q^2_{included}} \qquad 5.2$$

Table 5-17 Predictive Relevance Results

Dependent variable	**Q^2**	**Independent variable**	**q^2**
ASQ	0.356	Adoption	0.553
Adoption	0.366	Fit	0.009
		InfoCont	0.014
		InfoForm	0.005
		InfoInt	0.000
		InfoPro	0.002
		Viability	0.167
Fit	0.402	ComT	0.087
		Comx	0.075
		RA	0.035
		Task	0.022
Viability	0.245	Econ	0.013
		IT	0.014
		Org	0.066

As shown in Table 5-17, the highest predictive relevance effect sizeq^2onASQ was from Adoption (with 0.553), as it is the only independent variable. For the Adoption construct, the highest $q^2$was for Viability (0.167), while the lowest q^2 was for InfoInt with 0 (no effect). Furthermore, ComT had a q^2 value of0.087 which is the highest among the Fit's independent variables, while Org variable had the highest value of q^2 (0.066) on the Viability construct.

5.5 Discussion

The Cloud-Based E-Learning is a successful educational model and should be adopted in Higher Education Institutions (HEIs) for improving the education ecosystem (B.-N. Hwang et al., 2016; Ibrahim, 2014; Makoza, 2015). The significance of e-learning model has attracted HEIs to adopt cloud-based e-learning due to several reasons, such as saving cost, time, and zero upfront infrastructure (Al-Balushi et al., 2016; B.-N. Hwang et al., 2016; Sabi et al., 2017). Nowadays, the required capital expenditure is critical to any organization in the public or private sector and in HEIs, in particular, to catch up with the rapidly increasing requirement and demands. This cloud computing servicedo not require any up-front budget due to the Pay-as-You-Go scheme as earlier explained.

The result of this study showed that there are many factors that should be considered before taking a decision on the adoption of Cloud-Based E-Learning in HEIs in Oman. Most of them are related to infrastructure and cost. In addition, the result showed that factors such as Task's requirements, Relative advantage, Less-Complexity, Compatibility, Cost reduction, Scalability, and Availability can be considered as drivers for the adoption of Cloud-Based E-Learning in HEIs in Oman. This takes us to a point that the higher education institutions in Oman can adopt Cloud-Based E-Learning in order to overcome the challenges of delivering quality academic services (QAS) at the end. Consequently, this will help them for institutional accreditation and program accreditation. Therefore, the proposed model is needed to examine these most significant factors that influence the decision on the adoption of Cloud-Based E-Learning in HEIs in Oman.

The proposed model consists of three dimensions; firstly, the fitness of the Cloud-Based E-Learning to the HEIs: this was examined by task characteristics and technological characteristics (relative advantages, complexity, and compatibility) based on TTF model. Secondly, the viability of Cloud-Based E-Learning to the HEIs: this was examined by organizational characteristic (decision makers), economic evaluation (cost reduction) and technical readiness (IT readiness). Thirdly, the effect of information culture's factors on decisions for Cloud-Based E-Learning adoption: this was examined by information integrity, information formality, information control, and information pro-activeness. Consequently, the proposed model hypothesized that the adoption of Cloud-Based E-Learning has an effect on the quality of academic services in HEIs and is influenced by two main factors(Tjan, 2001). The following sections discussed the result for each of the hypothesis in this study.

5.6 Result of Hypothesis Testing

In response to RO3, SEM-PLS was used to test this research hypothesis to identify the significant and non- significant hypothesis. Path coefficient (β), the critical ratio (p-value), and level of significant (t-value) were used in this research. The threshold for the estimated (β) must be different from zero, t-value must be more than 1.96, and p-value must be between 0.05 and 0.01(Hair Jr et al., 2016). The Goodness-of-fit among the variables in the proposed hypotheses must be adequate to be accepted if not, must be rejected(Byrne, 2013).

5.6.1 H1: The fitness and Cloud-Based E-Learning adoption

The first hypothesis stated that the fitness of Cloud-Based E-Learning to the HEIs task characteristics positively influences HEI's intention for its adoption. Fitness refers to "the degree to which technology assists an individual in performing a portfolio of tasks"(Goodhue & Thompson, 1995).Fitness between the nature of cloud computing and task characteristic is a critical factor for HEIs to adopt Cloud-Based E-Learning. This hypothesis proposed the more the fitness of Cloud-Based E-Learning (Fit) to the HEIs task requirements,the more the decision to adopt it; this is statistically represented as Fit -> Adoption. The fitness dimension is a part of the fit-viability model (FVM)(Goodhue & Thompson, 1995), and task construct is a part of Task-Technology

Fit (TTF). However, the result of the empirical investigation showed that this hypothesis was not significant, with a p-value 0.112. Further, the path coefficient of 0.087 represents no relation between these two variables.

This means that this study rejects the existence of any relationship between the fitness of cloud computing services and the task characteristics to adopt Cloud-Based E-Learning in HEIs in Oman. However, this result contradicts the previous literature on technology adoption studies. The previous literature of technology adoption studies usually support the positive influence of the task on an innovation adoption(Goodhue & Thompson, 1995; Liang & Wei, 2014; Fathey Mohammed et al., 2016; F. Mohammed et al., 2017). Regarding the relationship between the task of technology and its fitness to specific tasks, these studies supported this relationship. In the context of this study, this hypothesis was rejected due to the lack of knowledge in Oman amongst HEIs as we have stated in the literature review, and this was one of the problems. The in-person interview suggests this as the author had to explain more about cloud computing services. This leads to less awareness of cloud services and features as 66 % of the respondents were not considering cloud computing in their HEIs or still evaluating, as shown in the statistical details.

5.6.2 H2: Viability and Adoption of Cloud-Based E-Learning.

The second hypothesis stated that the viability of Cloud-Based E-Learning has a positive influence on HEIs' adoption decision.Viability refers to the "measure of the extent of the value-added potential of new network applications, requirements of human resource, capital needs and so on"(Tripathi & Nasina, 2017). This hypothesis states that there is a positive influence/impact of the viability of the decision to adopt Cloud-Based E-Learning (Viability) in the HEIs, which is represented statistically as Viability ->Adoption. The viability dimension is the second main part of the theoretical foundation for Fit-Viability model(Goodhue & Thompson, 1995) in technology adoption. Regarding the context of this study, viability refers to the extent to which the infrastructure of the HEIs is ready for Cloud-Based E-Learning, considering general economic feasibility, technical infrastructure, and social readiness. Theempirical result showed that this hypothesis is highly significant at a level of 0.01 with a *p*-valueof 0.000.

Further, the related path coefficient of 0.585 represents a strongrelationship between viability and HEI's intention to adopt Cloud-Based E-Learning.This means that when viability goes up by 1 standard deviation, CBEL adoption goes up by 0.585 standard deviations. The finding showed that the viability dimensions have a strong influence on HEIs' intention to adopt Cloud-Based E-Learning in Oman. This result is consistent with the literature review (Goodhue & Thompson, 1995; Liang & Wei, 2014; Fathey Mohammed et al., 2016; F. Mohammed et al., 2017). Furthermore, this result is a new contribution to the context of this study.

5.6.3 H3: Task and Fitness of Cloud-Based E-Learning Adoption.

The third hypothesis stated that the HEIs-related tasks requirements positively influence the decision to adopt Cloud-Based E-Learning. This hypothesis stated that there is a positive influence of task requirements of HEIs on the fitness of cloud computing to encourage the HEIs to adopt Cloud-Based E-Learning. This is represented statistically as Task ->fit. This task construct is a part of task characteristics in Task-Technology Fit(TTF) theory(Goodhue & Thompson, 1995) which is a theoretical foundation for Fit-Viability Model(FVM) (Tjan, 2001) in the new technology adoption. This theory is used for measuring whether technology is properly used or not through two dimensions as explained in detail in the literature section. In another word, measuring the extent HEIs tasks requirements will be accomplished by adopting Cloud-Based E-Learning will encourage decision-makers to decide to adopt or not. The empirical result of this study showed that this hypothesis is highly significant at a level 0.01 with a *p*-valueof 0.001.

Further, the related path coefficient (ß) of 0.156 represents the existence of a relationship between task and fitness for adoption decision, which means that when a task goes up by 1 standard deviation, CBEL adoption goes up by 0.156 standard deviations. This finding showed that identifying the task characteristics has a positive influence on the fitness of the adoption of Cloud-Based E-Learning in HEIs in Oman. The influence of task on the fitness of technology has been established in previous studies (Goodhue & Thompson, 1995; Liang & Wei, 2014; Fathey Mohammed et al., 2016; F. Mohammed et al., 2017)). In the context of this study, the HEIs in Oman as earlier discussed must consider the Task-Technology Fit upfront before deciding onCloud-Based E-Learning adoption.

5.6.4 H4: Relative Advantage and Fitness of Cloud-Based E-Learning Adoption.

The fourth hypothesis stated that relative advantage positively influences the fitness of Cloud-Based E-Learning to HEIs' computing needs. This hypothesis stated that there is a positive influence of relative advantage (RA) on the fitness (Fit) of cloud computing for Cloud-Based E-Learning in the HEIs; this is represented statistically as RA -> Fit. The relative advantage construct is the first selected factor for this study from the technological characteristics of Task-Technology Fit(TTF) theory (Goodhue & Thompson, 1995)due to its frequent consideration in the previous studies. It is the theoretical foundation for Fit-Viability model in technology adoption. The empirical result revealed that this hypothesis is highly significant at a level of 0.01 with a *p*-valueof 0.001.

Further, the related path coefficient of 0.202 represents the existence of a strong relationship between relative advantage and fitness, which means that when relative advantage goes up by 1 standard deviation, the fitness of CBEL goes up by 0.202 standard deviations. Relative advantage refers to the degree to which development is seen as better the previous ones (B.-N. Hwang et al., 2016; Ibrahim, 2014; Makoza, 2015; Sabi et al., 2017). This finding showed that the population of this study strongly support the adoption of this new integrated technology (Cloud-Based E-Learning) in HEIs in Oman as they considered it better than the existing one. This result, in fact, is very consistent with the literature review for past few year in HEIs context (Alkhater et al., 2014; Gangwar et al., 2015; Hussein et al., 2012; B.-N. Hwang et al., 2016; Ibrahim, 2014; Low et al., 2011; Makoza, 2015; Morgan & Conboy, 2013; Oliveira et al., 2014; Humphrey M Sabi et al., 2016; Sabi et al., 2017; Stieninger et al., 2014).

Therefore, there is a higher level of perceived relative advantage related to higher CBEL adoption among HEIs in Oman. This takes the researcher to the result that relative advantage encourages the HEIs owners/decision makers to adopt Cloud-Based E-Learning to improve their academic and non-academic services. In addition, previous studies and expert opinions have stressed this result regarding relative advantage as the most significant factor that influences decisions on CBEL adoption. Based on this result, HEIs decision makers/owners should consider the relative advantages of CBEL adoption.

5.6.5 H5: Complexity and Fitness of Cloud-Based E-Learning Adoption:

The fifth hypothesis stated that complexity negatively influences the fitness of Cloud-Based E-Learning to HEI's computing needs. This hypothesis stated that there is a negative influence/impact of complexity (Comx.) on the fitness (Fit) of cloud computing to the HEIs to adopt Cloud-Based E-Learning. This is represented statistically as Comx ->Fit. Complexity refers to "the degree an advancement is seen as being hard to utilize or get" (Charlebois et al., 2016; Hussein et al., 2012; Morgan & Conboy, 2013). The complexity construct is the second selected factor for this study from the technological characteristics of Task-Technology Fit (TTF) theory (Goodhue & Thompson, 1995) which is a theoretical foundation for Fit-Viability model (FVM) in technology adoption. In the context of this study, complexity refers to the degree to which Cloud-Based E-Learning is seen as being hard to utilize or get by HEIs (Sabi et al., 2017). The empirical result of the study showed that this hypothesis is highly significant at a level of 0.01 with a *p*-value of 0.000.

Further, the related path coefficient of 0.319 represents a strong relationship between the two variables; this finding shows that the lesser the complexity of Cloud-Based E-Learning, the higher the chances of its adoption in HEIs in Oman. This result is consistent with the related literature in different contexts (Alkhater et al., 2014; Charlebois et al., 2016; Gangwar et al., 2015; Ibrahim, 2014; Low et al., 2011; Makoza, 2015; Morgan & Conboy, 2013; Oliveira et al., 2014; Humphrey M Sabi et al., 2016; Sabi et al., 2017; Stieninger et al., 2014), (Borgman et al., 2013; Chong et al., 2009; Hussein et al., 2012; Sila, 2013). Most of these studies stated that the perceived complexity of any technology might affect its level of adoption. In addition, previous studies and expert opinion support this result as they stressed that less complexity is amongst the most significant factors that play a major role in CBEL adoption. Based on this result, HEIs decision makers/owners should consider the complexity level prior to CBEL adoption.

5.6.6 H6: Compatibility and Fitness of Cloud-Based E-Learning Adoption:

The sixth hypothesis stated that compatibility has a positive influence on the fitness of Cloud-Based E-Learning to HEIs's computing needs. The hypothesis stated

that there is a positive influence/impact of compatibility (ComT) on the fitness of cloud computing to the HEIs to adopt Cloud-Based E-Learning; this is represented statistically asComT -> Fit. Compatibility refers to "the degree a development is seen steady with the current values, needs and encounters of potential adopters" (Chong et al., 2009; Hussein et al., 2012; Nunes et al., 2017). In the context of this study, compatibility refers to the degree Cloud-Based E-Learning is seen steady with the current values, needs and encounters of HEIs (Alkhater et al., 2014; Low et al., 2011; Nunes et al., 2017; Oliveira et al., 2014; Sabi et al., 2017; Tashkandi & Al-Jabri, 2015). The compatibility construct is the third selected factor for this study from the technological characteristics of Task-Technology Fit (TTF) theory, which is a theoretical foundation for Fit-Viability model in technology adoption. The study result showed that this hypothesis is highly significant between the variables at a level of 0.01 with a *p*-value of 0.000.

Further, the related path coefficient of 0.446 represents the existence of a strong relationship between compatibility and fitness, which means that when compatibility goes up by 1 standard deviation, the fitness of CBEL goes up by 0.446 standard deviations. This finding showed strong support for Cloud-Based E-Learning adoption by the HEIs in Oman due to its compatibility with higher education context. This result is also consistent with the existing literature (Alkhater et al., 2014; Borgman et al., 2013; Charlebois et al., 2016; Chong et al., 2009; Gangwar et al., 2015; Hussein et al., 2012; Ibrahim, 2014; Low et al., 2011; Makoza, 2015; Morgan & Conboy, 2013; Nunes et al., 2017; Oliveira et al., 2014; Sabi et al., 2016; Sabi et al., 2017; Stieninger et al., 2014)). However, previous studies have stressed that higher perceived compatibility is amongst the most significant factors that play a major role in CBEL adoption. Based on this result, HEIs decision makers/owners should consider the compatibility of CBEL prior to its adoption.

