CLOUD COMPUTING ADOPTION MODEL IN HIGHER EDUCATION INSTITUTIONS

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Doctor of Philosophy (Information and Communication Technology)

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DECLARATION

I hereby declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently submitted for any other degree at Universiti Tenaga Nasional or at any other institutions. This thesis may be made available within the university library and may be photocopies and loaned to other libraries for the purpose of consultation.

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ABSTRACT

Cloud computing is seen as one of many new innovation solutions in assisting higher education institutions (HEIs) in improving their learning outcome delivery processes and efficiency, especially in terms of minimizing financial investments while becoming readily accessible to wider pools of potential students. While it has been widely adopted in HEIs, its adoption in developing countries is very low and there is a lack of empirical studies that examine the factors that influence its adoption in HEIs. This research proposes a conceptual model that identifies the factors that influence the adoption of cloud computing in HEIs in a developing country by integrating technological, organizational, environmental and human factors. Hypotheses were developed using four theories: (a) Technology, Organization and Environment Framework, (b) Diffusion of Innovations Theory, (c) Technology Acceptance Model and (d) Theory of Reasoned Action. A survey questionnaire was administered to 288 individuals comprising IT managers, IT staff and IT lecturers in HEIs in Yemen. Data were analysed using Statistical Package for the Social Sciences (SPSS) and Structural Equation Modelling (SEM) technique. The results indicate that Relative Advantage, Compatibility, Complexity, Data Concern, Top Management Support and Technology Readiness had significant effects on Perceived Usefulness towards the Intention to adopt cloud computing in HEIs. Perceived Ease of Use was found to have been significantly affected by Complexity, Data Concern, Technology Readiness, and IT Skills. In addition, the results also show that Subjective Norms positively moderates the relationship between Perceived Usefulness and Attitude towards the Intention to adopt cloud computing in HEIs. This research shows that for HEIs in Yemen to successfully adopt cloud computing, the top management has to play significant roles in ensuring that the technologies to support this initiative has to be in place and are compatible with other existing technologies adopted in HEIs.

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DEDICATION

To My Lost Homeland

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LIST OF ABBREVIATIONS

HEI	Higher Education Institution
CC	Cloud Computing
ICT	Information and Communication Technology
SLA	Service - Level-Agreements
TRA	Theory of Reasoned Action
TPB	Theory of Planned Behavior
TAM	Technology Acceptance Model
MPCU	Model of PC Utilization
MM	Motivational Model
SWOT	Strength, Weakness, Opportunities, Threat

LIST OF PUBLICATIONS

- Saleh, Drus, & Shariff, Empirical Studies on Cloud Computing Adoption: A Systematic Literature Review Journal of Theoretical & Applied Information Technology, 2017.
- Saleh, Drus, & Shariff, Cloud Computing Adoption Among Higher Education Institutions In Yemen: An Integrated Conceptual Framework International Journal of Engineering & Technology , 2018 .

CHAPTER 1

INTRODUCTION

1.1 Research Background

Developing countries face tremendous pressure to expand the use of information and communication technology (ICT) in their organizations and businesses in order to reduce the effects of digital divide between their countries and the developed ones. This could be attributed to the significant widespread use of ICT in recent years (Bloom, Garicano, Sadun, & Reenen, 2014; Hinostroza, 2018). Educational systems have also been affected by such widespread use of ICT adoption as they are currently used in educational content delivery such as Blackboard, Moodle, and Rcampus, as well as the management of academic resources. In addition, ICT can also be integrated in delivering non face-to-face education, such as through video conferencing, teleconferencing, emails and other communication channels.

Nevertheless, improving educational outcome in higher education institutions (HEIs) requires significant technological start-up investments including those that cover software licenses, hardware costs, training with regard to the use of equipment and maintenance, and learning material development (Osman, 2015; Powelson, 2011). However, these challenges could be minimized by adopting cloud computing as it could reduce associated costs on software applications, infrastructure and maintenance (Liang, 2016; Shahzad, Golamdin, & Ismail, 2016). Cloud computing virtualizes resources such as laboratory and software applications and allows the resources to be delivered over the Internet instead of installing them on individual students' computers or HEIs' workstations (Chen & Almunawar, 2016; Radwan et al., 2017).

HEIs invest in different cloud computing resources and services such as the Software as a Service (SaaS), the Platform as a Service (PaaS) or the Infrastructure as a Service (IaaS)(Chen & Almunawar, 2016; Idris & Osman, 2015; Jula, Sundararajan, & Othman, 2014). Among the reasons HEIs invest in cloud computing are to reduce costs associated with storage and system maintenance, software licensing fees, and also IT staff training and up-skilling, protection against natural disasters, reduction of the number of stressed IT staff, and the embarkation on green technology (Chen & Almunawar, 2016; Idris & Osman, 2015).

There are three (3) different types of cloud computing environments that can be adopted by HEIs. Firstly, HEIs may create their own cloud computing infrastructure, which is called the private cloud (Doelitzscher, Sulistio, Reich, Kuijs, & Wolf, 2011). Secondly, HEIs may establish associations with other institutions to implement cloud computing infrastructure, which is called the community cloud (Cappos, Beschastnikh, Krishnamurthy, & Anderson, 2009a; Chen & Almunawar, 2016), or the respective governments may provide shared cloud computing infrastructure for HEIs. Lastly, HEIs may purchase services of cloud computing, called the public cloud, from third party providers (Chen & Almunawar, 2016; Gray, 2010).

Yemen is one of the developing countries that is looking forward to improving the educational process in ensuring that education reaches as many of its citizens as possible, especially in HEIs as tertiary education is important for the economic growth of a nation. UNICEF (2011) and SCEP (2013) reported that in 2025, the total population in Yemen who are in the age range of attending HEIs, that is between 20 to 29 years old, is projected to be about 6.07 million, which constitutes almost 20% of its total population of 33.6 million. Thus, Yemen has to find ways to ensure that higher education could be reachable for these groups of population as funding becomes currently limited in the country, as a result of which, there is lack of infrastructure and equipment to adequately deliver good education to its population (SCEP, 2013).

1.2 Problem Statement

Higher education institutions (HEIs) in developing countries are looking at the possibility of integrating traditional face-to-face learning with ICT in improving the quality of educational delivery and increasing learning effectiveness, efficiency and satisfaction. Adopting ICT in HEIs to improve the quality of educational delivery requires a large initial investment and advanced infrastructure (Idris & Osman, 2015; Irfan, Putra, & Alam, 2018). However, most of the HEIs in developing countries face the problem of poor ICT infrastructures as well as lack of experts in ICT solutions (Mwakyusa & Mwalyagile, 2016). Thus, many developing countries, such as Yemen, experience difficulties in improving the educational process due to financial constraints, the lack of human resources and the unavailability of ICT infrastructure (Al-Rashidi, 2013; Lashayo & Gapar, 2017; Rana, Dwivedi, & Williams, 2013). As such, the adoption of cloud computing can minimise the aforementioned challenges faced by HEIs. Cloud computing reduces the associated costs of procuring and maintaining software applications and hardware infrastructure (Mtebe & Kissaka, 2015).

Although cloud computing has been discussed as a new technology that can provide operational and strategic advantages, its adoption rate is slower than expected (Gangwar, Date, & Ramaswamy, 2015a; Saleh, Drus, & Shariff, 2017b). Despite the perceived benefits, institutions still feel hesitant in adopting cloud computing(Aymerich, Fenu, & Surcis, 2008; Fishman, 2012; Luftman & Ben-Zvi, 2010; Saleh et al., 2017b) due to data security, privacy concerns and vendor lock-in.

In addition, cloud computing has not been widely adopted in the education sector (Mircea & Andreescu, 2011; Mustafee, 2010; Saleh, Drus, & Shariff, 2017a; Vakil, Lu, & Russakoff, 2012). This could be attributed to HEIs' lack of understanding of the factors that affect the adoption of cloud computing (Klug & Bai, 2015b) due to the limited relevant research available to their IT decision makers (Ibrahim, Salleh, & Misra, 2015; Saleh et al., 2017a).

Four (4) theoretical models namely Technology Acceptance Model (TAM), Theory of Reasoned Action (TRA), Diffusion of Innovation (DOI) and Technology, Organizational and Environment (TOE) framework are integrated and adopted in this research to strengthen the predictive power of the resulting model. All these theories are used to address the problem of lack of understanding on the factors for the successful adoption of cloud computing in higher education. The integration of constructs was conducted in both non-human (technical) and human (social) to offer an enriching theoretical framework for predicting and explaining adoption behaviour.

Several frameworks have been proposed for cloud computing adoption (Alkhater, Wills, & Walters, 2014; Alshamaila, Papagiannidis, & Li, 2013; Awa, Ojiabo, &

Emecheta, 2015; Gangwar, Date, & Ramaswamy, 2015b; Klug & Bai, 2015b; Low, Chen, & Wu, 2011). However, these frameworks may not be suitable for HEIs in developing countries such as Yemen due to the following reasons:

- Most of the existing cloud computing frameworks are implemented in the business sector, the environment of which differs from that of the education sector.
- Most of these frameworks are implemented in the Western education sector and in developed countries, such as Europe, the United States of America (USA), and Canada, all of which have different education systems and environments compared to those in Yemen.
- These frameworks only concentrate on factors that affect cloud computing adoption at the organizational level, which include pricing mechanisms, security aspects, and implementation issues. Factors that affect cloud computing adoption from the individual or the user's perspective (e.g. perceived ease of use) have also been largely ignored.

Thus, this research attempts to develop a conceptual model for cloud computing adoption that can be used by HEIs in developing countries, specifically and especially in Yemen, to improve their educational delivery by integrating the four (4) renowned theories in new technology adoption.

1.3 Research Questions

Based on previous discussions, the following questions are addressed by this research:

1. What are the factors that affect cloud computing adoption in HEIs in developing countries?
2. What are the effects of technological, organizational, environmental, and individual factors on cloud computing adoption intention?

1.4 Research Objectives

The objectives of this research are as follows:

1. To determine the factors that affect cloud computing adoption in HEIs in developing countries.

2. To examine the effects of technological, organizational, environmental, and individual factors on cloud computing adoption intention.

The mapping of research objectives and research questions is in Table 1.1, which shows the links between research objectives, research questions and methods of inquiry.

Table 1.1 Mapping of Research Problem

Research Problem	Research Questions	Research Objectives	Method of Inquiry
Lack of understanding on the factors that affect the adoption of cloud computing in HEIs in developing countries	• What are the factors that affect cloud computing adoption in HEIs in developing countries?	• To determine the factors that affect cloud computing adoption in HEIs in developing countries.	• Literature Review • Survey
	• What are the effects of technological, organizational, environmental, and individual factors on cloud computing adoption intention?	• To examine the effects of technological, organizational, environmental, and individual factors on cloud computing adoption intention.	• Literature Review • Survey

1.5 Methodology Overview

This research adopted the quantitative research approach, whereby the survey questionnaires were distributed to IT professionals which include IT staff, IT managers, and IT lecturers in higher education institutions (HEIs) in Yemen. The collected data were analyzed using the SPSS and the Structured Equation Modeling technique to test the proposed hypotheses regarding cloud computing adoption in HEIs in Yemen.

1.6 Scope of Study

This research was conducted in higher education institutions (HEIs) in Yemen. This research is considered as perceptual study as it is intended to evaluate and measure the perceptions of IT professionals (IT staff, IT managers, and IT lecturers) on adopting and using cloud-computing technology in HEIs in Yemen, which is considered as a new technology to be adopted. The results of this research can help decision makers to have a better understanding on the factors that influence cloud computing adoption which are necessary in designing new approaches and solutions to assist HEIs in Yemen to use cloud computing effectively to achieve optimal results.

HEIs in Yemen are chosen as the scope for this research as they are currently faced with several barriers and challenges in their delivery of good education to the whole population (SCEP, 2013; UNICEF, 2011). Some of the challenges are enumerated under this sub-section. First, Yemeni HEIs are characterized by lack of infrastructure and equipment that help with new technology adaption among students and second, several HEIs do not have sufficient resources in accommodating the increasing number of applicants. Third, HEIs lack teaching staff and expertise although physical buildings are available and affiliate countries, including Germany, Saudi Arabia, and South Korea have made donations in the form of infrastructure and equipment to Yemeni educational institutions, including HEIs. However, majority of such institutions lack technical staff expertise for operation, support and maintenance of the donated infrastructures and equipments. Fourth, there is lack of funding to satisfy HEIs requirements and needs and fifth, several HEIs are located in isolated areas in Yemen, which contributes to more barriers to communication and supervision of relevant entities evaluation (e.g., government and government agencies). Sixth, the present learning and teaching resources in HEIs are lacking as distribution is not equal (distribution based more on personal reasons or rationale), leading to unbalanced institutional development. Majority of Yemeni HEIs are still largely dependent on traditional methods of teaching, primarily face-to-face lecturing sessions and printed-hardcopy materials and handouts.

In order to deliver education effectively and efficiently and to overcome the HEIs challenges in Yemen, the present study conducted an examination of the perceptions of

IT staff, IT manager, makers and IT lecturers in the said institutions regarding the adoption of cloud computing for improving educational process

1.7 Working Terms and Definitions

Several key terms were adopted in this and their definitions are tabulated in Table 1.2.

Table 1.2 Definition of Key Terms

Key Terms	**Definition**
Higher Education Institution (HEIs)	A tertiary education institution, such as universities and community colleges, which awards professional certifications or academic degrees (James & Vujić, 2019).
Cloud Computing	A model that enables convenient, on-demand network access to a common pool of computing resources that can be shared (e.g., networks, servers, storage, applications and services) and provides the least level of effort from management and provider to interact (Mell & Grance, 2011).
Intention to adopt Cloud Computing	An organization's intention to adopt cloud computing in the future (Sallehudin, Razak, & Ismail, 2015).

1.8 Chapter Summary

This research focuses on the ability of HEIs in developing countries such as Yemen to keep abreast with new technology approach by adopting cloud computing technology. The study identifies and investigates the impeding and motivating factors, which affect the decision-makers of HEIs, which include IT staff, IT decision makers, IT lecturers and policy makers towards adopting cloud computing technology, and the impact of implementation of cloud computing technology in HEIs.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter discusses the relevant literature on the use of cloud computing in higher educations as well on the theories related to technology adoption. This chapter starts by introducing the general concept of education, the challenges in the current education environment, the role of technology in education and challenges in the education in Yemen. Next, it proceeds to discuss about the characteristics of cloud computing, service and deployment models of cloud computing as well as looking at the driver of cloud computing adoption and cloud computing adoption factors. Finally, this chapter presents the models and theories that are used in explaining, understanding, and predicting adoption of new technology.

These adoption models have been developed over the years and came as the result of continual efforts of models' validation and expansion, and as such, the evolution of these adoption models is also presented. For instance, psychology domain utilizes and contributes to the development of Theory of Reason Action (TRA), which was extended to Theory of Planned Behavior (TPB), and later to Decomposed Theory of Planned Behavior (DTPB). Similarly, Information System (IS) domain contributes to the Technology Acceptance Model (TAM), which was extended to the Unified Theory of Acceptance and Use of Technology (UTAUT), which was created based on the above mentioned models in addition to Model of PC Utilization (MPCU), Diffusion of Innovation (DOI), and Motivational Model (MM). Figure 2.1 shows the literature review map for this research.

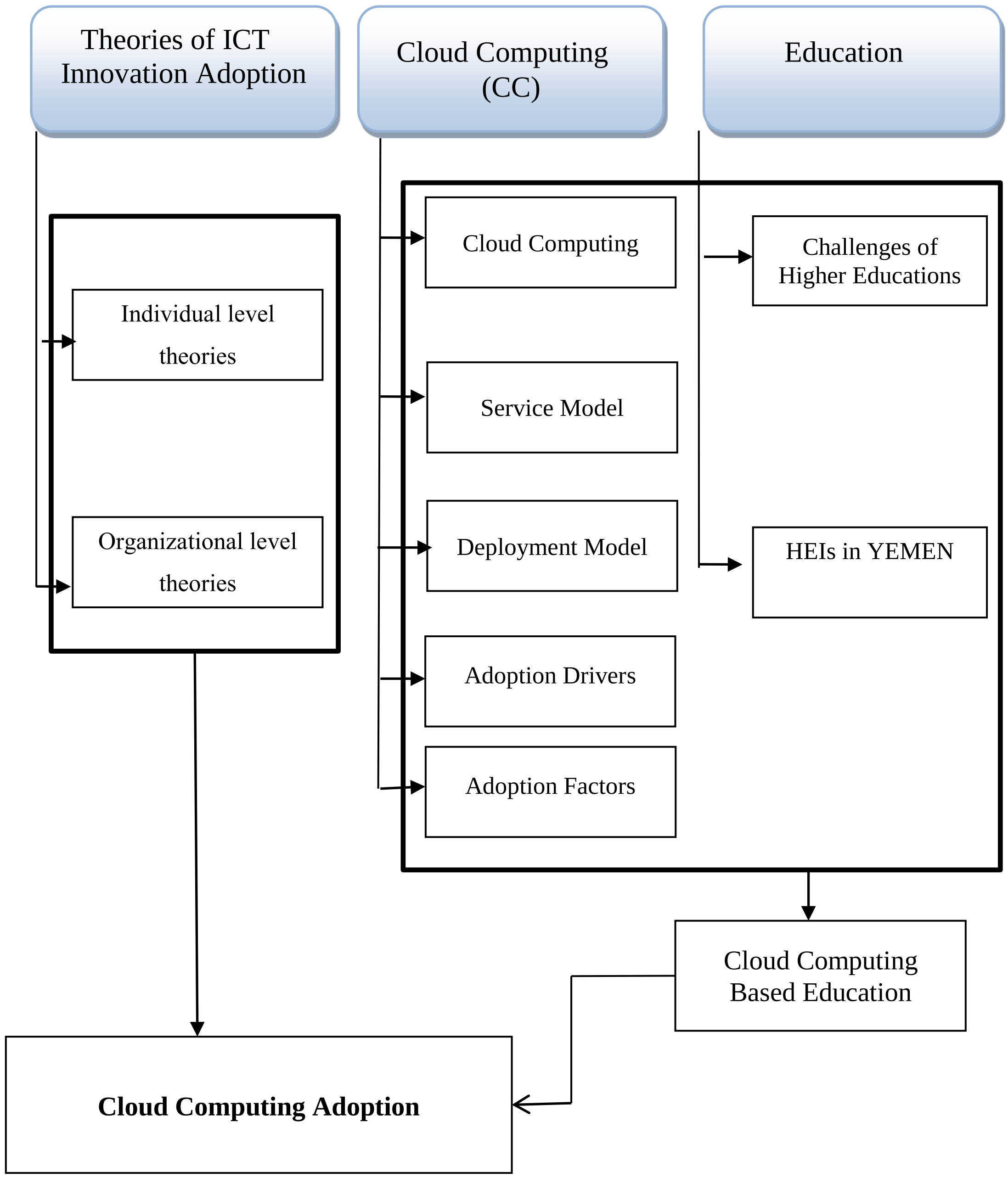

Figure 2. 1 Literature Review Map

2.2 ICT Innovation Adoption Theories

Adoption is defined as a decision to start something, for instance, a plan, idea or new technology (Rogers, 1995). The adoption process is a sequence of stages prior to the acceptance of new service, product, or idea. The stages start by getting first knowledge of innovation, attitude toward innovation, deciding to reject or adopt, implementing new idea, and confirming the decision (Rogers, 1995).

Generally, ICT innovation adoption theories can be categorized into two (2) different units of analyses: individual (micro-level), and organization (macro level). For individual level, there are many theories in the field of adoption and acceptance of technology such as a) Theory of Reasoned Action (TRA), b) Technology Acceptance Model (TAM), c) Unified Theory of Acceptance and Use of Technology (UTAUT), d) Theory of Planned Behavior (TPB), e) Model of PC Utilization (MPCU), f) Motivational Model (MM), and g) Combined TAM and TPB (C-TAM-TPB). The main objective of these models is to determine which factors affect user adoption and usage behavior (Ndubisi & Jantan, 2003). According to Kim, Erdem, Byun, and Jeong (2011), there are a suitable number of theories and models employed in studying individuals' ICT adoption and post-adoption behaviors such as, Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), Technology Acceptance Model 2 (TAM2), and Unified Theory of Acceptance and Use of Technology (UTAUT). At the organizational level, several theories have been in literature on the adoption technology, such as Technology, Organizational, Environment (TOE) framework and Diffusion of Innovation (DOI) Theory. Table 2.1 illustrates the technology adoption theories. The detailed discussions about these theories are elaborated in Section 2.2.1.1 to 2.2.1.6 and Section 2.2.2.1 to 2.2.2.2

Table 2.1 Theories of Adoption Technology

Theory	**Level of analysis**	**Authors**
Theory of Reasoned Action (TRA)	Individual	(Ajzen & Fishbein, 1975)
Theory of Planned Behavior (TPB)	Individual	(Ajzen, 1991)
Technology Acceptance Model (TAM)	Individual	(Davis, Bagozzi, & Warshaw, 1989)
Unified Theory of Acceptance and Use of Technology	Individual	(Venkatesh, Morris, Davis, &

(UTAUT)			Davis, 2003)
Model of PC Utilization (MPCU)		Individual	(Thompson, Higgins, & Howell, 1991)
Motivational Model (MM)		Individual	(Davis, Bagozzi, & Warshaw, 1992b)
Technology-Organization-Environment Framework	(TOE)	Organization	(Tornatzky, Eveland, & Fleischer, 1990)
Diffusion of Innovation (DOI) Theory		Organization	Rogers (2003), (E. Rogers, 1995)

According to Oliveira and Martins (2010b), the theories in the field of technology adoption that are used in most of studies in the literature are a) Technology Acceptance Model (TAM); b) Unified Theory of Acceptance and Use of Technology (UTAUT); c) Theory of Planned Behavior (TPB); d) Technology Organization and Environment Framework (TOE) and e) Diffusion of Innovation (DOI) Theory.

2.2.1 Individual Level Theories

Individual level theories (micro level theories) are the theories which focus on individuals and their interaction. There are a number of individual level theories, which are discussed in the subsequent subsections.

2.2.1.1 Theory of Reasoned Action

Ajzen and Fishbein (1975) developed and introduced the Theory of Reasoned Action (TRA), which is one of the top essential and effective human behavior theories, used to provide description of extensive behavior range (Venkatesh et al., 2003). According to the theory, the rejection or acceptance intention of a specific technology has its basis on trade-offs between the system's perceived benefits to the end-user and the system use complexity. TRA also posits that the beliefs of the individual influence his attitudes and as such, intentions are created that will lead to behavioral actions (Ramayah & Jantan, 2004). Kurland (1995) explains that TRA focuses on intended behaviors and relationships between behavioral intention and actual behavior, where behavioral intention (BI) is a dependent variable, and attitude, and subjective norm are idependent variables. TRA contains three (3) major variables, which are attitude towards behavior, subjective norm and intention and are illustrated in Figure 2.2.

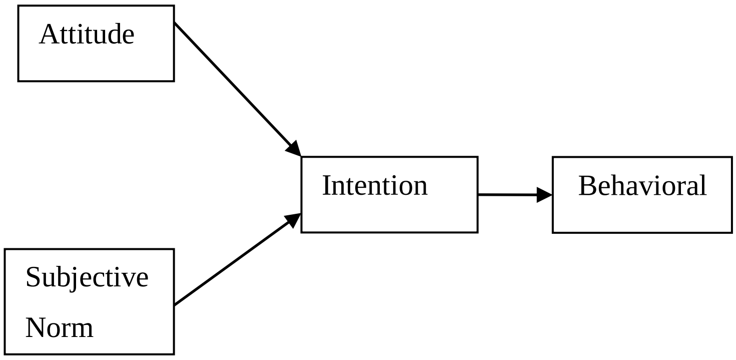

Figure 2. 2 Theory of Reasoned Action (Source : Ajzen and Fishbein, 1975)

The first variable, attitude towards behavior is the indicator of the level to which behavioral performance is valued in a negative or positive way (Ajzen & Fishbein, 1980). Next variable, subjective norm indicates the perception of the people who are most important to an individual on whether he should or refrain from performing a specific behavior. And lastly, intention refers to the readiness of the individual to perform a specific behavior and it precedes behavior (Ajzen & Fishbein, 1980).

Although the TRA has been used in many academic disciplines, it has several limitations. One of the limitations is TRA assumes that actions are always under the preference of individuals (Kurland, 1995). This assumption falls short of acknowledging that individual behaviors may be directed by the system limitation and the like. This highlights the fact that TRA is only applicable to conscious behavior while habitual actions, irrational decisions and unconscious behavior cannot be examined by the theory. Another limitation is the general aspect of the theory by Davis et al. (1989), which means it is only applicable to behavior that is pre-consciously thought out (Al-Qeisi, 2009). Therefore, it is a must to determine the beliefs that are important for subjects concerning the examined behavior. Due to the limitation of TRA, a new theory known as Theory of Planned Behavior (TPB) was proposed as an extension to TRA by Ajzen (1991), where perceived behavioral control variable was added to TPB.

2.2.1.2 Theory of Planned Behavior (TPB)

As explained earlier, Theory of Planned Behavior (TPB) was introduced as an extension of the original model by Ajzen (1991) due to the limitations of TRA in addressing behaviors which individuals have no total control over. TPB is among the most extensively used behavioral theories and a closely inter-connected family of theories that uses cognitive approach in providing a description of the attitudes and beliefs of individuals. The theory sheds light on the intention to act, where intention stems from a combination of attitudes towards the behavior. In other words, a negative or positive assessment of the behavior and the foreseeable results and subjective norms are all deemed as social pressures that weight in on the individual outcomes based on the perceptions of the others who are important to them think on what they should do or refrain from doing. More importantly, a third factor is included in the TPB, which comprises of perceived behavioral control, where it is deemed to be an additional predictor of behavior and intention (Venkatesh et al., 2003). Also, based on Egmond and Bruel (2007) study, the TPB posits that attitudes, perceived behavioral control and subjective norms are predictors of behavioral intention, prior to the carrying out of the specific behavior. Intention, in this case, is a top predictor of the actual behavior.

TPB also posits that perceived behavioral control is an estimation of the skills required to express the behavior and the potential to cope with hindrances to the behavior. In turn, the actual behavior provides feedback on the behavior expectations. TPB assumes that individual decides on a specific behavior by weighing the benefits of different action courses and the associated costs, and then decide on the optimum alternative that increases their net benefits. The theory has been used to examine extensive behavioral ranges to shed light on the individuals' behavior. In fact, the TPB is among the top-supported social psychological theories when it comes to human behavior prediction (Sommer, 2011) . The theory is presented in a structural diagram form in Figure 2.3

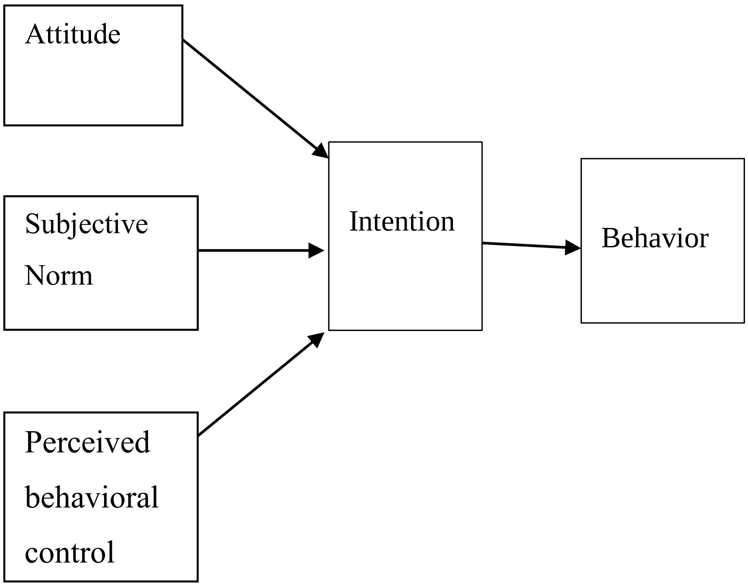

Figure 2. 3 Theory of Planned Behavior (Source : Ajzen ,1991)

2.2.1.3 Technology Acceptance Model

Technology Acceptance Model (TAM), which is developed by Davis et al., (1989) is considered as one of the most common technology acceptance models that provides a theoretical grounds for adoption, and it was developed based on the information technology context (Davis et al., 1989). According to Surendran (2012), TAM is one of the top models to predict the acceptance of technology by individual users. It is founded on TRA theory, and it was developed to depict technology adoption and usage at individual level. The main constructs in TAM are perceived usefulness and perceived ease of use. Figure 2.4 illustrates the model.

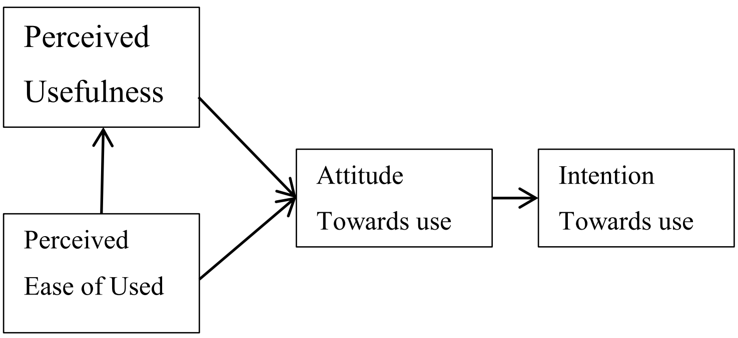

Figure 2. 4 Technology Acceptance Model (Source : Davis et al., 1989)

Perceived usefulness (PU) is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis et al., 1989). Individual’s decision on whether to use or not to use an application is based on their belief as whether the application will be able assist them to perform their jobs better or not. In other words, perceived usefulness describes the individual’s perception on whether the technology will improve his workplace performance. Meanwhile, perceived ease of use (PEOU) explains the individual’s perception on the amount of efforts required to use the system or the extent to which a user believes that using a particular technology will be effortless (Davis et al., 1989).