5.6.7 H7: Decision Makers and Viability of Adoption of Cloud-Based E-Learning

The seventh hypothesis stated that decision makers' support has a positive influence on the viability of Cloud-Based E-Learning adoption in HEIs. In another word, the hypothesis stated that there is a positive influence/impact of the decision maker (Org.) on the viability (Viability) of the cloud computing by the HEIs to adopt

Cloud-Based E-Learning; this is represented statistically as Org ->Viability. The decision makers construct is represented as the organizational characteristics of viability dimension theory based on related work section. It is a theoretical foundation of Fit-Viability model in technology adoption(Goodhue & Thompson, 1995). Viability refers to the extent the infrastructure of the organization is ready for application. In the context of this study, it refers to the attitude of management in HEIs toward Cloud-Based E-Learning, and the level of support devoted to its adoption (Alkhater et al., 2014; Borgman et al., 2013; Charlebois et al., 2016; Chong et al., 2009; Gangwar et al., 2015; Hussein et al., 2012; Ibrahim, 2014; Low et al., 2011; Makoza, 2015; Morgan & Conboy, 2013; Nunes et al., 2017; Oliveira et al., 2014; Humphrey M Sabi et al., 2016; Sabi et al., 2017; Stieninger et al., 2014).The general economic feasibility, technical infrastructure and social readiness of the organization must be considered"(Goodhue & Thompson, 1995; Liang & Wei, 2014; Fathey Mohammed et al., 2016; F. Mohammed et al., 2017). The empirical result showed that this hypothesis is highly significant at a level of 0.01 with a p-value of 0.000.

Further, the related path coefficient of 0.337 represents a strong relationship between decision-makers and viability, which means that when a decision maker goes up by 1 standard deviation, the viability of CBEL goes up by 0.337 standard deviations. This finding showed that the decision makers have a strong influence on the viability of Cloud-Based E-Learning on adoption in HEIs. This result is consistent with the existing literature (Alharthia et al., 2017; Alkhater et al., 2014; Borgman et al., 2013; Chong et al., 2009; Gangwar et al., 2015; Hassan et al., 2017; Ibrahim, 2014; Kayali et al., 2016; Low et al., 2011; Makoza, 2015; Oliveira et al., 2014; Sila, 2013). However, the previous studies have stressed that higher perceived decision makers' intention is amongst the most significant factors that play a major role in CBEL adoption. Based on this result, HEIs should consider the decision makers' awareness and support for CBEL adoption.

5.6.8 H8: Cost Reduction and Viability of Adoption of Cloud-Based E-Learning:

The eighth hypothesis stated that the economical factor has a positive influence on the viability of Cloud-Based E-Learning for HEIs adoption. In another word, the hypothesis stated that there is an influence/impact of cost reduction (Econ.) on the

viability (Viability) of cloud computing to the HEIs to adopt Cloud-Based E-Learning; this is represented statistically as Econ ->Viability. Cost reduction refers to "the amount of financial and human resources science and technology institutions invest to implement and manage cloud computing" (B.-N. Hwang et al., 2016), (Saya et al., 2010), (Al-Balushi et al., 2016). The cost reduction construct represents the economic characteristics of viability dimension theory(Goodhue & Thompson, 1995), which is a theoretical foundation for Fit-Viability model in technology adoption. In the context of this study, it refers to the amount of financial and human resources HEIs need to invest to implement and manage Cloud-Based E-Learning, as shown in table (5-15) (O. Ali et al., 2016; Arvanitis et al., 2016; Hassan et al., 2017; Nunes et al., 2017). The empirical result showed that this hypothesis is significant at a level of 0.05 with a *p*-value of 0.029.

Further, the related path coefficient of 0.116 represents the relationship between cost reduction and viability, which means that when cost reduction goes up by 1 standard deviation, the viability of CBEL goes up by 0.116 standard deviations. This finding showed that cost reduction has a strong influence on the viability of Cloud-Based E-Learning adoption by the HEIs. This result is consistent with the existing literature (Al-Balushi et al., 2016; O. Ali et al., 2016; Arvanitis et al., 2016; Hassan et al., 2017; B.-N. Hwang et al., 2016; Nunes et al., 2017; Odeh et al., 2016; Oliveira et al., 2014; Humphrey M Sabi et al., 2016; Saya et al., 2010). However, the previous studies have stressed that a higher perceived cost reduction is amongst the most imperative factors that play a major role in CBEL adoption. Based on this result, HEIs decision makers/owners should consider cost reduction prior to CBEL adoption.

5.6.9 H9: IT readiness and Viability of Adoption of Cloud-Based E-Learning

The ninth hypothesis stated that IT readiness has a positive influence on the viability of Cloud-Based E-Learning adoption in HEIs. In another word, this hypothesis stated that there is a positive influence/impact of IT readiness infrastructure (IT) on the viability of the cloud computing (Viability) to the HEIs to adopt Cloud-Based E-Learning, which is represented statistically as IT ->Viability. IT readiness refers to "the degree of readiness of the IT infrastructure and human resources in terms of cloud computing". Oliveira et al. (2014) also defined it as "measured by the software and

hardware maturity, data management and the competency of the IS staff" (Tripathi & Nasina, 2017). The IT readiness constructs were selected to represent of technological characteristics of viability dimension theory, which is a theoretical foundation of the fit-viability model in technology adoption. In the context of this study, it refers to the readiness of HEIs in terms of IT technical infrastructure, IT human capability, and IT managerial capability for Cloud-Based E-Learning (Alharthia et al., 2017; Alkhater et al., 2014; Makoza, 2015; Nunes et al., 2017; Oliveira et al., 2014). The variables of IT readiness and viability are highly significant at a level of 0.01 with a p-value of 0.001 in the empirical study.

Further, the related path coefficient of 0.259 represents a strong relationship between IT readiness and viability, which means that when IT readiness goes up by 1 standard deviation, the viability of CBEL goes up by 0.259 standard deviations. The finding shows that IT readiness has a strong influence on the viability of Cloud-Based E-Learning on HEIs adoption. This result is consistent with the existing literature(Masud & Huang, 2012), (Ashtari & Eydgahi, 2017).However, the related work stressed that higher perceived IT readiness is imperativefor CBEL adoption. Based on this result, HEIs decision makers/owners should consider IT readiness prior to CBEL adoption. The interviewee, during the in-person interview, has addressed the necessity of training courses for the staff to increase their IT competence.

5.6.10 H10: Information Integrity and Adoption of Cloud-Based E-Learning:

The tenth hypothesis stated that information integrity has a positive influence on Cloud-Based E-Learning adoption by HEIs. In another word, the hypothesis stated that Information integrity(InfoInt)has a positive influence/impact on the adoption of (Adoption)Cloud-Based E-Learning in HEIs; this is represented statistically as InfoInt -> Adoption. Information integrity refers to "the use of information in a trustful and principled manner at the individual and organizational level"(Choo et al., 2008). Information integrity construct is the first factor of the six-information behaviors identified by Marchand(Marchand et al., 2002) to characterize the information culture in any organization (which we have explained and justified)(Choo et al., 2008).In the context of this study, it refers to the use of Cloud-Based E-Learning information in a trustful manner at the individual and organizational level in HEIs to increase

information management and information quality (Abrahamson & Goodman-Delahunty, 2013; Choo et al., 2008; Sinitsyna, 2014).However, the result of the empirical investigation showed that this hypothesis is not significant between the two variables. The related p-value is 0.390. Further, the path coefficient of -0.029representa very weak relationship between them.

This means that this study rejects the existence of any relationship between information integrity of cloud computing and the influence to adopt Cloud-Based E-Learning in HEIs in Oman. This result contradicts the literature on information culture(IC) studies as they founded empirically that information integrity is an important factor for the organization. The literature of IC studies usually supports the positive impact of the task on an innovation adoption(Choo et al., 2008).This is due to the less awareness of the respondents on how information integrity can flow smoothly using cloud computing services and can be incorporated intoCloud-Based E-Learning.

5.6.11 H11: Information Formality and Adoption of Cloud-Based E-Learning:

The eleventh hypothesis stated that information formality has a positive influence on Cloud-Based E-Learning adoption by HEIs.The hypothesis state that the information formality(InfoForm)has a positive influence/impact to adopt(Adoption) Cloud-Based E-Learning in HEIs, which is represented statistically as InfoForm -> Adoption.Information formality refers to the willingness to use and trust institutionalized information over the informal source(Choo et al., 2008). Information formalityconstruct is the second factor of the six-information behaviors identified by Marchand to characterize the information culture in any organization(Choo et al., 2008).In the context of this study, it refers to the willingness of decision-makers to use and trust institutionalized information over Cloud-Based E-Learning in HEIs in Oman(Abrahamson & Goodman-Delahunty, 2013; Choo et al., 2008; Hwang, 2011; Sinitsyna, 2014).However, the result of the empirical investigation showed that this hypothesis is not significant as its related *p*-value *is 0.086.*

Further, the path coefficient of 0.11 represents a very weak relationship between them. This means that this study rejects the existence of any relationship between information formality of cloud computing and the influence to adopt Cloud-Based E-Learning in HEIs in Oman. This result contradicts the literature on technology adoption

studies. The literature on technology adoption studies usually supports the positive impact of information formality adoption(Choo et al., 2008). This result can be justified due to the less adoption of the targeted HEIs in Oman for this study.

5.6.12 H12: Information Control and Adoption of Cloud-Based E-Learning:

The twelfths hypothesis stated that information control has a positive influence on Cloud-Based E-Learning adoption by HEIs in Oman. In another word, the hypothesis stated that information control (InfoCont) has a positive influence/impact on the adoption (Adoption) of Cloud-Based E-Learningin HEIs; this is represented statistically asInfoCont -> Adoption. There are few studies that examined information factor as an information culture factor on cloud computing adoption. Therefore, this study focused on Oman as an example of developing countries to address the effect of information control on HEIs adoption of CBEL applications. Information control construct is the third factor of the six-information behaviors identified by Marchand to characterize the information culture in any organization(Choo et al., 2008). Information control refers to "the extent to which information about performance is continuously presented to people to manage and monitor their performance. Managers use the information to monitor and control operational activities and decisions to achieve the intended strategy and improve business performance"(Choo et al., 2008). In the context of this study, it refers to the extent to which information in Cloud-Based E-Learning performance is continuously presented to staff in HEIs to manage and monitor their performance while doing routine tasks. However, the result of the empirical investigation showed that this hypothesis is significantat a level of 0.05 in the two variables, with a related *p*-value of 0.011.

Further, the path coefficient of 0.243 represents a strong relationship between them, which means that when information control goes up by 1 standard deviation, CBEL adoption goes up by 0.243 standard deviations. This means that this study accepts the existence of a relationship between information control of cloud computing and the influence to adopt Cloud-Based E-Learning in HEIs in Oman. This result is consistent with the existing literature of technology adoption studies. The literature of technology adoption studies usually supports the positive impact of information control on adoption(Choo et al., 2008). However, the previous studies have stressed that higher perceived information control is amongst the most significant factors that play a major

role in CBEL adoption. Based on this result, HEIs decision makers/owners should consider information control prior to CBEL adoption. Information control encourages HEIs to use online applications, including CBEL. In other words, people feel that information on business performance/quality of academic services has a positive influence on working behavior.

5.6.13 H13: Information Pro-activeness and Adoption of Cloud-Based E-Learning:

The thirteenth hypothesis stated that information pro-activeness has a positive influence on Cloud-Based E-Learning adoption by HEIs in Oman.This hypothesis stated that information pro-activeness(InfoPro)has appositive influence/impact on Cloud-Based E-Learning adoption in HEIs (InfoPro -> Adoption).Information pro-activeness refers to "the active concern to think about how to obtain and apply new information in order to respond quickly to business changes and to promote innovation in products and services"(Choo et al., 2008).Information pro-activenessconstruct is the fourth factor of the six-information behaviors identified by Marchand to characterize the information culture in any organization(Choo et al., 2008).In the context of this study, it refers to the active concern to consider how to apply new information by Cloud-Based E-Learning in order to respond quickly to business changes in HEIs (Abrahamson & Goodman-Delahunty, 2013; Choo et al., 2008; Hwang, 2011; Sinitsyna, 2014).However, the result of the empirical investigation showed that this hypothesis is not significant as its related p-value is *0.305*. Further, the path coefficient of -0.037representsa very weak relationship between them. This means that this study rejects the existence of any relationship between information pro-activeness of cloud computing and the influence to adopt Cloud-Based E-Learning in HEIs in Oman. This result contradicts the literature of technology adoption studies which usually support the positive impact of information pro-activeness on adoption(Choo et al., 2008).This rejection is due to the lack of a clear understanding of the meaning of this word based on the feedback received from the respondents.

5.6.14 H14: Adoption of Cloud-Based E-Learning and QAS:

This study highlighted the influence of Cloud-Based E-Learning on the quality of academic services in the HEIs. The fourteenth hypothesis stated that the adoption of Cloud-Based E-Learning has a positive impact on the quality of academic services in

HEIs in Oman. In other words, the hypothesis stated that there is a positive influence/impact on the HEIs to adoptCloud-Based E-Learning; this is represented statistically as Adoption ->QAS. The empirical result showed that this hypothesis is highly significant between Cloud-Based E-Learning adoption and quality of academic services variables at a level of 0.01 with a *p*-valueof 0.000.

Further, the related path coefficient of 0.749 represents astrongrelationship between Cloud-Based E-Learning adoption and the quality of academic services in the HEIs, which means that when CBEL adoption goes up by 1 standard deviation, the quality of academic services goes up by 0.749 standard deviations. This result is consistent with the existing literature. However, the previous studies have stressed that a high perceived quality of academic services is amongst the most significant factors that play a major role in CBEL adoption. Based on this result, HEIs decision makers/owners should consider Cloud-Based E-Learningfor improved quality of academic services. The influence of CBEL can be measured by the ranking of the HEIs after adoption. In addition, the netprofit of the organization should be improved compared to the status before CBEL adoption. The employee's satisfaction rate is also one of the major indicators to measure the effect of CBEL adoption (REF). It is therefore, recommended that the HEIs in Oman should consider CBEL adoption to improve their overall HEIs quality and academic services.

5.7 The Cloud-Based E-Learning Adoption Model in Oman

The main goal of this study is to investigate the significant factors that influence the adoption decision of Cloud-Based E-Learning in HEIs in Oman and to come out with an integrated model that can be used to examine these proposed factors. Many factors were reviewed and tested in various context; the selected factors were examined in HEIs context as per the literature for recent years by empirically validating the proposed model factors and eliminating the non-influencing factors (non-statistically significant hypotheses).