Gentry and Calantone (2002) indicate that TAM is superior for explaining differences in behavioral intention (BI). A significant point to note is that, there has been increasing concern about comprehensiveness and suitability of TAM, in spite of its common use to clarify technology acceptance by users. Some researchers have criticized TAM for its assumption that PU and PEOU are always the primary determinants of users’ acceptance technology (Hwang & Park, 2007). According to Wu (2011), TAM includes limited constructs so it cannot handle the issue of adopting new solutions or services.

To address TAM’s limitations, TAM 2 was developed based on Technology Acceptance Model by integrating additional theoretical constructs including cognitive instrumental process (Result Demonstrability, Job Relevance, and Output Quality) and the social influence process (Image, Voluntariness, and Subjective Norm) (Venkatesh & Davis, 2000). The general determinants of perceived usefulness in TAM 2 model are: Result Demonstrability, Job Relevance, and Output Quality, Subjective Norms, perceived ease-of-use and Image. Furthermore, TAM 2 model determines the moderator’s voluntariness and experience. Figure 2.5 illustrates the model.

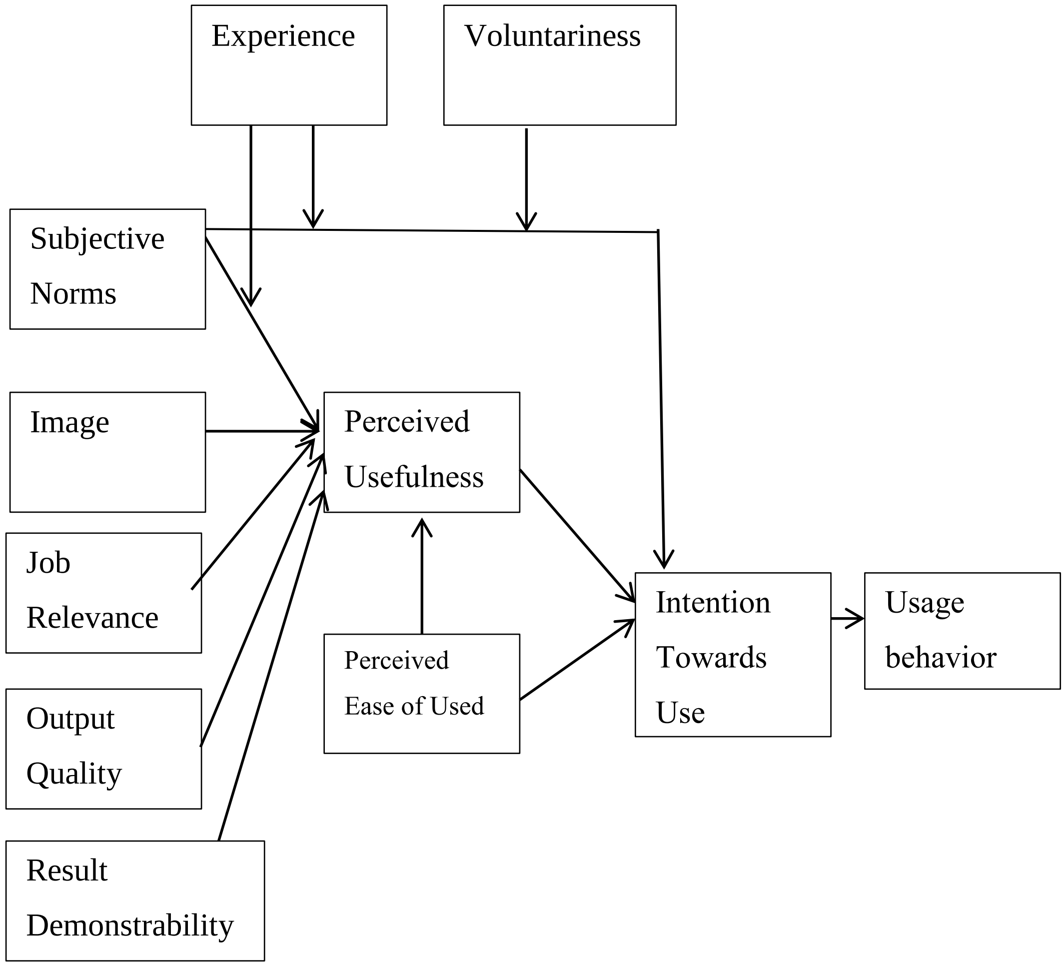

Figure 2. 5 Technology Acceptance Model 2 (Source : Venkatesh & Davis, 2000)

A Combined TAM-TBP model, which was developed by (Taylor & Todd, 1995) includes the combination of the predictors from TBP and TAM model. The predictors in C-TAM-TBP model are attitude toward behavior (adapted from TBP/TRA), perceived behavioral control (adapted from TBP), subjective norm (adapted from TBP/TRA) perceived usefulness, and perceived ease of use (adapted from TAM). According to the C-TAM-TPB model, behavior is affected by behavioral intention, which, in turn, is affected by attitude, subjective norm, perceived usefulness, and perceived behavioral control. Figure 2.6 illustrates the C-TAM-TBP model.

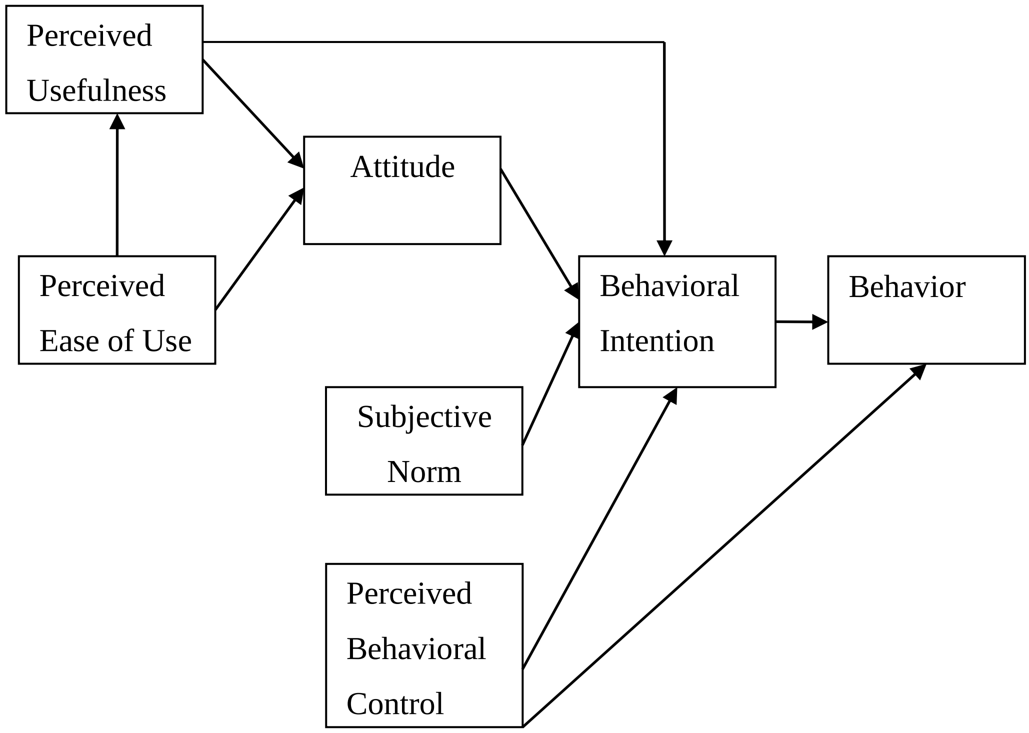

Figure 2. 6 Combined TAM-TBP Model (Source : Taylor & Todd, 1995)

2.2.1.4 Model of PC Utilization

Model of PC Utilization (MPCU) developed by Thompson et al. (1991) evolved to explain how computer systems are utilized and adopted by knowledge workers (Hakkarainen, 2013a). MPCU (as illustrated in Figure 2.7) posits that six (6) factors have direct impact on the degree of PC utilization, which are complexity, job fit, affect towards use, long term consequences, facilitating conditions and social factors.

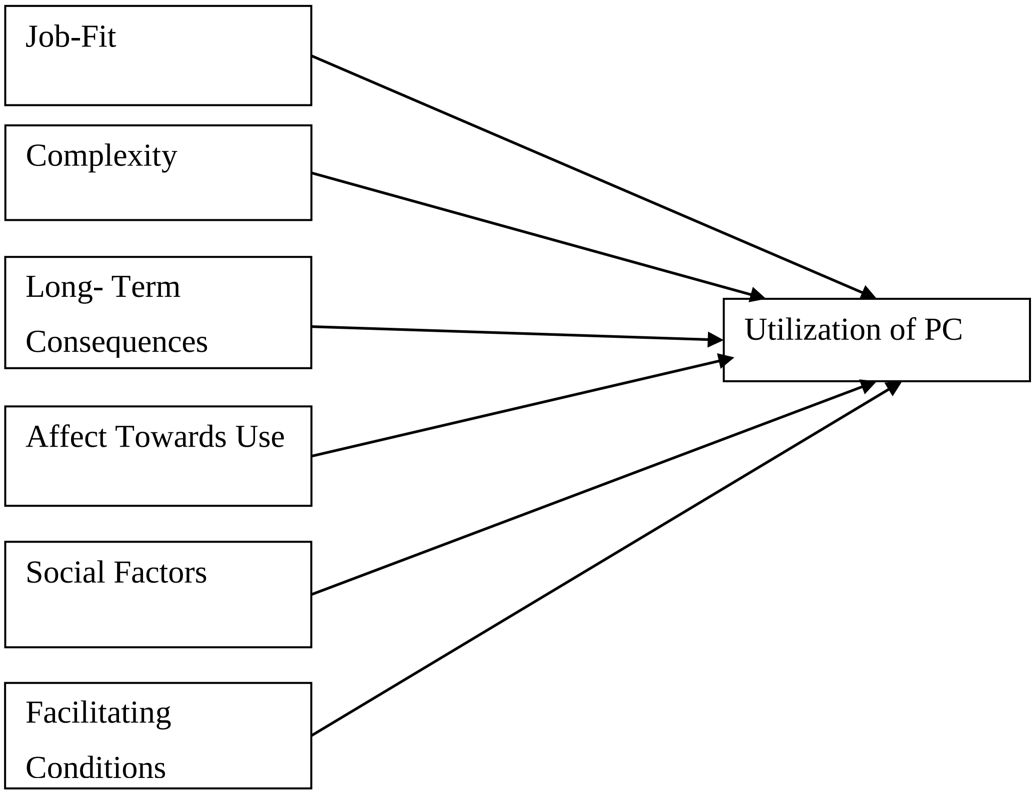

Figure 2. 7 Model of PC Utilization (Source : Thompson et al,1991)

According to Thompson et al. (1991), job-fit is defined as a measure of how the technology fits the user's needs in her or his work - in other words, how the technology is capable of meeting the needs of user's work performance. Job-fit is very identical to perceived usefulness (PU) construct in TAM model and is a popular factor or construct that is accepted and researched in understanding the cause of technology adoption (Hakkarainen, 2013b).

The complexity construct in MPCU gauges the same phenomenon as TAM's ease of use construct, except it is assessing from the opposite direction. According to Thompson et al. (1991), it strives to clarify system use based on the assumption that the more complex a system is to use, the lower will be its adoption rate. Another construct in MPCU, long-term consequences is defined as a construct , which suggests that even though a system would not help a user greatly in her or his current job, the user could adopt the system if there were positive outcomes in the future (Hakkarainen, 2013b).

Effect towards use construct is defined as feelings of elation, joy, depression, pleasure, displeasure, disgust, or hate related by an individual to a particular act, whereas social factors reflect what individuals think they are expected or even required to do. The final construct in MPCU is facilitating conditions, which is defined as provision of support for users of PCs that can influence utilization of systems.

MPCU was developed by Thompson et al. (1991) in an empirical study of knowledge workers in manufacturing industry, which comprised of professionals and managers, who use PCs in their daily jobs voluntarily. That means, MPCU is more applicable and suitable to be used in setting where the utilization of systems or applications within a voluntary environment.

2.2.1.5 Motivational Model

The Motivational Model (MM) was developed to compensate the shortage of research that had empirically addressed the relative effects of enjoyment against usefulness. Both Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) are addressed in MM, in addition to enjoyment, output quality, and task importance (Davis, Bagozzi, & Warshaw, 1992a).

Motivational theorists often distinguish between two (2) sorts of motivation to perform an activity or task, which are intrinsic and extrinsic motivations. Extrinsic motivation indicates the performance of an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself such as, improved job performance, pay or promotions, while extrinsic motivation affects behavior due to the reinforcement value of outcomes. Intrinsic motivation indicates the enjoyment of using the technology regardless of the performance outcome that can be obtained.

Within the information systems domain, MM is applied to understand new technology adoption and use (Venkatesh et al., 2003), which complements the Technology Acceptance Model (TAM) by combining enjoyment, with perceived usefulness preceding intention to use a technology.

In MM, perceived ease of use (PEOU) and output quality has impact on perceived usefulness and perceived enjoyment, which, in turn affect the intentions to use the system. Furthermore, MM posits that intention to use mediates the influence of perceived enjoyment and perceived usefulness on the system usage behavior. Lastly, MM model assumes that task importance moderates the relationships between output quality and perceived ease of use with perceived usefulness (Panagopoulos, 2010). Figure 2.8 illustrates the model.

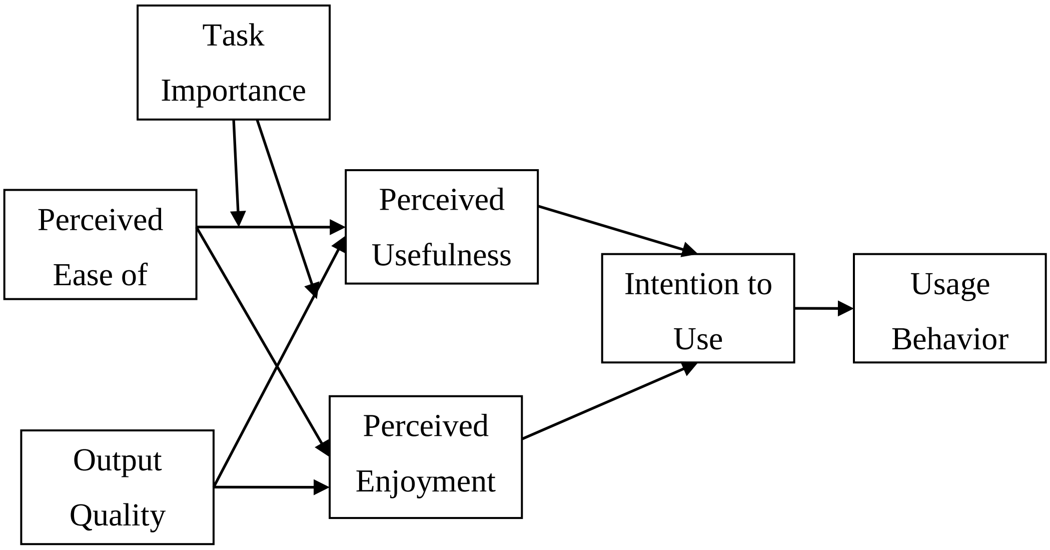

Figure 2. 8 Motivational Model (Source : Davis, 1992a)

Davis et al. (1989) referred to perceived ease of use (PEOU) as the degree to which the prospective user expects the target system to be free of effort. Furthermore, Davis et al. (1989) defined output quality as judged by observing intermediate or end products of using the system (e.g., graphs, calculations, documents, etc.). In addition, Davis (1989) defined perceived usefulness (PU) as the degree to which a person believes that using a particular system would enhance his or her job performance. Moreover, Davis et al. (1992a) defined perceived enjoyment as the extent to which the activity of using the skill of computer is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated.

In summary, MM focuses on perceived ease of use, output quality, perceived usefulness, perceived enjoyment and ignores factors that encourage the users to accept the technology.

2.2.1.6 Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh et al. (2003) introduced the Unified Theory of Acceptance and Use of Technology (UTAUT) (as shown in Figure 2.9) based on the Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Planned Behavior (TPB), Model of PC Utilization (MPCU), Innovation theory and the Social Cognitive theory with the aim of achieving a unified point of view.

There are four (4) major constructs in UTAUT, namely, performance expectancy, effort expectancy, social influence and facilitating conditions, and they influence behavioral intention towards using technology and technology use. UTAUT posits that performance expectancy, effort expectancy and social influence affect behavioral intention towards technology usage, whereas behavioral intention and facilitating conditions are the determinants of technology use (Venkatesh, Thong, & Xu, 2012).

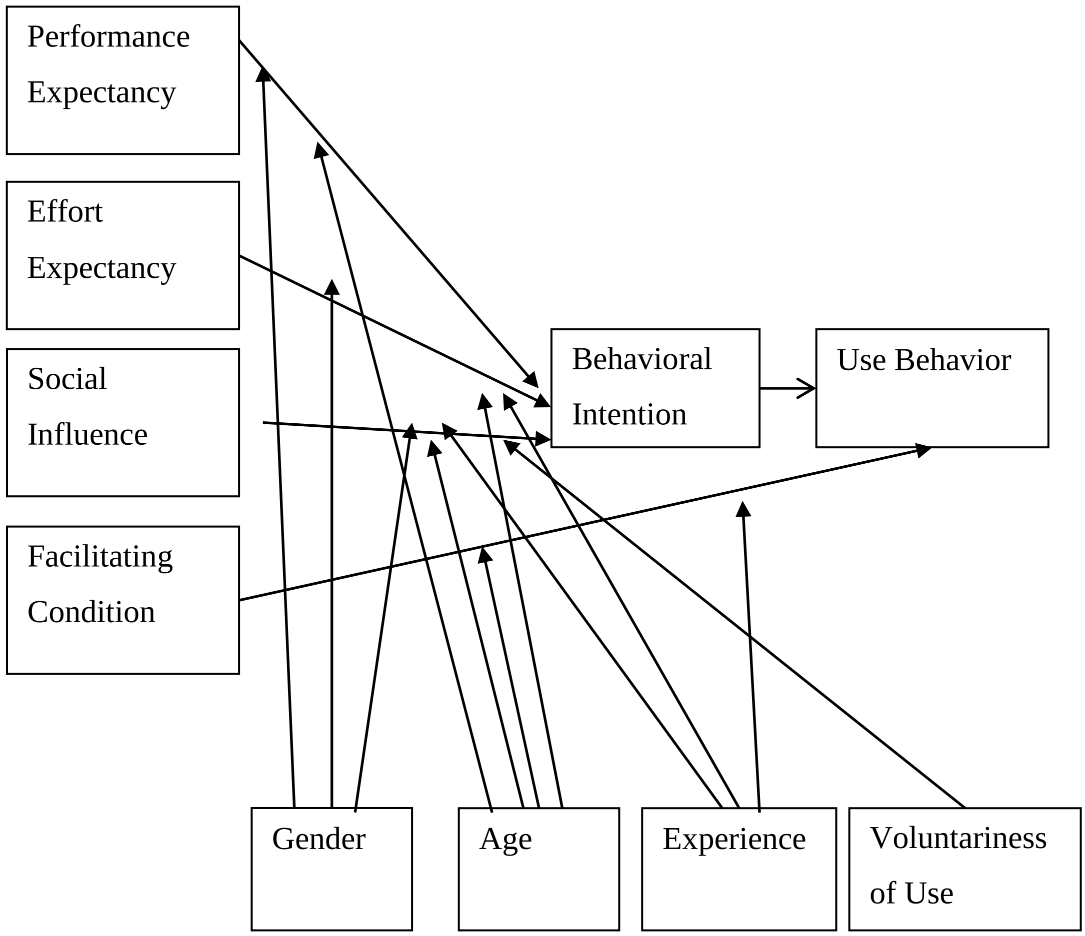

Figure 2. 9 Unified Theory of Acceptance and Use of Technology (UTA UT) (Source : Venkatesh et al,2003)

Table 2.2 presents a summary of the source of each UTAUT construct model, with description of perception and the models from which each construct is derived from.

Table 2.2 Description of UTAUT Variables

Construct	Description of Perception	Similar construct & corresponding Model
Effort Expectancy	The degree of ease associated with the use of the system	-PEOU (TAM)
Performance Expectancy	The degree to which an individual believes that using the system will help her or him to attain gains in job performance	-PU (TAM), (C-TAM-TPB) -Job-fit (MPCU) -Social factor (MPCU)
Social influence	The degree to which an individual perceives that important others believe she/he should use the new system	-Subjective Norm (TRA, TBP, C-TAM-TBP). -Social factor(MPCU)
Facilitating condition	Refer to consumers 'perception of the resources and support available to perform a behavior	-PBC (TBP, C-TAM-TBP) -Facilitating Condition (MPCU)

2.2.2 Organization level Theories

Organizational Level Theories (Macro Level Theories) are theories which focus more on social process, social structure and their interrelationship. At the organization level, organizational behavior includes the study of topics such as organizational structure, organizational culture, technology, external environmental forces, and cultural diversity.

2.2.2.1 Technology-Organization-Environment (TOE) framework

Technology, Organization and Environment (TOE) framework, which was developed and proposed by L. Tornatzky et al. (1990), refers to a framework that is used to assess organizational level adoption as the reflections of the organization's innovation process (e.g. how the organizational context influences its innovation adoption and implementation) (Baker, 2012). TOE framework posits three (3) enterprise contexts that influence innovation adoption of an organization, which are technological, organizational and environmental contexts. The framework was originally developed and presented, after which it was adapted in IT adoption studies as an analytical framework to examine IT innovation adoption and assimilation (Oliveira & Martins, 2010b). TOE is illustrated in Figure 2.10.

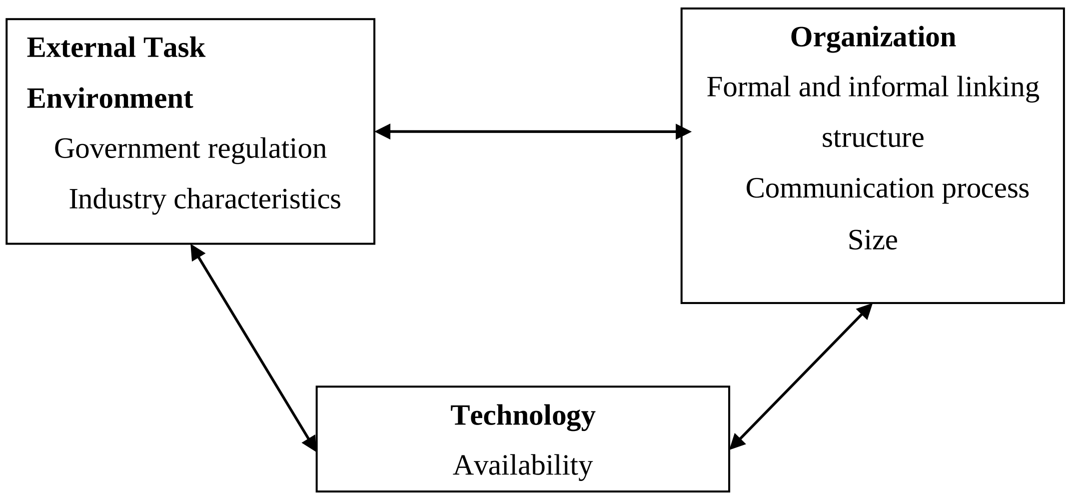

Figure 2. 10 Technology, Organization, and Environment Framework (Source : Tornatzky et al.,1990)

In TOE framework, the technological context covers the internal and external technologies that are of relevance to the organization, which include equipment and processes. This context refers to the technologies that are currently used by the organizations as well as technologies that are available in the market. On the other hand, the organizational context covers the characteristics and resources of the organization such as organizational size, centralization degree, formalization degree, managerial structure, human resources, amount of slack resources and the relationships among employees. Lastly, the environmental context covers the industry size and structure, the rivals of the organization and the macroeconomic factors as well as the regulatory environment of the organization.

There are several limitations highlighted in TOE framework by studies in the literature. For instance, according to Gangwar et al. (2015a), TOE is just a taxonomy for classifying factors and it does not represent a well-defined theory or integrated conceptual framework, Therefore, there is a requirement of a more robust framework to study organizational adoption .

2.2.2.2 Theory on Diffusion of Innovation (DOI)

The Diffusion of Innovation Theory (DOI) is described as an invaluable systemic framework used to predict the adoption or non-adoption of new technology. Studies dedicated to the diffusion of innovation have put importance on individual as well as organizational analysis levels (Slappendel, 1996). Generally, diffusion happens with information and opinions shared among the system's users concerning new technology using communication channels. Users obtain personal knowledge of the new technology that is the first step of the five (5) stages of the adoption process explained by E. Rogers (1995). The remaining four (4) steps are persuasion, decision, implementation and lastly, confirmation.

Added to the above, DOI is a theory that answers the why, how and what rate novel ideas and technology proliferate through cultures. Diffusion refers to a process wherein innovation is relayed through specific channels as time passes among the societal members. According to Roger E. Rogers (1995), each inclination and ability of the adopter to adopt innovation would depend on his/her awareness, interest, trial, evaluation and adoption. This argument resulted in the five-stage model of the DOI, with the elements being innovation, communication channels, social system and time. Moreover, E. Rogers (1995) stated that the perceived innovation attributes are one of the significant ways to explain its adoption rate. It was evidenced that 49-87% of the variance in adoption rate can be described by the five (5) attributes of relative advantage, complexity, compatibility, trialability and observability (E. M. Rogers, Burdge, & Korsching, 1983). The determinants of the innovation adoption rate are depicted in Figure 2.11.

Variables Determining the Rate of Adoption

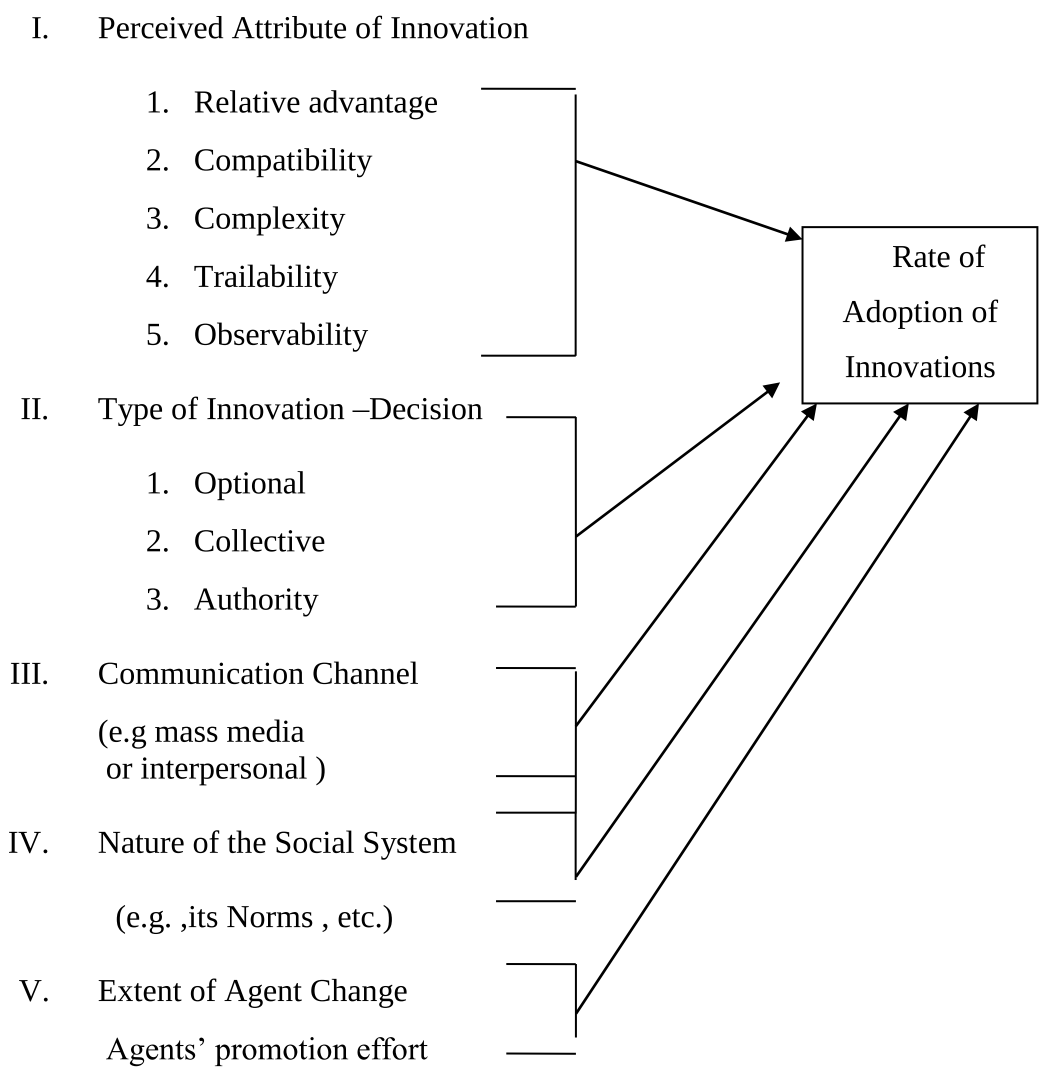

Figure 2. 11 Variables Determining the Rate of Adoption of Innovations (Source : E. Rogers,1995)

On the whole, the DOI theory is primarily focused on the product or innovation and it largely ignores the complexities within the society, economy and culture that can potentially determine the adoption of products in the society. In this regard, Ward (2013) noted that several attempts in literature to examine the DOI model were made, but on the basis of other studies (Oliveira & Martins, 2010b), the DOI has several limitations, with one of them being that the theory is focused on the organizational level and not on the individual level.