The final model of this study was finalized as shown in Figure 5-1 based on the empirical study output**.** The final model includes four dependent variables; Fit, Viability, Adoptionand QAS.The fitness of Cloud-Based E-Learning and its viability for HEIs influences the decision to adopt the intended technology; this was empirically

proven in this study as it improved the quality of academic services. The model also comprises of 11 independent variables constructs; task, relative advantages, complexity, compatibility, decision makers, cost reduction, IT readiness, information integrity, information formality, information control, and information pro-activeness. Five constructs represent the factors that influence the fitness (task, relative advantages, complexity, and computability) and three constructs represent the factors that influence the viability from three perspectives; organizational perspective (decision makers), technological perspective (IT readiness), and economic perspective (cost reduction). Finally, the factors that influence the adoption of Cloud-Based E-Learning were identified as information culture behaviors, information integrity, information formality, information control, and information pro-activeness.

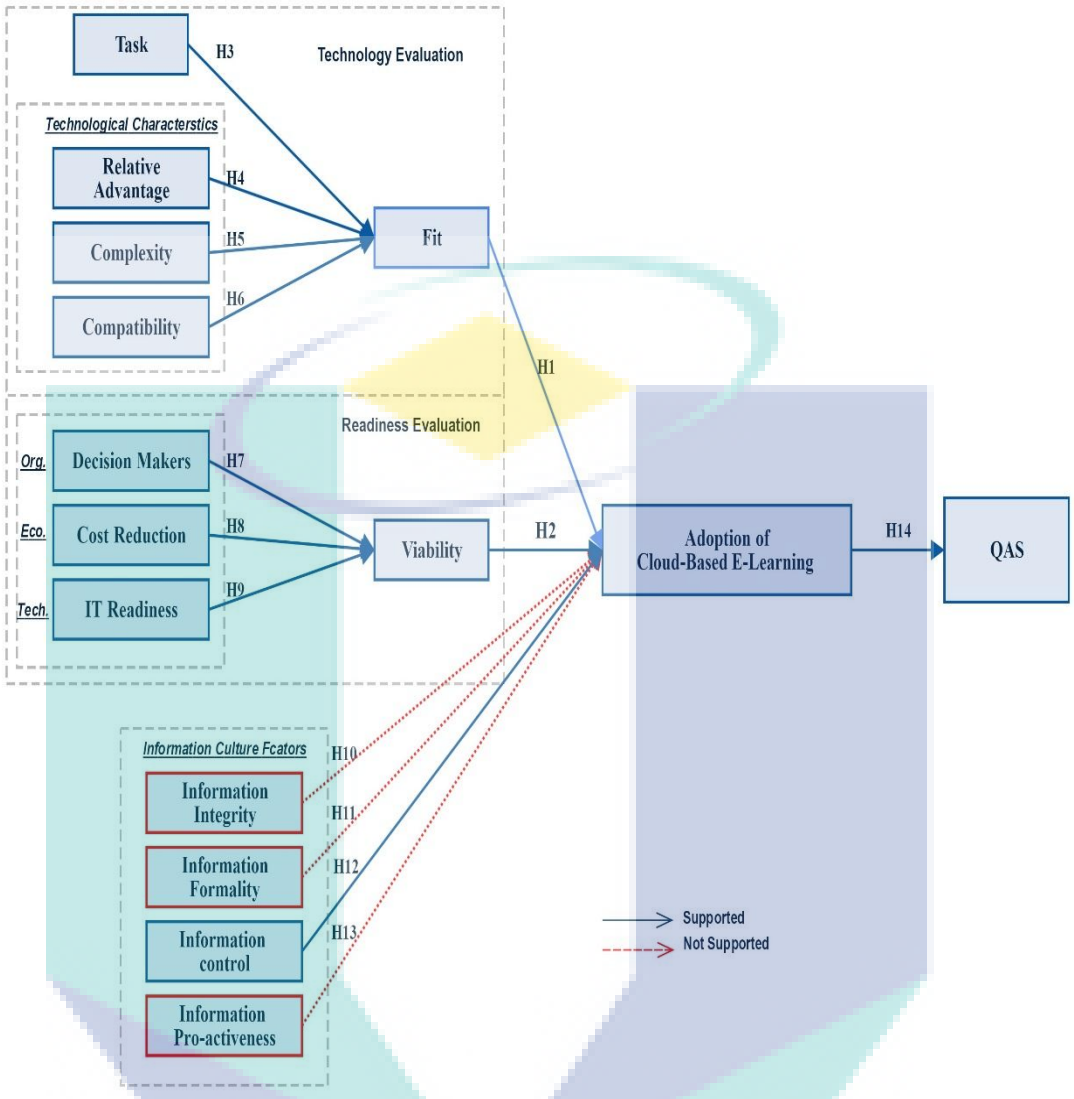

Figure 5-1 The Final Model and Hypotheses

The first descriptive analysis discussed is the demographics of the sampled population. Most of the respondents were male (65%), and most were age group 34-40 (36%).Majority of the respondents hold master qualification (41%). In order to start the analysis, some processes were considered in the collected data (data preparation). The data was screened for any outliers, missing data, and normality, then, coded and entered in a table format in SPSS for validity and reliability tests. Then, to Smart PLS v.3 for advanced statistical analysis tools. From the outcome of this process, three responses were dropped/removed due to a high percentage of missing data. In addition, the data was examined against some analysis requirements criteria, such as the adequacy of the sample and the normality of data distribution to ensure reliable results. The sample size of 312was sufficient and data distribution was normal. However, the bootstrapping

procedure was recommended which omits the need for normality distribution of the data. When all pre-analysis procedures and requirements were accomplished, the data was statistically analyzed.

The statistics of the demographic data, HEIs information, and cloud computing factors were described. Thereafter, the measurements of the model constructs were assessed against reliability and validity. To reach the reliability and validity of the measurements, Cronbach's alpha, composite reliability, convergent, and discriminant were examined and reported. Then, the proposed hypotheses were tested by assessing the structural model using path coefficients significance which indicates the relationships between dependent and independent constructs, and the R^2 value for each endogenous construct which represents the amount of variance explained by related exogenous constructs. To ensure that the path coefficients are free of bias, the collinearity of the structural model was examined. The results showed that four hypotheses were not significant and hence, were rejected. These results were discussed and linked to the prior researches and to the context of this study.

Finally, the final study model was presented in Figure 5-1. The fit viability model (FVM) was examined to investigate the factors that influence the decision to adopt Cloud-Based E-Learning in the HEIs in Oman. According to this proposed model, the decision to adopt cloud computing to replace the existing traditional technology in HEIs should rely on the fitness of the technology to the task requirements that it is to be adopted for. It also depends on the capability and readiness of the HEIsto implement the technology. Previous fit-viability model studies measured the fitness of technologyby the tasks that may be done by the technology. Therefore, fitness is forever high. During this study, the research examined the match dimension notwithstanding the precise characteristics of the technology. The innovation technology factors from the diffusion of innovation theory were used to assess the fitness of cloud computing to adopt Cloud-Based E-Learning.

The viability dimension was examined using the FVM factors in the context of HEIs. The results showed that all the fit dimension hypotheses were supported; it also showed that the fitness of Cloud-Based E-Learning to the HEIs tasks has a medium effect on the adoption decision (Path coefficient 0.156). Three hypotheses related to the factors influencing the viability of cloud computing to adopt HEIs were accepted. They

are the influence of organizational factors, economic factors, and IT readiness on viability. Moreover, the effect of viability on the decision to adopt Cloud-Based E-Learning was strong, with a path coefficient of 0.585.The IC dimensions were examined using four of the information behaviors identified by Marchand to characterize the information culture in any organization(Choo et al., 2008). Only one of them (information control) was supported for the context of this study (HEIs).

The measurement model of this study was evidenced to be valid and reliable as the outer loading for all the investigated factors were more than the recommended value (≥ 0.7), proving that the reliability is acceptable. Furthermore, the Cronbach's alphaand composite reliability exceeded the suggested value of 0.7. Finally, the Average Variance Extracted (AVE) of the model constructs exceeded the recommended values by the previous researches (0.5), ranging from 0.521 to 0.763. The structural model also showed an acceptable level of validity. The R^2values of the quality of academic services and Cloud-Based E-Learning adoption (CBELAdoption) were substantial. The suggested level of significant Path coefficient (β) value is 0.1, while in this study, were at t-statistics1.217 and 16. 967.Ten of the 14hypotheses were supported, and the effect size was within the recommended range of value.

5.8 Summary

The model was validated by the model fit which showed an appropriate model validity. The level of the measurement models' quality was at an average commonality index value of 0.777 while the level of structural model quality was at an average redundancy index of 0.173. However, the Good-of-Fitness of the model was large at 0.687. This showed that the global model validity was excellent. The final model of this study is considered to be of prime importance and can help the decision makers of HEIs in developing countries like Oman to decide on adopting CBEL successfully and on the right time towards qualifying its academic services. The final model showed that 68.2% of the significant factors for the adoption of CBEL was covered, and by adopting this model, 56.1% improvement will be achieved in the quality of the academic services.

CHAPTER 6

CONCLUSION, RECOMMENDATIONS AND FUTURE WORK

6.1 Introduction

Cloud-Based E-Learning (CBEL) is meant to be an urgent need to the HEIs, whether private or public. CBEL adoption has been investigated and examined thoroughly on the perspective of HEI in Oman, and the output showed that CBEL adoption is well useful for the HEIs. However, the adoption rate of CBEL is still low in developing countries like Oman, therefore, the main aim of this study was to propose and validate the CBEL adoption model that would be used to recognize the significant factors that influence the decision for CBEL adoption in HEIs in Oman.

This chapter concluded the whole achievements of this research based on the research questions and objectives. It demonstrated how this research finding contributes to the body of knowledge as theoretical contributions. Then, it exposed how the result of this research can be beneficial and to whom as practical contributions. Next, the limitations were highlighted Before making the recommendations for further research.

6.2 Implication of Study

This research achievement, as presented earlier, is beneficial to the field of Cloud-Based E-Learning. The main contributions of this research are the developed model of cloud computing adoption for E-Learning in HEIs in Oman. In addition to that, the significant theoretical and practical implications are further discussed in the following sections.

6.2.1 Research Objectives Achievement

This objective of this study which focused on the development of a CBEL adoption model for HEIs for the examination of the influence of proposed factors on the Quality of academic services of HEIs in Oman was achieved as shown in Table 6-1. The detailed objectives achievements were discussed as follows:

Table 6-1 Objectives Achievements

Phases	Main Activities	Outcome	
Preliminary Study and Literature review	➢Problem Identification. ➢Formulation RQ & RO ➢Literature Review. ➢Experts validity	✓Problem statement. ✓RO & RQ. ✓Related Work. ✓Factors selected.	Objective 1
Model Development	➢Grouping factors. ➢Building up research model. ➢Derive research hypothesis.	✓Research Model. ✓Forming the model. ✓Research Hypothesis.	Objective 2
Questionnaire	➢Questionnaire Development. ➢Define population. ➢Expert feedback. ➢Piloting. ➢Questionnaire refinement	✓Initial questionnaire. ✓Sample size. ✓Validated questionnaire. ✓Reliability & Validity. ✓Final questionnaire.	Objective 3
Data Analysis	➢Actual Survey-Data Collection. ➢Data analysis. ➢Model Validation. ➢Hypothesis testing	✓Row of Data. ✓Validated research model. ✓Model Validated. ✓Empirical Result.	Objective 4

Objective 1: To determine the factors that significantly affect the adoption of CBEL in Higher Education Institutions (HEIs): Chapter 2 of this study critically discussed the most recent information system adoption theories, organizational factors and various related-works of cloud computing adoption, E-Learning, and Information culture. As an outcome of the review, the factors were grouped in three dimensions according to the literature, namely: technological evaluation, readiness evaluation, and information culture factor. Technological evaluation and readiness evaluation represented the most examined by Fit-Viability Model (FVM). First dimension: Technological evaluation dimension is the most significant factor that influences CBEL adoption. Task, relative advantage, compatibility, and complexity represent the fit part of FVM and technological factors of DOI. Second dimension: Readiness evaluation dimension is the most perceived influencing factor while decision makers, cost reduction, and IT readiness were the viability part of FVM and organizational factors of DOI. Third dimension: The last dimension of the model was the selected factors of

information culture which were information integrity, information formality, and information control, and information pro-activeness. Therefore, the first research objective was achieved as shown in Table 6-1. Finally, the initial model was proposed.

Objective 2: To develop an adoption model for the relationship between the organizational factors, CBEL, adoption, and quality of academic services. After reviewing CBEL adoption studies, the developed model was generated, and factors were identified based on the literature review as shown in Figure 5-2. Three contexts were selected as organizational factors toward identifying their influence on CBEL adoption and quality of academic services. The output was 14 hypotheses which were explained in chapter 4. A questionnaire survey was used to evaluate the relationship between these factors. After data collection and analysis, the model was formulated, and the reliability and validity tests were done using SPSS V. 23. Then, the model was tested, validated, and finalized after dropping the non-significant items using Smart PLS V 0.3. Finally, the relationship between the investigated factors was established. By this, the model achieved the goodness-of-fit criteria and the second research objective was achieved as shown in Table 6-1. Finally, the measurement and structural assessments were applied.

Objective 3: To investigate the effect of these factors on CBEL adoption as well as CBEL on the QAS in HEIs in Oman. The model analysis showed that relative advantage, compatibility, complexity, decision makers, cost reduction, IT readiness, information integrity, information formality, information control, and information pro-activeness with path coefficients of 0.202, 0.446, 0.319, 0.337, 0.166, 0.259, -0.029, 0.11, 0.243and -0.037respectively, explain 88.2% of the variance in CBEL adoption. The hypotheses (H2, H3, H4, H5, H6, H7, H8, H9, H12,and H14) were supported, whereas H1“Fitness”, RH10“Information integrity”H11 “Information formality” andH13 “information pro-activeness” did not have any significant influence on CBEL adoption. It was found that CBEL adoption explained 34.3% of the variance in the quality of academic services. These results were presented in Chapter 5. Then, objective 3 was achieved as shown in Table 6-1as the final model was developed.

Objective 4: To validate the CBEL adoption model for successful implementation in HEIs in Oman. Based on the third research question, statistical results with a high level of significance show that the model is comprehensive with

factors that help CBEL adoption in HEIs. Furthermore, the model is reliable, and its usage would help to improve the quality of academic services in HEIs in Oman. As long as the final model is presented, the fourth research objectives were achieved as shown in Table 6-1. The final model of this study is considered to be of prime importance and can help the decision makers of HEIs in developing countries like Oman to decide on adopting CBEL successfully and on the right time towards qualifying its academic services. The final model showed that 68.2% of the significant factors for the adoption of CBEL was covered, and by adopting this model, 56.1% improvement can be achieved in the quality of the academic services.

6.2.2 Research contributions

This result of this study has contributed in terms of theoretical and practical implication:

6.2.2.1 Theoretical Implication

This research contributes to the body of knowledge from three different perspectives. This research contributes to the technology adoption, E-learning and cloud computing adoption for HEIs in Oman as follows:

The extensive review of the recent literature in the field of information systems, in the context of CBEL adoption, led to the extension of the Fit Viability model (FVM) to bridge the gap in the previous studies. Combining the innovation factors of Diffusion of Innovations (DOI) theory and information culture factors as the technology dimension of Task-Technology Fit (TTF) measurement was the main novelty of this study. As per the final model, the decision on Cloud-Based E-Learning adoption requires a deep evaluation of the suitability of the intended technology for a specific task and assessing its capability and readiness for HEIs to implement it.

Application and empirical validation of this extended FVM in the context of Cloud-Based E-Learning adoption research. The extended model included cloud-related constructs, such as relative advantages, complexity, and computability. In addition, one of the significant advantages of Cloud-Based E-Learning is cost reduction, decision makers, and IT infrastructure's readiness. Cultivating information culture and FVM as factors in this extended model in the field of higher education is a big value to the literature. As per the literature, this research is one of the very genuine empirical studies

that has linked information culture to CBEL adoption in the higher education sector of the developing countries like Oman. The empirical investigation of the significant factors influencing Cloud-Based E-Learning in the context of Higher Education in Oman can be considered as fundamental for future strategies on CBEL adoption in HEIs, particularly in Oman.

6.2.2.2 Practical Implication

In this research, the main question was: How can Cloud-Based E-Learning be adopted in HEIs in Oman and implemented successfully? Accordingly, this research has significant implications for the practice of Cloud-Based E-Learning implementation. The investigations of the factors that affect the adoption in developing countries, especially Omani HEIs were discussed. In the end, this will help policymakers to take the right decision towards migrating their business to the cloud or not and at the right time.

Additionally, the validation of the developed model for Cloud-Based E-Learning adoption in HEIs in Oman provides empirical evidence regarding what affects the adoption of cloud computing for e-learning implementation. This will facilitate decision making by HEIs to adopt cloud computing. The cloud computing adoption model for e-learning implementation implies that to make a decision on the adoption, HEIs should evaluate the fitness of cloud computing for its e-learning system requirements. In addition, they should assess the capabilities/readiness required to implement Cloud-Based E-Learning.

The fitness of cloud computing depends on its advantages compared to other alternatives in term of cost and ready-for-start time. In addition, it depends on its compatibility for specific requirements of the e-learning systems, including the security and privacy, and the control that can be provided by cloud computing. However, cloud computing can be a good option to facilitate migrating to Cloud-Based E-Learning. This would not be everything to decide to adopt or not, the decision to adopt cloud computing needs readiness of the HEIs; then, cloud computing should be viable to the HEI that intends to adopt Cloud-Based E-Learning. The viability of cloud computing also depends on the economic feasibility and the technology readiness in terms of IT infrastructure, IT competent staff, IT policies and regulations. Finally, this research provides decision makers in developing countries especially in Oman, with a tool to

assess its readiness for successful adoption and implementation of Cloud-Based E-Learning at the right time. They can benefit by identifying the aim of CBEL adoption using open source application prior to the pilot implementation of these applications.

6.3 Limitation of the Study

The study encountered various limitation, such as inflexibility of regulators in some of the HEI; the data was collected from one country which cannot be generalized for other country without empirical validation in the future. This research faced some challenges during the data collection period. During the exercise, the researcher encountered the predicament of administering the research instruments due to the inflexibility of the regulator in some of the HEIs. However, the MoHE decided to provide the researcher with an approval letter to carry out the research with no assistance. As a result, the researcher was forced to conduct the research personally and work directly with the respondents.

The researcher also realized that the targeted group that took part in the research was not biased. It may have been conducted in such a manner, as they perceive that giving out negative information about the institution may lead to the loss of their jobs. Nevertheless, the researcher needed to convince the participants that the information they provide will not be disclosed or threaten their careers. They will also be guaranteed that the researcher would maintain a high confidentiality level and their names would remain anonymous. All the data collected, and findings will be used for academic purposes only. The author further assured the respondents that they were not supposed to include their names on the questionnaire, which is a good way to ensure the information provided is confidential.

The study experienced major changes in the original by one month. Further, the researcher encountered difficulties in secondary data collection. Finding secondary data may be challenging since there are numerous articles that the researcher has to go through and seek out the vital ones. Similarly, it took a lot of time and efforts to locate the right literature that is allocated for this research. Consequently, the study and research process was completed successfully on time. In the end, the researcher gathered the necessary information to carry out the study.

6.4 Recommendations for future work

This study was deeply focused on Cloud-Based E-Learning adoption in HEIs in Oman; the following recommendation is based on the scope, theoretical, and methodological assumptions of this research.

Firstly, in response to the scope of this research, which focuses on HEIs in Oman, it would be very interesting to have a study in different sectors and in different contexts, then evaluate the differences in the relationships between factors affecting Cloud-Based E-Learning adoption. In addition, this research can be conducted in another developing country in GCC in order to evaluate the factors affecting Cloud-Based E-Learning in a different environment. Different countries would have different organizational situations, financial situation, and cost concerns. This will help in understanding if this research's model can be generalized or not, and if the empirical finding is applicable in different countries and contexts or not.

Secondly, the extended model can be tested in other contexts of cloud computing adoption in organizationslike SMEs, health institutions and industry. This will help to establish the theoretical contribution of the FVM model in the cloud computing context. This model can also be evaluated with other technologies or services by considering the characteristics of each technology or services, such as social media in HEIs or different contexts.

Finally, with respect to the methodological perspective, further study can be conducted on the adoption factors using different methodologies. A qualitative approach can be applied for a specific adoption project. Any cloud model (Public, Private, Community or Hybrid) can be examined to be adopted. In conclusion, to help the HEIs in Oman adoption of Cloud-Based E-Learning, this study suggests that the significant factors affecting Cloud-Based E-Learning adoption in HEIs should be analyzed and checked before deciding on its adoption in Oman. This finding showed that the most significant factors influencing Cloud-Based E-Learning adoption as those presented in the final model in Figure 5-2. These factors were examined by developing a model of cloud computing adoption. This developed model contributed to the theoretical and practical aspects of Cloud-Based E-Learning. Limitations were addressed and recommendations for further study were provided.

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APPENDIX-A: DEFINATION OF TERMS

Traditional E-learning: Learning utilizing electronic technologies to access educational curriculum outside of a traditional classroom where the infrastructure hosted and maintained by the HEI itself (Riahi, 2015)as long as they are connected to the Internet.

E-learning: It is a new method of learning that is conducted through electronic media where dynamically scalable and often virtualized resources are offered as a service over the internet.

Cloud Computing: It is a new style or model of computing that involves the use of a certain network of remote servers that is hosted on the Internet that helps in storage, managing, and processing data, instead of using a personal computer(Alharthia et al., 2017).

Cloud-Based E-Learning: It's a new model of Online learning, that is accessible and available in the cloud; which means the resources are stored in a virtual platform, and accessed from various forms of web-enabled devices(SKillsoff, 2018).

IaaS (Infrastructure as a Service): It enables the user to easily install and execute the actual software. With this platform, the user has access to virtualised servers. It targets operating systems including hardware, CPUs, networks and storage.

SaaS (Software as a Service): In the cloud system, service providers offer software services such as CRM or CAD/CAM. The users can access these services in form of software and use it for their own businesses. SaaS services are also available on a rental basis or on per use basis(Shaikh & Sasikumar, 2015).

PaaS (Platform as a Service): This platform allows users to use a cloud computing system to develop any application with the help of a development kit that is provided by cloud computing. Examples of the major cloud computing vendors include Microsoft, Amazon, and Google.

APPENDIX-B1: OMANI MINISTRY APPROVAL

Sultanate of Oman
Ministry of Higher Education
Directorate General of colleges
of Applied Sciences

سلطنة عمان
وزارة التعليم العالي
المديرية العامة لكليات العلوم التطبيقية

الرقم 6 / 5 / 43 / 2017 - صد

التاريخ: 25 / 9 / 2017م

الأفاضل / عمداء كليات العلوم التطبيقية المحترمين

السلام عليكم ورحمة الله وبركاته،،،

الموضوع: تسهيل مهمة الباحث / قاسم بن عبدالله العجمي

نود إفادة عنايتكم الكريمة بأن الفاضل / قاسم بن عبدالله العجمي – يقوم بإعداد دراسة بحثية بعنوان:

(Adoption Factors of E-Learning Based on Cloud Computing (ELBCC) in Higher Education Institutions in Oman)

وذلك ضمن متطلبات الحصول على درجة الدكتوراه من جامعة ماليزيا بهانج بالجمهورية الماليزية.

عليه يرجى التكرم بتسهيل مهمة الباحث لإجراء هذه الدراسة، علماً بأن هذه البيانات والنتائج المستخلصة سوف تستخدم لأغراض البحث العلمي فقط.

شاكرين لكم حسن تعاونكم الدائم.

وتفضلوا بقبول فائق الاحترام والتقدير

عزيزة بنت سهيل المهرية
مديرة مساعدة مركز البحث العلمي

*المدير العام
*المدير العام المساعد للشؤون الأكاديمية

نحو تعليم عالٍ ذي جودة عالية يلبي متطلبات التنمية المستدامة
سلطنة عُمان ص.ب: ٨٢ روي - الرمزالبريدي: ١١٢ - هاتف ٢٤٣٤٠٥٨٠ / فاكس ٢٤٣٤٠٥٧٨
Sultanate of Oman, P.O.Box: 82 Ruwi, PC 112, Tel:24340580 / Fax 24340578 www.mohe.gov.om

APPENDIX-B2: APPLIED COLLEGES APPROVAL

Sultanate of Oman
Ministry of Higher Education
Directorate General of
Private Universities & Colleges
التاريخ ١٩/ ٩/ ٢٠١٧م

سلطنة عمان
وزارة التعليم العالي
المديرة العامة للجامعات والكليات الخاصة
الرقم ٢٠١٧/٩٥٦/١/٥ - ٢٠٩

المدير العام
بتاريخ ١٩/ ٩/ ٢٠١٧

تعميم رقم (١١٩/ ٢٠١٧)

الأفاضل / رؤساء الجامعات الخاصة المحترمين
الأفاضل / عمداء الكليات الخاصة المحترمين

السلام عليكم ورحمة الله وبركاته... وبعد ،،،

الموضوع/ تسهيل مهمة باحث

نود إفادتكم بأن الفاضل / قاسم بن عبدالله بن حسن العجمي يقوم حاليا بإجراء إستبيان حول دراسته لمرحلة الدكتوراه بعنوان (دراسة عوامل الإعتماد على التعليم الإلكتروني بواسطة خدمات السحابة الحاسوبية بمؤسسات التعليم العالي الخاصة بالسلطنة) كمتطلب من متطلبات الحصول على درجة الدكتوراه.

عليه.. يرجى التكرم الإيعاز للمختصين لديكم بالمؤسسة التعاون مع المذكور وتسهيل مهمته لأغراض الدراسة المشار إليها حسب المعمول به لديكم.

هذا وفي حال رغبتكم في التواصل مع الباحث فيرجى التواصل معه على الرقم(٩٩٨٠٤٤٨٨) أو على البريد الإلكتروني (Alajmi.qasim@gmail.com)

شاكرين لكم حسن التعاون.

وتفضلوا بقبول فائق التقدير والإحترام...،،

جوخة بنت عبدالله الشكيلية
المديرة العامة للجامعات والكليات الخاصة

نسخة إلى:
- رئيس مكتب معالي الدكتورة الوزيرة
- مدير مكتب سعادة الدكتور الوكيل

APPENDIX-B3: SQU APPROVAL

بسم الله الرحمن الرحيم

Sultan Qaboos University

OFFICE OF THE ADVISOR
FOR ACADEMIC AFFAIRS

جامعة السلطان قابوس

مكتب المستشار
للشؤون الأكاديمية

9th October 2017

TO WHOM IT MAY CONCERN

This is to certify that the University has no objection of Mr Qasim Abduallah Al-Ajmi, PhD student from Universiti Malaysia Pahang, to conduct a questionnaire that is part of his research entitled:

"The Adoption Factors of E-learning Based Oncloud Computing in Higher Education Institutions in Oman"

Kindly cooperate with him to do the necessary to conduct the questionnaire within SQU.

Prof. Taher Ba-Omar
VC's Advisor, Academic Affairs

APPENDIX-B4: UMP APPROVAL

Universiti Malaysia PAHANG

Universiti Malaysia Pahang
Lebuhraya Tun Razak, 26300 Gambang
Kuantan, Pahang Darul Makmur
Tel: +609-549 2133| Faks/Fax: +609-549 2144

Fakulti Sistem Komputer & Kejuruteraan Perisian
Faculty of Computer Systems & Software Engineering

UMP.12.02/PCC16005 22 August 2017

To whom it may concern,

This is to verify that Qasim Abdullah Hassan Alajmi is currently a student of Universiti Malaysia Pahang. The details are as follows:

Programme	**: Doctor Of Philosophy**
Mode of Study	**: Research**
IC No/Passport No	**: 03565294**
Research Title	**: The Adoption Factors of E- Learning Based on Cloud Computing in Higher Education Institutions in Oman**

2. Qasim Abdullah Hassan Alajmi is registered as a full time postgraduate student pursuing a Doctor of Philisophy degree under Faculty of Computer Systems & Software Engineering,Universiti Malaysia Pahang. The commencement of his studies here began on 22 February 2016 and the programme which he is presently enrolled in requires him to complete his studies within 4 semesters (2 years) and 12 semesters (6 years).

2. Qasim Abdullah Hassan Alajmi is working on "The Adoption Factors of E- Learning Based on Cloud Computing in Higher Education Institutions in Oman" fo his thesis.He is preparing an interview and survey in achieving his thesis objectives. I would be glad if you will provide his questions answer. All the replies come from the interview and survey such as name and the details of your organization will be kept confidential.

3. In highly appreciated if u could kindly asisst him with needs and thank you in advanced for your co operation and support. Please do not hesitate to contact us for any enquires you might have

Thank you for you co-operation.

Yours faithfully,

ASSOC. PROF. DR. MAZLINA BINTI ABDUL MAJID
Deputy Dean (Research & Graduate Studies)

APPENDIX-C: QUESTIONNAIRE

CONCEPTUAL MODEL FORACLOUD-BASED E-LEARNINGADOPTION IN HIGHER EDUCATION INSTITUTIONS IN OMAN.

Dear Sir/Madam,

You are kindly requested to participate in this survey as you are working in a Higher Education Institutions (HEIs) in Oman at the one of the following positions (Decision Makers with IT background, Faculty at Computer department or any related field, IT support staff, or any related position).I am Qasim Al-Ajmi, a PhD candidate; this survey is conducted under the supervision of Associate Professor Ruzaini bin Abdullah Arshah from Faculty of Computer Systems& Software Engineering, Universiti Malaysia Pahang.

The main purpose of this study is to examine the factors that effect on Cloud-Based E-Learning adoption in HEIs in Oman. It would be much appreciated when you manage spending a few minutes of your time filling the attached questionnaire.Cloud Computing is defined as every service made available to HEIs on demand via the Internet from a cloud computing providers servers such as data storage and software services. E-Learning refers to application used as LMS in the HEIs.