Furthermore, the DOI is more suitable to higher education and educational surroundings, and as such, it is a suitable theory to examine technology adoption in the context of higher education (Medun, 2001; Qazi, Raza, & Shah, 2018). Another limitation is that the theory largely ignores several significant aspects in the complex technologies diffusion and thus, researchers using the theory should be cautious in recognizing the complex, interconnected and learning intensive characteristics of technology. The DOI also fails to provide sufficient constructs to address the collective adoption behaviors (Lyytinen & Damsgaard, 2001). It also fails to explain the way attitude is developed to reject/accept decisions, and the way innovation characteristics match this process (Gillenson & Sherrell, 2002; Karahanna, Straub, & Chervany, 1999).

Study of Alwan (2016) summarized the following conclusions about the DOI; 1) its focus is on the product/innovation and ignore how product is adopted, 2) it is weak in predicting individuals' behaviour, 3) it does not provide sufficient constructs to address the collective adoption behaviors and lastly, 4) it is more related to the educational environments. The theory attempts to decide adoption/rejection of new technology but in some instances, users' adoption of technology is not under their volition, which means the theory is a suitable as an alternative choice only.

To conclude, as evident from the thorough presentation and review of theories, the adoption behavior of users is not a simple decision process and as such, no single theory can explain its complexity. It is thus crucial to adopt an extensive combination of different theories.

2.2.3 Summary of the Strengths and Limitations of the Theories

As described in Section 2.2.1 to 2.2.2, there are few theories and models that are suitable to be used to assess the technology adoption at individual level and organizational level. Table 2.3 shows the summary of the strengths and limitations of the ICT adoption theories that are discussed in these sections.

Table 2.3 Summary of The Strengths and Limitations of the ICT Adoption Theories

Theories/ Model	Strength	Limitation
Theory of Reasoned Action (TRA)	• Applied in different academic discipline • Influential theory in the field of human behavior	• It is limited to evaluating settings in which the actions or behaviors are mandatory (Ibrahim, 2014) • Mainly concentrates on the behavioral intention and behavior without concentrating on particular behavior (Al-Qeisi, 2009).
Theory of Planned Behavior (TPB)	• It is one of most widely cited and applied behavioral theories. • It is one of the best-supported social psychological theories with respect to predicting human behavior. • TPB has been applied to a wide range of behavior	• The theory of planned behavior only concentrates on the intention and behavior (Alwan, 2016).
Technology Acceptance Model (TAM)	• TAM is a general and extensive model used in studies of the determinants of IS and IT acceptance. • In TAM, PU and PEOU are more related to problem statement.	• TAM concentrates only on PU and PEOU and ignore the social factors (Gangwar et al., 2015a).
Unified Theory of Acceptance and Use of Technology (UTAUT)	• UTAUT model was created based on eight outstanding models. • Explain 70% of intention variance	• UTAUT model does not address individual factors that encourage decision makers to use technology such as self-motivation (Im, Hong, & Kang, 2011).
Model of PC Utilization (MPCU)	• Effective model to depict how computer systems are utilized and adapted by users.	• In MPCU, the sample was exclusive to professionals and managers who use PCs in their jobs voluntarily (Alwan, 2016).
Motivational Model (MM)	• MM was developed to compensate the shortage of research that had empirically addressed the relative effects of enjoyment against usefulness. • In MM, output quality and ease of use are important constructs that affect usage indirectly through and enjoyment usefulness.	• MM neglects many factors that promote client to use technology (Alwan, 2016).
Technology-Organizational-Environment (TOE)	• TOE is an essential framework that concentrates on the importance of organizational, technology, and environment factors. • TOE provides helpful analytical framework that can be utilized for studying the adoption of different types of IT innovation.	• TOE is just a taxonomy for classifying factors and it does not represent a well-defined theory or integrated conceptual framework (Gangwar et al., 2015a)
Diffusion of Innovation	• DOI is the most suitable for	• DOI theory has a weakness in

(DOI)	investigating the adoption technology in higher education sector. • DOI is an effective theory in the field of educational environment. • DOI is a suitable theory to describe either adoption or rejection of new technology.	predicting behavior of individual user (Alwan, 2016). • DOI does not have a proper construct to deal with collective adoption behavior (Lyytinen & Damsgaard, 2001). • DOI theory concentrates on innovation or product and ignores other factors that determine how the product is adopted (Alwan, 2016).

2.3 Cloud Computing

This section discusses the definitions of cloud computing, characteristics of cloud computing, service and deployment model of cloud computing, and the drivers of cloud computing adoption.

Cloud computing refers to a current technology that delivers IT-related services and infrastructure that originated from the development of several technologies (e.g., hardware, system management, the Internet, and distributed computing (Buyya, Broberg, & Goscinski, 2010; Garrison, Wakefield, & Kim, 2015; Jawad, Ajlan, & Abdulameer, 2017). Owing to the flexible characteristic of cloud computing and the economic benefits that can be reaped from its adoption, organizations have begun to change their IT strategy towards it (Armbrust et al., 2010; Gangwar et al., 2015b). In addition, cloud computing has been described as a computation model, providing resources and capability of IT including, storage, application, collaboration, communication and infrastructure as Internet services relayed through cloud computing provider. Similarly, the National Institute of Standard and Technology (NIST) defined cloud computing as a model that enables convenient, on-demand network access to a common pool of computing resources that can be shared (e.g., networks, servers, storage, applications and services) and provided with the least level of effort from management and provider to interact (Mell & Grance, 2011). It is a current model that organizes and managers ICT resources and is deemed to be one of the current technology trends that will affect the learning and teaching environment in a significant manner (Ercan, 2010; Istenic Starcic & Bagon, 2014).

Cloud computing is an enhanced computing, grid computing, distributed computing and distributed database resource (Ercan, 2010; Sanchati, 2011). In this regard, companies that have no budget for buying cloud computing can opt to subscribe to the services by the cloud computing providers according to their needs and requirements.

Cloud computing has a lot of significant characteristics that can be described as follow (Aljenaa, Al-Anzi, & Alshayeji, 2011):

- **Flexibility**

Cloud computing offers a dynamic scalability on demand. Infrastructure of cloud can be scaled to maximize investment. For example, Google has more than 1 million servers (Bittman, 2009), which offer a lot of services such as, cloud storages, e-mail access, web analytic and text translation. Hundreds of thousands of servers are managed by Microsoft to allow users to move applications into cloud by Microsoft Share Point. Using cloud, SaleForce.com runs multiple applications for its customers. Based on cloud computing platforms which are available to users, they can develop new applications (Singh & Hemalatha, 2012) and cloud service providers can expand capacity of services as much as the end user needs (Bittman, 2009; Mokhtar, Ali, Al-Sharafi, & Aborujilah, 2013).

- **Virtualization**

Virtualization of computing resources is a new way that offers utilizing computer resources remotely. Clients can access resources of computing from their devices anywhere and anytime without the need to know where the physical location of computer resources is (Mokhtar et al., 2013; Zhang, Zhang, Chen, & Huo, 2010).

- **High trustable**

Cloud provider offers computing services resource, which is more reliable, compared to local resources. The resources services are distributed in several locations by a cloud provider (Mokhtar et al., 2013; Zhang et al., 2010).

- **Versatility**

Cloud service can serve a lot of sectors which exist in the same cloud environment and are not limited to specific applications such as image processing sector, video covering format, log analysis system, and batching data information (Mokhtar et al., 2013; Singh & Hemalatha, 2012).

- **On demand service**

Clients have the ability to use their needs of service according to their business function. Therefore, they pay according to their consumption (Bittman, 2009; Chandra & Malaya, 2012) . Unlimited computing infrastructure can be given to end users and they can utilize cloud resources automatically and with no need of any human interaction (Chandra & Malaya, 2012; Mokhtar et al., 2013).

- **Cost**

Implementation cloud computing and renting cloud service play an important role in reducing the costs of expenditure, and will therefore reduce the management costs (Chandra & Malaya, 2012; Mokhtar et al., 2013; Singh & Hemalatha, 2012).

2.3.1 Cloud Computing Service Model

Cloud computing service model is a Service Oriented Architecture (SOA) where services are distributed into several levels of abstraction. Based on service delivery, cloud computing comprises of three (3) main layers (Y. Chen, Li, & Chen, 2011): Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). Figure 2.12 shows a comparison between cloud service models.

- **Software as a Service (SaaS)**

Cloud Service Providers (CSP) is responsible for the maintenance and running of cloud resources, applications, and operating system. From the client's perspective, Software as a Service (SaaS) is considered as web application that delivers applications and services through the internet. The applications run on the cloud server and customers can access services over the internet by choosing one or more services provided.

Saleforce.come is a good example of this service (Pund, Nair, & Deshmukh, 2012; Wu, Yu, Shi, Yang, & Lu, 2014). The main advantage of this service model is that the client does not need to pay for purchasing licenses.

- **Platform as a Service(PaaS)**

It is responsible for providing powerful tools and suitable environment server platform to developers for creating and deploying application. The client can run and manage an application via an operating system and virtual computing resources provided by Cloud Service Provider (CSP). In this service model, the user has control over the operating system and computing resources is scant. The Google AppEngine is a good example of this service (Pund et al., 2012; Wu et al., 2014) .

- **Infrastructure as a Service (IaaS)**

It is responsible for providing scalable infrastructure resources such as software, servers, storage and network requirement. In IaaS Model, the user has full control on maintaining and running the software applications and operating system over these virtual resources. Elastic Compute Cloud (EC2) from Amazon is a good example of this service (Pund et al., 2012; Radhakrishnan, Chelvan, & Ramkumar, 2012; Wu et al., 2014).

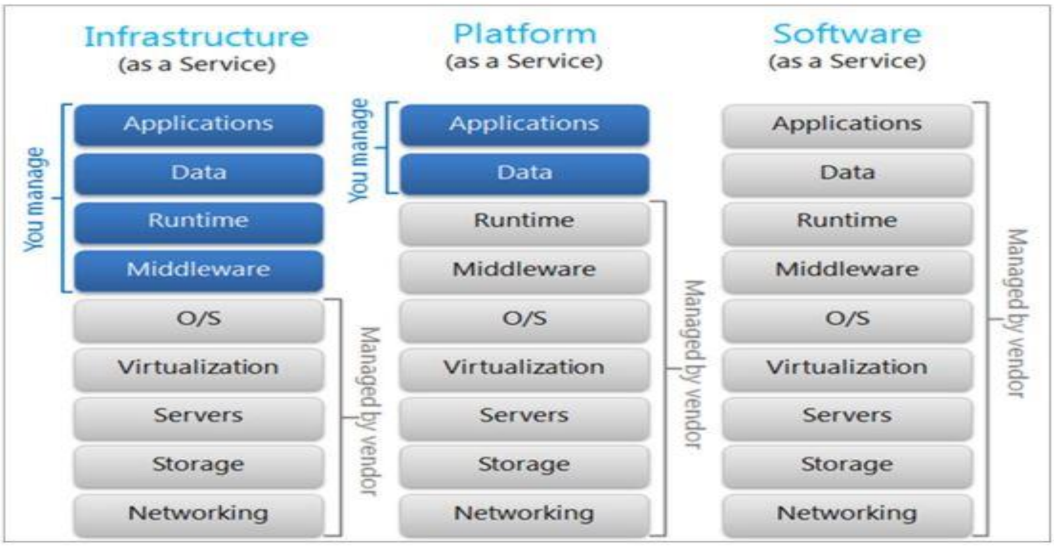

Figure 2. 12 Cloud Computing Service Models (Source: msdn.microsoft.com)

This research concentrates on all models of delivery as the research aims to adopt cloud computing for higher education institutions.

2.3.2 Cloud Computing Deployment Model

There are four (4) ways of how cloud computing could be deployed, namely, a) private cloud, b) public cloud, c) community cloud, and d) hybrid cloud. Figure 2.13 shows the cloud deployment models.

- **Private Cloud**

It is established for an organization or specific group. It is built by one client and it provides quality of services and data security. Cloud infrastructure is allocated only for a single organization, whether managed by the organization or by a third party and hosted externally or internally. (Aljenaa et al., 2011; Chen et al., 2011; Pund et al., 2012). Examples of vendors offering managed private clouds: Cisco and HP.

- **Public Cloud**

It is run by a third company such as Microsoft, Google and Amazon. It can be accessed by any subscriber, where the cloud infrastructure is available to several subscribers and is managed by the service provider (Aljenaa et al., 2011; Chen et al., 2011; Pund et al., 2012) . Amazon and Google is good example for this deployment model.

- **Community Cloud**

It is shared by several organizations that have same objectives; for instance, mission, policy and security (Aljenaa et al., 2011; Chen et al., 2011; Pund et al., 2012).Government or G-cloud is good example for this deployment model.

- **Hybrid Cloud**

It is a mix between at least two (2) clouds deployment models, where the clouds could contain a combination of private, public or community (Aljenaa et al., 2011; Pund et al., 2012). For example, data stored in private cloud and agency database manipulated by a program running in the public cloud

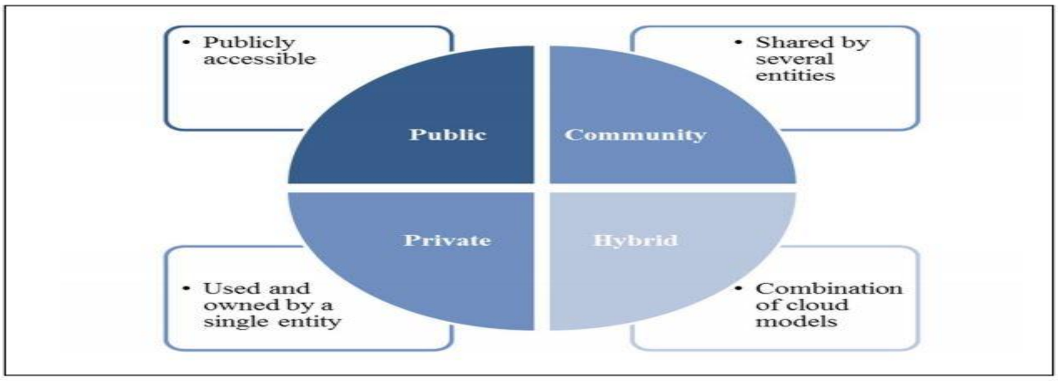

Figure 2. 13 Cloud Deployment Models (Source: Sawant, 2014)

2.4 Cloud Computing Adoption Drivers

The benefits of cloud computing can be attractive for both public and private sectors. The advantage of cloud computing may stimulate the education sector to exploit the benefits. From the literature review (see Table 2.4), some studies addressed the drivers of cloud computing adoption such as, cost saving, improved efficiencies, need for scalability, disaster recovery and availability, and improved transparency and participation. Table 2.4 shows the context of cloud computing adoption, problems that are currently faced and solutions and drivers of the cloud computing adoption.

Table 2.4 Cloud Computing Adoption Cases

Authors	Case study	Problem	Solution	Benefits	Drivers
(Kundra, 2010)	General Services Administration (GSA) - USA	- Long Delay -Downtime	Terramark Enterprise cloud	-Reducing the upgrade time -Reducing the down time -Cost saving by 72%	-Service efficiency -Cost Savings
(Viotti, Bowman, Harris, Mercuri, & Satorius, 2010)	National Aeronautics and Space Administration (NASA) - USA	- Inadequate data storage system.	-Microsoft Silverlight -Windows Azur	- Motivate citizens to engage in scientific activities -Processing a huge number of queries successful. -Access to high quality pictures via a rich graphical interface.	-Efficiency and service quality - Participation
(Kundra, 2010)	Recovery Accountability and Transparency Board (RATB)- Recovery Gov. USA	Lack of ability to do the maintenance cost	Amazon Elastic Compute Cloud	-100% uptime -Storage of important data -Cost savings	-Availability -Efficiency -Cost saving
(Glick, 2009)	-Government Cloud (GC) United Kingdom	-Need of scalability and flexibility -Costly of ICT infrastructure	Private Cloud G-cloud	-Sustainability	-Cost saving -Scalability
(Glick, 2009)	Government Cloud Australia	Decreasing in ICT budget due to the economic crisis	-Private Public Hybrid Cloud	-Cost savings	-Cost saving
(Glick, 2009)	Korean Cloud Computing (KCC) South Korea	Not mentioned	Korean cloud Computing	-Saving 50% in infrastructure budget	-Cost saving
(Craig et al., 2009)	Kasumigaseki Cloud Japan	Raise Demands of Government IT System	-Kasumigaseki Private cloud	-No need to manage separate IT system for several ministries	-Cost saving
(Bhisikar , 2011)	G- Cloud Singapore	-Need of Scalability and Flexibility -Lack of Infrastructure	- Ggovernment's Private Cloud Infrastructure	- Elasticity	-Cost savings - Scalability

Table 2.5 summarizes the cloud computing adoption drivers in each of the stated case study in Table 2.4.

Table 2.5 Cloud Computing Adoption Drivers

Drivers	**Case study**							
	GSA-USA (Kundra, 2010)	**NASA –USA** (Viotti et al., 2010)	**RATB-USA** (Kundra, 2010)	**UK** Glick, 2009)	**Australia** (Glick, 2009)	**South Korea** Glick, 2009)	**Singapore** (Bhisikar, 2011)	**Japan** Craig et al., 2009)
Improve efficiencies	√							√
Cost saving			√	√	√	√	√	√
Need for scalability		√	√	√				√
Improve transparency and participation		√						
Disaster recovery and availability			√					

As seen in the Table 2.5, cost saving and the needs for scalability (storage computing) are the most popular drivers that motivated these case studies to adopt cloud computing. Furthermore, the role of cloud computing technology to ensure improve efficiencies and disaster recovery and availability cannot be neglected.

2.5 Cloud Computing Based Education

In the context of higher education institutions (HEIs), cloud computing is a relatively new technology. According to Sultan (2011) , Okai, Uddin, Arshad, Alsaqour, and Shah (2014), Sabi, Uzoka, Langmia, Njeh, and Tsuma (2016), Cloud computing enables academic and non-academic staff as well as students and researchers of HEIs to access resources and services provided by the cloud service provider. In comparison, in the traditional educational environment such as classroom learning approach, the resources ownership and maintenance onsite by the HEIs are evidenced to be in need of significant investments (Masud & Huang, 2012). Therefore, HEIs adoption of cloud computing can mitigate costs related with IT equipment maintenance and energy use, and facilitate IT resources virtualization (e.g., operating system, storage device, server and network resources) (Sabi, Uzoka, Langmia, Njeh, et al., 2016; Vouk et al., 2008).

In other words, cloud computing plays a key role in distance and online education learning, mobile learning as well as e-learning (Al-Samarraie & Saeed, 2018; Vishwakarma & Narayanan, 2012).

HEIs can adopt three (3) main cloud computing deployment models as follows: a) HEIs can obtain the paid services provided by a cloud computing service provider (Microsoft, 2010), which is called Educational and Learning as a service (Alabbadi, 2011); b) HEIs form association among themselves to establish a cloud computing infrastructure (Crawford, 2015); c) HEIs create their own cloud computing environment which is called private clouds (Chen et al., 2011; Pund et al., 2012).

Many of universities and colleges have started using cloud and obtaining its benefits (Aldrich, 2010; Bernius & Krönung, 2012; Blue & Tirotta, 2011; Cappos, Beschastnikh, Krishnamurthy, & Anderson, 2009b; Doelitzscher et al., 2011; Educause, 2009; Gray, 2010; P. Li, Toderick, & Lunsford, 2009; Scale, 2010; Sheard, 2010; Sultan, 2010; Tariq, Tayyaba, Rasheed, & Ashraf, 2017). Due to the cost efficiency provided by cloud computing in terms of software implementation and maintenance (Rao, Sasidhar, & Kumar, 2012; Tariq et al., 2017), cloud computing can be adopted to improve the quality of education by developing and enhancing low cost education on a global basis (Rajesh, 2017; Rao et al., 2012).

Universities and colleges around the world are purchasing and creating a variety of cloud computing services (Sultan, 2010; Tariq et al., 2017). Case studies from universities and colleges in England addressed the propensity of universities toward cloud computing adoption.

In United Kingdom, the government has built cloud infrastructure for higher education institutions by investing £12 million in share data management services, data management applications, and share storage (Information, 2011). A total of £5.7 million was invested in cloud computing infrastructure by university that includes networking, virtualized shared services and servers (Flinders, 2013). The University of Westminster saved £ 1 million in costs related to ongoing maintenance storage, servers, staff expenses and licensing by adopting Google application (Sultan, 2010).

Educational sector always looks for opportunities to rationalize the resources of management. In this regard, cloud computing is a new information technology that has been applied in education. Furthermore, most of the reviewed literature on cloud computing adoption have concentrated on organizational users, but little studies have addressed how individual users accept cloud computing to accomplish individual needs (Li & Chang, 2012).

2.5.1 Advantages of Cloud Computing Based Education

Cloud computing offers several advantages to HEIs and they are discussed as follows:

For HEIs

In HEIs, in addition to access portability, flexibility and availability of resources (Borangiu, Curaj, & Dogar, 2010), cloud computing provides agility to host applications. Furthermore, it is not necessary to create application to be compatible for each operating system. Instead, there is just one application for all web operating systems (Lawton, 2008). By implementing cloud computing, HEIs are free from thinking about maintenance, which will influence the educational process (Ivica, Riley, & Shubert, 2009; Vaquero, 2011) owing to the fact that the issue is unrelated to the course material - for instance, installation problems and networking. Furthermore, implementing cloud computing allows the educators to easily present the complexity of course to students (Tariq et al., 2017; Vaquero, 2011).

For Student

The availability of the needed resources is the main advantage for students who have courses on cloud (Vaquero, 2011). Cloud computing has a portability which allows students to work on their applications or on their programs (Lawton, 2008; Tariq et al., 2017) and students are enabled to access the system without any location restriction or time. This way students can be left to concentrate on their assignments without any distraction (Ivica et al., 2009; Vaquero, 2011) in the form of networking problem, lack of resources, software and hardware restrictions and maintenance operation. Furthermore, it assists students to fulfill their tasks faster (Caeiro-Rodriguez, Fontenla-González, Pérez-Rodríguez, & Anido-Rifón, 2010; Vaquero, 2011). Implementing cloud computing technology encourages and enhances the result of students (Vaquero,

2011) and provides their experience in dealing with new technology. The students do not need to download software application or, setup configuration or use quality equipment (Zhang et al., 2010) because the software application will be already on cloud (i.e., Software as a Service, SaaS). The students just need to write their application and run it to facilitate easy interaction between educators and students.

For HEIs Administration

With regards to the administration of HEIs, there is no need to take software license and infrastructure into consideration (Jun, 2010) so the cost of application license and infrastructure will be non-existent. Moreover, the constraints of hardware will be cancelled because of virtualization (Borangiu et al., 2010; Dong, Zheng, Yang, Li, & Qiao, 2009), which allows resource sharing of any operating system despite the type of hardware being used. In the same way, administrators are enabled to run large scale applications without resource limitation. Otherwise, administrators will have to be concerned with Service Level Argument (SLA), which identifies disaster recovery process and the quality of service.

2.6 Cloud Computing Adoption Factors

The concept of adoption is quite a significant one, particularly when it comes to technology. Adoption is a decision to begin the use of something, which may take the form of an idea or technology (Rogers, 1995). It refers to the technology diffusion phase, where in an organization/individual decides on choosing a technology to use (Khosrow-Pour, 2005). With the widespread dissemination of the new technology's potential advantages, individuals and organizations that are still unfamiliar with the new technology will attempt to adopt this technology to survive in the dynamic business environment. Therefore, this research examines the perception of IT professionals (comprised of IT staff, IT manager, and IT lecturers) in higher education institutions (HEIs) in Yemen to adopt cloud computing.

This research identifies and classifies the cloud computing adoption factors into four (4) groups: a) technological factor, which depicts the external and internal technologies relevant to organization (Oliveira & Martins, 2010b; RUI, 2007); b) organizational factor, which indicates the characteristics and resources of an organization that constrain or facilitate the adoption of cloud computing (Tornatzky et al., 1990); c) environmental factor, which describes the external factors to organization that affect the cloud computing adoption (Alshamaila et al., 2013; Hsu, Ray, & Li-Hsieh, 2014; Oliveira, Thomas, & Espadanal, 2014; Tornatzky et al., 1990); and d) individual factor, which refers to the individual characteristics of employees in an organization, such as behavior, intention, attitude, and interaction with HEIs. Since the scope of this research focuses on higher education institutions (HEIs), so the four (4) groups of cloud computing adoption factors are examined from the context of HEIs.

Based on the systematic literature review conducted by searching numerous reputable and established journals using the keyword "cloud computing" with "diffusion" , adoption or "acceptance" a total of 484 number of publications were returned and only 50 number of publications were identified to be relevant to this research.

From the shortlisted publications, only 18% of these studies are found to be focused on investigating factors related to cloud computing adoption in the educational sector (Dawson, 2015; Klug & Bai, 2015b; Li & Chang, 2012; Mansour, 2013; Sabi, Uzoka, Langmia, & Njeh, 2016; Tashkandi & Al-Jabri, 2015; Yuvaraj & Yuvaraj, 2016), while 82% of the studies focused on investigating factors related to cloud computing adoption in the industrial sectors. This finding indicates that the empirical studies on cloud computing adoption in the educational sector are limited as compared to other sectors. Furthermore, the educational sector shows hesitation and reluctance in adopting cloud computing despite the perceived benefits due to data security, privacy concerns and vendor lock-in. (Saleh et al., 2017a).

The literature review also shows that most studies on cloud computing adoption concentrated on the organizational level theory (61%), whereas 26% focused on the individual level theories and the remaining 13% integrated both individual and organizational-level theories. Furthermore, on the context of theories adopted in these studies, 34% of the studies used Technology, Organization and Environment (TOE) Framework, 22% of the studies used Technology Acceptance Model (TAM), 5% used Theory of Planned Behavior (TBP), and 3% used Theory of Reasoned Action (TRA).

Furthermore, 34% of studies used Technology, Organization and Environment (TOE) framework, 22% used Technology Acceptance Model (TAM), 5% used Theory of Planned Behavior (TBP), and 3% used Theory of Reasoned Action (TRA). These results show that most of the studies focused on decision makers, who are having the authority in determining the possibility of with the ability to adopting cloud computing, but put less emphasis on and largely ignored the people handling the technology. In addition, most of these studies were conducted in the developed countries and only a few studies were conducted in developing countries. This finding could imply that awareness regarding the benefits of adopting and using cloud computing in the developing countries is currently very quite low. As such, it is hoped this research is also to provide additional insights in cloud computing adoption from the context of developing countries.

2.7 Education

Education sector is the backbone of socio-economic development as it motivates economic growth of a nation and at the same time promotes poverty reduction, thus leading to improved living. This can be evidenced as many countries have intensified the efforts to ensure that education remains a top priority (Gamundani & Kandjii, 2016; Kwabena Ayeh, 2008) and increase investment in education to improve quality of education (Bettinger & Loeb, 2017; Siemens, Dawson, & Lynch, 2013).

Higher education is a crucial element of human development all over the world as it provides high-level skills required for the labor market and training that is required for professionals. Such individuals that develop the capacity and analytical skills driving economies also reinforce the development of civil society, effective running of governments and enable informed decision-making in societies.

2.7.1 Challenges of Higher Education Institutions

This section describes and provides an overview of the challenges that faced by higher education institutions (HEIs). The following are some of the challenges that HEIs in developing countries face as they seek to improve the quality of education.

- **Lack of Infrastructure**

Lack of infrastructure is considered as the main challenge in HEIs in developing countries. Infrastructure facilities like power and telecommunication and buildings require significant investments from both private and public players. Furthermore, poor quality of education in developing countries and physical infrastructure may lead to a high dropout rate (Graham, Woodfield, & Harrison, 2013; Idris & Osman, 2015; Lashayo & Gapar, 2017; Tarus, Gichoya, & Muumbo, 2015).

- **Lack of Administrative Support**

Administrative support is a crucial for the successful integration of ICT into learning and teaching process in higher education. Administrative support provides the requirements that are needed, for instance, resources and ICT policy. Al-Rashidi (2013) confirmed that for the integration of ICT to be sustainable and effective, administrators themselves must be competent in the use of technology and must have a broad understanding of the pedagogical, technical, financial, administrative, and social dimensions of ICT in education (Al-Rashidi, 2013; Kaur, 2013; Sife, Lwoga, & Sanga, 2007).

- **Lack of Technical Support**

Lack of technical support can bring about issues related to operation, maintenance installation network administration and security. This is considered the important part of the implementation and integration of ICT in education system. In developing countries, there are a few technical experts to implement and provide ICT maintenance (Idris & Osman, 2015; Kaur, 2013; Sife et al., 2007). Nevertheless, the mitigation of such challenges may be possible through the cloud computing adoption that can serve as a platform in higher education institutions. In relation to this, cloud computing can minimize the related software applications, infrastructure and maintenance costs (Ji & Liang, 2016; Shahzad et al., 2016)

2.7.2 Higher Education Institutions in Yemen

In Yemen, higher education institutions (HEIs) and education system call for dire remedial actions to fulfil the increasing population growth and the socio-economic needs for the provision of effective higher education services (SCEP, 2013). Yemen needs a quality higher education system that is characterized by efficiency and dynamism. Yemen is not blessed with natural resources like its neighbors, it has to depend on exploiting human resources to develop successfully into the 21st century envisioned society and economy. As such, having HEIs in Yemen with adequate facilities to enable delivery of effective education to its citizen will play a key role. This is particularly pertinent as it is predicted that the number of secondary school graduates will multiple by four (4) or five (5) times in the next 20 years, and there is a need for the higher education system to accommodate and meet a considerable magnitude of educational demand (Alsurori & Salim, 2017).

The history of higher education institutions (HEIs) in Yemen goes back to the beginning of the 1970s when the first public universities were established (Aden University and Sana'a University). Currently, there are currently nine (9) public universities and 14 community colleges in Yemen with IT departments, where these HEIs are supported by 571 IT professionals (comprised of IT staff, IT manager, and IT lecturers). It is projected that 20% of Yemen population will be in the age range to attend HEIs (United Nations, 2017). The current population of Yemen is more than 26 million (FactBook, 2016), where people in rural and urban areas are faced with challenges when it comes to receiving good education (UNICEF, 2011). Thus, HEIs in Yemen are facing challenges in reaching to the mass populace in the current traditional classroom setup due to lack of infrastructure. Table 2.6 shows the breakdown of the current HEIs and IT staff in each city in Yemen.