There are no anticipated risks participating in this study. The results of this study may benefit your institution through identifying the factors which might increase its performance/quality of academic services. Your participation is voluntary and your identity will be kept as anonymous. All information provided will be strictly confidential and will be purely used for academic purposes only. If requested, you will receive a summary of the results of this study when it has been completed.

I would like to thank you in advance for your kind acceptance to participate in this survey. If you have any questions about the current study or the questionnaire, please contact me using the information below:

Qasim Abdullah Hassan Al-Ajmi-Faculty of Computer Systems & Software Engineering/University Malaysia Pahang

LebuhrayaTunRazak, 26300 Gambang, Pahang
Mobile: 00968-99804488/Email: alajmi.qasim@gmail.com

The following section seeks general information about you and your institution. Please answer by ticking (√) in the appropriate bracket below:

A: Personal Information

Gender? [ ] Male [ ] Female

What is the age group you belong to?
[ ] 18 -25 years [ ] 26 - 33 years [ ] 34 – 40 years [ ] 41 – 50 years [ ] 51 years old or older

What is the highest degree you have earned?
[ ] High School and less [ ] College diploma [ ] Bachelor degree [ ] Master Degree [ ] PhD

What is your academic title?
[ ] Prof. [ ] Associate Prof. [ ] Assistant Prof. [ ] Lecturer [ ] Technician Other (specify):

What is your position or title at your organization?
[ ] Owner [ ] Dean [ ] IT Manager [ ] Other (please specify):

How long have you been working in this position?
[ ] Less than 3 years [ ] 3-5 years [ ] 5-10 years [ ] Over 10 years

B: Institution Information

Select from below the status of your institution in adopting cloud computing?
□ Not considering.
□ Have evaluated, but not planning to adopt cloud computing.
□ Currently evaluating cloud computing.
□ Have evaluated and planning to adopt cloud computing.
□ Have already adopted cloud computing.

Select the status of IT resources/services from below (please tick the plan thatapplies to you)**:**

IT resources/services	Hosted	Plan to host	No plan
E-mail			
Learning management systems (e.g. Blackboard, Moodle,Edmodo etc…)			
Library system			
University/college website or portal			
File backup and storage			
Online collaboration or conferencing			
Student record system			
File sharing			
Office productivity suite (e.g. Office 365)			
ERP(Enterprise resource planning)			

Which of the following cloud computing types has your institution adopted or considers to be adopted?
[ ] Public cloud [ ] Private cloud [ ]Hybrid cloud [ ] Do not know

What is the Cloud computing model usage?
[ ]IaaS [ ] PaaS [ ] SaaS [ ] Do not know

Please indicate your agreement to the following statements regarding technology factor(s)that affect(s)**the adoption of CBEL in your institution [1: Strongly Disagree; 2: Disagree; 3: Neutral; 4: Agree; 5: Strongly Agree]:**

#	**Relative Advantage**	**Please tick one**				
		1	**2**	**3**	**4**	**5**
1	▪ The adoption of CBEL enables my institution to accomplish a specific task more quickly.(RA1)					
2	▪ The adoption of CBEL improves my performance in my job.(RA2)					
3	▪ The adoption of CBEL helps increasingthe productivity of my job.(RA3)					
4	▪ The adoption of CBEL enhances effectiveness in my job.(RA4)					
5	▪ The adoption of CBEL makes it easier to carry out my job.(RA5)					
6	▪ Ifound that the adoption of CBEL is useful for my job.(RA6)					
#	**Complexity**	**Please tick one**				
		1	**2**	**3**	**4**	**5**
1	▪ The adoption of CBEL requires a lot of mental effort.(Com.1)					
2	▪ The adoption of CBEL is frustrating.(Com.2)					
3	▪ The adoption of CBEL is too complex for providing educational services. (Com.3)					
4	▪ The integration of CBEL with cloud computing services in your current work practice will be very difficult. (Com.4)					
5	▪ You believe that the adoption of CBEL is cumbersome to use. (Com.5)					
#	**Compatibility**	**Please tick one**				
		1	**2**	**3**	**4**	**5**
1	▪ The adoption of CBEL fits all aspects ofyour work. (Comt. 1)					
2	▪ The adoption of CBEL technology is in line with your business strategy. (Comt. 2)					
3	▪ The adoption of CBEL technology is compatible with your IT infrastructure. (Comt. 3)					
4	▪ Transformation towards the adoption of ELBCCin yourinstitution is favorable. (Comt. 4)					
5	▪ You believe that the adoption ofELBCCis consistent with yourinstitutionculture. (Comt. 5)					
6	▪ Using cloud computing services are compatible with yourinstitution's corporate culture and value system. (Comt. 6)					
#	**Fit**	**Please tick one**				
		1	**2**	**3**	**4**	**5**
1	▪ CBEL would be a good way to share and exchange information among various HEIs. (Fit 1)					
2	▪ Yourinstitution's computing task requirements is closely aligned with cloud services. (Fit 2)					
3	▪ Cloud computing will satisfy your institution's computing needs. (Fit 3)					
4	▪ The current applications in yourinstitution can be easily adapted to the cloud. (Fit 4)					
5	▪ It seems that cloud computing fits our requirements to provide academic services. (Fit 5)					

B: Viability Factors:

Please indicate your agreement to the following statements regarding viability factors that affect the **adoption of CBEL in your institution**:
[1: Strongly Disagree; 2: Disagree; 3: Neutral; 4: Agree; 5: Strongly Agree]:

#	Organizational Factors(Decision Makers)	Please tick one				
		1	2	3	4	5
1	▪ Yourdecision makers are interested in the adoption of CBEL.(DM. 1)					
2	▪ Yourdecision makers are effectively committed and supporttheadoption of CBEL. (DM. 2)					
3	▪ Yourdecision makers allocate adequate resources for the adoption of CBELtechnology. (DM. 3)					
4	▪ Yourdecision makers constantly encourage the employees to use new technologies in their daily work. (DM. 4)					
5	▪ Yourdecision makers have a desire to adopt and use new technologies to improve your competitive edge. (DM. 5)					
6	▪ Yourdecision makersconsider the adoption of CBEL is important to your institution. (DM. 6)					
#	**Economical factor (Cost Reduction)**	Please tick one				
		1	2	3	4	5
1	▪ The adoption of CBEL services reduces the operating cost. (Cost1)					
2	▪ The benefits of the adoption of CBEL services are greater than the costs of implementation. (Cost2)					
3	▪ The adoption of CBEL services has a considerable cost saving and low purchasing over traditional computing methods in the long run. (Cost3)					
4	▪ Maintenance costs of the adoption of CBEL are reasonable. (Cost4)					
5	▪ Overall, the adoption of CBEL servicescost is efficient. (Cost5)					
#	**Infrastructure Factors (IT Readiness)**	Please tick one				
		1	2	3	4	5
1	▪ YourInstitution is well-computerized through using a local area network. (IT1)					
2	▪ Your Institutionhas high bandwidth Internet connectivity. (IT2)					
3	▪ Yourinstitution has individuals who are experts, skilled and well-trained in IT and CBEL technologies. (IT3)					
4	▪ Your Institutionhas experts who are able to plan, carry out, and evaluate all procedures related to the adoption and implementationof CBEL technology. (IT4)					
5	▪ The vast majority of your institution's employees have an unrestricted access to computers and internet. (IT5)					
6	▪ Most of yourinstitution'semployees are computer-skilled. (IT6)					
#	**Viability**	Please tick one				
		1	2	3	4	5
1	▪ Your Institution's capabilities and current resources support CBEL. (Viability 1)					
2	▪ Your Institution can efficiently move computing needs to CBEL. (Viability 2)					
3	▪ Cloud computing is viable to implement CBEL services in your institution. (Viability 3)					

C: Information Culture Factors:

Please indicate your agreement to the following statements regarding Information Culture factors that affect the **adoption of CBEL in your institution: [1: Strongly Disagree; 2: Disagree; 3: Neutral; 4: Agree; 5: Strongly Agree]:**

#	Information Integrity	Please tick one				
		1	2	3	4	5
1	▪ You used to be certain that the information is accurate before passing among each other as a common practice within our work environment. (Info.Int.1)					
2	▪ You consider that our institution's employeesdo not keep the information for themselves as a common practice among them. (Info.Int.2)					
3	▪ You consider that our institution'semployees do not exploit business information for self interest as a common practice in our work. (Info.Int.3)					
4	▪ The enhancement of trust in information sharing among employees is one of the common practices in your work. (Info.Int.4)					
5	▪ The information integrity improves information sharing among your staff effectively and openly. (Info.Int.5)					
#	**InformationFormality**	**Please tick one**				
		1	2	3	4	5
1	▪ You used to verify the information from informal sources as a common practice in our work environment. (Info.form.1)					
2	▪ You used to trust the formal sources of information as a common practice in our work environment. (Info.form.2)					
3	▪ You consider that the formal sources of information are credible. (Info.form.3)					
4	▪ Ignoring information from informal resources is often a dominant practice among our staff. (Info.form.4)					
5	▪ Trust in quality of information from formal sources is a common practice in your work environment. (Info.form.5)					
#	**Information Control**	**Please tick one**				
		1	2	3	4	5
1	▪ The performance information is usually presented to yourinstitution'semployees. (Info.control.1)					
2	▪ Revealing the fact of performance information positively influences working behavior. (Info.control.2)					
3	▪ Yourinstitution's staff is using the performance information to improve their performance. (Info.control.3)					
4	▪ The scattered and unorganized information leads to increasing the difficulty of control over the people and/or processes. (Info.control.4)					
5	▪ The knowledge among the institution's staffabout organizational performance positively influences their work. (Info.control.5)					
#	**Information Pro-activeness**	**Please tick one**				
		1	2	3	4	5
1	▪ The institution encouragesthe staff to get benefit from and use information related to the best practices and success stories. (Info.pro.1)					
2	▪ The institution motivatesthe employees to read the published journals and other publications related to their tasks. (Info.pro.2)					
3	▪ The institution urgestheemployeesto keep abreast of new developments at work. (Info.pro.3)					
4	▪ The institution follows thework slogan "If you have questions, don't hesitate to ask". (Info.pro.4)					
5	▪ The institution encouragesthe staff to take the initiative, learn new things and present their creative ideas. (Info.pro.5)					

D: Adoption of E-Learning Based Cloud Computing

Please indicate your agreement to the following statements regarding the **adoption of CBEL in your institution:** **[1: Strongly Disagree; 2: Disagree; 3: Neutral; 4: Agree; 5: Strongly Agree]:**

#	Adoption of E-Learning Based On Cloud Computing(CBEL)	Please tick one				
		1	2	3	4	5
1	▪ It is recommended to use ELBCC in the HEIs. (Adop. 1)					
2	▪ You feel comfortable recommending cloud computing approaches in yourinstitution. (Adop. 2)					
3	▪ Yourinstitution plan to evaluate and adopt cloud computing for E learning. (Adop. 3)					
4	▪ Yourinstitution is currently engaged at the initial stage of Cloud Computing adoption. (Adop. 4)					
5	▪ You anticipating that your institution will adopt Cloud Computing in the nearest future. (Adop. 5)					

E: Academic Service Quality

Please indicate your agreement to the following statements regarding the **Quality of Academic Services in your institution**:**[1: Strongly Disagree; 2: Disagree; 3: Neutral; 4: Agree; 5: Strongly Agree]:**

#	Quality of Academic's Service	Please tick one				
		1	2	3	4	5
1	▪ Adoption of the ELBCC willhelp yourinstitution for planning and managingthe academic support services on student learning need. (QAS1)					
2	▪ Adoption of the ELBCC will helpyourinstitution totake into account the specific needs of students in non-standard modes of study and/or studying in different locations. (QAS2)					
3	▪ Adoption of the ELBCC will help yourinstitution in analyzing the profile of the student population to inform strategic decision making and longer-term planning and development of academic support services. (QAS3)					
4	▪ ELBCC will help your institution in regularly reviewing the effectiveness of its approach to academic support services planning and management in order to ensure it positively contributes to students' academic achievement.(QAS4)					

Thank You for Your Cooperation

APPENDIX-D: CONTENT VALIDITY LETTERS BY EXPERTS

To whom it may concern

I have participated in the content validation of *Qasim Al-Ajmi's instrument for his PhD. **Study; "A Conceptual Model for A Cloud-Based E-Learning Adoption in Higher Education Institutions in Oman"** and approve them from a content perspective.

Name: Dr. Mohamed Al-Hammed Signature:
Date: 20/08/2017

Contact Information:

Department: Computer Science & MIS(**HoD**)
College/University: Oman College of Management & Technology.
Address: Oman, Muscat.
Phone: 00968-79097685
Email: mohammed.alhamad@omancollege.edu.om.

**Qasim Al-Ajmi, a PhD candidate; under the supervision of Prof. Dr. Ruzaini bin Abdullah Arshah from Faculty of Computer Systems& Software Engineering, Universiti Malaysia Pahang.*

To whom it may concern

I have participated in the content validation of Qasim Al-Ajmi's instrument for his PhD. Study; "A **Conceptual Model for A Cloud-Based E-Learning Adoption in Higher Education Institutions in Oman**" and approve them from a content perspective.

Name: Dr. Mohammad Alazawi Signature: _____
Date: 20/08/2017

Contact Information:

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To whom it may concern

I have participated in the content validation of Qasim Al-Ajmi's instrument for his PhD. Study; "A **Conceptual Model for A Cloud-Based E-Learning Adoption in Higher Education Institutions in Oman**" and approve them from a content perspective.

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APPENDIX-E: OUTLIERS

	D2	d2/df
Case 1	47.051	0.645
Case 2	70.732	0.969
Case 3	124.002	1.699
Case 4	105.718	1.448
Case 5	58.547	0.802
Case 6	64.891	0.889
Case 7	155.793	2.134
Case 8	72.243	0.990
Case 9	86.719	1.188
Case 10	53.454	0.732
Case 11	137.179	1.879
Case 12	49.481	0.678
Case 13	78.081	1.070
Case 14	30.282	0.415
Case 15	9.762	0.134
Case 16	97.420	1.335
Case 17	48.273	0.661
Case 18	45.903	0.629
Case 19	142.850	1.957
Case 20	19.188	0.263
Case 21	103.320	1.415
Case 22	78.340	1.073
Case 23	117.460	1.609
Case 24	70.465	0.965
Case 25	47.620	0.652
Case 26	94.023	1.288
Case 27	116.426	1.595
Case 28	118.479	1.623
Case 29	81.896	1.122
Case 30	89.037	1.220
Case 31	54.062	0.741
Case 32	92.384	1.266
Case 33	79.512	1.089
Case 34	41.516	0.569
Case 103	95.572	1.309
Case 104	34.809	0.477
Case 105	30.919	0.424
Case 106	26.011	0.356

	D2	d2/df
Case 35	63.861	0.875
Case 36	61.766	0.846
Case 37	94.044	1.288
Case 38	64.918	0.889
Case 39	76.836	1.053
Case 40	49.933	0.684
Case 41	63.851	0.875
Case 42	14.593	0.200
Case 43	86.168	1.180
Case 44	112.811	1.545
Case 45	49.383	0.676
Case 46	86.498	1.185
Case 47	46.170	0.632
Case 48	44.327	0.607
Case 49	19.769	0.271
Case 50	42.337	0.580
Case 51	48.507	0.664
Case 52	39.536	0.542
Case 53	48.562	0.665
Case 54	48.106	0.659
Case 55	81.077	1.111
Case 56	147.982	2.027
Case 57	64.376	0.882
Case 58	83.171	1.139
Case 59	69.986	0.959
Case 60	113.598	1.556
Case 61	76.259	1.045
Case 62	106.909	1.465
Case 63	80.156	1.098
Case 64	5.999	0.082
Case 65	79.408	1.088
Case 66	97.271	1.332
Case 67	9.220	0.126
Case 68	36.624	0.502
Case 140	111.063	1.521
Case 141	121.177	1.660
Case 142	68.541	0.939
Case 143	47.419	0.650

	D2	d2/df
Case 69	98.488	1.349
Case 70	126.986	1.740
Case 71	91.052	1.247
Case 72	83.429	1.143
Case 73	82.744	1.133
Case 74	65.201	0.893
Case 75	45.078	0.618
Case 76	53.424	0.732
Case 77	51.822	0.710
Case 78	44.822	0.614
Case 79	31.907	0.437
Case 80	48.836	0.669
Case 81	31.586	0.433
Case 82	125.366	1.717
Case 83	42.046	0.576
Case 84	67.276	0.922
Case 85	70.559	0.967
Case 86	18.133	0.248
Case 87	58.342	0.799
Case 88	52.773	0.723
Case 89	91.130	1.248
Case 90	51.898	0.711
Case 91	71.408	0.978
Case 92	83.214	1.140
Case 93	99.464	1.363
Case 94	102.244	1.401
Case 95	20.019	0.274
Case 96	37.487	0.514
Case 97	73.523	1.007
Case 98	15.904	0.218
Case 99	96.467	1.321
Case 100	76.981	1.055
Case 101	71.971	0.986
Case 102	23.342	0.320
Case 177	49.107	0.673
Case 178	75.652	1.036
Case 179	25.460	0.349
Case 180	68.885	0.944

Case 107	134.826	1.847
Case 108	106.939	1.465
Case 109	132.298	1.812
Case 110	107.543	1.473
Case 111	95.296	1.305
Case 112	46.071	0.631
Case 113	96.362	1.320
Case 114	63.763	0.873
Case 115	149.767	2.052
Case 116	31.979	0.438
Case 117	48.924	0.670
Case 118	134.878	1.848
Case 119	101.004	1.384
Case 120	102.720	1.407
Case 121	52.687	0.722
Case 122	33.875	0.464
Case 123	55.542	0.761
Case 124	44.982	0.616
Case 125	41.211	0.565
Case 126	83.920	1.150
Case 127	100.958	1.383
Case 128	113.320	1.552
Case 129	94.364	1.293
Case 130	132.657	1.817
Case 131	56.228	0.770
Case 132	87.580	1.200
Case 133	19.638	0.269
Case 134	70.817	0.970
Case 135	78.882	1.081
Case 136	56.004	0.767
Case 137	64.507	0.884
Case 138	43.136	0.591
Case 139	67.661	0.927
Case 214	29.747	0.407
Case 215	50.544	0.692
Case 216	125.222	1.715
Case 217	21.691	0.297
Case 218	68.602	0.940
Case 219	53.621	0.735
Case 220	96.892	1.327
Case 221	161.688	2.215
Case 222	64.545	0.884

Case 144	79.788	1.093
Case 145	42.969	0.589
Case 146	78.890	1.081
Case 147	109.027	1.494
Case 148	103.462	1.417
Case 149	11.220	0.154
Case 150	138.592	1.899
Case 151	114.220	1.565
Case 152	63.863	0.875
Case 153	50.010	0.685
Case 154	81.689	1.119
Case 155	77.055	1.056
Case 156	95.183	1.304
Case 157	114.205	1.564
Case 158	119.216	1.633
Case 159	38.077	0.522
Case 160	33.173	0.454
Case 161	39.256	0.538
Case 162	63.540	0.870
Case 163	101.342	1.388
Case 164	53.106	0.727
Case 165	50.429	0.691
Case 166	126.847	1.738
Case 167	40.327	0.552
Case 168	44.877	0.615
Case 169	25.337	0.347
Case 170	47.191	0.646
Case 171	14.485	0.198
Case 172	148.799	2.038
Case 173	50.314	0.689
Case 174	51.787	0.709
Case 175	98.481	1.349
Case 176	78.834	1.080
Case 251	224.458	3.075
Case 252	50.246	0.688
Case 253	92.683	1.270
Case 254	72.503	0.993
Case 255	99.842	1.368
Case 256	84.648	1.160
Case 257	150.022	2.055
Case 258	63.980	0.876
Case 259	69.714	0.955

Case 181	58.148	0.797
Case 182	64.621	0.885
Case 183	35.433	0.485
Case 184	62.857	0.861
Case 185	43.131	0.591
Case 186	66.483	0.911
Case 187	68.234	0.935
Case 188	108.292	1.483
Case 189	78.036	1.069
Case 190	60.168	0.824
Case 191	120.486	1.650
Case 192	57.865	0.793
Case 193	47.584	0.652
Case 194	132.750	1.818
Case 195	29.476	0.404
Case 196	101.608	1.392
Case 197	76.637	1.050
Case 198	100.828	1.381
Case 199	99.456	1.362
Case 200	93.133	1.276
Case 201	123.575	1.693
Case 202	45.397	0.622
Case 203	110.276	1.511
Case 204	34.315	0.470
Case 205	55.958	0.767
Case 206	70.209	0.962
Case 207	46.907	0.643
Case 208	165.260	2.264
Case 209	45.470	0.623
Case 210	95.784	1.312
Case 211	70.846	0.970
Case 212	88.769	1.216
Case 213	56.552	0.775
Case 288	58.599	0.803
Case 289	45.123	0.618
Case 290	84.827	1.162
Case 291	151.477	2.075
Case 292	140.538	1.925
Case 293	108.356	1.484
Case 294	85.432	1.170
Case 295	129.780	1.778
Case 296	100.355	1.375

Case 223	57.384	0.786
Case 224	121.167	1.660
Case 225	53.839	0.738
Case 226	19.884	0.272
Case 227	68.742	0.942
Case 228	77.049	1.055
Case 229	39.328	0.539
Case 230	29.370	0.402
Case 231	65.875	0.902
Case 232	88.534	1.213
Case 233	90.489	1.240
Case 234	78.504	1.075
Case 235	32.641	0.447
Case 236	118.534	1.624
Case 237	20.983	0.287
Case 238	29.132	0.399
Case 239	56.662	0.776
Case 240	74.092	1.015
Case 241	114.452	1.568
Case 242	67.465	0.924
Case 243	48.013	0.658
Case 244	86.877	1.190
Case 245	62.488	0.856
Case 246	109.333	1.498
Case 247	71.762	0.983
Case 248	96.935	1.328
Case 249	79.466	1.089
Case 250	80.034	1.096

Case 260	25.657	0.351
Case 261	65.565	0.898
Case 262	39.998	0.548
Case 263	87.178	1.194
Case 264	88.907	1.218
Case 265	73.802	1.011
Case 266	58.093	0.796
Case 267	79.655	1.091
Case 268	68.851	0.943
Case 269	91.897	1.259
Case 270	40.306	0.552
Case 271	27.942	0.383
Case 272	10.070	0.138
Case 273	26.364	0.361
Case 274	118.253	1.620
Case 275	45.274	0.620
Case 276	62.078	0.850
Case 277	82.269	1.127
Case 278	55.676	0.763
Case 279	61.865	0.847
Case 280	69.106	0.947
Case 281	53.693	0.736
Case 282	25.511	0.349
Case 283	37.041	0.507
Case 284	83.379	1.142
Case 285	142.922	1.958
Case 286	101.290	1.388
Case 287	125.818	1.724

Case 297	44.040	0.603
Case 298	122.894	1.683
Case 299	89.195	1.222
Case 300	66.513	0.911
Case 301	80.028	1.096
Case 302	126.558	1.734
Case 303	129.537	1.774
Case 304	114.090	1.563
Case 305	94.146	1.290
Case 306	63.062	0.864
Case 307	42.498	0.582
Case 308	41.675	0.571
Case 309	83.538	1.144
Case 310	99.180	1.359
Case 311	60.301	0.826
Case 312	77.988	1.068

APPENDIX-F: NORMALITY

	Task 1	Task 2	Task 3	Task 4	RA1	RA2	RA3	RA4	RA5	RA6	ComX 1	ComX 2	ComX 3	ComX 4	ComX 5
Skewness	.123	.096	-.081	-.326	-1.065	-1.047	-1.046	-1.017	-.860	-.853	-.532	-.402	-.436	-.468	-0.418
Kurtosis	-.476	-.582	-.427	-.154	1.450	1.554	1.929	2.089	1.227	1.529	.465	-.095	.095	-.144	-0.353

	ComT 1	ComT 2	ComT 3	ComT 4	ComT 5	ComT 6	Fi1	Fi2	Fi3	Fi4	Fi5	Org 1	Org 2	Org 3	Org 4	Org 6
Skewness	-.417	-.637	-.642	-.714	-.500	-1.171	-.508	-.824	-.389	-.707	-.551	-.512	-.399	-.529	-.673	-.564
Kurtosis	.861	.963	1.287	1.338	1.067	3.250	.785	2.128	.437	1.940	.856	.836	.620	.775	1.127	.948

	Eco1	Eco2	Eco3	Eco4	Eco5	IT1	IT2	IT3	IT4	IT5	IT6	Vi1	Vi2	Vi3
Skewness	-.526	-.305	-.388	-.318	-.336	-.876	-.646	-.720	-.581	-.584	-.772	-.290	-.463	-.446
Kurtosis	.581	.262	.611	.623	.529	1.144	.113	.489	.377	-.155	.726	.063	.487	.870

	Info Int1	Info Int2	Info Int3	Info Int4	Info Int5	Info Form1	Info Form2	Info Form3	Info Form4	Info Cont1	Info Cont2	Info Cont3	Info Cont4	Info Cont5
Skewness	-.302	-.444	-.329	-.451	-.487	-.374	-.453	-.510	-.674	-.489	-.531	-.503	-.719	-.302
Kurtosis	-.094	.119	.057	.576	.702	.269	.605	.771	1.063	.798	.773	.912	2.044	-.094

	Info Pro1	Info Pro 2	Info Pro3	Info Pro4	Info Pro5	Adopt1	Adopt2	Adopt3	Adopt4	Adopt 5	ASQ1	ASQ2	ASQ3	ASQ4
Skewness	-.683	-.684	-.759	-.811	-.769	-.833	-.608	-.313	-.566	-.656	-.754	-.904	-.640	-.603
Kurtosis	1.551	.883	1.244	1.259	1.223	.985	.552	.074	.676	1.011	1.682	2.066	1.493	.929

APPENDIX-G: RELATED-WORK

Author(s)	Type of Industry	Place of Research/ Number of Sampling	Research Methods	Model/Theory	Explanatory Variables	Major Findings
(Ziadat et al., 2013)	University graduate students	Jordan / 100	Survey Questionnaires	TAM	Perceived usefulness, Perceived ease of use, awareness and trust.	Significant and positive link between all four variables, and attitude toward EC.
(Nguyen et al., 2014). (Rong et al., 2013)	Education	Vietnam /282	Survey Questionnaires	(UTAUT2) and consum-er innovativeness .	Effort Expectancy, Social Influence, Facilitating Condition ,Price Value, Hedonic Motivation , Habit Innovativeness , CBEL Intention	The findings indicate that the adoption of cloud-based E-learning is influenced by performance expectancy, social influence, hedonic motivation, and habit.
(Ibrahim, 2014)	EDUCATION INSTITUTION IN	NIGERIA / 127	questionnaire	TOE	Relative advantage, compatibility, complexity, top management, firm size, amount of information, pressure coercive and quality of internet connection.	The amount of information will be a related to leads adopt the cloud computing in HEIs in Nigeria. Compatibility, Complexity, Pressure, quality of internet competitor , Top Management , Firm size and Relative advantage Will Be Positively Related To Adopt The Cloud Computing In HEIs In Nigeria, Top Management, will be negatively related to leads adopt the cloud computing in HEIs in Nigeria.

(Behrend et al., 2011)	higher education settings	USA/ 750	Questionnaire	TAM3	Perceived Usefulness, Perceived ease of use, Individual differences, system characteristics, social influences, facilitating conditions.	Students' use of cloud computing was a function of ease-of-use perceptions, as well as the students' access to alternative tools. Usefulness was not a factor in predicting actual usage; however, usefulness did predict the student's intention to use cloud computing technologies like VCL in the future found that the ease-of-use perception was a much stronger predictor of adoption than the usefulness perception.
(Makoza, 2015)	Higher Education Institutions	Malawi/ 15 HEIs	Questionnaire & Interview Open-ended questionnaires	TOE	Relative advantage, Complexity, Compatibility, Management support, Organization size, Technology readiness, Competition, Pressure from partners, Regulatory compliance .	The results showed that cloud computing could mitigate some of the challenges of HEIs. There were concerns of top management support, potential security risks and inadequate legal frameworks that may affect HEIs when adopting cloud computing. The HEIs were in the early stages for adopting cloud computing. The insights from the study highlight the opportunities and challenges that can inform managers when adopting cloud computing in HEIs.
(B. N. Hwang et al., 2016)	Education	Taiwan	Questionnaire	TAM	Cost, Performance, Security, Integration Elasticity, Interoperability, Capacity, Availability, Reliability, Service Level Agreement, Governance Adaptability, Heterogeneity, Quality improvement.	The decision makers should act on the main cause dimensions by striving for a high degree of compatibility and a low degree of complexity in order to realize the maximum relative advantage of cloud computing.

(Alharthia et al., 2017)	Universities	Saudi	A conceptual framework	TOE	Reliability, Interoperability ,Security & Privacy, Disaster recovery, Network Bandwidth , Ministry of Education Policies, Top Management Support, Users' awareness, Customizable SLA requirements, Degree of Control.	Cloud computing for higher education institutions can provide flexible, on demand resources to multiple users at any time based on the share of services used over a Pay As You Go model. The migration process to cloud based services within the Saudi context faces many challenges and these challenges vary according to the cultural aspects of the technology, organization, legislation and their requirements and infrastructure.
(Sabi et al., 2017)	universities	sub-Saharan Africa	Questionnaire/ 355	DOI/TAM	1) Relative advantage (2) complexity assesses (3) compatibility assesses (4) trialability assesses (5) observability assesses (6) results demonstrable assesses.	Indicated that socio-cultural factors, results demonstrability, usefulness, and data security significantly impact their propensity to recommend adoption of cloud computing in the universities.
(Tashkandi & Al-Jabri, 2015)	higher education institutions	Saudi Arabia	34 education institutions	TOE	Relative advantage, Compatibility, Complexity, Top management support, Vendor lock-in, Data concern, Government regulations, Peer pressure.	Three factors were found significant in this context. Relative advantage, complexity and data concern were the most significant factors. The model explained 47.9 % of the total adoption variance. The findings offer education institutions and cloud computing service providers with better understanding of factors affecting the adoption of cloud computing.