Table 2.6 Public Universities and Community Colleges

Community Colleges	**No. of IT Professional**	**Public Universities**	**No of IT Professional**
Sana'a	36	Sana'a	62
Aden	44	Aden	75

Abs	10	Taiz	61
Sanhan	10	Hodeidah	56
Yarim	5	Ibb	54
Amran	7	Dhamar	48
Al-Khabt	4	Hadramout	49
Sayoon	6	Amran	22
Asher	2	Hajja h	10
Aluhaia	4	-	-
Al-Maafer	7	-	-
Al-Darb	3	-	-
Al-dhalea	4	-	-
Sharaab	2	-	-
Total	144	Total	427

In Yemen, the higher education is under the purview of Ministry of Higher Education (MHE) and Ministry of Technical Education and Vocational Training (MTEVT), which are committed to provide tertiary education to all citizens despite the numerous challenges. Among the identified challenges are:

- The number of the higher educational institutions (HEIs) is not adequate to cope with the growing number of applicants.
- Most of the higher educational institutions (HEIs) in Yemen still rely on traditional methods of teaching (i.e. classroom learning approach), whereby having a high reliance on face-to-face lecturing sessions as well as printed/ hardcopy notes and handouts.
- Lack of teaching staff and expertise despite the availability of physical building in higher educational institutions (HEIs). Some affiliate countries such as Germany, Saudi Arabia, and South Korea have donated infrastructure and equipment to educational institutions in Yemen. Unfortunately, most of these institutions do not possess the technical expertise to operate, support, and maintain these infrastructures and equipment.

- A number of higher educational institutions (HEIs) are geographically isolated from the main cities of Yemen, thus resulting in difficulties in communication, supervision and evaluations by the relevant agencies and government bodies.
- Lack of infrastructure and equipment which assist students to adapt with new technology.
- There is limited funding to meet the requirements and needs of higher educational institutions.
- The current learning and teaching resources are not distributed across education institutions based on the needs of the institutions, but more on personal reasons or rationales, thus resulting in unbalanced development among the institutions.

Due to these challenges, the use of technology, such as cloud computing, will help to improve education and keep abreast with educational approaches such as blended learning implementation with minimum cost.

2.8 Chapter Summary

This chapter addressed the characteristics of cloud computing, cloud computing service model, cloud computing deployment model and cloud computing adoption in business and educational sectors. Systematic Literature Review (SLR) was conducted to review empirical studies on cloud computing adoption in general, identify the influencing factors of cloud computing adoption, and categorize these factors into technological, organizational, environmental, and individual factors. This chapter assessed nine (9) theories of technology adoption based on literature review. The aim is to select the most suitable theories to be adopted in this research based on the problem statement defined and the review of the literature.

CHAPTER 3

DEVELOPMENT OF A CONCEPTUAL MODEL

3.1 Introduction

This chapter discusses the development of conceptual model for this research. This chapter is divided into two (2) main sections, whereby Section 3.2 presents the definitions of variables and the hypotheses developed for this research and Section 3.3 presents the conceptual model, which was developed based on the research questions highlighted in this research. Finally, Section 3.4 summarizes the chapter.

3.2 Operational Definition of Variables

As discussed in Section 2.6, a systematic literature review (SLR) was adopted in identifying the factors that influence cloud computing adoption. 124 factors were identified related to cloud computing adoption. The similarities among these 124 factors were assessed (as shown in Appendix B) and 13 distinct significant variables were identified and shortlisted, which are grouped into four (4) categories, namely technological, organizational, environmental and individual contexts. This section addresses each of these variables and explains the measurements of each variable. Table 3.1 presents the significant variables obtained from the literature review.

Table 3.1 Variables Based on their Relative Importance

Context	Factors	Description	Theory/ Model Adopted	Level of Analysis
Technological-related	Relative advantage	Indicates the degree to which an innovation is perceived as providing more benefits than its predecessor (E. Rogers, 1995).	DOI/ TOE	Organizational Level
	Compatibility	It refers to the extent to which an innovation is perceived as consistent with the existing values, past	DOI/ TOE	

		experience and needs of potential adopter(E. Rogers, 1995).		
	Complexity	It is defined as "the degree to which an innovation is perceived as relatively difficult to understand and use" (E. Rogers, 1995).	DOI/ TOE	
	Data Concern	Data concern is seen as audit-ability, data confidentiality, data storage security loss of data and breach of privacy in the business operations Tashkandi & Al-Jabri, 2015)	TOE	
Organizational-related	Top management support	This indicates the attitude of top management support toward the technology and the level of support devoted for its adoption (Tashkandi & Al-Jabri, 2015).	TOE	
	Technology readiness	It is defined as 'managers' perception and evaluation of the degree to which they believe that their organization has the resources, commitment, awareness and governance to adopt IT (Tan, Tyler, & Manica, 2007).	TOE	
	Skill of IT professional	It is defined as the degree to which a firm instructs its employees in using a tool in terms of quantity and quality (Mehrotra, 2010; Pillania, 2006)	TOE	
Environmental-related	Regulatory policy	This indicates the policies imposed by the government to regulate cloud computing market (Tashkandi & Al-Jabri, 2015).	TOE	
	Awareness	It is how a person understands the activities of others, which provides a context for his own activities (Dourish & Bellotti, 1992).	TOE	
Individual	Perceived usefulness (PU)	It is defined as the degree to which the person believes using new technology will enhance his/her performance (Nasri & Charfeddine, 2012).	TAM	Individual Level
	Perceived ease	This refers to the degree to which the	TAM	

of use (PEOU)	prospective user expects the target system to be free of effort (Davis et al., 1989).	
Attitude	Attitude refers to individual's negative or positive feeling toward target behavior (Ajzen & Fishbein, 1980).	TAM-TRA
Subjective Norm (SN)	Subjective Norm (SN) indicates the individual's perception that most of people to him/her think he/she should or should not perform the behavior (Ajzen & Fishbein, 1975).	TRA
Behavioral intention to adopt cloud computing (BI)	An organization's intention to adopt cloud computing in the future (Sallehudin et al., 2015).	

3.2.1 Technological Factors

Technological context depicts the external and internal technologies relevant to organization (Oliveira & Martins, 2010b; RUI, 2007). It concentrates on the attributes of technology innovation, whereby looking at both technologies that have been or currently being used at the organization or those available in market but still not in use(P.-F. Hsu et al., 2014; Klug & Bai, 2015b). This context is important to be considered in this research as IT professionals in Yemeni HEIs are required to gain clear understanding of the new technology proposed, which is cloud computing and its benefits to their educational institutions. There are four (4) factors in the technological context that are identified as significant and included in this research, which are relative advantage, compatibility, complexity and data concern.

a) Relative advantages

Relative advantage indicates the degree to which innovation is perceived as being more beneficial than its predecessor (E. Rogers, 1995). It is related with responsiveness to business requirements and cost reduction (N. Sultan, 2010). Cloud computing provides a number of advantages such as reduced cost, increased mobility and shared resources, flexibility and scalability (Marston, Li, Bandyopadhyay, Zhang, & Ghalsasi, 2011). Cloud computing frees HEIs from administering and maintaining IT infrastructure every year as it offers rented services based on the usage volumes, which facilitates the adjustment of the level of usage according to the current needs of HEIs. In addition, mobility provides cloud computing users the facility of accessing their documents from anywhere and the user does not even need a computer to use the services provided by cloud computing. Cloud computing is also seen to increase the efficiency of educational institutions (Karim & Rampersad, 2017; A. Tashkandi & I. Al-Jabri, 2015).

Cloud computing must increase the efficiency of educational institutions (Karim & Rampersad, 2017; Tashkandi & Al-Jabri, 2015). According to Gangwar et al. (2015a), relative advantage has a positive strong correlation with perceived usefulness (PU) and perceived ease of use (PEOU). This shows that the adoption of cloud computing is dependent on the relative advantages - for example, mobility, scalability pay per use, among others. The relative advantages of cloud computing would subsequently lead to improved customer service, greater efficacy of internal process, reduced cost, improve productivity, performance, service usefulness and job effectiveness (Sabi, Uzoka, Langmia, and Njeh (2016). Based on this notion, this research proposes the hypotheses related to relative advantage as:

+H1a: Relative advantage has a positive effect on PU
+H1b: Relative advantage has a positive effect on PEU

b) Compatibility

Compatibility refers to the extent to which an innovation is perceived as consistent with the existing values, past experience and needs of potential adopter (Rogers, 2003). Cloud computing is considered a revolution for information technology services. In cloud computing, it is required and needed to understand whether the coud computing technology is compatible with the existing infrastructure of HEIs. It is anticipated that compatibility with cloud computing will facilitate its adoption process. From business perspective, there is a need for procedural and requirements of innovation to be consistent and compatible with technology requirement of technology adoption (Lertwongsatien & Wongpinunwatana, 2003).

Gangwar et al. (2015a), Ibrahim (2014), Sabi, Uzoka, Langmia, and Njeh (2016) and Cheng (2014) found that compatibility has a strong impact on perceived usefulness (PU) and perceived ease of use (PEU). As such, for cloud computing to be successfully adopted by HEIs, it is perceived that it must be compatible with the existing technology and its format. On the basis of the above arguments and based on theories which are mentioned in Chapter 2, this research proposes the hypotheses related to compatibility as :

+**H2a**: Compatibility has a positive effect on PU.
+**H2b**: Compatibility has a positive effect on PEU.

c) Complexity

Complexity is defined as “the degree to which an innovation is perceived as relatively difficult to understand and use” (Rogers, 2003). Adoption of innovation would be less likely if innovation is considered as more challenging to use (Rogers, 2003). It is expected that cloud computing is less complex from the technical perspective. One of the objectives of adopting cloud computing is to facilitate and simplify the use of IT resources. Complexity may appear when integrating cloud computing with the existing process.

Previous studies have shown that complexity factor has a significant effect on cloud computing adoption (Alshamaila et al., 2013). Moreover, Parveen and Sulaiman (2008), Sabi, Uzoka, Langmia, and Njeh (2016) and (Gangwar et al., 2015b) found that complexity has a negative effect on perceived usefulness (PU) and perceived ease of use (PEOU). Based on this notion, this research proposes the hypotheses related to complexity as:
-**H3a**: Complexity has a negative effect on PU.
-**H3b**: Complexity has a negative effect on PEU.

d) Data concern

Data concern is seen as loss of data confidentiality and data storage security, and breach of privacy in the business operations. In the context of cloud computing, data concern is very important because data are sent across communication channels of different countries and data storage is in the cloud, which is usually not within the physical access of the data owner. In addition, laws regarding data privacy are different in different countries and therefore there is a possibility to get access to sensitive data and exposure of those data to unauthorized individuals (Tout, Sverdlik, & Lawver, 2009).

In the case of cloud computing, security concern is very high because the data is easy to locate; data is sent across communication channels of different countries, and laws of data privacy are potentially different and as such, there is a possibility to get sensitive data and expose it to the snooping eyes of unauthorized individuals (Gangwar et al., 2015a; Tout et al., 2009). From the literature, data concern can be expressed in term of:

i) Risk - "The potential harm that may arise from some current process or some current event" (Gangwar et al., 2015b). Risk in cloud computing relates to the critical security information it contains; for instance, personally identifiable information, protection of intellectual property and trade secret falling into the hands of unethical people (Bisong & Rahman, 2011).
ii) Threats – These describe what we are trying to protect against. Cloud service providers (CSP) deal with these threats by performing security measurement tests as well as by enforcement of security through contracts with online service provider (Chow et al., 2009). Certain other threats involve lack of standards, loss of physical control of data, regulation at local, among others.
iii) Vulnerability - This is defined as weakness in security system, which leads to causing harm to the system. In case of cloud computing, vulnerability involves cracking, hacking, malicious attacks, and eavesdropping (Pfleeger & Pfleeger, 2006).

A study of (Gangwar et al., 2015a) found that cloud concern security has strong positive effect on perceived usefulness (PU) and perceived ease of use (PEU) . Managing confidential data by external provider is a serious concern. Generally, data concern is considered as a serious barrier for the adoption of cloud computing. Based on this notion, this research proposes the hypotheses related to data concern as:

-H4a: Data Concern has a negative effect on PU.
-H4b: Data Concern has a negative effect on PEU.

3.2.2 Organizational Factors

Organizational factors indicate the characteristics and resources of an organization that constrain or facilitate the innovation adoption (Tornatzky et al., 1990). Organizational context is significant to this research as organization and its top management support is the key determinant in potential process change, culture and work relationship when it comes to new technology (e.g., cloud computing) adoption. There are three (3) factors in the organizational context that are identified as significant and included in this research, which are top management support, organizational readiness and skill of IT professional.

a) Top management Support

Top management support is considered as one of the important organizational factors in adoption of new technologies such as cloud computing (Oliveira et al., 2014; Tweel, 2012). Top management support indicates the attitude of the management of an organization towards the level of support devoted to the relevant new technology for adoption. If the top management is satisfied with the current technology adopted and feel no pressing needs for new technology or they might are reluctant to take risks with the new technological adoption, thus the new technology adoption will not be supported (Alshamaila et al., 2013; Oliveira et al., 2014). In addition, if top management buy-in is not attained for a new technology adoption, it is anticipated that top management will forsake the technology and direct the resources to other initiatives that they support (A. Tashkandi & Al-Jabri, 2015). Top management support can assist the adoption process of cloud computing by sending positive perceptions to the staff in HEIs. In addition, adoption of new technology such as cloud computing requires change management in HEIs to adapt with this new technology.

Haderi and Saleh (2012) found that top management support has positive effect on perceived usefulness (PU) and perceived ease of use (PEOU) using Technology Acceptance Model in Yemeni environment. Similarly, (Gangwar et al., 2015a) found that top management support has appositive effect on perceived usefulness (PU) and perceived ease of use (PEU). Based on this notion, this research proposes the hypotheses related to top management support as:

+H5a: Top Management Support (TMS) has a positive effect on Perceived Usefulness (PU)

+H5b: Top Management Support (TMS) has a positive effect on Perceived Ease of Use Top management support has a significant effect on PEU.

b) Technology Readiness

Technology readiness is defined as "managers' perception and evaluation of the degree to which they believe that their organization has the resources, commitment, awareness and governance to adopt IT (Tan et al., 2007). Technology readiness includes human resources and infrastructure for cloud computing usage and management (Musawa & Wahab, 2012; Oliveira & Martins, 2010a). The study of (Gangwar et al., 2015a) found that technology readiness has a positive effect on perceived usefulness (PU) and perceived ease of use (PEU) because organizations which have efficient infrastructure, financial support and expertise have a higher tendency to adopt cloud computing. This is also supported in studies by (Alkhater et al., 2014; Barth, 2015; Low et al., 2011) Based on this notion, this research proposes the hypotheses related to organizational readiness as:

+H6a: Technology Readiness (TR) has a positive effect on Perceived Usefulness (PU)

+H6b: Technology Readiness (TR) has a positive effect on Perceived Ease of Use (PEU)

c) Skill of IT Professional

Skill of IT or training is defined as a degree to which a firm instructs its employees in using a tool in terms of quantity and quality (Mehrotra, 2010; Pillania, 2006). Since cloud computing is new technology that have not been adopted and implemented previously by the organization, the employees need to be trained in order improve their skills and knowledge. The training will reduce employees' anxiety and stress about the using of cloud computing and it will provide motivation and more understanding about the benefits of cloud computing (Gangwar et al., 2015b).

As such, skill of IT professional is related to the training that they received as training may help to decrease ambiguity and assist employees in improving and developing knowledge for effective usage in future as well as responsible to know and understand its relevance in their job performance. Therefore, this research perceives that skill of IT professional is related to the trainings that they receive and use these two (2) terms interchangeably. The study of (Lee, Lee, Olson, & Hwan Chung, 2010) found that training and education positively affect perceived usefulness (PU) and perceived ease of use (PEOU). Similarly, (Gangwar et al., 2015a) and (Kerimoglu, Basoglu, & Daim, 2008) found that training and education have impact on perceived usefulness (PU) and perceived ease of use (PEOU). Furthermore, Al-Ansi, Ismail, and Al-Swidi (2013) study indicated that training is a significant factor influencing IT utilization in Yemen. Based on this notion, this research proposes the hypotheses related to skill of IT professional as:

+H7a: Skill of IT Professional (ITSK) has a positive effect on Perceived Usefulness (PU)

+H7b: Skill of IT Professional (ITSK) has a positive effect on Perceived Ease of Use (PEU)

3.2.3 Environmental Factors

Environmental context describes the external factors to the higher educational institutions (HEIs) that could affect the adoption of cloud computing in the HEIs (Alshamaila et al., 2013; Hsu et al., 2014; Oliveira et al., 2014; Tornatzky et al., 1990). Environmental context is important to be included in this research as HEIs need to understand to the extent to which cloud computing adoption decisions are going to be influenced by awareness and regulatory policy, which are seen as the two (2) factors in the environmental context that are relevant to this research.

a) Regulatory policy

Regulatory policy indicates the policies imposed by the government to regulate cloud computing market (Tashkandi & Al-Jabri, 2015). The issues extend from government tax policies to privacy and security concern in the academic situation (Pan & Jang, 2008; Zhu, Kraemer, & Xu, 2006). It is very important to understand the perceptions with respect to existence and enforcement of rules and regulations that protect clients of cloud services hosted in campus or out of campus.

The study of Barth (2012) found that regulatory policy has a negative effect on adoption cloud computing. The result is similar to that reported by (Alkhater et al., 2014; Borgman, Bahli, Heier, & Schewski, 2013; Klug & Bai, 2015b; Tashkandi & Al-Jabri, 2015). As the cloud computing is a new technology, it is anticipated that the perception is negative in Yemen; therefore, this research proposes the hypothesis related to Regulatory policy as:

-H8: Regulatory policy has a negative effect on the behavioral intention towards cloud computing adoption.

b) Awareness

Awareness refers to how a person understands the activities of others, which provides a context for his own activities (Dourish & Bellotti, 1992). To encourage students, lecturers, and employees to adopt cloud computing services, HEIs should increase the awareness of its employees. Lack of awareness is considered a major concern relating to the development and use of new technology (Jabi, 2015; Nir, 2010; Tusubira & Mulira, 2004).

Sabi, Uzoka, Langmia, Njeh, et al. (2016) and Jabi (2015) found that awareness has a significant effect on intention to adopt cloud computing. As cloud computing is still deemed as a new technology, it is anticipated that awareness will encourage HEIs to adopt cloud computing in Yemen. Therefore, based on this notion, this research proposes the hypothesis related to awareness as:

+H9: Awareness has a positive effect on behavioral intention towards cloud computing adoption.

3.2.4 Individual Factors

Individual context refers to individual characteristics of employees such as behavior, intention and attitude, and how employees interact with the organization. Individual context is important to be included in this research as the enterprise level innovation adoption largely hinges on the decision maker's functional or emotional feelings, reflecting their individual attitudes, perceptions, motivations, psychographics, and other individual factors (Awa et al., 2015). There are four (4) factors in the individual context that are identified as significant and included in this research, which are perceived usefulness, perceived ease of use, attitude and subjective norm.

a) Perceived Usefulness

Perceived Usefulness (PU) is defined as the degree to which the person believes using new technology will enhance her or his performance in an organizational context (Nasri & Charfeddine, 2012). This research defines perceived usefulness (PU) as the degree to which IT professionals believe that adopting cloud computing can assist to enhance the learning outcomes of HEIs in Yemen.

In a related study, Shiau and Chau (2016) found that PU is positively associated with attitude towards studying cloud computing , which is also corroborated by the results in (Al-Somali, Gholami, & Clegg, 2009; M.-C. Lee, 2009; Y. Li & Chang, 2012). PU is considered as a significant indicator because when IT professionals believe that using services of cloud computing can improve performance, productivity and efficiency, then only they are willing to adopt cloud computing (Senk, 2013). Based on this notion, this research proposes the hypotheses related to perceived usefulness (PU) as:

+H10: Perceived Usefulness (PU) has a positive effect on Attitude towards behavioral intention to adopt cloud computing (ATT).

H13: Perceived Usefulness (PU) mediates the relationship between Perceived Ease of Use (PEU) and Attitude (ATT)

b) Perceived Ease of Use

Perceived Ease of Use (PEU) refers to the degree to which the prospective user expects the target system to be free of effort (Davis et al., 1989) . This research defines PEU as the IT professionals' perceptions on the ease of use of cloud computing. PEU has influence on both Perceived Usefulness (PU) and attitude towards behavioral intention.

Study of (Shiau & Chau, 2016) found that Perceived Ease of Use (PEU) is positively associated with both Perceived Usefulness (PU) and attitude toward studying cloud computing classroom. The result is similar to study of (Al-Somali et al., 2009; Lee, 2009; Y. Li & Chang, 2012). PEU of cloud services is considered as an effective motivator in using cloud service because users can use IT solution and computing resources without going into detail or having deep knowledge on how to operate them (CIO, 2011). The TAM model suggests that PEU influences PU, because technologies that are easy to use can be more useful (Schillewaert, Ahearne, Frambach, & Moenaert, 2005). So, following hypotheses are proposed:

+H11a: PEU has positive effect on attitudes towards behavioral intention to adopt cloud computing.
+H11b: PEU has positive effect on PU.

c) Attitude

Attitude refers to individual's negative or positive feeling towards the targeted behavior (Icek Ajzen & Fishbein, 1980). This research defines attitude as a positive or negative feeling of IT professionals towards behavioral intention to adopt cloud computing. The relationship between attitude and behavior intention is fundamental to Technology Acceptance Model (TAM) and Theory of Reasoned Action (TRA).

Shiau and Chau (2016) found that attitude is positively associated with behavioral intention to study in a cloud computing classroom. The result is similar to those reported in prior studies (Al-Somali et al., 2009; Lee, 2009; Y. Li & Chang, 2012). Based on the above arguments, we propose that:

+H12: Attitude has a positive effect on the behavioral intention to adopt cloud computing.

d) Subjective Norm

Subjective Norm (SN) indicates the individual's perception on what most people important to him or her think he or she should or should not be performing a particular behavior (Icek Ajzen & Fishbein, 1975). In this research, subjective norm could be considered as the basis from which IT professionals in HEIs formulate their decisions to adopt cloud computing, which is affected by the recommendations of consultants, technology of publications and experiences from successful implementations of technology in the same organization.

Studies such as (Li & Chang, 2012; Shiau & Chau, 2016; Taylor & Todd, 1995) found that SN has a significant effect on behavioral intention. Thus, it is anticipated that the individuals come up with motivation which encourage them into comply with choices offered by people who are important to them (Hoehle, Scornavacca, & Huff, 2012). In this research, SN is considered to be the key factor in determining attitudes of IT professionals in HEIs towards adopting cloud computing as SN significantly influences IT professionals' attitudes (Nysveen, Pedersen, & Thorbjørnsen, 2005; Schierz, Schilke, & Wirtz, 2010), which may reduce the negative influence of low usefulness and moderate their attitude towards behavioral intention (BI). In this research, while testing the influence of SN on attitude, SN influence on perceived usefulness (PU) is also tested as a moderator. Based on this notion, this research proposes the hypothesis related to subjective norm as:

H14: Subjective Norm (SN) moderates the relationship between Perceived Usefulness (PU) and Attitude (ATT.

In summary, as elaborated earlier, 13 factors are identified to be relevant to this research, which are translated into 22 hypotheses Table 3.2 presents the code and description of research hypotheses.

Table 3.2 Research Hypotheses Codes and Descriptions

Code	Description	Path
Direct Effect of Constructs		
H1a+	Relative Advantage (RA) has a positive effect on Perceived Usefulness (PU)	RA → PU
H1b+	Relative Advantage (RA) has a positive effect on Perceived Ease of Use	RA → PEU
H2a+	Compatibility (CMT) has a positive effect on Perceived Usefulness (PU)	CMT → PU
H2b+	Compatibility (CMT) has a positive effect on Perceived Ease of Use (PEU)	CMT → PEU
H3a-	Complexity (CMX) has a negative effect on Perceived Usefulness (PU)	CMX → PU
H3b-	Complexity (CMX) has a negative effect on Perceived Ease of Use (PEU)	CMX → PEU
H4a-	Data Concern (DC) has a negative effect on Perceived Usefulness (PU)	DC → PU
H4b-	Data Concern (DC) has a negative effect on Perceived Ease of Use (PEU)	DC → PEU
H5a+	Top Management Support (TMS) has a positive effect on Perceived	TMS → PU
H5b+	Top Management Support (TMS) has a positive effect on Perceived Ease of	TMS → PEU
H6a+	Technology Readiness (TR) has a positive effect on Perceived Usefulness	TR → PU
H6b+	Technology Readiness (TR) has a positive effect on Perceived Ease of Use	TR → PEU
H7a+	Skill of IT Professional (ITSK) has a positive effect on Perceived Usefulness	ITSK → PU
H7b+	Skill of IT Professional (ITSK) has a positive effect on Perceived Ease of Use	ITSK → PEU
H8-	Regulatory Policy (RPL) has a negative effect on Behavioral Intention (BHI)	RPL → BHI
H9+	Awareness (AW) has a positive effect on Behavioral Intention (BHI)	AW → BHI
H10+	Perceived Usefulness (PU) has a positive effect on Attitude (ATT)	PU → ATT
H11a+	Perceived Ease of Use (PEU) has a positive effect on Attitude (ATT)	PEU → ATT
H11b+	Perceived Ease of Use (PEU) has a positive effect on Perceived Usefulness	PEU → PU
H12+	Attitude (ATT) has a positive effect on Behavioral Intention (BHI)	AT → BHI
Mediation Effect of Subjective Perceived Usefulness (PU)		
H13	Perceived Usefulness (PU) mediates the relationship between Perceived Ease of Use (PEU) and Attitude (ATT)	PEU→PU→ATT
Moderation Effect of Subjective Norm (SN)		
H14	Subjective Norm (SN) moderates the relationship between Perceived Usefulness (PU) and Attitude (ATT)	(SN*PU)→ATT

3.3 The Proposed Conceptual Model

Based on the review of literature, there is lack of empirical studies on the factors that affect the adoption of cloud computing in higher education. A single theory cannot be applied to all kind of innovations due to the different innovation types (Zmud, 1982). Consequently, an integrated model of theories may need to be applied in determining the adoption of certain types of innovation (Zmud, 1982). Furthermore, a decision to adopt new technology, such as "cloud computing", may involve some risks. A conceptual model that can evaluate the probability of successful application provides a useful guide for elaboration and assessment of successful technology adoption (Liang, Huang, Yeh, & Lin, 2007). Consequently, developing a conceptual model that can predict the applicability of new technology will be worthy. The applicability of technology may be concerned not only with characteristics of technology, but also about the readiness of the context (Tjan, 2001). The organization intending to adopt new technology should assess whether or not the technology characteristics can satisfy the functionality of the organization. Furthermore, it should evaluate its readiness (in the aspects of organizational, technical, environmental, and individual perspective) to use the technology.

In this research, the decision to adopt and use new technology will be determined by IT professionals which comprises of IT experts, IT managers, and IT lecturers whose behavioral intention towards the innovation will affect their recommendations on whether to adopt the innovation or not. As discussed earlier in Chapter 2, Technology Acceptance Model is the first traditional adoption theory in IT field (Benbasat & Barki, 2007; Jones et al., 2011). TAM model provides the basis for uncovering (unveiling) the impacts of external factors on adoption decision. It proposes Perceived Ease of Used (PEOU) and Perceived Usefulness (PU) as primary determinants of IT adoption. Although Technology Acceptance Model (TAM) has been tested for empirical validation, replication and application (Gounaris & Koritos, 2008), the model provides less significant information on user's opinions about adopting a specific system by narrowing its constructs to only PEOU and PU. Hence, the need exists to expand or integrate it with other acceptance models to improve its explanatory and predictive utilities.

The strengths of Diffusion of Innovation Theory (DOI) (Rogers, 1995) and Theory of Reasoned Action (TRA) (Ajzen, 1991) have been explored to improve TAM by adding external variables that affect the technology adoption. Although TRA theory and TAM model ignored the effects of social, psychological and interpersonal variables on IT adoption decision (Ukoha, Awa, Nwuche, & Asiegbu, 2011), TRA theory complemented TAM Model by adding subjective norms (SN) to describe perception of difficulty. Taylor and Todd (1995) believed that TRA theory's explanatory and productive utilities are better enhanced by integrating it with TAM.

Moreover, the Technology –Organization-Environment (TOE) framework supposes a generic set of factors to predict the probability of technology adoption. TOE framework suggests that adoption is affected by technological context (Kauffman & Walden, 2001), organizational context (Chatterjee, Grewal, & Sambamurthy, 2002), and environmental context (Kowtha & Choon, 2001). Technological context explains that adoption relies on the pool of technologies outside and inside of the firm. Organizational context describes the characteristics and resources of the firm that constrain or facilitate the adoption of innovation. Environmental context refers to the inhibiting and facilitating factors in the area of operations. The major snag of TOE framework is its nature of just being a taxonomy for categorizing variables and it does not represent a developed theory (Dedrick & West, 2003). According to Low et al. (2011), TOE framework has no major constructs, hence, there is a need to integrate it with other acceptance models to provide richer theoretical underpinnings to understand the behavior of adoption.

The current literature shows that there are a number of existing cloud computing frameworks (Alkhater et al., 2014; Alshamaila et al., 2013; Awa et al., 2015; Gangwar et al., 2015b; Klug & Bai, 2015b; Low et al., 2011). However, the existing cloud computing frameworks are not suitable to be adopted in Yemeni education sector for several reasons. Among the reasons are: first, majority of the cloud computing frameworks that exist are adopted in the business sector, whose environment differs from that of the education sector. Second, majority of such frameworks have been implemented in the education sector of the West (e.g., European countries, the U.S., and Canada); where such countries have distinct education systems and environments that differ from that of Yemen's education system. Lastly, the existing cloud computing frameworks place emphasis on the factors influencing cloud computing at the level of the organization and these include pricing mechanisms, security details and issues relating to implementation, with the factors influencing the adoption from the perspective of the individual/user (e.g., perceived ease of use) are largely under explored.

Based on literature review, this research's underpinning theories comprise of multiple technology adoption models including Technology Organization Environment (TOE), which was developed by (Tornatzky et al., 1990) , Diffusion of Innovation (DOI), Technology Acceptance Model (TAM), and Theory of Reasoned Action (TRA). Many studies (Alkhater et al., 2014; Alshamaila et al., 2013; Awa et al., 2015; Cheng & Bounfour, 2015; Gamage, 2019; Gangwar et al., 2015b; Klug & Bai, 2015b; Lee, 2009; Low et al., 2011; Shiau & Chau, 2016) have justified the dominant, significant and relevant role of multiple models in explaining technology adoption at the individual level and organizational level. The conceptual model was developed by integrating all theories that are appropriate to address the problems in Yemen for the successful adoption of cloud computing in higher education. The integration of constructs was conducted in both non-human (technical) and human (social) to offer an enriching theoretical framework for predicting and explaining adoption behavior. Moreover, the proposed conceptual model consists of the following variables: technology context (relative advantage, complexity, compatibility, data concern), organizational context (top management support, skill of IT professional, technology readiness), environmental factors (regulatory policy, awareness), and individual context (perceived usefulness, perceived ease of use, attitude, subjective Norm). Figure 3.1 presents the conceptual model .

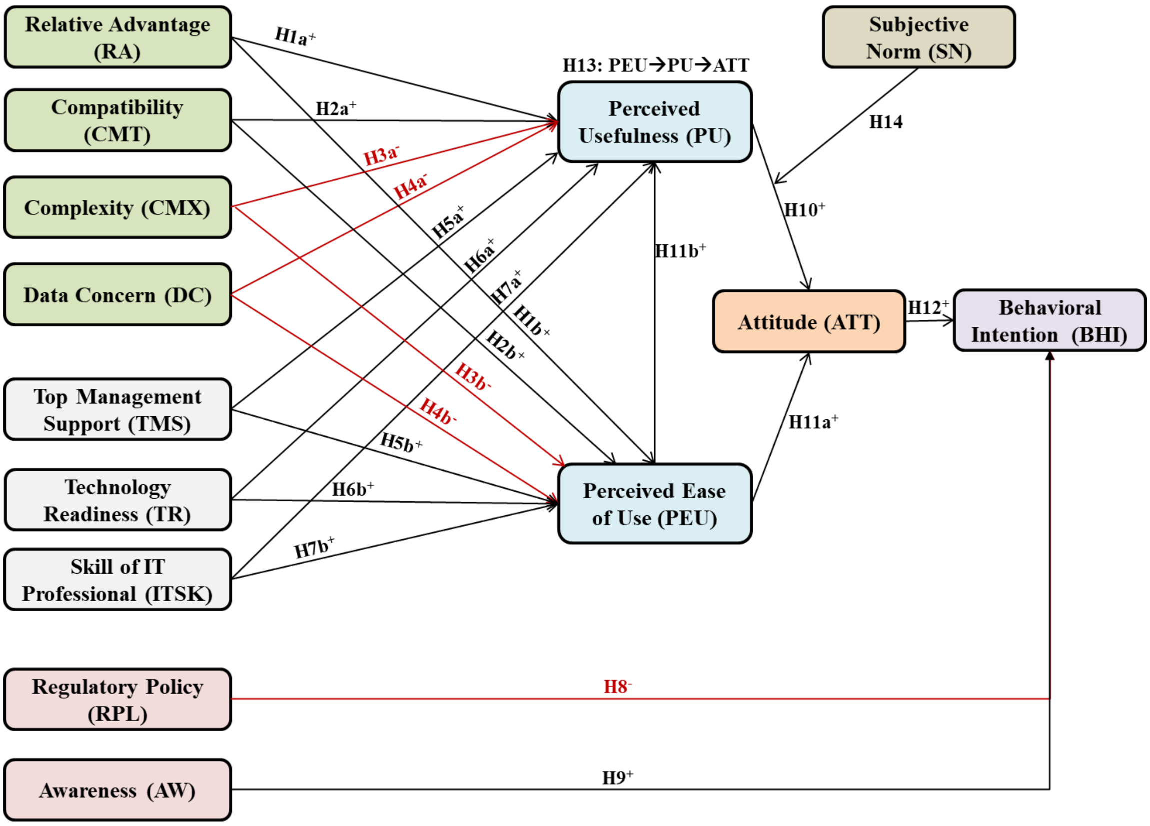

Figure 3. 1 A Cloud Computing Adoption Model

Table 3.3 lists the variables that are proposed in the conceptual model, which comprises of nine (9) independent variables, one (1) mediating variables and one (1) moderating variables.

Table 3.3 Constructs of the Research

Factors	Variable	Types	Authors
Technological Context	Relative advantage	IV	(Sabi, Uzoka, Langmia, & Njeh, 2016; Klug & Bai, 2015b; A. Tashkandi & I. Al-Jabri, 2015; Gangwar et al., 2015b; Polyviou & Pouloudi, 2015; Alkhater et al., 2014; Tehrani & Shirazi, 2014; Alshamaila et al., 2013; Borgman et al., 2013; M. Tan & Lin, 2012; Tweel, 2012; Powelson, 2011; Low et al., 2011).
	Compatibility	IV	(Sabi, Uzoka, Langmia, & Njeh, 2016; Klug & Bai, 2015b; A. Tashkandi & I. Al-Jabri, 2015;

			Gangwar et al., 2015b; Polyviou & Pouloudi, 2015; Alkhater et al., 2014; Tehrani & Shirazi, 2014; Ibrahim, 2014; Alshamaila et al., 2013; Borgman et al., 2013; M. Tan & Lin, 2012; Tweel, 2012; Powelson, 2011; Low et al., 2011).
	Complexity	IV	(Sabi, Uzoka, Langmia, & Njeh, 2016; Klug & Bai, 2015b; A. Tashkandi & I. Al-Jabri, 2015; Gangwar et al., 2015b; Polyviou & Pouloudi, 2015; Barth, 2015; Alkhater et al., 2014; Tehrani & Shirazi, 2014; Ibrahim, 2014; Alshamaila et al., 2013; Borgman et al., 2013; M. Tan & Lin, 2012; Powelson, 2011; Low et al., 2011).
	Data Concern	IV	(Sabi, Uzoka, Langmia, & Njeh, 2016; A. Tashkandi & I. Al-Jabri, 2015; Gangwar et al., 2015a; Lian, 2015; Gupta, Seetharaman, & Raj, 2013; Stankov, Miroshnychenko, & Kurbel, 2012; Ross, 2010).
Organizational Context	Top Management Support	IV	(Tashkandi &Al-Jabri, 2015; Gangwar et al., 2015a; Alkhater et al., 2014; Mansour, 2013; Alshamaila et al., 2013; Borgman et al., 2013; Tweel, 2012; Low et al., 2011).
	Technology Readiness	IV	(Sabi, Uzoka, Langmia, & Njeh, 2016; Klug & Bai, 2015b; Gangwar et al., 2015a; Barth, 2015; Alkhater et al., 2014; Tweel, 2012; Low et al., 2011).

	Skills of IT staff	IV	(Gangwar et al., 2015a; Tehrani & Shirazi, 2014; Mansour, 2013; Alshamaila et al., 2013; Borgman et al., 2013).
Environmental Context	Regulatory policy	IV	Barth, 2015; Klug & Bai, 2015b; A. Tashkandi & I. Al-Jabri, 2015; Alkhater et al., 2014; Borgman et al., 2013).
	Awareness	IV	(Sabi, Uzoka, Langmia, Njeh, et al., 2016); (Jabi, 2015).
Individual Context	Attitude	DV	(Shiau & Chau, 2016; Y. Li & Chang, 2012; M.-C. Lee, 2009; Al-Somali et al., 2009).
	PU	Mediating	(Shiau & Chau, 2016; Y. Li & Chang, 2012; M.-C. Lee, 2009; Al-Somali et al., 2009).
	PEOU	DV	(Shiau & Chau, 2016; Y. Li & Chang, 2012;M.-C. Lee, 2009;Al-Somali et al., 2009).
	SN	Modiator	(Shiau & Chau, 2016; Lian, 2015; (Y. Li & Chang, 2012; Opitz, Langkau, Schmidt, & Kolbe, 2012; Schierz et al., 2010; M.-C. Lee, 2009; Nysveen et al., 2005; Taylor & Todd, 1995).
BI to adopt cloud computing		DV	(Shiau & Chau, 2016; Aharony, 2015; Lian, 2015; Ibrahim, 2014; Opitz et al., 2012; Y. Li & Chang, 2012).

The measurement of each factor was determined based on literature review, which was cited in various reputable journals. Table 3.4 summarizes the hypotheses addressed in this research and their sources of references.

Table 3.4 Summary of Hypotheses

Hypothesis	**References**
+H1a: Relative advantage has a positive effect on PU.	(Gangwar et al., 2015a; Sabi, Uzoka, Langmia, & Njeh, 2016).
+H1b: Relative advantage has a positive effect on PEOU.	(Gangwar et al., 2015a; Sabi, Uzoka, Langmia, & Njeh, 2016).
+H2a: Compatibility has a positive effect on PU.	(Gangwar et al., 2015a; Sabi, Uzoka, Langmia, & Njeh, 2016); Ibrahim, 2014);Y.-M. Cheng, 2014).
+H2b: Compatibility has a positive effect on PEOU.	(Gangwar et al., 2015a; Sabi, Uzoka, Langmia, & Njeh, 2016; Ibrahim, 2014; Y.-M. Cheng, 2014).
-H3a: Complexity has a negative effect on PU.	(Parveen & Sulaiman, 2008; Gangwar et al., 2015b; Sabi, Uzoka, Langmia, & Njeh, 2016).
-H3b: Complexity has a negative effect on PEOU.	(Parveen & Sulaiman, 2008; Gangwar et al., 2015b; Sabi, Uzoka, Langmia, & Njeh, 2016).
-H4a: Data concern (Security) has a negative effect on PU.	(Ibrahim, 2014; Gangwar et al., 2015a).
H4b: Data Concern (Security) has a negative effect on PEOU.	(Ibrahim, 2014; Gangwar et al., 2015a).
+H5a: Top management support has a significant effect on PU.	(Haderi & Saleh, 2012; Gangwar et al., 2015a; Al-Mamary, Shamsuddin, & Hamid, 2015).
+H5b: Top management support has a significant effect on PEOU.	(Haderi & Saleh, 2012; Gangwar et al., 2015a).
+H6a: Organizational readiness has a significant effect on PU.	(Gangwar et al., 2015b; Barth, 2015; Alkhater et al., 2014; Low et al., 2011).
+H6b: Technology readiness has a significant effect on PEOU.	(Gangwar et al., 2015b; Barth, 2015; Alkhater et al., 2014; Low et al., 2011).
+H7a: Skill of IT has a significant effect on PU.	(Kerimoglu et al., 2008; Lee et al., 2010; Gangwar et al., 2015a).
+H7b: Skill of IT has a significant effect on PEOU.	(Kerimoglu et al., 2008; Lee et al., 2010; Al-Ansi et al., 2013; Gangwar et al., 2015a).
-H8: Regulatory policy has a negative effect on behavioral intention towards cloud computing adoption.	(Borgman et al., 2013; Alkhater et al., 2014; (Klug & Bai, 2015b; A. Tashkandi & I. Al-Jabri, 2015).
+H9: Awareness has a positive effect on behavioral intention towards cloud computing adoption.	(Sabi, Uzoka, Langmia, Njeh, et al., 2016; Jabi, 2015).
+H10. PU has a positive effect on attitudes towards behavioral intention to adopt cloud computing.	(M.-C. Lee, 2009; Al-Somali et al., 2009; Y. Li & Chang, 2012; Shiau & Chau, 2016).

+H11a. PEOU has a positive effect on attitudes towards behavioral intention to adopt cloud computing.	(M.-C. Lee, 2009; Al-Somali et al., 2009; (Y. Li & Chang, 2012; Shiau & Chau, 2016).
+H11b. PEOU has a positive effect on PU.	(M.-C. Lee, 2009; Al-Somali et al., 2009; (Y. Li & Chang, 2012; Shiau & Chau, 2016).
+H12. Attitude has a positive effect on behavioral intention to adopt cloud computing.	(M.-C. Lee, 2009; Al-Somali et al., 2009; (Y. Li & Chang, 2012; Shiau & Chau, 2016).
H13. Perceived Usefulness (PU) mediates the relationship between Perceived Ease of Use (PEU) and Attitude (ATT)	(Mohammadi, 2014)
H12. Subjective Norm (SN) moderates the influence of perceived usefulness (PU) on attitude towards behavioral intention to adopt cloud computing.	(Taylor & Todd, 1995; Y. Li & Chang, 2012; Shiau & Chau, 2016).

3.4 Chapter Summary

The importance of information communication technology (ICT) for learning outcome in education sector drives the decision makers to put into consideration the significance of factors that influence the acceptance of technology adoption to improve and enhance the quality of education in the education sector. A systematic literature review (SLR) was adopted for identifying the factors that influence cloud computing adoption. Next, these identified factors were used in developing the conceptual model. This reserch determined the variables included in the conceptual model based on literature review and theories that were discussed in Chapter 2. As shows in Table 3.3 the proposed conceptual model consists of nine (9) independent variables, one (1) mediator variable and one (1) moderator variable.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

The objective of this chapter is to show, justify and discuss the methodology that was adopted for this research containing research approach, research paradigm, research method and techniques. Choosing the proper research methodology is a fundamental part in defining steps which will be taken for answering the research questions. According to Blaikie (2007), research questions have a relationship with research approach, research paradigm and method (as illustrated in Figure 4.1).

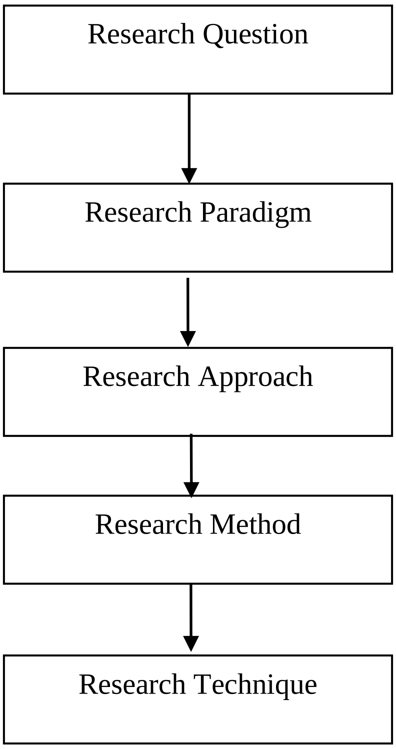

Figure 4.1 Research Methodology

According to Blaikie (2007), the reliability and validity of research findings rely on the robustness of the adopted methodology. Before a research can be undertaken, the related choices concerning the research problem, research questions, and choosing of research paradigm and research strategy, have to be identified (Blaikie, 2007). The problem that was investigated in this research is identifying the factors that influence the adoption of cloud computing in higher education institutions (HEI) in Yemen. The most important part of a research is the research questions. Consequently, the research problem must to be translated into research questions that determine the scope of the study. Then, qualitative or quantitative research method or mixed research method should be chosen.

4.2 Research Paradigm

Paradigm is a set of assumptions which explain the way of thinking about how to gain knowledge and conduct research. According to Oates (2005), information systems research is based on assumption of three (3) paradigms which called interpretive, positivist, and critical.

An interpretive paradigm is the epistemology that includes the phenomenon subjectively and stimulate researcher to be more inductive (Walsham, 2006). Interpretivism supposes that reality can be get it by understanding phenomenon and how it is perceived by researcher and people (Clarke, 2000; Myers & Avison, 2002). Interpretive researchers spend a lot of effort to interpretive phenomenon. They suppose that reality is communicated by means of social constructions for instance perceptions, language, and understanding (Myers & Avison, 2002; Oates, 2005). According to Walsham (2006), interpretivism is suitable when the study from a different cultural context takes into consideration different professionals' opinion in different organizations. Thence, it provides worthy guidelines how the case studies are conducted.

Positivist paradigm is considered the oldest among the three (3) paradigms. It depends on scientific method which is the approach to research in natural science (Oates, 2005). According to Yin (1994), the positivist approach tests theory for formal propositions and developing hypotheses. A lot of assumptions and features were attributed to the positivist paradigm. For example, phenomenon and researcher under the study are independent entities, and researchers reveal facts by testing hypothesis. Positivist paradigm supposes that reality is objectively given, can be measure, and it is concerned with testing theories and hypothesis with quantifiable measures(Myers & Avison, 2002).

The third paradigm is the critical research which supposes that reality historically established and recreated by people. In critical research, reality is recreated by people who cannot easily change the economic status and social due to some constraints. According to Oates (2005), the main task of critical research is to discover the contradictions, conflicts, and challenges related with the social reality, in order to release and empower people.

In conclusion, this research adopted the positivist epistemology. This is because the technology adoption (of cloud computing) which is the focus of this research is well defined and is considered to be one of the most matured area in Information System (IS) research. Furthermore, a number of constructs (independent and dependent variables) that are studied in this research are available from the literature, which can be adapted to study the adoption of new technology.

4.3 Research Approaches

There are two (2) kinds of approaches to conduct a research, qualitative and quantitative. The qualitative research was grounded in social science with the intention of investigating social and cultural phenomenon while quantitative research was developed in natural science for studying natural phenomenon (Myers & Avison, 2002). Qualitative approach is subjective and mainly related to the interpretive paradigm while quantitative approach is objective and mainly related to the positivist paradigm (Johnson & Onwuegbuzie, 2004; Oates, 2005). However, qualitative and quantitative can be utilized with any research paradigm, interpretive, positivist, and critical, replying on the assumptions of the researcher.

Qualitative approach generates rich, descriptive data that assist in identifying and interpreting social phenomenon (Boeije, 2009), whilst quantitative approach deals with numeric data that depends on statistics (Oates, 2005). Qualitative researchers study a phenomenon via answering what, how, and why types of questions whereas quantitative researchers study a phenomenon through breaking it down into quantifiable categories (Oates, 2005). Furthermore, quantitative approach focuses on hypothesis testing and fixes measurements, whereas qualitative approach is more flexible and provides intention to the meaning (Denzin & Lincoln, 2008). Table 4.1 presents the comparison between qualitative and quantitative methods.

Table 4.1 Comparison between Qualitative and Quantitative Methods

(adapted from (Denscombe, 2014)

	Qualitative	**Quantitative**
Approach	Inductive	Deductive
Main elements	Words, feeling, Emotions, vision, sound.	Calculations, Numbers, Formulas
Procedures	Research procedure Cannot replicate	Research procedures can be Replicated
Measures	Measurements are created taking into account unique aspect of the study	Standard exist measurements
Size of the sample	Usually small	Usually large
Presentation	Tend to be in the form of texts	Statistic, graph, table, and chart
Data Collection Methods	Interviews, focus group	Survey

Mixed method approach is defined as way to combine both qualitative and quantitative to contribute to more strong results. According to (Creswell, 2013), there are three (3) kinds of mixed method strategy : (1) sequential explanatory mixed method includes a first step of quantitative data collection and analysis followed by the collection and analysis of qualitative data in second step that builds on the results of the initial quantitative step. (2) Sequential exploratory mixed method includes a first step of qualitative data collection and analysis followed by a second step of quantitative data collection and analysis that builds on the results of the first qualitative step. (3) Concurrent mixed method includes combining quantitative and qualitative data in order to provide a comprehensive analysis of the research problem. The researcher collects both forms of data (qualitative & quantitative) concurrently.

4.4 Research Design

Research design is the total plan within which the conceptual research problems are related to the relevant and realizable empirical research (Ghauri & Grønhaug, 2005). Research design depicts the methods, required data to be collected and analyzed, and how to answer the research questions. Figure 4.2 presents the operational framework that shows the stages and activities/steps undertaken to conduct this research and the outcomes of the stages. This research consists of five (5) main phases: research problem formulation, model development, methods selection, and instrument and data collection and analysis and results.

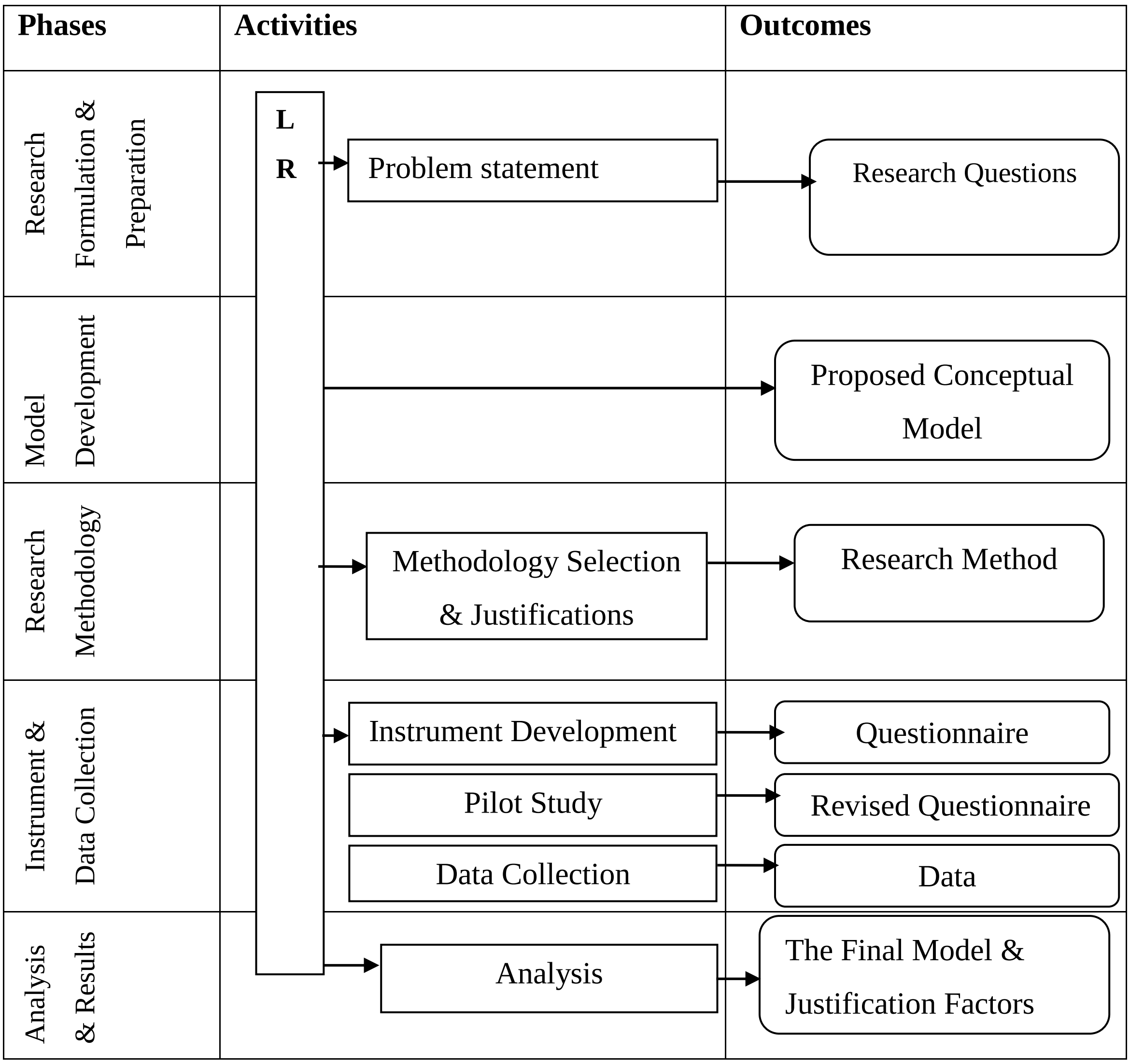

Figure 4. 2 Research Operational Framework

Phase 1: Research Formulation

This research starts by formulating the main research question through identifying the problem statement. The real problem is lack of understanding on the factors that affect the adoption of cloud computing in HEIs in developing countries specifically in Yemen.

Phase 2: Model Development

For answering the main research question which is 'What is the proposed conceptual model that can be used to examine the impact factors on the adoption cloud computing in HEIs in developing countries?", the researcher proposed a conceptual model for examining the factors that affect cloud computing adoption in higher educations HEIs in developing countries. The initial proposed conceptual model, which is replied on based on integrating of TAM-DOI, TOE, TRA, was explained in Chapter 3.

Phase 3: Methodology Selection

This research adopted the quantitative approach. The quantitative survey method was chosen based on the assumption of researcher's positivist paradigm, research problem, and research question.

Phase 4: Instrument and Data Collection

To examine the variables and concepts in the proposed conceptual model and verifying the significant factors on cloud computing adoption for HEIs of Yemen, the quantitative survey is developed. The questionnaire undergone a set of procedures to ensure its reliability and validity whereby pilot study, content validity, and pre-test are applied. The questionnaire is targeted the sample in higher education in Yemen to collect the required data for validating the conceptualmodel .

Phase 5: Data Analysis

In this stage, the collected data are prepared for analysis. It is verified and tabulated against missing data. Then, it is used to examine and verify the validity and reliability of the measures. Finally, the relationship and related hypothesizes are examined and final conceptual model is pre-tested.

4.5 Research Methods

There are a various methods under the category of quantitative approach, for example laboratory experiments and surveys (Myers & Avison, 2002). Moreover, ethnography, case study, grounded theory, and action research are methods fall under category of qualitative approach (Denzin & Lincoln, 2008; Myers & Avison, 2002). In this section, the summarized description for each method, followed by a discussion and explain a justification on the chosen method are discussed.

Experiments method are the method which investigates and test the relationship between cause and effect to prove or disprove hypothesis. A researcher measures the findings of the experiment and interprets as predicting future event (Oates, 2005). A survey is way to collect the same type of data from a large group of population. A researcher analyzes data and then generalize the findings (Oates, 2005).

Ethnography comes from cultural and social anthropology disciplines (Myers, 1997). Researcher spend a lot of time in the context of research for creating cultural and social understandings of phenomena (Myers, 1999). The ethnography provides information systems researchers with rich in-depth and intensive insight about phenomena which is under studying. the main disadvantage of ethnography is that it spend a lot of time from researcher in order to fulfill the study (Myers, 1999; Myers & Avison, 2002).

Case study is an empirical research which describes and investigates phenomena with its real life context. It is proper when the boundaries between the phenomena and its context of research are an ambiguous and not clear (Yin, 2013). Case study researcher attempts to gain detailed information in depth about phenomena (Oates, 2005). The main advantage of a case study is that provides an opportunity to understand the problem (Yin, 2013).

Grounded theory is a set of procedures are applied to develop a theory for a phenomena (Strauss & Corbin, 1994). Researchers who use grounded theory method mainly collect data by using interviews. Then, test phenomena and analyze data with no predefined concept (Allan, 2003). According to Lacey and Luff (2009), grounded theory is distinguished from other qualitative methods because it focuses on theory as final output of study.

Finally, action research is qualitative method that aims to assist in applying social techniques which lead to solve practical social problem (Oates, 2005). Study of (Baskerville & Wood-Harper, 2016) that action research is widely accepted in in organizational development. Study of Oates(2005) argues that goal of action research is to change and make difference instead of only describing and observing.

4.6 Research Methodology Selection

In this research, the suitable research approach is the quantitative approach. Quantitative survey method was chosen for several reasons. Based on the adopted paradigm for this research, the reality can be measured and objectivity can be gained. The researcher supposes that the adoption of new technology is an objective phenomenon with known dimensions and attributes. In addition, to understand the context of research related to higher education, and process where hypotheses are effected by adopting new technology, hypotheses validation and verification are useful. For that reason, this research concerns with testing hypotheses and measure of adoption factors quantifiably. Thence, the positivist paradigm is considered the dominant approach for this research. In addition, the uncertainty of the investigated phenomenon considers as an important factor in choosing a proper research method (Trauth, 2001).

In this research, little is known about cloud computing adoption in developing countries, as such the phenomenon under consideration can be considered as undefined and unexplored. Moreover, depending on the assumption of objectivity of the study, this research points out that the phenomenon under investigation is measurable. For this reason, the positivist study approach was selected to be the main and proper method.

In regards to the area of this research, the researcher investigates the factors effecting cloud computing adoption in education sector by applying different theoretical perspectives. This research attempts to combine various constructs from predominant theories in order to understand the intention to adopt cloud computing. The researcher suggested a conceptual model that explains the issue under investigation. As such, the appropriate approach to conduct this research is quantitative approach via survey method.

4.7 Data Collection and Techniques

4.7.1 Survey

The survey was utilized to collect quantitative data. Applying the survey to gather data includes identifying the population and sampling techniques, validating and developing the instrument, and choosing the proper way of analyzing the collected data.

4.7.2 Sampling

Sampling is a procedure of identifying a part of population who will be the target in a study investigation (Grinnell Jr & Unrau, 2005). First, the population must be identified and then the sample created. A population is all entities (organization, units, person, etc.) which is related to the study (Grinnell Jr & Unrau, 2005). Sampling is a procedure of drawing entities (units or individuals) from population in way that the phenomena can be generalized from the sample to population. There are two (2) main kind of sampling, which are non-probability sampling and probability sampling. Probability sampling is a procedure of choosing a sample in which all units or people have similar probability to be a part of sample. In non-probability sampling, the entities of population do not have the same known probability of being chosen. As a result, sampling involves identifying the unit of analysis, choosing the organizations and participants, and determining the kind of sampling.