(Saya et al., 2010)	Universities	Singapore	preliminary survey IT professionals	TOE	perceived accessibility, perceived scalability, perceived cost effectiveness, perceived lack of security.	Institutional influences significantly affect perceptions related to the accessibility, scalability, cost effectiveness, and lack of security of cloud computing. Perceptions about these technological characteristics influence the recognition of growth, abandonment, and deferral options in the adoption of cloud computing and subsequently the intention to adopt the technology.
(Al-Balushi et al., 2016)	Omani Government Organizations	Oman	case study, Questionnaire	TOE	Technological risks, IT infrastructure, evaluation frameworks, personnel IT knowledge, IT sophistication, data security and privacy, data consistency, integration standards, distributed database and data quality. centralization, return on investment (ROI), manager capability, barriers, benefits, formalization, proper implementation planning, size, IT support, , meeting user requirements, system training, cost, commitment by management, change resistance .	there are 8 factors found to be influential during the implementation process, (The paper did not mention these exact 8 factors)

(Masud & Huang, 2012)	Education	Hong Kong	Questionnaire/ 478	(SQ), (SE), (MM),(TAM	Perceived behavioral control , Subjective norms, Attitude, Perceived ease of use, Perceived usefulness, Perceived playfulness , Computer self-efficacy	MM and TAM were the most effective theoretical models for elucidating BI. Revealed that the TAM and TPB had larger effect sizes than the other models.
(Kayali et al., 2016)	Education	Malaysia	Systematic Review	TAM, TOE, UTATU	Ease of use, Usefulness, Security, Top management Support, compatibility.	The result showed that ease of use, usefulness and security are the most frequent factors. TAM is still the most widely used theory for the adoption of cloud based learning. Followed by TOE and UTAUT.
(Odeh et al., 2016)	Higher Education	kingdom of Jordan	qualitative research method	DOI	Cost and payment method , lack of electric power, stability and poor broadband infrastructure , lack of awareness , security and privacy concerns , and lack of cloud computing technical experts.	The finding suggests that the adoption of cloud computing at educational institutions in developing countries is strongly recommended by academic experts as well as technical professionals. The cloud computing adoption is supported by several enablers such as cost effectiveness, ease of use, improving the level of sharing knowledge, compatibility with devices and software, and geographical decentralization ability to use cloud applications.
(Alkhater et al., 2014)	Organizations	Saudi Arabia	Questionnaire, 20 IT experts at different organizations	integrated model of (TOE)	Availability, Reliability, Security, Privacy , Trust, Relative advantage, Compatibility, Complexity , Top management support , Organization size, Technology readiness, Compliance with,	It is interesting to note that security, privacy and trust issues were the big concerns for most organizations participating in this study, and were the main reasons behind their decisions not to adopt cloud services. Also, compliance with regulations is an important factor impacting

					regulations, Competitive pressure, Trading partner.	cloud adoption.
(Gangwar et al., 2015)	Organizations	India	questionnaire	TAM, TOE	Relative advantage, compatibility, complexity, organizational readiness, top management commitment, and training and education , perceived ease of use (PEOU) and perceived usefulness (PU) as mediating variables. competitive pressure and trading partner support.	The study identified relative advantage, compatibility, complexity, organizational readiness, top management commitment, and training and education as important variables for affecting cloud computing adoption using perceived ease of use (PEOU) and perceived usefulness (PU) as mediating variables. Also, competitive pressure and trading partner support were found directly affecting cloud computing adoption intentions. The model explained 62 percent of cloud computing adoption.
(H. M. Sabi et al., 2016)	Universities	sub-Saharan Africa	a survey of university lecturers and IS experts	DOI, TAM	Awareness , Costs, Risks & security, Relative advantage, Compatibility, Complexity, Observabilit, Trialability, Results demonstrable, Ease of use, Usefulness, National infrastructure, ICT infrastructure, Intention to adopt and use .	Finally, the study will contribute to the ongoing research into best technology adoption models that are relevant for developing country contexts.
(Arpaci, 2017)	Educational institutions	Turkey	221 undergraduate students	TAM	Continued use intentions, Attitude, Perceived ease of use, Perceived usefulness, Knowledge creation and discovery Knowledge, storage, Knowledge sharing, Knowledge application, Innovativeness, training and education.	The results indicate that the perceived usefulness is significantly associated with the expectations for knowledge creation and discovery, storage, and sharing . The findings suggested that educational institutions may promote adoption of cloud computing in education by increasing the awareness of knowledge management practices

(Ashtari & Eydgahi, 2017)	Education	Southeast Michigan	40, undergraduate students	TOE, TAM	Computer Anxiety, Computer Self-efficacy, Internet Self-efficacy, IT Self-efficacy, Perceived Ease of Use, Perceived Usefulness.	The results statistically present significant correlations between each measured variable and support the interaction between perceived ease of use, computer anxiety, computer self-efficacy, and internet self-efficacy with the perceived usefulness of cloud applications in a higher education setting.
(Stieninger et al., 2014)	Education	Austria	Review	DOI, TAM	"Compatibility", "Relative advantage", "Complexity", "Image" and "Security & trust".	Based on widely accepted theories such as Rogers' DoI theory [11] and Davis' TAM [14] the paper discusses, re- conceptualizes and operationalizes main factors for use in the context of cloud computing. This provides researchers a rigorous basis for model and theory development.
(Charlebois et al., 2016)	Education	Canada	Review	DOI	Compatibility , Complexity, Trialability, trust, Observability	Five major themes were generated to facilitate understanding of how ethical, legal and privacy issues interrelated with considerations regarding the adoption and use of cloud technology among the participants: 1) Getting comfortable with cloud computing; 2) Weighing the advantages and the risks of cloud computing; 3) Reconciling cloud technology with data privacy; 4) Maintaining trust when using cloud technology and 5) Anticipating the cloud by creating the conditions for cloud adoption.
(O. Ali et al., 2016)	Organization	Australian	Survey, 480 IT staff across 47 regional manager	-	Internet connectivity, Internet speed, availability, reliability, data storage location, security, data sovereignty, cost, integration, data backup,	The findings of this research may help managers increase their awareness about factors to be considered when regional municipal governments planning to adopt cloud computing.

					provider dependability, employees' knowledge, and transportability .	
(Arvanitis et al., 2016)	Firms	Northern and Southern European firms	Survey, 556 European firms	-	(a) ICT investment reduction; (b) supporting and facilitating product/service innovation and process innovation; (c) experimenting with and exploiting new ICT; and (d) supporting and facilitating electronic innovation collaboration .	These findings indicate that Southern European firms are mainly oriented towards 'first-level' cost (and especially investment) reduction related benefits from CC as well as from new emerging ICT, while on the contrary Northern European firms are mainly oriented towards 'second-level' transformation related benefits from CC, which are associated with support and facilitation of innovation and external collaboration.
(Morgan & Conboy, 2013)	Education	-	Questionnaire	TOE	Relative advantage Compatibility Complexity Trialability Increased collaboration Increased traceability and audit ability Convincing IT managers Security and legal issues Perception of the term cloud	Found that many of the issues surrounding cloud adoption are user related and not technical. One key challenge comes from IT managers and employees who are resistant to cloud adoption based on a fear of losing their job or a lack of under- standing about the cloud's impact on their work. Our case studies can provide a better understanding of how certain factors impact cloud adoption and in turn lead to a more informed managerial decision- making process regarding adoption of cloud systems. Our research design was exploratory, so further work should more closely examine each adoption factor to gain a more integrated perspective on cloud services adoption.
(Hussein et al., 2012)	Firms	Egypt/160	Survey + Interviews	DOI+TOE	Innovation Attributes(Relative Advantages, Compatibility, Observability, Trialability, Complexity, Perceived	Relative Advantages, Complexity, Employees' IT Knowledge, Marketing Capabilities, Organizational Learning, attitude toward Change and Response to Risk were significant predictors to differentiate adopters from non-adopters The

					Risk), Firm Resources (Firm Size, Employees' IT Knowledge, Marketing Capabilities, Organisational Learning, Market Orientation), Individual Factors(To Management Support, Attitude toward Change, Response to Risk)	results also found that Perceived Risk, Marketing Capabilities and Response to Risk are significant predictors to differentiate simple adopters from sophisticated adopters.
Jia et al. (2017)	Firms	China / 228	Survey	TOE	firm size, firm scope, subjective norms and competitive pressure from the perspective of organizational and environmental context	The research findings show that organizational and environmental context factors, including subjective norms and competitive pressure, significantly influence enterprises' intentions to renew their E2.0 service in addition to technology perceptions. Perceived usefulness and satisfaction are no longer the strongest predicators of continuance usage in the context of enterprise systems.
Lian (2015)	Individual	Taiwan/ 521	Survey	UTAUT2	Performance expectation, effort expectation, social influence, facilitating condition, trust in e-government, security concerns, risk. Moderators: gender and age	The results indicate that effort expectation, social influence, trust in e-government, and perceived risk have significant effects on the intention to adopt e-invoicing. Additionally, trust in e-government and perceived risk mediates the relationship between behavioral intention and security concerns regarding e-government. Gender differences moderate the relationship between social influence and behavioral intention. Age level is found to moderate the relationship between perceived risk and behavioral intention.
(Low et al., 2011)	Firms	Taiwanese / 111	Survey	TOE	Technological context (relative advantage, complexity, compatibility), Organisational context (top management support,	The findings revealed that relative advantage, top management support, firm size, competitive pressure, and trading partner pressure characteristics have a significant effect on the adoption of cloud computing.

					firm size, technology readiness) **Environmental context** (Competitive pressure and trading partner pressure).	
Oliveira et al. (2014)	Firms	Portugal/369	Survey	TOE+DOI	Technological context (IT readiness), Innovation characteristics (relative advantage, complexity, compatibility Organisational context (top management support, firm) Environmental context (competitive pressure, regulatory support).	The relative advantage, complexity, technology readiness, top management support, and firm size are also confirmed for the full sample. Compatibility, competitive pressure, and regulatory support are not statistically significant for the full sample.
Sila (2013)	Firms	North American firms / 275	Survey Questionnaires	TOE	Technological context (Cost, Complexity, Network reliability, Data security, Scalability), Organizational context (Top management support, Firm size, Firm type, Management level, Trust), Environmental context (Pressure from trading partners, Pressure from competitor)	The findings show that pressure from competitors, network reliability, scalability, top management support, and trust play a significant role in contributing to firms' decision to adopt B2B EC. However, pressure from trading partners, costs, data security, and complexity do not.
Ghobakhloo and Tang (2013)	small businesses (SBs)	Iran / 268	Survey Questionnaires	Literature review	Innovativeness, IS and computer knowledge, perceived risks, perceived costs, perceived compatibility, Perceived benefits.	Perceived benefits, perceived compatibility, perceived risks, perceived costs, and innovativeness were found to be the significant determinants of decision to adopt EC.

Ziadat et al. (2013)	University graduate students	Jordan / 100	Survey Questionnaires	TAM	Perceived usefulness, Perceived ease of use, awareness and trust.	Significant and positive link between all four variables, and attitude toward EC.
Al-Ghaith et al. (2010)	Individual	Saudi Arabia / 651	Survey Questionnaires	DOI	Security, Privacy, E-Service Quality, Loyalty, Relative Advantage, Compatibility, Complexity, Trialability, Observability.	Perceived Complexity was found to be the most significantly related factor affecting e-service adoption in Saudi Arabia, followed in turn by Privacy and Compatibility. Quality of the Internet and its relative advantage also had a notable effect on e-service usage and adoption in Saudi Arabia.
Nathan (2009)	Individual	Arab countries / 300.	Survey Questionnaires	Literature review	Risk perception, trust Mediator: consumer knowledge.	Results reveal knowledge as the most important factor that contributes to EC adoption and it mediates consumers' perception of risk and trust in contributing to their EC adoption.
Salwani et al. (2009)	Firms	Malaysia / 165	Survey Questionnaires	TOE+RBV	Technological context (technology competence), Organisational context (size, scope, web-technology investment, managerial believes), External environmental context (regularity support, pressure intensity) Moderator: EC experience, back-end integration as mediator	The structural equation modeling results indicate that technology competency, firm size, firm scope, web-technology investment, pressure intensity, and back-end usage have significant influence on e-commerce usage. Among these variables, back-end integration is found to function as a mediator. E-commerce experience (in years) is found to moderate the relationship between e-commerce usage and business performance. In addition, EC usage significantly impact on organizational performance.
(Abou-Shouk & Abd-Elraouf, 2012)	Firms	Egypt / 210	Survey	TOE+TAM +DOI	Essential Benefits (Sales, Revenue and Profits Growth, Support Effective Reintermediation, Attracting New Services/ Investment, Enable and Facilitate Collaboration), Marketing and Competition	Profit Growth, Investment, Collaboration, Reintermediation, Improved Knowledge and Transactions Management, Effective Partnership Building, Better Accountability, and Increased Staff Satisfaction, Competitive Advantages, Access to Global Markets are Significant Predictors that influence decision makers to adopt advanced level of e-commerce rather than

					Benefits (Customizing Services to Customer Needs, Improve Customer Satisfaction, Increase Competitive Advantages, Establish Reputation in the Global Markets, Improve Distribution Channels), Business Internal Efficiency Benefits (Effective partnerships, Improve Accountability, Enhance Staff Satisfaction, Easiness of Carrying Out Transactions, Improve Internal Knowledge Flow and Sharing, Provide Support for Strategic Decisions)	low level of e-commerce in travel agencies.
(Nunes et al., 2017)	E_firms	Portugal	Review	TAM, UTAUT, UTAUT2	Trust, Perceived ease of use, Social Influence, Attitude Towards Effort Expectancy, Performance Expectancy, Compatibility, Internet Skill, Quality, User acceptance , Management Readiness, Sensitivity to cost, Usability, Computer resource requirement, Technical support requirement , Security Provision, Services efficiency, Perceived Credibility, Internet Accessibility, Facility conditions , Image	variables are most present in the studies in the adoption of electronic government services, where eight variables were identified, with the variable trust being the most present in the studies: (1) Trust; (2) Perceived Ease of Use; (3) Social Influence; (4) Effort Expectancy; (5) Performance Expectancy; (6) Facilitating Conditions; (7) Perceived Usefulness; (8) Perceived Risk.