Comrey and Lee (1992) claim that sample size of 1,000 respondents or more is considered excellent, 500 is considered very good, 300 is considered good, 200 is considered fair, and 100 is considered poor. This is also corroborated by Wimmer and

Dominick (2008) that sample size of 1000 respondents is recommended as excellent, 500 as very good, and 250 as good.

This research aimed to investigate cloud computing in higher education institutions (HEIs) in Yemen. It means that the subject under investigation is a new technology (cloud computing) adoption. Furthermore, according to the scope of this research, higher education institutions (HEIs) were identified as the context of this research.

Non-probability sampling is selected to be the most proper method for sample in this research. Non-probability sampling method can be categorized into four (4) various types: purposive, quota, judgmental, availability sampling (Grinnell & Williams, 1990). Purposive sampling method is an idealistic for this research because this method oftentimes applied when only a little people have access to the information the researchers looking for (Oliver & Jupp, 2006). According to the purposive sampling method, the individuals selected as the sample are based upon some criteria for example, the knowledge about the topic, willingness and capacity to participate (Oliver & Jupp, 2006).

In this research, the population is first established. There are 6665 academic and administrative staff in HEIs in Yemen. The sample consists of IT professionals who include IT managers, IT staff and IT lecturers in Yemeni higher education institutions who are responsible for adopting, implementing, and managing cloud computing in higher education. The purposive sampling method is selected for this research as it requires the potential respondents to have some fundamentals knowledge of IT and cloud computing. Furthermore, the objective of this research is to examine the factors that influence cloud computing adoption in higher education institutions from the perspective of IT professionals as their perceptions could lead to rapid adoption or rejection of the new technology proposed. 571 questionnaires were distributed and 288 questionnaires were returned (50.4% of response rate).

4.7.3 Survey Instrument Development

The quality of information acquired from a survey is directly proportionate to the quality of survey (Peterson, 2000).Thus, designing survey is a complex process and challenging (Creswell, 2002). Consequently, the questionnaire must be designed carefully for taking consideration the main issues for instance, wording, length, sequence and order of questions, and the layout. The questionnaire must have a cover letter to provide a keywords definition to avoid ambiguity. Questionnaire must be divided into a lot of parts to ensure that every part has a clear title that reflects the consistency of items. Moreover, to collect data that efficiently answers the research questions, the questionnaire must be designed that each item is brief and simple as possible and concentrate on specific issue (Alreck & Settle, 1995). Furthermore, to ensure effort and less time to answer the questions, questions must be classified by scales as well as by topics and expressed with proper technical words (Alreck & Settle, 1995).

4.7.4 Survey Design and Contents

The questionnaire in this research includes an introduction that depicts the terms used in the questionnaire. Next, the questionnaire is divided into four (4) parts. Each part has a certain purpose. Table 4.2 provides a summary description of these parts of questionnaire.

The first part of this questionnaire, Part A is designed and developed for investigating the current barriers and challenges to adopt cloud computing in higher education institutions in Yemen, which are based upon the notions extracted from the literature review (see Appendix D). The second part, Part B, is aimed to examine the respondents' perceptions of the benefits and drivers of cloud computing in the context of higher education. The questions are constructed via reviewing the drivers of adopting cloud computing in different cases in the world. The data gathered from this part is analyzed and linked to the challenges and barriers in Part A. The third part, which is Part C is related to the objective of this research which is identifying the factors that effect cloud computing adoption in higher education institutions. It is considered the main part of the questionnaire because it was used to verify the hypotheses of the conceptual model.

Table 4.2 The Questionnaire Structure

Part	Title	Description
A	Barriers and Challenges	Investigate the existing barriers and challenges to adopt cloud computing in higher education. The items of this part of questionnaire are developed replied on the challenges which are extracted by literature review.
B	Cloud Computing Adoption Drivers	Examine the respondents' perceptions of cloud computing benefits and drivers in the context of higher education. The items of this part built via reviewing of the drivers of adoption cloud computing in different cases studies in the world. This part related to objective 2
C	Cloud Computing Adoption Factors	Developed based on theoretical proposed framework. The items of this part of questionnaire adapted from the related literature review.

To develop the instrument scale, the definition of each construct is reviewed based on on theories and literature review. Next, the dimensions of each construct are identified. To measure each construct, the items are adapted and adopted from the literature review in the domain realted to investigation of cloud computing and which are relevant to the context of this research. Table 4.3 presents the detailed list of dimensions for each construct included in the instrument.

Table 4.3 Questionnaire Items Development Based on the Literature

Construct	No of Item	References
Relative advantage	4	(Hsu et al., 2014, Gangwar et al., 2015b, Oliveira et al., 2014).
Compatibility	4	(Alshamaila et al., 2013, Lian, Yen, & Wang, 2014, Oliveira et al., 2014).
Data Concern	4	(Tashkandi & Al-Jabri, 2015, Hsu et al., 2014).
Complexity	5	(Klug & Bai, 2015a, (Hsu et al., 2014, Espadanal, 2012)
Top Management Support	5	(Lian et al., 2014, (Hsu et al., 2014,Gangwar et al., 2015b, Mansour, 2013).
Technology Readiness	4	(Gangwar et al., 2015a, abi, Uzoka, Langmia, Njeh, et al., 2016, Mohammed, Ibrahim, Nilashi, & Alzurqa, 2017).

Skill of IT Staff	4	(Mansour, 2013)
Regulatory policy	5	(Tashkandi & Al-Jabri, 2015, Klug & Bai, 2015a) (Mohammed et al., 2017, Espadanal, 2012).
Awareness	4	(Sabi, Uzoka, Langmia, Njeh, et al., 2016,Jabi, 2015)
Perceived Usefulness	6	(Sabi, Uzoka, Langmia, Njeh, et al., 2016, (Ekufu, 2012)
Perceived Ease of Use	4	(Sabi, Uzoka, Langmia, Njeh, et al., 2016, Ekufu, 2012, Cheng, Lam, & Yeung, 2006)
Attitude	4	(Taylor & Todd, 1995)
Subjective Norm	3	(Ekufu, 2012, Taylor & Todd, 1995)
Adoption Intention	3	(Liu, Li, & Carlsson, 2010)

4.8 Validity and Reliability

According to Forzano and Gravetter (2009), validity is the degree to which an instrument measure what it claims to measure. Validity allows researcher to find if the study fits the reality and if the researcher measures what he wants to measure (Churchill Jr, 1979). Reliability is defined as the degree to which an instrument can create consistent results from measurement errors (Churchill Jr, 1979). To ensure the validity and reliability of the instrument, content validity, pilot study, and pre-testing are conducted for this research.

4.8.1 Content Validity

Content validity of construct of instrument is defined as the degree to which a group of items form a sufficient operational definition of the construct (Polit & Beck, 2006). To ensure content validly of the instrument for this research, five (5) experts evaluated the items in each construct. To assist the content validity evaluation, a form was developed to allow the experts to assess the instrument from the following perspectives (as elaborated in Appendix C in details) :

- If each item is related to terms of domain (Cloud computing).
- Whether there are any necessary changes in the wording of items.
- If the items comprehensively represent the total domain (Cloud computing).

The evaluation of experts' items relevance was analysed for each constructs. The Content Validity Index (CVI) was used to analyze for finding considerable consistency for item- level which is called I-CVIs (Polit & Beck, 2006). There are two (2) kinds of CVI. Item level (I-CVI), which includes validity of individual items and the Scale Level (S-CVI) which measures the validity of total scale (Polit & Beck, 2006). The Item –Level (I-CVI) is calculated by number of agreements (number of experts giving a rating of item relevance) divided by the overall number of experts. For this research, the results showed that Item-Level (I-CVI) for all items override the criteria of item suggested by (Polit & Beck, 2006), which is 0.78. (See Appendix E for detail explanation). In addition, there are two (2) ways for calculating the scale level (S-CVI). One requires to compute the universal agreement among experts, which is called S-CVI/UA). It measures the ratio of items that achieved ratings of relevance by all experts. The other way for calculating S-CVI is by computing the average of I-CVI across items which is called S-CVI-Ave. The result of calculating the S-CVI for this research show that S-CVI/UA and S-CVI/Ave are 0.855 and 0.95 respectively. These values are acceptable for S-CVI identified by Davis (1992), which is 0.80. Furthermore, each expert was given opportunity to comment for each item or for the whole construct. Based on the comments made by the experts, the instrument was updated accordingly (in the term of wording).

4.8.2 Pre-test

Pre-testing is a procedure in which small group of respondents will evaluate the instrument in term of simplicity, vocabulary and grammar, focus, and ambiguity of wording (Creswell, 2002). Pre-testing assists to determine whether respondents can understand the question or not. Sample of IT professionals were included in this procedure. Based on feedback from respondents, the researcher did some updates and editing to some of the mesurment items. Most of the comments from the raters were related to the translation to Arabic. The validity of the instruments used in the questionnaire according to the comments of five (5) IT professionals are presented in Table 4.4

Table 4.4 Validity of the Questions according to 5 Respondents's Answers

Construct	**Item**	**Totally Suitable (5)**	**Suitable (4)**	**Moderate (3)**	**Unsuitable (2)**	**Totally Unsuitable (1)**	**Validity %**
Relative Advantage (RA)	RA1	3	2				92%
	RA2	4	1				96%
	RA3	3	2				92%
	RA4	3	1	1			88%
Compatibility (CMT)	CMT1	2	2		1		80%
	CMT2	2	1	2			80%
	CMT3	4			1		88%
	CMT4	4	1				96%
Complexity (CMX)	CMX1	4	1				96%
	CMX2	4	1				96%
	CMX3	3	2				92%
	CMX4	4	1				96%
Data Concern (DC)	DC1	2	3				88%
	DC2	4	1				96%
	DC3	3	2				92%
	DC4	4	1				96%
Top Management Support (TMS)	TMS1	5	0				100%
	TMS2	3	1	1			88%
	TMS3	3	2				92%
	TMS4	4	1				96%
	TMS5	3	2				92%
Technology Readiness (TR)	TR1	4	1				96%
	TR2	3	2				92%
	TR3	4	1				96%
	TR4	3	2				92%
Skill of IT Professional (ITSK)	ITSK1	3	2				92%
	ITSK2	3	1	1			88%
	ITSK3	4	1				96%
	ITSK4	4	1				96%
Regulatory Policy (RPL)	RPL1	3	1		1		84%
	RPL2	4	1				96%
	RPL3	3	2				92%
Awareness (AW)	AW1	4	1				96%
	AW2	3	1	1			88%
	AW3	3	2				92%
	AW4	4	1				96%
Perceived Usefulness (PU)	PU1	3	1	1			88%
	PU2	4	1				96%
	PU3	4	1				96%
	PU4	2	2		1		80%
Perceived Ease of Use (PEU)	PEU1	3	1	1			88%
	PEU2	3	2				92%
	PEU3	3	1	1			88%

	PEU4	3	1	1			88%
Attitude (ATT)	ATT1	2	2	1			84%
	ATT2	4	1				96%
	ATT3	4	1				96%
	ATT4	2	1	2			80%
Behavioral Intention (BHI)	BHI1	3	2				92%
	BHI2	2	2		1		80%
	BHI3	3	2				92%
Subjective Norm (SN)	SN1	3	1	1			88%
	SN2	4	1				96%
	SN3	3	2				92%
						Total	91%

Example: Calculation the percentage of first question validity

$$V_1 = \frac{(3\times5)+(2\times4)}{5\times5} = \frac{23}{25} = 92\%$$

Calculation the percentage of validity belonging to questions in the questionnaire:

$$V_{Total} = \frac{\sum_{1}^{54} V_i}{54} = 91\%$$

As shown in Table 4.4, the agreement in the perspective of the experts towards the questionnaire was 91%, this could be a considerable result that shows the validity of the instrument used in the questionnaire.

4.8.3 Pilot Study

This research conducted a pilot study to examine the level of the respondents' understanding of the questionnaire and the consistency of the questions. Conducting pilot study have saved many previous studies from failure through the use of responses from the respondents to restructure and modify perceived ambiguous, complicated, and offensive questions (Cooper, Schindler, & Sun, 2006). This research employed the convenience sampling technique in the selection of the sample size for the pilot study. In convenience sampling, data are collected from members of the population who are available and ready to take part in the pilot study.

The validity and reliability of the instrument were tested in the pilot study. The accuracy of the instrument employed in data collection and consistency of the data collected show the validity and the reliability of the instrument and the data respectively. Lodico, Spaulding, and Voegtle (2010) suggested that correlational studies should present proof of the validity and reliability of the instruments used and the data collected respectively. It further suggested the use of a pilot study in a small sample of interested respondents in survey. Pilot test not only enables researcher to determine the validity of an instrument and the reliability of the data, but also help a researcher to estimate the time required to implement the instrument(Slater, 1995).

This research targeted 30 respondents for the pilot study in order to be able to undertake an appropriate statistical testing process, to assess the reliability of the data collected. The respondents were informed logically about the aim of the research. The Cronbach Alpha Coefficient was employed in assessing the data reliability as well as its measurements. In evaluating the quality of the instrument used in this research, it is necessary to first measure the reliability of the data (Jr & Peter, 1984). The Cronbach's Alpha minimum accepted value generally ranges from 0.60 to 0.70 (Hair, Black, Babin, Anderson, & Tatham, 1998). The reliability test results were assessed from the responses of 30 respondents used in the pilot study, and are demonstrated in Table 4.5.

Table 4.5 Reliability Tests for Pilot Study

1st Order Constructs	**Number of Items (54)**	**Internal Reliability (Cronbach Alpha)**
Relative Advantage (RA)	4	0.881
Compatibility (CMT)	4	0.794
Complexity (CMX)	4	0.899
Data Concern (DC)	4	0.885
Top Management Support (TMS)	5	0.797
Technology Readiness (TR)	4	0.792
Skill of IT Professional (ITSK)	4	0.821
Regulatory Policy (RPL)	3	0.849
Awareness (AW)	4	0.893
Perceived Usefulness (PU)	4	0.850
Perceived Ease of Use (PEU)	4	0.827
Attitude (ATT)	4	0.819
Behavioral Intention (BHI)	3	0.860
Subjective Norm (SN)	3	0.823

In this research, the Cronbach's Alpha test for the reliability of the constructs ranged from 0.792 to 0.899, revealing that that all the constructs were above 0.7 which is the minimum cut-off value(Hair, Anderson, & Tatham, 2003). The confirmatory factor analysis (CFA) is usually conducted after the reliability test, to test for the convergent and discriminant validity. However, the CFA assessment could not be conducted in this pilot study because it is not useful in a small sample size, and the sample size of this pilot study was only 30 respondents. Hence, the CFA will be conducted in the analysis of actual data collection. Similarly, the factor loadings evaluation and testing and the Cronbach Alpha's internal reliability will be performed in the final data collection.

4.9 Data Collection Procedure

Data collection was conducted in September 2017. Before the questionnaires were distributed, permission was gained from the Ministry of Higher Education and Ministry of Technical Education. After that, IT managers were informed about the purpose of this research and they were made clear that the information collected was only for academic purposes. Nine (9) public universities and 14 community colleges in Yemen were identified and contacted. The researcher visited each university and community college and met the IT manager and Dean of IT College. After that, the researcher explained and distributed the questionnaires to IT professionals in the HEIs. Consequently, 571 hardcopy questionnaires were distributed and 288 were returned (50.4% of response rate).

4.10 Chapter Summary

For answering research question, a set of assumption must be identified, a research strategy must be followed and proper method must be chosen. This chapter reviewed the research paradigm, research approaches, research strategy and methods. According to the context of this research and its assumptions, the most appreciate research methodology was justified and chosen. Moreover, the selected method and sampling of population were explained. Next, the ways of ensuring validity and reliability of the instrument of data collection were explained. Finally, the research design and operational framework were discussed and elaborated.

CHAPTER 5

RESULT AND DISCUSSION

5.1 Introduction

In this chapter, the analyses used and conducted, and the empirical results obtained from such analyses are examined corresponding to the research hypotheses. Such analyses were conducted using SPSS18 and SMART-PLS 2.0 software and for proper presentation and explanation, the chapter is divided into nine(9) sections. The first section is dedicated to introduction of the chapter and this is followed by an overview of the general assumptions in Structural Equation Modellling (SEM), and the first order latent constructs, with their relative measurement items.

The next section is dedicated to data screening, wherein the utilized procedures for data cleaning involving missing values, outliers and normality testing are presented and described. This is followed by the section that provides the results obtained using Confirmatory Factor Analysis (CFA) to assess the constructs uni-dimensionality, reliability and validity, after which, the descriptive results of the constructs are presented.

The second last section contains the structural models results that tested the hypothesized effects (direct, mediation and moderation) of this research. Lastly, a summary of data analysis results and findings are enumerated.

5.2 An Overview of Structural Equation Modelling (SEM)

The Partial Least Squares (PLS) method is described as a part of Structural Equetion Modellling (SEM) that is used to analyze the causal relationships among constructs through the use of software application called the Smart PLS2.0. PLS technique is best suited for testing complex structural models (Gamage, 2019). According to Henseler, Ringle, and Sinkovics (2009), a two-step approach is used for analyzing data. First, the analysis of the measurement model is described and second, the structural relationships among the latent constructs are examined. These steps are focused on confirming the measures' reliability and validity prior to moving on to assessing the structural model's relationships.

Among the primary benefits of SEM is its effectiveness in assessing construct validity of measurements, in which case, construct validity is described as the measurements accurate ability to gauge (Hair et al., 1998). And in SEM analysis, construct validity is confirmed using two (2) primary components namely, convergent validity and discriminant validity. Convergent validity reflects the similarity in the level of variance among items that indicate a specific construct and it can be gauged through the size of the factor loading (standard regression weights) using Average Variance Extracted (AVE) and construct reliability (CR) on the construct items. Specifically, the factor loading provides an estimate and indicates that the values 0.6 or higher and extracted average variance of 0.5 or higher confirm sufficient convergence of the construct items(Hair et al., 1998). The AVE is measured by dividing the sum square of the standardized factor loading over the number of factor loadings. Meanwhile, the construct reliability (CR) has to be 0.6 or greater for sufficient internal consistency (Bagozzi & Yi, 1988). It is obtained by calculating the square sum of factor loading and sum of error variance terms of a construct (Hair et al., 1998).

In the same line of analysis, the measurement items, representing every variable, have to be confirmed for their internal reliability, where reliability refers to the level to which a measure is free of error. In other words, to ensure that the items produce a reliable scale, the Cronbach's Alpha Coefficient of internal consistency has to be tested. In this regard, the greater the Cronbach's Alpha value, the higher will be the reliability (from 0.00 to 1.00). According to Nunnally and Bernstein (1994), Cronbach's Alpha should exceed 0.70.

Moving on to discriminant validity, it is a type of validity that ensures the construct is distinct from other constructs and it can be evaluated by conducting a comparison of the square root of the AVE for two (2) constructs and their correlations. Discriminant validity is said to be confirmed when the correlation between two (2) constructs is less than the square root of each construct's AVE (Fornell & Larcker, 1981; Hair et al., 1998). Also, the factors' correlations should remain below 0.85 as established by Kline (2011).

The structural model's accuracy can be confirmed through the value of R-squared (R^2), which represents the variance portion in dependent variable that is described by the predictors, and this has to exceed 0.10 (Patterson, 2013). Aside from the R^2 magnitude estimation, recent studies have included the predictive relevance of Stone (1974) and Geisser (1975) to gauge the fit of the model. Such method represents the adequacy of the model to predict the manifest indicators of every latent construct. More specifically, in Stone-Geisser (Q^2), cross-validated redundancy, the computation of it reflects the predictive relevance through the use of PLS blindfolding procedure. The study of Chin (2010) established the guidelines for Q^2 values, in that a value that is greater than zero confirms the predictive relevance of the model.

In order to test the developed hypotheses, Wetzels, Odekerken-Schröder, and Oppen (2009) recommended the use of parameter estimates and coefficient values examination using the bootstrapping method of 1000 replications. Parameter estimates are utilized for the estimation of population covariance matrix of the model (Tabachnick & Fidell, 2007). The values of coefficients are obtained through the division of the variance estimate over the standard error. Here, when the critical value or z-value exceeds 1.96 for a regression weight, then the parameter is deemed to have statistical significance level of 0.05.

Lastly, the f-squared (f^2) may also be utilized for the determination of the effect size, which is only considered with R^2 changes because regression changes in the path coefficients are not as accurate indicators of the same (Carte & Russell, 2003). In relation to this, f^2 is obtained by calculating using the following formula; [R^2(path included model) – R^2(path excluded model)] / [1-R^2(path included model)]. For f-squared not exceeding 0.02, there is no effect size, and for those between 0.02 and 0.15, effect size is small, between 0.15 and 0.35 is medium, and over 0.35 is large.

5.3 Construct Measures

The principal construct measures had their basis on prior developed instruments. The summarized version of the research variables measurement items along with the latent construct are presented in Table 5.1.

Table 5.1 List of Constructs and Measurement Items

1st Order Construct	Number of Items (54)
Relative Advantage (RA)	4
Compatibility (CMT)	4
Complexity (CMX)	4
Data Concern (DC)	4
Top Management Support (TMS)	5
Technology Readiness (TR)	4
Skill of IT Professional (ITSK)	4
Regulatory Policy (RPL)	3
Awareness (AW)	4
Perceived Usefulness (PU)	4
Perceived Ease of Use (PEU)	4
Attitude (ATT)	4
Behavioral Intention (BHI)	3
Subjective Norm (SN)	3

5.4 Data Screening

It is important to screen data to check its correct entry into the software and to confirm the absence of missing values, outliers and normality.

5.4.1 Replacing Missing Values

Missing data arises when the respondents fail to answer one or more survey items. In this research, analysis was conducted for each measurement item for ensuring that the data was free from missing value. Current literature proposes that Expected Maximization method is a suitable method to be used to treat missing data (Graham, Hofer, Donaldson, MacKinnon, & Schafer, 1997). This method is considered because of the fact that the median substitution is the most commonly used methods (Schwab, 2013). The findings of data screening indicate the least number of missing data, which were resolved through variable median response replacement for every measurement item (m) variable.

5.4.2 Removing Outliers

Outliers indicate the observations that have an unusual value for a current variable (Tabachnick & Fidell, 2007). They are identified by using multivariate and univariate detections. For uni-variate detection, besides box-plots and examining histograms, each variable was examined for the standardised (z) score (Tabachnick & Fidell, 2007). According to Hair et al. (2006), a case is considered an outlier if its standard score is between -4.0 and +4.0 or beyond. Thus any Z-score less than -4 or greater than 4 is considered to be an outlier. Table 5.2 presents the standardised (z) scores for the items in each variable.

Table 5.2 Result of Univariate Outlier Based on Standardized values

Construct	**Item**	**Standardized value (Z-Score)**	
		Lower Bound	**Upper Bound**
Relative Advantage (RA)	RA1	-2.262	1.062
	RA2	-2.255	1.145
	RA3	-2.361	1.153
	RA4	-2.331	1.081
Compatibility (CMT)	CMT1	-2.275	1.820
	CMT2	-2.262	1.674
	CMT3	-2.165	1.978
	CMT4	-2.019	1.794
Complexity (CMX)	CMX1	-1.151	2.320
	CMX2	-1.123	2.220
	CMX3	-0.992	2.283
	CMX4	-1.083	2.307
Data Concern (DC)	DC1	-1.741	1.717
	DC2	-1.516	1.791
	DC3	-1.681	1.866
	DC4	-1.784	1.873
Top Management Support (TMS)	TMS1	-1.650	2.092
	TMS2	-2.029	2.206
	TMS3	-2.133	2.103
	TMS4	-1.845	2.048
	TMS5	-1.617	1.788
Technology Readiness (TR)	TR1	-2.472	1.916

	TR2	-2.566	2.024
	TR3	-2.653	1.822
	TR4	-2.397	1.688
Skill of IT Professional (ITSK)	ITSK1	-1.963	1.990
	ITSK2	-2.046	2.011
	ITSK3	-2.209	1.949
	ITSK4	-2.287	1.915
Regulatory Policy (RPL)	RPL1	-2.191	1.456
	RPL2	-2.161	1.473
	RPL3	-2.105	1.339
Awareness (AW)	AW1	-1.708	1.644
	AW2	-1.695	1.805
	AW3	-1.421	2.217
	AW4	-1.663	1.858
Perceived Usefulness (PU)	PU1	-2.267	1.422
	PU2	-2.200	1.617
	PU3	-2.205	1.650
	PU4	-2.191	1.430
Perceived Ease of Use (PEU)	PEU1	-2.382	1.720
	PEU2	-2.156	1.659
	PEU3	-2.255	1.748
	PEU4	-2.650	1.699
Attitude (ATT)	ATT1	-2.835	1.572
	ATT2	-2.547	1.489
	ATT3	-2.696	1.559
	ATT4	-2.990	1.659
Behavioral Intention (BHI)	BHI1	-2.053	1.603
	BHI2	-1.807	1.589
	BHI3	-1.834	1.760
Subjective Norm (SN)	SN1	-2.215	1.504
	SN2	-2.169	1.447
	SN3	-2.235	1.585

As shown in Table 5.2, the findings show that the standardised (z) scores of the cases for the research variables ranged from -2.990 to 2.320, indicating that none of the items exceeded the threshold of ±4. So, no uni-variate outlier was present among the 288 cases.

5.4.3 Assessment of the Data Normality

Data normality was tested to confirm the normal distribution of data because the absence of such distribution evidences the presence of highly skewed distribution to the right or left. According to Brown (2012), non-normal distribution may also be attributed to the presence of kurtotic variables and they can lead to distorted relationships and significant tests. Therefore, this research used SPSS skewness and kurtosis values to evaluate data normality. For univariate normality testing, kurtosis and skewness values have to be lower than 2 and 7 respectively, for sufficient normality (Olsson, Foss, Troye, & Howell, 2000; Oppenheim, 1966). Table 5.3 tabulates the skewness and kurtosis values.

Table 5.3Assessment of Normality of All Items

Construct	**Item**	**Skewness**	**Std. Error of Skewness**	**Kurtosis**	**Std. Error of Kurtosis**
Relative Advantage (RA)	RA1	-0.731	0.144	-0.455	0.286
	RA2	-0.526	0.144	-0.571	0.286
	RA3	-0.706	0.144	-0.182	0.286
	RA4	-0.734	0.144	-0.289	0.286
Compatibility (CMT)	CMT1	-0.074	0.144	-0.327	0.286
	CMT2	-0.265	0.144	-0.496	0.286
	CMT3	0.122	0.144	-0.211	0.286
	CMT4	-0.165	0.144	-0.545	0.286
Complexity (CMX)	CMX1	0.808	0.144	-0.12	0.286
	CMX2	0.761	0.144	-0.244	0.286
	CMX3	0.906	0.144	-0.078	0.286
	CMX4	0.791	0.144	-0.165	0.286
Data Concern (DC)	DC1	-0.109	0.144	-0.832	0.286
	DC2	0.086	0.144	-0.874	0.286
	DC3	0.104	0.144	-0.677	0.286
	DC4	-0.064	0.144	-0.768	0.286
Top Management Support (TMS)	TMS1	0.138	0.144	-0.506	0.286
	TMS2	0.042	0.144	-0.354	0.286
	TMS3	0.122	0.144	-0.284	0.286
	TMS4	-0.081	0.144	-0.349	0.286
	TMS5	0.184	0.144	-0.9	0.286
Technology Readiness (TR)	TR1	-0.301	0.144	-0.24	0.286
	TR2	-0.16	0.144	0.058	0.286
	TR3	-0.154	0.144	-0.086	0.286
	TR4	-0.272	0.144	-0.232	0.286
Skill of IT Professional (ITSK)	ITSK1	-0.074	0.144	-0.371	0.286
	ITSK2	-0.035	0.144	-0.353	0.286
	ITSK3	-0.04	0.144	-0.246	0.286
	ITSK4	-0.166	0.144	-0.392	0.286
Regulatory Policy (RPL)	RPL1	-0.165	0.144	-0.809	0.286
	RPL2	-0.225	0.144	-0.653	0.286
	RPL3	-0.348	0.144	-0.641	0.286
Awareness (AW)	AW1	-0.086	0.144	-0.855	0.286
	AW2	0.038	0.144	-0.756	0.286
	AW3	0.236	0.144	-0.68	0.286

	AW4	0.119	0.144	-0.784	0.286
Perceived Usefulness (PU)	PU1	-0.379	0.144	-0.416	0.286
	PU2	-0.034	0.144	-0.563	0.286
	PU3	-0.299	0.144	-0.238	0.286
	PU4	-0.374	0.144	-0.482	0.286
Perceived Ease of Use (PEU)	PEU1	-0.322	0.144	-0.204	0.286
	PEU2	-0.026	0.144	-0.705	0.286
	PEU3	0.044	0.144	-0.544	0.286
	PEU4	-0.112	0.144	-0.627	0.286
Attitude (ATT)	ATT1	-0.542	0.144	0.004	0.286
	ATT2	-0.273	0.144	-0.208	0.286
	ATT3	0.038	0.144	-0.454	0.286
	ATT4	-0.674	0.144	0.045	0.286
Behavioral Intention (BHI)	BHI1	-0.164	0.144	-0.719	0.286
	BHI2	-0.084	0.144	-0.926	0.286
	BHI3	0.024	0.144	-0.521	0.286
Subjective Norm (SN)	SN1	-0.503	0.144	-0.506	0.286
	SN2	-0.093	0.144	-0.998	0.286
	SN3	-0.277	0.144	-0.448	0.286

All 54 items skewness and kurtosis values fell in the range of ±2 and ±7 respectively. In sum, data sets of the entire items were normally distributed. Table 5.3 presents that skewness values ranged from -0.734 to 0.906, while the kurtosis values from -0.998 to 0.058.

5.5 Descriptive Analysis

Descriptive statistics analysis is used to depict the basic feature of data. To depict the construct and item measurement data by summarizing distributions of scores, univariate descriptive statistics are reported. For each construct, distribution, dispersion and central tendency can be examined. The descriptive statistics for scale measurement contain the mean for representing the central tendency, maximum, minimum, and standard deviation for examining the dispersion of the data.

5.5.1 Statistic on Challenges of Higher Education Institutions

Table 5.4 shows the means, standard deviation and variance for the challenges of higher education institution related to the following factors; lack of IT infrastructure, lack of IT expertise, lack of funding, lack of employees with IT skills, and high cost of professional and consultancy. As shown in Table 5.4, the mean of these challenges ranged from to 3.94 for high cost of professional to 4.53 for lack of funding. This shows that the respondents indicated that lack of funding is the main challenge. This means that higher education institutions in Yemen face a big challenge in funding to improve education and keep abreast with educational approaches with minimum cost.

Table 5.4 Statistic of Higher Education Institutions Challenges

Challenges	**N Valid**	**Missing**	**Mean**	**Std. Error of Mean**	**Std. Deviation**	**Variance**
Lack of IT infrastructure	288	0	4.2	0.033	0.563	0.317
Lack of IT expertise	288	0	3.98	0.032	0.55	0.303
Lack of funding	288	0	4.53	0.029	0.5	0.25
Lack of IT employees	288	0	4.04	0.032	0.546	0.298
High cost of professional and consultancy	288	0	3.94	0.032	0.541	0.293

5.5.2 Statistic on Cloud Computing Adoption drivers

As for the drivers of cloud computing adoption that can boost and stimulate cloud computing implementation and adoption among higher education institutions (HEIs),Table 5.5 provides the corresponding analysis results.

Table 5.5 Statistic of Cloud Computing Adoption Drivers

Drivers	**N Valid**	**Missing**	**Mean**	**Std. Error of Mean**	**Std. Deviation**	**Variance**
Improve the educational processing and its efficiency	288	0	4.34	0.028	0.475	0.225
Cost saving	288	0	4.42	0.031	0.535	0.286
Need for scalability	288	0	3.94	0.029	0.494	0.244
Improve transparency and participation	288	0	3.78	0.035	0.592	0.351
Disaster recovery and availability	288	0	3.55	0.035	0.589	0.346

As can be noticed from Table 5.5, the means range from 3.55, which is somewhat over the medium score for the disaster recovery and availability, to 4.42, which is a high score for cost saving. These findings show that higher education institutions aware about the benefits of cloud computing.

5.5.3 Statistic on Cloud Computing Adoption factors

Under this statistical analysis, this research used covariance method to compute the descriptive analysis and to maintain the inclusion of all the variables in the analysis. The composite scores of the variables were obtained by parcelling the original measurement item scores, where parcels are referred to as the sum/average of individual indicators/relating to the factor loadings on the construct (Coffman & MacCallum, 2005; Hair, Black, Babin, Anderson, & Tatham, 2006). Table 5.6 presents the means and standard deviation value of the constructs, gauged using 5-point Likert scale.

Table 5.6 Results of Descriptive Statistic for Variables

Constructs	Mean	Standard Deviation	Minimum	Maximum
Relative Advantage (RA)	3.723	1.009	1.3	4.8
Compatibility (CMT)	3.214	0.788	1.3	4.8
Complexity (CMX)	2.307	1.046	1	4.8
Data Concern (DC)	2.943	0.989	1.3	4.8
Top Management Support (TMS)	2.929	0.807	1.3	4.8
Technology Readiness (TR)	3.319	0.715	1.3	4.8
Skill of IT Professional (ITSK)	3.090	0.787	1.3	4.5
Regulatory Policy (RPL)	3.410	0.991	1.3	4.7
Awareness (AW)	2.872	0.998	1.3	4.8
Perceived Usefulness (PU)	3.387	0.886	1.3	4.8
Perceived Ease of Use (PEU)	3.337	0.797	1.3	4.8
Attitude (ATT)	3.578	0.750	1.5	4.8
Behavioral Intention (BHI)	3.141	1.003	1.3	5
Subjective Norm (SN)	3.375	0.922	1.3	4.7

Generally, the mean values of majority constructs in this research exceeded the mid-point level of three (3) (See Table 5.6). Specifically, the consensus perception of the respondents towards complexity (CMX), data concern (DC), top management support (TMS) and awareness (AW) fell below average, while those of the other remaining constructs exceeded the average. The top mean rating was for relative advantage (RA) (3.723), and the lowest one was for complexity (CMX) (2.307). This demonstrates that the consensus perceptions of the respondents toward complexity variable is less than average of 3, meaning the majority of respondents are relatively disagree in answering the complexity' items in the questionnaire.

Moving on to standard deviation, it was obtained as a dispersion index representing the level to which individuals in each variable varies from the variable mean. Specifically, in this research, the standard deviation of complexity showed the most diversion from the mean (SD=1.046), indicating reasonably high variability in the perceptions of respondents towards complexity. Their consensus varied the most towards the complexity variable. In contrast, the lowest variable based on standard deviation values is technology readiness (SD=0.715). The mean values of the entire variables and their standard deviations are presented in Figure 5.1. Furthermore, the average standard deviation is 0.8 which indicates that the identified constructs are of important concern to the respondents' HEIs.

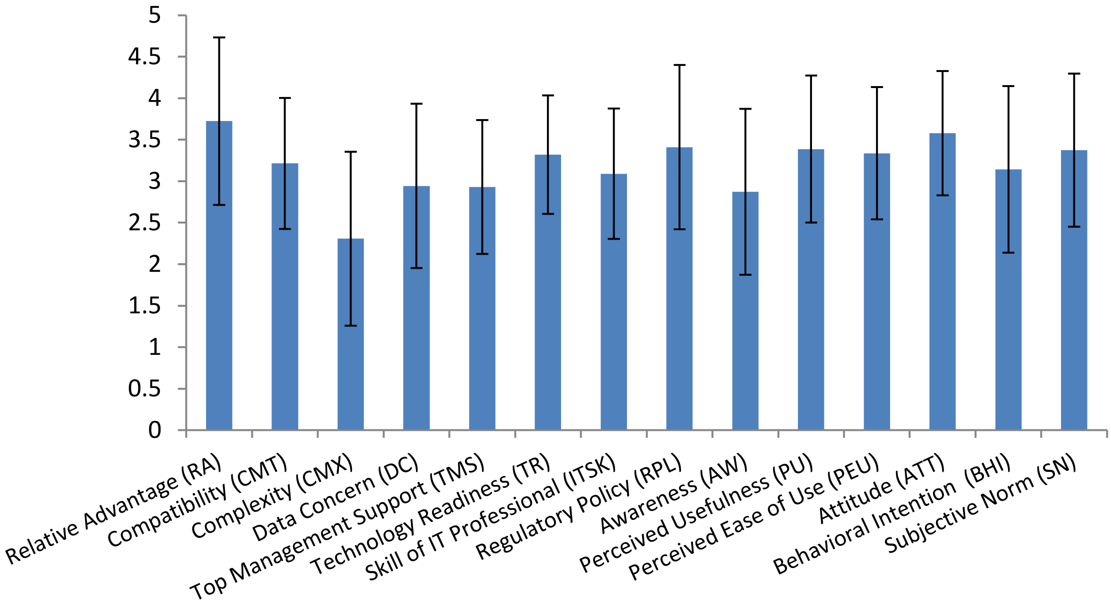

Figure 5. 1 Means and Standard Variations of All Variables

5.6 Measurement Model – Stage 1 of SEM

The measurement model (confirmatory factor analysis (CFA)) is utilized to identify the relationship between the measures and their latent constructs. The construct operationalization is considered as a very important step (Hair et al., 2006) for ensuring accuracy. Researchers can select from several established scales to attempt and ensure theoretical accuracy.

The 14 latent constructs were gauged via 54 items. In the measurement model, every construct was evaluated through CFA in terms of their reliability and validity. More specifically, reliability was evaluated through Composite Reliability (CR) ,Cronbach's Alpha and Average Variance Extracted (AVE), whereas construct validity (convergent and discriminant validity) were both used to confirm validity. The next sub-sections provide a description of the measurement model, with the convergent validity and discriminant validity tests carried out by SMART-PLS 2.00 presented.

5.6.1 Convergent Validity

As mentioned previously, convergent validity indicates the degree to which items of a construct have good correlation. Convergent validity can be measured by factor loading (individual item reliability), and Composite Reliability (CR), and Average Variance Extracted (AVE), among sets of items in the construct. The Average Variance Extracted (AVE) is considered the common indicator of construct's convergent validity (Farrell & Rudd, 2009). The AVE represents the average of variation that a construct is able to demonstrate in the measures to which it is theoretically related (Farrell & Rudd, 2009). The AVE is computed by summing the squared loadings of its measures divided by the number of measures. The Composite Reliability (CR) is calculated by summing the squared loadings of factor loading and sum of error variance terms for a construct. According to Hair et al. (2006), factor loading (individual item reliability) should be 0.6 or higher and AVE estimates should be 0.7 or greater. Furthermore, Composite Reliability (CR) estimates should be 0.6 or greater for adequate internal consistency (Bagozzi & Yi, 1988). Table 5.7 shows the findings of Cronbach's Alpha and convergent validity for the measurement model.

Table 5.7 Results of Convergent Validity for Measurement Model

Construct	***Item***	**Factor Loading**	**Average Variance Extracted (AVE)[a]**	**Composite Reliability (CR)[b]**	**Internal Reliability Cronbach Alpha**
Relative Advantage (RA)	RA1	0.902	0.734	0.917	0.881
	RA2	0.844			
	RA3	0.803			
	RA4	0.875			
Compatibility (CMT)	CMT1	0.788	0.612	0.863	0.791
	CMT2	0.747			
	CMT3	0.789			
	CMT4	0.804			
Complexity (CMX)	CMX1	0.886	0.768	0.930	0.900
	CMX2	0.862			
	CMX3	0.875			
	CMX4	0.883			
Data Concern (DC)	DC1	0.892	0.744	0.921	0.886
	DC2	0.850			
	DC3	0.873			
	DC4	0.833			
Top Management Support (TMS)	TMS1	0.815	0.655	0.884	0.825
	TMS2	0.822			
	TMS3	0.780			
	TMS4	0.819			
	~~TMS5~~	0.422[c]			

Technology Readiness (TR)	TR1	0.810	0.616	0.865	0.791
	TR2	0.743			
	TR3	0.742			
	TR4	0.840			
Skill of IT Professional (ITSK)	ITSK1	0.789	0.648	0.880	0.822
	ITSK2	0.824			
	ITSK3	0.805			
	ITSK4	0.802			
Regulatory Policy (RPL)	RPL1	0.834	0.761	0.905	0.850
	RPL2	0.920			
	RPL3	0.860			
Awareness (AW)	AW1	0.909	0.757	0.926	0.893
	AW2	0.822			
	AW3	0.864			
	AW4	0.884			
Perceived Usefulness (PU)	PU1	0.860	0.689	0.899	0.849
	PU2	0.795			
	PU3	0.803			
	PU4	0.862			
Perceived Ease of Use (PEU)	PEU1	0.852	0.662	0.887	0.829
	PEU2	0.784			
	PEU3	0.776			
	PEU4	0.840			
Attitude (ATT)	ATT1	0.810	0.646	0.879	0.819
	ATT2	0.854			
	ATT3	0.803			
	ATT4	0.744			
Behavioral Intention (BHI)	BHI1	0.891	0.782	0.915	0.861
	BHI2	0.881			
	BHI3	0.881			
Subjective Norm (SN)	SN1	0.894	0.738	0.894	0.824
	SN2	0.813			
	SN3	0.868			

[a]: Average Variance Extracted = (summation of the square of the factor loadings)/[(summation of the square of the factor loadings) + (summation of the error variances)].
[b]: Composite reliability = (square of the summation of the factor loadings)/[(square of the summation of the factor loadings) + (square of the summation of the error variances)].
[c]: denotes for discarded item due to insufficient factor loading below 0.6

It is evident from the Table 5.7 that the standardized factor loadings of the items in the model indicate initial standardized factor loadings of TMS 5 was 0.422, which stayed below the 0.6 cut-off. As a consequence, the item was dropped from the model as recommended by Hair et al. (2006). The single deleted item was not high in comparison to the total construct items of 54. Therefore, its removal made no significant change to the conceptualized constructs. Moreover, the standardized factor loadings for the rest of the items all exceeded 0.5 (from 0.742 to 0.920).

After the uni-dimensionality of the constructs were obtained, each of them was gauged in light of their reliability and this was conducted through Average Variance Extracted (AVE), Composite Reliability (CR) and Cronbach's Alpha. The AVE presented in Table 5.7 indicates that the overall variance amount in the indicators explained the corresponding latent construct, with cut-off over 0.5 for the entire constructs (from 0.612 to 0.782) as suggested by Hair et al. (2006). All the constructs composite reliability values exceeded 0.6 (from 0.863-0.930), where such values explain the level to which construct indicators explain the latent construct as suggested by Bagozzi and Yi (1988). As for the Cronbach's Alpha values, which refers to the level to which a measure is free of error, they exceeded the threshold of 0.7 (from 0.791 to 0.90) as suggested by Nunnally and Bernstein (1994).

5.6.2 Discriminant Validity

As mentioned in Section 5.2, the discriminant validity was conducted to evaluate how distinct a construct is from other constructs. In other words, it refers to the degree to which items differentiate among constructs. To assess discriminant validity, the square of AVE for two (2) constructs and their correlation must be compared. According to Fornell-Larcker criterion, the square root of AVE for each construct should be greater than its highest correlation with any other construct (Hair Jr, Hult, Ringle, & Sarstedt, 2016). Table 5.8 shows the discriminant validity of the measurement model.

Table 5.8 Results of Discriminant Validity

	ATT	AW	BHI	CMT	CMX	DC	ITSK	PEU	PU	RA	RPL	SN	TMS	TR
ATT	0.804													
AW	0.048	0.870												
BHI	0.333	0.239	0.884											
CMT	0.037	0.283	0.250	0.782										
CMX	-0.061	-0.098	-0.086	-0.179	0.876									
DC	-0.075	0.096	0.047	-0.045	-0.091	0.863								
ITSK	0.026	0.222	0.121	0.133	-0.131	-0.019	0.805							
PEU	0.228	0.072	0.150	0.181	-0.289	-0.196	0.245	0.814						
PU	0.237	0.332	0.177	0.303	-0.286	-0.117	0.232	0.354	0.830					
RA	0.111	0.134	0.145	0.182	-0.182	0.019	0.111	0.135	0.355	0.857				
RPL	-0.045	-0.085	-0.139	-0.093	0.077	-0.020	0.063	-0.019	-0.026	-0.010	0.872			
SN	0.412	0.109	0.365	0.149	-0.036	0.010	0.058	0.121	0.102	0.096	0.002	0.859		
TMS	0.098	0.243	0.246	0.227	-0.168	0.030	0.335	0.277	0.324	0.168	-0.012	0.123	0.809	
TR	0.118	0.201	0.159	0.145	-0.138	0.028	0.220	0.280	0.394	0.133	-0.037	0.069	0.266	0.785

Table 5.8 presents the inter-correlations among the 14 constructs and they range from -0.289 to 0.412, all below the 0.85 threshold, the cut-off established by Van der Kline (2005). Table 5.8 also presents that the correlations did not exceed the square root of the average variance extracted by the indicators, explaining good discriminant validity among the factors (Kline, 2005).

5.7 Structural Models - Stage 2 of SEM

This research conducted the second main process of SEM analysis for the achievement of the structural model. After the evaluation of the measurement model, the structural model representation is conducted by determining the constructs' relationships. This provides detailed information on the variables relationships and explains specific details of the exogenous and endogenous variables (Hair et al., 2006; Ho, 2006). The structural model assessment first involves the testing of the overall model, and the size, direction and significance of the estimates of the hypothesized parameter. This is depicted by the one-headed arrows in the path diagrams as suggested by Hair et al. (2006). The final step is to confirm the proposed relationship among the variables in the structural model.

The structural model was assessed to test the proposed hypotheses through the use of Smart PLS and Bootstrapping, with the help of 1000 replications. The next sub-sections present the structural model's examination.

5.7.1 Direct Effects of Constructs

As mentioned earlier, the structural equation model is evaluated by using significance of path coefficients. The path coefficients describe the hypothesized links between dependent and independent constructs. In this research, the structural model was assessed by testing the direct causal effects between the constructs. These effects refer to the 20 hypotheses namely: H1a, H1b, H2a, H2b, H3a, H3b, H4a, H4b, H5a, H5b, H6a, H6b, H7a, H7b, H8, H9, H10, H11a, H11ab and H12. Figure 5.2 sums up the structural model for testing the direct effects of the hypothesized variables. The Smart-PLS model is portrayed in Appendix F.

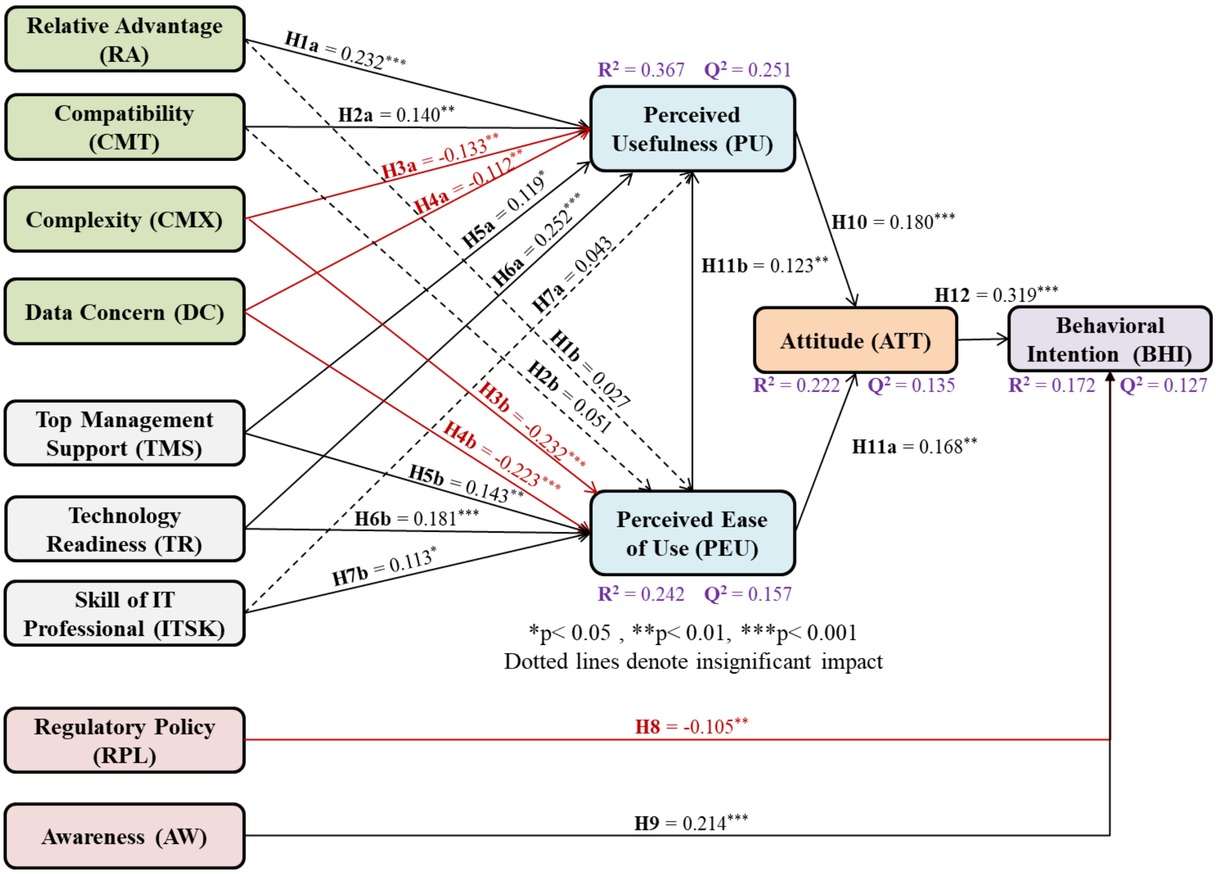

Figure 5.2 PLS Analysis of the Structural Model for Direct Effects

The research then examined the coefficient parameters estimates to test the direct effects of the variables (see Table 3.4 in Section 3.4). The path coefficients obtained from testing the hypothesized direct effects are shown in Table 5.9.

Table 5.9 Examining Results of Hypothesized Direct Effects of the Constructs

Path Shape	Path Coefficient	Standard Error	T-value	P-value	F-squared	Effect Size	Hypothesis Result
RA → PU	0.232***	0.041	5.677	0.000	0.078	Small	H1a^{+}) Supported
RA → PEU	0.027	0.047	0.577	0.564	0.001	None	H1b^{+}) Rejected
CMT → PU	0.140**	0.043	3.244	0.001	0.028	Small	H2a^{+}) Supported
CMT → PEU	0.051	0.045	1.140	0.255	0.003	None	H2b^{+}) Rejected
CMX → PU	-0.133**	0.043	3.070	0.002	0.024	Small	H3a^{-}) Supported
CMX → PEU	-0.232***	0.050	4.635	0.000	0.065	Small	H3b^{-}) Supported
DC → PU	-0.112**	0.040	2.830	0.005	0.017	None	H4a^{-}) Supported

DC → PEU	-0.223***	0.042	5.262	0.000	0.064	Small	H4b⁻) Supported
TMS → PU	0.119*	0.048	2.467	0.014	0.017	None	H5a⁺) Supported
TMS → PEU	0.143**	0.043	3.312	0.001	0.022	Small	H5b⁺) Supported
TR → PU	0.252***	0.044	5.700	0.000	0.085	Small	H6a⁺) Supported
TR → PEU	0.181***	0.040	4.491	0.000	0.039	Small	H6b⁺) Supported
ITSK → PU	0.043	0.045	0.950	0.343	0.003	None	H7a⁺) Rejected
ITSK → PEU	0.113*	0.045	2.482	0.014	0.014	None	H7b⁺) Supported
RPL → BHI	-0.105**	0.039	2.737	0.007	0.013	None	H8⁻) Supported
AW → BHI	0.214***	0.045	4.749	0.000	0.055	Small	H9⁺) Supported
PU → ATT	0.180***	0.049	3.685	0.000	0.030	Small	H10⁺) Supported
PEU → ATT	0.168**	0.048	3.520	0.001	0.027	Small	H11a⁺) Supported
PEU → PU	0.123**	0.039	3.159	0.002	0.019	None	H11b⁺) Supported
AT → BHI	0.319***	0.039	8.301	0.000	0.109	Small	H12⁺) Supported

*p< 0.05 , **p< 0.01, ***p< 0.001

As shown in Table 5.9, apart from two (2) paths from Relative Advantage (RA) and Compatibility (CMT) to Perceived Ease of Use (PEU) as well as a path from Skill of IT Professional (ITSK) to Perceived Usefulness (PU), all other paths were statistically significant as their p-values were below the standard significance level of 0.05. Thus, hypotheses H1a, H2a, H3a, H3b, H4a, H4b, H5a, H5b, H6a, H6b, H7b, H8, H9, H10, H11a, H11ab and H12 were supported. On the contrary, hypotheses H1b, H2b and H7a were rejected as their p-values were above the standard significant level of 0.05.

As mentioned previously, the coefficient of determination (R^2 value) is used to measure a predictive accuracy of the model. With regards to this research, the conceptual model includes four (4) endogenous constructs: Perceived Usefulness (PU), Perceived Ease of Use (PEU), Attitude (AT), and Intention to Adopt. From the obtained result, the R^2 of value for Perceived Usefulness (PU) is 0.36, which exceeds the 0.3 threshold suggested by Patterson (2013). This result means that about 36% of the variance of PU was explained by technological and organizational factors and Perceived Ease of Use (PEU) whereas 24% of variance of PEU was explained by technological and organizational factors. Furthermore, the R^2 value for Attitude is 0.236, which exceeds the 0.3 threshold suggested by Patterson (2013). This result indicates that about 23% of the variance of Attitude was explained by Perceived Usefulness (PU) and Perceived Ease of Use (PEU). The structural model explains model with 17% ($R^2 = 0.17$) of the variance in Cloud Computing adoption intention explained by Attitude and environmental factors (Regulatory Policy and Awareness).

As mentioned earlier, Q^2 value is an indicator to measure the model's predictive relevance. The current reserch model results in Q^2 values are 0.25, 0.15, 0.13, and 0.12 for the four (4) endogenous constructs: by Perceived Usefulness (PU), Perceived Ease of Use (PEU), Attitude, and Cloud Computing adoption intention respectively. These results are higher than zero (predictive relevance of the model recommended by Chin, 2010). On the whole, the model's fit and high predictive relevance are confirmed.

The goodness of fit (GoF) has been developed as an overall measure of model fit for PLS-SEM. It is the geometric mean of both average of R^2 and average variance extracted (AVE) of the endogenous variables (Tenenhaus, Vinzi, Chatelin, & Lauro, 2005). The purpose of goodness of fit (GoF) is to account on the study model at both level, namely structural and measurement model with concentrate on the overall performance of the model. The calculation formula of GoF is as follow:

$$GoF = \sqrt{(\overline{R^2} \times \overline{AVE})}$$

The value of GoF for the current model is 0.38 which recommended by Wetzels et al. (2009). This result indicates that GoF model of this research is fit to considered sufficient global PLS model validity.

5.7.2 Mediation Effects of Perceived Usefulness (PU)

The analysis of the mediating effects determines the mediating influence of Perceived Usefulness (PU) on the relationships between Perceived Ease of Use (PEU) as independent variable and Attitude (dependent variable) (H13). Correlation statistics was used to examine the mediating effects and in this regard, according to Mathieu and Taylor (2006), a decision tree framework may be used to test the covariance relationships among the independent, mediating and dependent variable. Figure 5.3 presents the framework of the effects.

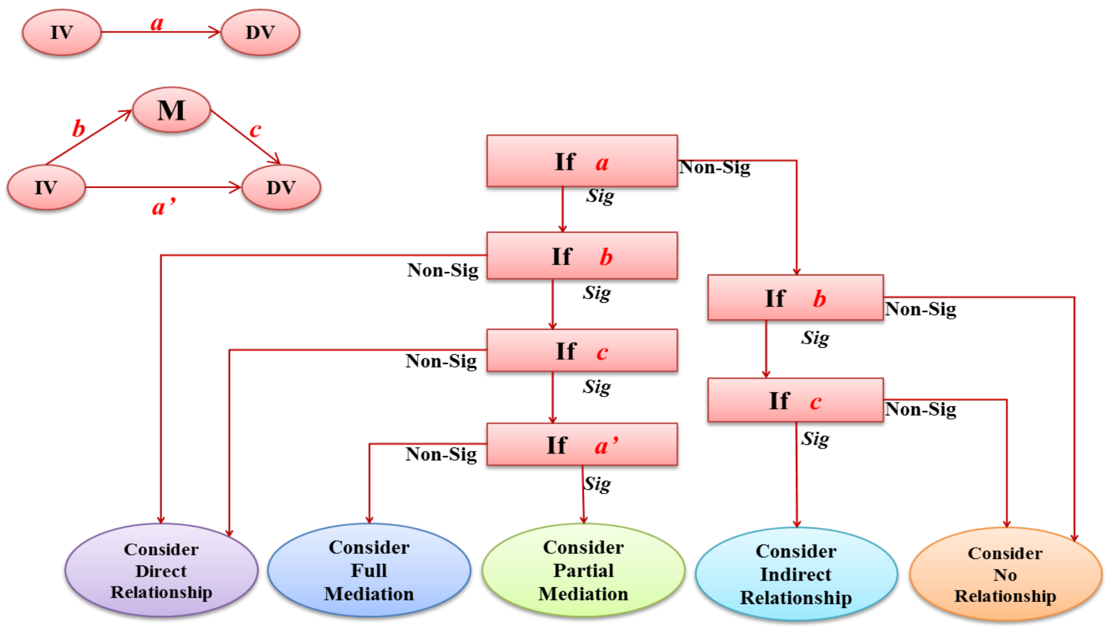

Figure 5.3 Decision Tee for Evidence Supporting Different Intervening Effects

On the basis of the above framework, the top requirements have to be satisfied to confirm the significant mediating effect and it is represented by the correlation paths between the three (3) variables, represented by paths *a*, *b* and *c* and their statistical significance. If one (1) of these three (3) path is not significant, then the possibility of significant mediation is null (Baron & Kenny, 1986; Mathieu & Taylor, 2006). If, on the other hand, there is significance in the three (3) paths, if the direct effect of independent variable on the dependent one turns insignificant with the addition of the mediator, then the mediator is a full mediating variable, otherwise, it is a partial mediating variable. However, in the absence of full/partial mediating effects, the relationship between the independent and dependent variables may be direct, indirect or no relationship. If a significant path *a* is absent, and significant effects of both paths *b* and *c* are present, then the independent variable is considered to have an insignificant indirect impact on the dependent variable via the proposed mediating variable. The reverse, which is the presence of a significant path *a*, but no significant effects of both paths *b* or *c* reflects a significant direct effect of the independent variable on the dependent one, while the absence of significant path *a*, and *b* and *c*, indicates no relationship between independent and dependent variables. SEM is a suitable method for regression techniques when it comes to confirming mediating effects as it allows modeling of both structural and measurement relationships, generating overall fit indices (Garver & Mentzer, 1999).

In this research, the significant regression coefficients between Perceived Ease of Use (independent variable) and Perceived Usefulness (mediator variable) and Attitude (dependent variable) were obtained for the determination of mediating effect and its level. Table 5.10 provides the description of the results of Hypothesis H13, represented by the standardized effect of different paths.