					Efficiency Effectiveness, External pressure , Perceived Usefulness Perceived risk.	
(Borgman et al., 2013)	Firms	27 global enterprises	Survey	TOE	Technological context relative advantage, complexity, and compatibility Organisational context firm size, top management support, and cloud/IT skills of non-IT employees External environmental context Competition intensity, Regulatory environment	Our research has conceptualized the link between the TOE framework and the decision of organizations to adopt cloud computing, as well as the moderating effect of IT governance structures and processes on these relationships A high perceived relative advantage of cloud computing, a high level of top management support and a high competition intensity (measured as a short lifecycle of products/services in the industry) are all three factors that are positively linked to the decision to adopt cloud computing.
(Chong et al., 2009)	E services	Malaysia	Questionnaire, 109	TOE	Innovation Attributes • Relative advantage • Compatibility • Complexity. Environmental • Expectations of market trends • Competitive pressure Information Sharing Culture • Trust • Information Distribution • Information Interpretation	The results of this study revealed that information sharing culture is perceived as a dominant factor in the adoption. The result shows that Information sharing Culture has the most significant in the adoption. Organization readiness is also an important determinant in whether organizations adopt. This study also shows that organizations which are committed to adopting c-commerce will have a higher adoption level. external environment also has a significant and positive relationship with c-commerce adoption.

					Organization readiness • Top management support • Feasibility • Project champion characteristics	
(Hassan et al., 2017)	SMEs	Malaysian	survey questionnaire , 140 responses	TOE	Technological Context: Perceived Benefits (customization, ease of data analysis, reduction of deployment time, IT, and IT employee costs, and ubiquitous access) Organizational Context : Top Management Support(the willingness of the top management to approve sufficient financial investment, human resources, and technological competencies).IT Resources (refer to the organization's readiness in terms of the technology resources) Environmental External Pressure refers to pressures faced by organizations from their competitors.	The results suggest the importance for SMEs to possess adequate IT resources, such as hardware and software, to support cloud computing. The ndings also can help SMEs to consider their IT investments when implementing cloud computing. For academia, this study provides a useful reference for future studies in this subject area, especially in the Malaysian context.

(Goodhue & Thompson, 1995)	Business			fit-viability framework	Task, technology, Economic, IT Infrastructure, Organization Fit, Viability, Performance.	The findingsdemonstrate that the fit-viability model (FVM) provides useful guidelines for enterprises in their decisions on whether to adopt a mobile technology
(F. Mohammed et al., 2017)	public organizations	Yemen	structured questionnaire with a sample of 296	Fit-Viability Model and Diffusion of Innovation	Relative advantage, compatibility, trialability and security, complexity, economic factors, technological readiness, top management support and cloud knowledge and viability.	he results clarify the need to consider factors affecting two dimensions, fit and viability, to make a decision to adopt cloud computing in an e-government context. The fitness of cloud computing to e-government tasks is affected by factors such as relative advantage, compatibility, trialability and security, but is not affected by the complexity of the technology. On the other hand, the viability is influenced by economic factors (return on investment and asset specificity) and technological readiness (IT infrastructure and IT policy and regulations), while the results do not support the relation between the organizational factors such as top management support and cloud knowledge and viability.
(Fathey Mohammed et al., 2016)	Organisation	Yemen	Questionnair, 26 information technology staff	*Organization environment framework (TOE), DOI, FVM*		The results show that the scale measurements meet the conventional criteria of reliability and validity
(Liang & Wei, 2014)	Educational	China		fit-viability framework, task-technology fit theory		one needs to evaluate not only the fit between task and technology but also its organizational viability

APPENDIX-H: CROSS LOADING RESULTS

	ASQ	Adoption	ComT	Comx	Econ	Fit	IT	InfoCont	InfoForm	InfoInt	InfoPro	Org	RA	Task	Viability
ASQ1	0.923	0.691	0.413	0.325	0.381	0.509	0.225	0.524	0.511	0.452	0.365	0.455	0.459	0.227	0.508
ASQ2	0.864	0.647	0.41	0.219	0.413	0.438	0.342	0.535	0.477	0.519	0.418	0.436	0.421	0.179	0.505
ASQ3	0.863	0.646	0.373	0.283	0.424	0.477	0.254	0.506	0.474	0.475	0.36	0.461	0.400	0.226	0.518
ASQ4	0.841	0.630	0.403	0.305	0.433	0.499	0.287	0.494	0.416	0.451	0.42	0.436	0.38	0.268	0.503
Adopt1	0.624	0.800	0.445	0.319	0.447	0.500	0.239	0.507	0.435	0.416	0.391	0.447	0.484	0.213	0.571
Adopt2	0.658	0.859	0.485	0.331	0.490	0.484	0.271	0.549	0.514	0.477	0.375	0.464	0.494	0.195	0.632
Adopt3	0.593	0.802	0.448	0.371	0.378	0.419	0.268	0.478	0.416	0.401	0.368	0.427	0.374	0.219	0.656
Adopt4	0.496	0.720	0.396	0.295	0.370	0.381	0.275	0.443	0.392	0.382	0.358	0.425	0.297	0.205	0.631
Adopt5	0.582	0.768	0.400	0.302	0.411	0.413	0.292	0.452	0.450	0.449	0.383	0.427	0.314	0.189	0.593
ComT2	0.377	0.447	0.762	0.410	0.466	0.606	0.269	0.469	0.381	0.391	0.276	0.434	0.525	0.29	0.464
ComT3	0.284	0.330	0.674	0.368	0.418	0.536	0.427	0.326	0.351	0.391	0.273	0.379	0.425	0.263	0.419
ComT4	0.345	0.417	0.697	0.357	0.424	0.554	0.388	0.406	0.385	0.375	0.323	0.468	0.398	0.167	0.372
ComT5	0.313	0.419	0.748	0.449	0.474	0.595	0.343	0.399	0.346	0.377	0.325	0.441	0.472	0.207	0.431
ComT6	0.393	0.451	0.862	0.473	0.547	0.685	0.366	0.391	0.382	0.352	0.219	0.466	0.501	0.238	0.462
ComX1	0.271	0.356	0.478	0.848	0.314	0.579	0.214	0.308	0.290	0.210	0.221	0.356	0.332	0.288	0.301
ComX2	0.242	0.319	0.417	0.761	0.276	0.520	0.105	0.227	0.220	0.120	0.162	0.292	0.271	0.245	0.211
ComX3	0.214	0.276	0.409	0.731	0.286	0.499	0.213	0.275	0.250	0.198	0.203	0.255	0.198	0.202	0.205
ComX4	0.270	0.350	0.439	0.770	0.362	0.526	0.182	0.337	0.328	0.240	0.205	0.276	0.287	0.238	0.264
ComX5	0.278	0.309	0.419	0.820	0.299	0.560	0.221	0.321	0.275	0.213	0.234	0.254	0.257	0.250	0.250
Eco1	0.438	0.483	0.548	0.276	0.793	0.534	0.362	0.434	0.432	0.436	0.272	0.517	0.465	0.229	0.397
Eco2	0.366	0.424	0.478	0.267	0.843	0.464	0.401	0.427	0.400	0.418	0.233	0.451	0.356	0.187	0.422
Eco3	0.404	0.422	0.496	0.358	0.782	0.494	0.375	0.391	0.389	0.375	0.205	0.452	0.407	0.226	0.391
Eco4	0.298	0.361	0.429	0.278	0.747	0.411	0.466	0.370	0.402	0.456	0.211	0.401	0.317	0.12	0.374

Eco5	0.350	0.405	0.504	0.364	0.776	0.499	0.525	0.394	0.405	0.454	0.242	0.467	0.363	0.223	0.389
Fi1	0.409	0.386	0.556	0.450	0.399	0.723	0.207	0.362	0.304	0.294	0.261	0.378	0.541	0.346	0.34
Fi2	0.439	0.435	0.653	0.590	0.503	0.812	0.355	0.427	0.426	0.384	0.302	0.49	0.465	0.359	0.446
Fi3	0.436	0.466	0.648	0.538	0.513	0.823	0.187	0.378	0.381	0.370	0.217	0.487	0.547	0.325	0.45
Fi4	0.386	0.375	0.591	0.527	0.422	0.712	0.318	0.362	0.356	0.321	0.264	0.384	0.353	0.358	0.406
Fi5	0.475	0.503	0.650	0.555	0.530	0.826	0.291	0.484	0.403	0.429	0.298	0.509	0.482	0.282	0.47
IT1	0.258	0.293	0.398	0.201	0.430	0.293	0.771	0.454	0.406	0.459	0.448	0.36	0.227	0.093	0.381
IT2	0.243	0.247	0.359	0.209	0.391	0.260	0.702	0.396	0.368	0.447	0.387	0.268	0.159	0.117	0.347
IT3	0.226	0.220	0.363	0.156	0.421	0.243	0.746	0.416	0.354	0.446	0.496	0.330	0.144	0.07	0.368
IT4	0.290	0.326	0.410	0.206	0.492	0.322	0.979	0.488	0.393	0.519	0.504	0.420	0.198	0.107	0.484
InfoCont1	0.367	0.429	0.416	0.314	0.354	0.376	0.411	0.697	0.475	0.513	0.466	0.419	0.321	0.139	0.328
InfoCont2	0.499	0.482	0.468	0.314	0.428	0.429	0.437	0.783	0.610	0.652	0.459	0.442	0.395	0.099	0.412
InfoCont3	0.367	0.403	0.383	0.303	0.367	0.387	0.441	0.655	0.446	0.529	0.547	0.374	0.369	0.123	0.383
InfoCont4	0.423	0.444	0.356	0.206	0.351	0.363	0.335	0.721	0.436	0.530	0.504	0.345	0.366	0.148	0.354
InfoCont5	0.460	0.46	0.289	0.218	0.347	0.313	0.347	0.746	0.505	0.565	0.444	0.275	0.294	0.152	0.365
InfoForm1	0.363	0.423	0.307	0.231	0.398	0.348	0.385	0.494	0.756	0.53	0.375	0.283	0.208	0.183	0.335
InfoForm2	0.416	0.442	0.376	0.306	0.387	0.391	0.388	0.523	0.791	0.543	0.425	0.341	0.262	0.183	0.367
InfoForm3	0.343	0.319	0.309	0.220	0.349	0.290	0.240	0.404	0.570	0.503	0.306	0.27	0.203	0.152	0.298
InfoForm4	0.451	0.442	0.437	0.256	0.375	0.371	0.342	0.581	0.790	0.58	0.477	0.413	0.31	0.199	0.405
InfoInt1	0.425	0.442	0.403	0.247	0.426	0.383	0.435	0.589	0.562	0.821	0.490	0.415	0.329	0.158	0.393
InfoInt2	0.340	0.365	0.324	0.111	0.400	0.296	0.386	0.435	0.499	0.679	0.346	0.336	0.207	0.075	0.36
InfoInt3	0.326	0.339	0.288	0.149	0.373	0.269	0.372	0.518	0.513	0.630	0.364	0.298	0.222	0.042	0.224
InfoInt4	0.433	0.410	0.383	0.161	0.420	0.354	0.516	0.631	0.555	0.763	0.524	0.333	0.32	0.101	0.4
InfoInt5	0.460	0.415	0.424	0.236	0.376	0.387	0.419	0.664	0.572	0.772	0.514	0.368	0.36	0.172	0.368
InfoPro1	0.400	0.393	0.281	0.254	0.251	0.311	0.419	0.644	0.467	0.497	0.830	0.379	0.269	0.097	0.371
InfoPro2	0.335	0.367	0.305	0.241	0.187	0.277	0.441	0.467	0.427	0.489	0.775	0.332	0.213	0.113	0.379
InfoPro3	0.333	0.368	0.347	0.190	0.254	0.314	0.442	0.517	0.439	0.526	0.778	0.375	0.254	0.135	0.39
InfoPro4	0.343	0.392	0.286	0.205	0.229	0.234	0.479	0.527	0.428	0.462	0.828	0.381	0.208	0.066	0.378
InfoPro5	0.381	0.383	0.280	0.160	0.265	0.247	0.508	0.522	0.434	0.498	0.809	0.359	0.218	0.123	0.381
Org1	0.418	0.511	0.453	0.289	0.495	0.490	0.353	0.421	0.392	0.397	0.360	0.873	0.372	0.108	0.475

Org2	0.442	0.48	0.516	0.287	0.518	0.518	0.302	0.454	0.397	0.394	0.343	0.921	0.420	0.085	0.502
Org3	0.431	0.448	0.558	0.331	0.514	0.477	0.405	0.425	0.357	0.421	0.388	0.944	0.407	0.097	0.514
Org4	0.439	0.429	0.471	0.279	0.449	0.450	0.377	0.41	0.341	0.383	0.432	0.731	0.391	0.099	0.398
Org5	0.434	0.436	0.451	0.313	0.441	0.478	0.414	0.462	0.393	0.448	0.416	0.695	0.370	0.130	0.379
Org6	0.416	0.474	0.466	0.340	0.488	0.499	0.336	0.415	0.384	0.368	0.367	0.814	0.357	0.161	0.443
RA1	0.348	0.374	0.406	0.207	0.309	0.387	0.157	0.356	0.278	0.296	0.226	0.299	0.631	0.160	0.307
RA2	0.358	0.368	0.44	0.244	0.342	0.463	0.154	0.388	0.257	0.289	0.211	0.311	0.756	0.121	0.321
RA3	0.416	0.384	0.492	0.273	0.376	0.479	0.215	0.395	0.269	0.295	0.249	0.366	0.781	0.084	0.277
RA4	0.463	0.465	0.574	0.277	0.437	0.526	0.218	0.441	0.298	0.382	0.270	0.415	0.859	0.120	0.367
RA5	0.405	0.46	0.569	0.356	0.476	0.578	0.210	0.441	0.323	0.369	0.266	0.440	0.943	0.161	0.397
RA6	0.398	0.448	0.593	0.336	0.455	0.601	0.178	0.400	0.274	0.343	0.230	0.451	0.981	0.147	0.380
Task1	0.166	0.185	0.233	0.165	0.192	0.216	0.090	0.130	0.182	0.094	0.071	0.101	0.067	0.507	0.083
Task2	0.261	0.223	0.269	0.266	0.202	0.382	0.135	0.157	0.209	0.147	0.149	0.125	0.134	0.898	0.150
Task3	0.174	0.189	0.208	0.153	0.136	0.261	0.052	0.141	0.132	0.096	0.127	0.095	0.101	0.613	0.211
Task4	0.138	0.158	0.198	0.290	0.199	0.342	0.061	0.107	0.189	0.103	0.035	0.07	0.141	0.803	0.076
Vi1	0.426	0.565	0.455	0.244	0.43	0.387	0.446	0.377	0.348	0.340	0.348	0.419	0.304	0.174	0.769
Vi2	0.503	0.669	0.500	0.253	0.423	0.516	0.440	0.448	0.435	0.439	0.435	0.495	0.373	0.126	0.872
Vi3	0.524	0.708	0.478	0.290	0.404	0.452	0.356	0.451	0.418	0.415	0.395	0.449	0.350	0.145	0.86