Table 5.10 Results of Examining Mediation Effect of Perceived Usefulness (PU)

DV = Attitude (ATT) **M = Perceived Usefulness (PU)**	**Perceived Ease of Use (PEU)**
Total Effect of IV on DV without M (path a)	0.182***(*P-value=0.000)*
Direct Effect of IV on DV with M (path a')	0.168**(*P-value=0.001)*
Indirect Effect of IV on DV through M (path bc)	0.014**
Effect of IV on M (path b)	0.123**(*P-value=0.002)*
Effect of M on DV (path c)	0.180***(*P-value=0.000)*
Mediation Path	PEU→PU→ATT
Mediation Effect	Yes
Degree of Mediation	Partial
Hypothesis Result	H13) Supported

*p< 0.05 , **p< 0.01, ***p< 0.001

As seen in Table 5.10, Perceived Usefulness (PU) mediates the effect of Perceived Ease of Use (PEU) on Attitude (ATT). Thus hypothesis H13 was supported.

5.7.3 Moderation Effect of Subjective Norm (SN)

This research examined Subjective Norm as a moderating variable between Perceived Usefulness and Attitude. To confirm such moderating effect, the nature of the relationship has to change with the changing moderating variable. This is possible by containing the interaction influence in the model and identifying if indeed such interaction is significant or not. The analysis is applied when all the predictors are standardized for easy interpretation and to steer clear of multicollinearity issues (Aiken, West, & Reno, 1991). This was conducted by subtracting a measured variable from its respective mean, after which the result was divided by the standard deviation of that measured variable. This was then followed by the calculation of the product of the centered indicator, using the indicators of the latent interaction term. The significance of the moderator is determined by noting the effect of interaction term on the dependent variables(whether it is significant or not).

A significant moderating influence can be determined by generating plots for every interaction to indicate the influence of the moderating effects on the predictor-outcome variables relationship as suggested by Aiken et al. (1991). Aiken et al. (1991) suggested the generation of four (4) cells for graphing the interaction between the variables. Both independent variable (low and high) and moderating variable (low and high) are dichotomized and crossed to obtain four (4) cell means. Low refers to one (1) standard deviation below the mean, whereas high refers to one (1) deviation higher than the mean. Figure 5.4 portrays a structural model with interaction terms to determine the Subjective Norm’s moderating effects. Appendix G contains the Smart-PLS model representing the effects.

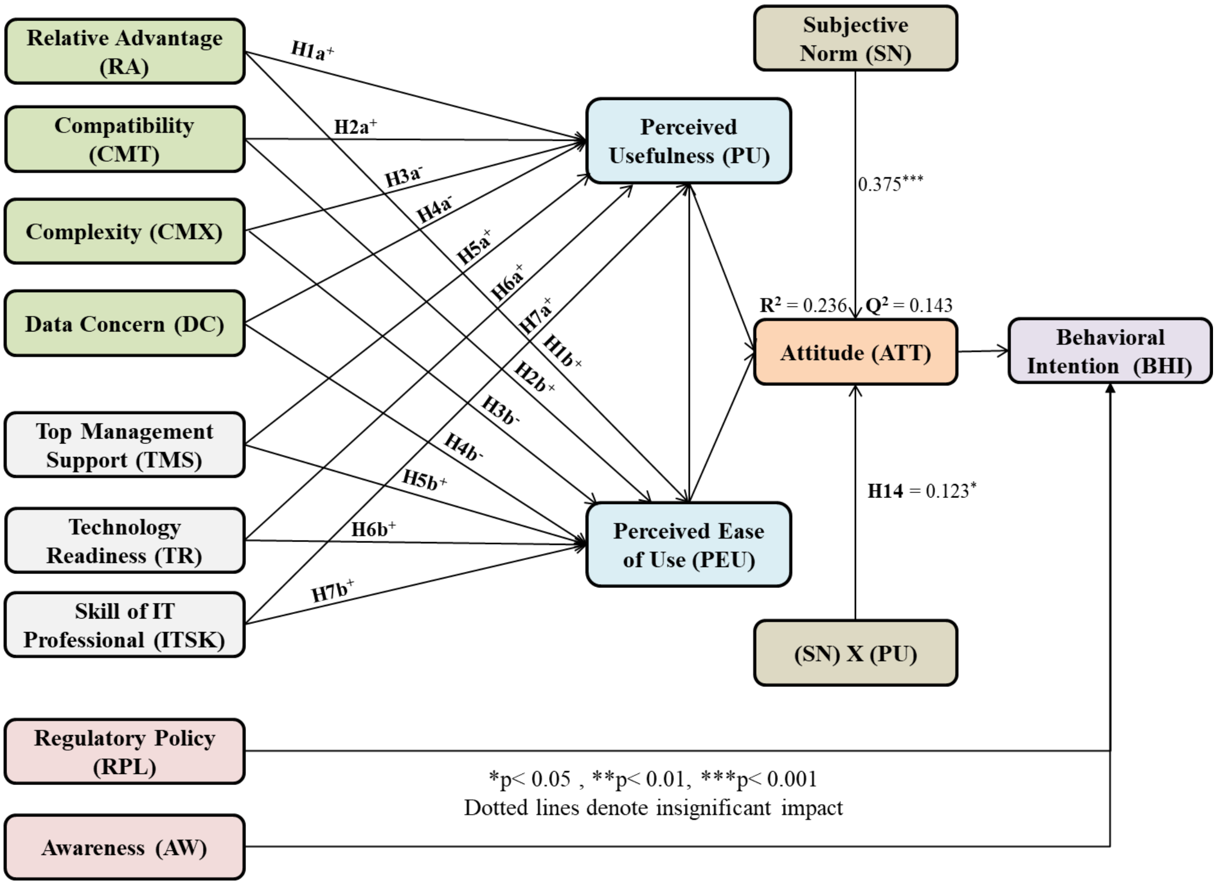

Figure 5.4 PLS Analysis for Moderation Effects of Subjective Norm (SN)

The moderation influence of Subjective Norm (SN) on the effects of Perceived Usefulness (PU) as independent variable on Attitude (ATT) as dependent variable (DV) were examined as presented in Table 5.11. Further, the path coefficient was used to evaluate the contribution of interaction term on the DVs.

Table 5.11 Moderation Effect of Subjective Norm (SN)

Path Shape	Path Coefficient	Standard Error	T-value	P-value	F-squared	Effect Size	Hypothesis Result
(SN*PU) → ATT	0.123*	0.051	2.392	0.017	0.019	None	H14) Supported

*p< 0.05 , **p< 0.01, ***p< 0.001

As seen in Table 5.11, the interaction terms of Subjective Norm (SN) with Perceived Usefulness (PU) had significant effect on Attitude (ATT) as its p-value was 0.017, lower than the standard significance level of 0.05. This result demonstrated that

Subjective Norm (SN) moderates the effect of Perceived Usefulness (PU) on Attitude (ATT). Therefore, hypothesis H14 was supported.

5.8 Discussion on Testing Research Hypothesis

Previous studies related to cloud computing (as elaborated in Appendix A) had identified the features that, if exploited, can bring about revolution in the provision of e-services. Such features include, scalability of infrastructure, cost saving, elimination of procurement and maintenance, access to IT capabilities, electricity consumption, and ease of implementation. The findings of this research presented earlier in this chapter (as discussed in Section 5.5.1) showed that the main obstacles and barriers facing higher education institutions in Yemen for improving quality of education are related to lack of funding, lack of IT infrastructure, and lack of IT employees. On the other hand, the findings presented that the most common drivers of cloud computing adoption are cost saving, improvement of the educational process and its efficacy, and the need for scalability and availability (as discussed in Section 5.7.2). This means that cloud computing features can drive higher education institutions in Yemen to adopt cloud computing to meet the challenges of higher education institutions. So, this research proposes a conceptual model to examine the factors affecting cloud computing adoption.

The following section discusses the results of path analysis in relation to the hypotheses in the structural model.

H1a^{+}) Relative Advantage (RA) has a positive effect on Perceived Usefulness (PU)

The Relative Advantage of cloud computing is hypothesized to have an impact on Perceived Usefulness to adopt cloud computing. As shown in Table 5.9 in Section 5.7.1, the t-value and p-value of Relative Advantage (RA) in predicting Perceived Usefulness (PU) are 5.677 and 0.000 respectively. It means that the probability of getting a t-value as large as 5.677 in absolute value is 0.000. In other words, the regression weight for Relative Advantage (RA) in the prediction of Perceived Usefulness (PU) is significantly different from zero at the 0.001 level (two-tailed). Thus, H1a is supported. The path coefficient was 0.232, indicating a positive relationship. It means, when Relative Advantage (RA) goes up by 1 standard deviation, Perceived Usefulness (PU) goes up by 0.232 standard deviations. Furthermore, the value of F-squared was 0.078, showing that the effect size of Relative Advantage (RA) on Perceived Usefulness (PU) was small. All these results confirm that Relative Advantage of cloud computing influences its Perceived Usefulness (PU) in higher education institutions in Yemen. This means that higher education institutions in Yemen appreciate the value of adopting cloud computing and it is predicted that cloud computing adoption will increase the productivity of employees in HEIs. These results are consistent with previous studies of Gamage (2019) and Gangwar et al. (2015a).

H1b$^+$) Relative Advantage (RA) has a positive effect on Perceived Ease of Use (PEU)

The Perceived Ease of Use (PEU) of cloud computing is influenced by the Relative Advantage. As shown in Table 5.9 in Section 5.7.1, the results indicate that there was no significant direct relationship between Relative Advantage (RA) and Perceived Ease of Use (PEU); path coefficient = 0.027, t-value = 0.577, p-value= 0.564. Thus, H1b was rejected. Furthermore, the value of F-squared was 0.001, indicating the effect size of Relative Advantage (RA) on Perceived Ease of Use (PEU) is rejected. These results mean that the Relative Advantage of cloud computing in higher education institutions in Yemen does not influence Perceived Ease of Use (PEU). This could indicate that HEIs still have some reservations towards the ease of use of cloud computing. This result contradicts with previous studies' results Gamage (2019) and Gangwar et al. (2015b).

H2a$^+$) Compatibility (CMT) has a positive effect on Perceived Usefulness (PU)

The proposed model hypothesized that the compatibility of cloud computing influences its usefulness in HEIs. As shown in Table 5.9, the t-value and p-value of Compatibility (CMT) in predicting the Perceived Usefulness (PU) were 3.244 and 0.001 respectively. It means that the probability of getting a t-value as large as 3.244 in absolute value is 0.001. In other words, the regression weight for Compatibility (CMT) in the prediction of Perceived Usefulness (PU) is significantly different from zero at the 0.01 level (two-tailed). Thus, H2a was supported. The path coefficient was 0.140, indicating a positive relationship. It means, when Compatibility (CMT) goes up by 1 standard deviation, Perceived Usefulness (PU) goes up by 0.140 standard deviation. Furthermore, the value of F-squared was 0.028, showing that the effect size of Compatibility (CMT) on

Perceived Usefulness (PU) was small. This result indicates that higher education institutions (HEIs) are aware of the needs to make some changes in existing processes in order to match cloud computing solution to the present institutions' infrastructure. These findings confirm the results of previous studies of Y.-M. Cheng (2014), Gangwar et al. (2015b) and Sabi, Uzoka, Langmia, Njeh, et al. (2016).

H2b^{+}) Compatibility (CMT) has a positive effect on Perceived Ease of Use (PEU)

The compatibility of cloud computing is also hypothesized to be influenced by its ease of use (PEU). As seen in Table 5.9, the results show that there was no significant direct relationship between Compatibility (CMT) and Perceived Ease of Use (PEU); path coefficient = 0.051, t-value = 1.140, p-value= 0.255. Furthermore, the value of F-squared was 0.003, indicating the effect size of Compatibility (CMT) on Perceived Ease of Use (PEU) was not considerable. Thus, H2b is rejected. It means that the compatibility of cloud computing does not influence its ease of use in higher education institutions in Yemen. This might be due to HEIs may lack confidence in adopting a cloud computing because it is relatively new to them and it may take users a long time to understand and implement the new system. The result is consistent with literature such as Ibrahim (2014).

H3a^{-}) Complexity (CMX) has a negative effect on Perceived Usefulness (PU)

The complexity of cloud computing affects its perceived usefulness (PU) to adopt cloud computing in HEIs. As seen in Table 5.9, the t-value and p-value of Complexity (CMX) in predicting the Perceived Usefulness (PU) were 3.070 and 0.002 respectively. It means that the probability of getting a t-value as large as 3.070 in absolute value is 0.002. In other words, the regression weight for Complexity (CMX) in the prediction of Perceived Usefulness (PU) is significantly different from zero at the 0.01 level (two-tailed). Thus, H3a was supported. The path coefficient was -0.133, indicating a negative relationship. It means, when Complexity (CMX) goes up by 1 standard deviation, Perceived Usefulness (PU) goes down by 0.133 standard deviations. Furthermore, the value of F-squared was 0.024, showing that the effect size of Complexity (CMX) on Perceived Usefulness (PU) was small. It means that technical complexity is a hindrance to adopting cloud computing in higher education institution in Yemen. The result is consistent with literature by Alshamaila et al. (2013), Gamage (2019), Gangwar et al. (2015b) and Sabi, Uzoka, Langmia, Njeh, et al. (2016).

H3b⁻) Complexity (CMX) has a negative effect on Perceived Ease of Use (PEU)

The complexity of cloud computing influences its Perceived Ease of Use (PEU). The t-value and p-value of Complexity (CMX) in predicting Perceived Ease of Use (PEU) were 4.635 and 0.000 respectively. It means that the probability of getting a t-value as large as 4.635 in absolute value is 0.000. In other words, the regression weight for Complexity (CMX) in the prediction of Perceived Ease of Use (PEU) is significantly different from zero at the 0.001 level (two-tailed). Thus, H3b was supported. The path coefficient was -0.232, indicating a negative relationship. It means, when Complexity (CMX) goes up by 1 standard deviation, Perceived Ease of Use (PEU) goes down by 0.232 standard deviations. Furthermore, the value of F-squared was 0.065, showing that the effect size of Complexity (CMX) on Perceived Ease of Use (PEU) was small. It means that the technical complexity of cloud computing is a hindrance to cloud computing in higher education institutions in Yemen. This may be due to lack of technical skills required to adopt cloud computing. The result is consistent with the findings of studies in literature by Alshamaila et al. (2013) , Gangwar et al. (2015a), Parveen & Sulaiman, (2008) and Sabi, Uzoka, Langmia, Njeh, et al. (2016).

H4a⁻) Data Concern (DC) has a negative effect on Perceived Usefulness (PU)

The Data Concern of cloud computing influences its Perceived Usefulness (PU) to adopting it in higher education institutions. As seen in Table 5.9, the t-value and p-value of Data Concern (DC) in predicting Perceived Usefulness (PU) were 2.830 and 0.005 respectively. It means that the probability of getting a t-value as large as 2.830 in absolute value is 0.005. In other words, the regression weight for Data Concern (DC) in the prediction of Perceived Usefulness (PU) is significantly different from zero at the 0.01 level (two-tailed). Thus, H4a was supported. The path coefficient was -0.112, indicating a negative relationship. It means, when Data Concern (DC) goes up by 1 standard deviation, Perceived Usefulness (PU) goes down by 0.112 standard deviations. Furthermore, the value of F-squared was 0.017, indicating the effect size of Data Concern (DC) on Perceived Usefulness (PU) was not considerable. As more data is stored in the cloud, the more HEIs will be very concerned about privacy of data. This indicates that the data concern of cloud computing is a hindrance to adopting cloud computing. The results support the literature review that suggests the significant effect of data concern of cloud computing on its perceived usefulness (PU) such as Asadi, Nilashi, Husin, and Yadegaridehkordi (2016), Gangwar et al. (2015a) and Ibrahim,(2014).

H4b-) Data Concern (DC) has a negative effect on Perceived Ease of Use (PEU)

The Data Concern (DC) of cloud computing influences its Perceived Ease of Use (PEU) to adopt cloud computing. As shown in table 5. 9,the t-value and p-value of Data Concern (DC) in predicting the Perceived Ease of Use (PEU) were 5.262 and 0.000 respectively. It means that the probability of getting a t-value as large as 5.262 in absolute value is 0.000. In other words, the regression weight for Data Concern (DC) in the prediction of Perceived Ease of Use (PEU) is significantly different from zero at the 0.001 level (two-tailed). Thus, H4b was supported. The path coefficient was -0.223, indicating a negative relationship. It means, when Data Concern (DC) goes up by 1 standard deviation, Perceived Ease of Use (PEU) goes down by 0.223 standard deviations. Furthermore, the value of F-squared was 0.064, showing that the effect size of Data Concern (DC) on Perceived Ease of Use (PEU) was small. The result indicates that HEIs are highly concerned about cloud computing, specifically as data is stored in the cloud so the concerns include, the easy location of data, easy dissemination of data to different countries, and the potentially different data privacy laws within the countries that may expose data to third parties that do not hold the authority to be privy to it. This finding is consistent with findings found in the literature review which confirm the effect of data concern on perceived ease of use (PEU) such as Asadi et al. (2016), Gangwar et al. (2015a) and Ibrahim, (2014).

H5a^{+}) Top Management Support (TMS) has a positive effect on Perceived Usefulness (PU)

Top management support (TMS) has a positive effect on its perceived usefulness among IT managers, IT lecturers and IT professionals. As shown in Table 5.9, the t-value and p-value of Top Management Support (TMS) in predicting the Perceived Usefulness (PU) were 2.467 and 0.014 respectively. It means that the probability of getting a t-value as large as 2.467 in absolute value is 0.014. In other words, the regression weight for Top Management Support (TMS) in the prediction of Perceived Usefulness (PU) is significantly different from zero at the 0.05 level (two-tailed). Thus, H5a was supported. The path coefficient was 0.119, indicating a positive relationship. It means, when Top Management Support (TMS) goes up by 1 standard deviation, Perceived Usefulness (PU) goes up by 0.119 standard deviations. Furthermore, the value of F-squared was 0.017, indicating the effect size of Top Management Support (TMS) on Perceived Usefulness (PU) was not considerable. This means that top management support (TMS) has matured toward adopting cloud computing. This finding is consistent with findings found in the literature review which confirmed the effect of top management support (TMS) on perceived usefulness (PU) such as Gangwar et al. (2015a) and Haderi & Saleh, (2012).

H5b+) Top Management Support (TMS) has a positive effect on Perceived Ease of Use (PEU)

Top Management Support (TMS) influences its perceived Usefulness (PU) among IT managers and IT professionals and is reflected in their toward attitude to adopt cloud computing technology. As shown in Table 5.9, the t-value and p-value of Top Management Support (TMS) in predicting Perceived Ease of Use (PEU) were 3.312 and 0.001 respectively. It means that the probability of getting a t-value as large as 3.312 in absolute value is 0.001. In other words, the regression weight for Top Management Support (TMS) in the prediction of Perceived Ease of Use (PEU) is significantly different from zero at the 0.01 level (two-tailed). Thus, H5b was supported. The path coefficient was 0.143, indicating a positive relationship. It means, when Top Management Support (TMS) goes up by 1 standard deviation, Perceived Ease of Use (PEU) goes up by 0.143 standard deviations. Furthermore, the value of F-squared was 0.022, showing that the effect size of Top Management Support (TMS) on Perceived Ease of Use (PEU) was small. This indicates that the top management supports the adoption of cloud computing as it could enhance the productivity and work accomplishment. This result is consistent with that in literature review studies such as Gangwar et al. (2015a) and Haderi & Saleh, (2012).

H6a+) Technology Readiness (TR) has a positive effect on Perceived Usefulness (PU)

The Perceived Usefulness (PU) of cloud computing is influenced by technology readiness of higher education institutions in Yemen. As shown in Table 5.9, the t-value and p-value of Technology Readiness (TR) in predicting Perceived Usefulness (PU) were 5.700 and 0.000 respectively. It means that the probability of getting a t-value as large as 5.700 in absolute value is 0.000. In other words, the regression weight for Technology Readiness (TR) in the prediction of Perceived Usefulness (PU) is significantly different from zero at the 0.001 level (two-tailed). Thus, H6a was supported. The path coefficient was 0.252, indicating a positive relationship. It means, when Technology Readiness (TR) goes up by 1 standard deviation, Perceived Usefulness (PU) goes up by 0.252 standard deviations. Furthermore, the value of F-squared was 0.085, showing that the effect size of Technology Readiness (TR) on Perceived Usefulness (PU) was small. It means that higher education institutions, which have efficient infrastructure, are more likely to adopt cloud computing. This result is consistent with previous studies by Awa et al. (2015) and Gangwar et al. (2015a).

H6b+) Technology Readiness (TR) has a positive effect on Perceived Ease of Use (PEU)

The Perceived Ease of Use (PEU) of cloud computing is influenced by technology readiness of higher education institutions in Yemen. As shown in Table 5.9, the t-value and p-value of Technology Readiness (TR) in predicting Perceived Ease of Use (PEU) were 4.491 and 0.000 respectively. It means that the probability of getting a t-value as large as 4.491 in absolute value is 0.000. In other words, the regression weight for Technology Readiness (TR) in the prediction of Perceived Ease of Use (PEU) is significantly different from zero at the 0.001 level (two-tailed). Thus, H6b was supported. The path coefficient was 0.181, indicating a positive relationship. It means, when Technology Readiness (TR) goes up by 1 standard deviation, Perceived Ease of Use (PEU) goes up by 0.181 standard deviations. Furthermore, the value of F-squared was 0.039, showing that the effect size of Technology Readiness (TR) on Perceived Ease of Use (PEU) was small. These results mean that the technology readiness in higher education institution in Yemen influences their ability to adopt cloud computing.

This result is consistent with previous studies by Awa et al. (2015) and Gangwar et al. (2015a).

H7a⁺) Skill of IT Professional (ITSK) has a positive effect on Perceived Usefulness (PU)

The proposed model hypothesizes that IT Skills affects the Perceived Usefulness (PU) of cloud computing to be adoptedin HEIs. As shown in Table 5.9, the results indicated that there is no significant direct relationship between Skill of IT Professional (ITSK) and Perceived Usefulness (PU); path coefficient = 0.043, t-value = 0.950, p-value= 0.343. Thus, H7.a is rejected. Furthermore, the value of F-squared was 0.003, indicating the effect size of Skill of IT Professional (ITSK) on Perceived Usefulness (PU) is not considerable. These results indicate that Skill of IT Professional (ITSK) does not affect Perceived Usefulness (PU) of cloud computing. This may be due to lack of knowledge about benefits of cloud computing among IT staff in HEI .The result is inconsistent with previous studies by Gangwar et al., (2015a) and Lee et al., (2010). These results mean that skill of IT professional does not influence intention to adopt cloud computing through perceived usefulness.

H7b⁺) Skill of IT Professional (ITSK) has a positive effect on Perceived Ease of Use (PEU)

The proposed model hypothesizes that IT Skills affects the Perceived Ease of Use (PEU) of cloud computing to be adopted. As seen in Table 5.9, with regards to the Skill of IT Professional (ITSK) as predictor of Perceived Ease of Use (PEU), the presented t-value was 2.482, while the p-value was 0.014, indicating that there is a probability of obtaining a t-value as large as 2.482 in absolute value at 0.014. The regression weight of ITSK in predicting PEU significantly differs from zero at the level of 0.05 (two-tailed), and as such, H7b was deemed to be supported. And because path coefficient was 0.013, the relationship was positive. It means, when Skill of IT Professional (ITSK) goes up by 1 standard deviation, Perceived Ease of Use (PEU) goes up by 0.113 standard deviations. Furthermore, the value of F-squared was 0.014, indicating the effect size of Skill of IT Professional (ITSK) on Perceived Ease of Use (PEU) was not considerable. These results show that Skill of IT Professional (ITSK) influence Perceived Ease of Use (PEU) of cloud computing. This result indicates that it could be easy for IT professionals in HEIs to adopt and use cloud computing. The result is inconsistent with previous studies by Lee et al. (2010) and Gangwar et al. (2015a).

H8^{-}) Regulatory Policy (RPL) has a negative effect on Behavioral Intention (BHI)

This research hypothesizes that Behavioural Intention (BHI) to adopt cloud computing is influenced by Regulatory Policy (RPL). Table 5.9 shows that for the Regulatory Policy (RPL) prediction of Behavioral Intention (BHI), the t-value was 2.737 and the p-value was 0.007, indicating that there is a probability of obtaining a t-value as large as 2.737 at 0.007 absolute value. Stated clearly, the RPL regression weight in predicting BHI significantly differs from zero at the level of 0.01 (two-tailed), and as such hypothesis H8 was supported. With a path coefficient of -0.105, the said relationship was negative, indicating that with 1 standard deviation increase in RPL, behavioral intention standard deviation decreases by 0.105 standard deviations. Furthermore, the value of F-squared was 0.013, indicating the effect size of Regulatory Policy (RPL) on Behavioural Intention (BHI) was not considerable. This result means that the Regulatory Policy (RPL) is an obstacle to intention to adopt cloud computing in higher education institutions in Yemen. This might be due to the lack of clear government regulations related to storing data in the cloud outside of Yemen. The result is inconsistent with previous studies by Senyo, Effah, Addae, Irani, and Irani (2016) and Tashkandi & Al-Jabri, 2015).

H9^{+}) Awareness (AW) has a positive effect on Behavioral Intention (BHI)

This research hypothesizes that Behavioural Intention (BHI) to adopt cloud computing is influenced by Awareness (AW). Table 5.9 shows that in predicting behavioral intention (BHI), the t-value of awareness (AW) was 4.749 and p-value was 0.000, which shows that the probability of obtaining a t-value with a magnitude of 4.749 in absolute value is 0.000. The regression weight of AW in its prediction of BHI significantly differs from zero at the level of 0.001 (two-tailed), and thus supporting hypothesis H9. Because the path coefficient was 0.214, the relationship was positive. The result indicates that with an increase of standard deviation in BHI by 1, the standard deviation of BHI increases by 0.214. Furthermore, the value of F-squared was 0.055, showing that the effect size of Awareness (AW) on Behavioural Intention (BHI) was small. These results confirm that Awareness (AW) is considered as a motivating construct that encourages decision makers to adopt cloud computing in higher education institution in Yemen. The result is inconsistent with previous studies by Jabi (2015) and Sabi (2016).

H10^{+}) Perceived Usefulness (PU) has a positive effect on Attitude (ATT)

The proposed model hypothesizes that the Attitude (ATT) toward intention to adopt cloud computing is influenced by its Perceived Usefulness (PU). As shown in Table 5.9, the t-value and p-value of Perceived Usefulness (PU) in predicting Attitude (ATT) were 3.685 and 0.000 respectively. It means that the probability of getting a t-value as large as 3.685 in absolute value is 0.000. In other words, the regression weight for Perceived Usefulness (PU) in the prediction of Attitude (ATT) is significantly different from zero at the 0.001 level (two-tailed). Thus, H10 was supported. The path coefficient was 0.180, indicating a positive relationship. It means, when Perceived Usefulness (PU) goes up by 1 standard deviation, Attitude (ATT) goes up by 0.180 standard deviations. Furthermore, the value of F-squared was 0.030, showing that the effect size of Perceived Usefulness (PU) on Attitude (ATT) was small. These results confirm that perceived usefulness of cloud computing is a significant indicator of attitude to adopt cloud computing. This might be due to the IT professionals belief that using services of cloud can improve their performance, productivity and efficiency in HEIs. This result is consistent with previous studies by Li and Chang (2012) and Shiau and Chau (2016).

H11a^{+}) Perceived Ease of Use (PEU) has a positive effect on Attitude (ATT)

This research hypothesizes that the attitude (ATT) toward intention to adopt cloud computing is influenced by its Perceived Ease of Use (PEU). As shown in Table 5.9, the t-value and p-value of Perceived Ease of Use (PEU) in predicting Attitude (ATT) were 3.520 and 0.001 respectively. It means that the probability of getting a t-value as large as 3.520 in absolute value is 0.001. In other words, the regression weight for Perceived Ease of Use (PEU) in the prediction of Attitude (ATT) is significantly different from zero at the 0.001 level (two-tailed). Thus, H11a was supported. The path coefficient was 0.168, indicating a positive relationship. It means, when Perceived Ease of Use (PEU) goes up by 1 standard deviation, Attitude (ATT) goes up by 0.168 standard deviations. Furthermore, the value of F-squared was 0.027, showing that the effect size of Perceived Ease of Use (PEU) on Attitude (ATT) was small. This results confirm that the Perceived Ease of Use (PEU) of cloud computing is an influential motivator toward attitude to adopt cloud computing in higher education institutions in Yemen. This might be due to IT professionals' belief that users can use cloud services without going into details or having knowledge to operate them. This result is consistent with previous studies by Li and Chang (2012) and Shiau & Chau, (2016).

H11b⁺) Perceived Ease of Use (PEU) has a positive effect on Perceived Usefulness (PU)

The proposed model hypothesizes that the perceived usefulness (PU) of cloud computing is influenced by the Perceived Ease of Use (PEU) to adopt cloud computing in higher education institutions in yemen. As shown in Table 5.9, the t-value and p-value of Perceived Ease of Use (PEU) in predicting the Perceived Usefulness (PU) were 3.159 and 0.002 respectively. It means that the probability of getting a t-value as large as 3.159 in absolute value is 0.002. In other words, the regression weight for Perceived Ease of Use (PEU) in the prediction of Perceived Usefulness (PU) is significantly different from zero at the 0.01 level (two-tailed). Thus, H11b was supported. The path coefficient was 0.123, indicating a positive relationship. It means, when Perceived Ease of Use (PEU) goes up by 1 standard deviation, Perceived Usefulness (PU) goes up by 0.123 standard deviations. Furthermore, the value of F-squared was 0.019, indicating the effect size of Perceived Ease of Use (PEU) on Perceived Usefulness (PU) was not considerable. This result means that decision makers, IT professionals, and IT lecturers believe that if cloud computing is easy to use, it can be more useful. This result is consistent with previous studies by Al-Somali et al., (2009), Li and Chang (2012) and Shiau & Chau, (2016).

H12) Attitude (ATT) has a positive effect on Behavioral Intention (BHI)

This research hypothesizes that the Behavioural Intention (BHI) to adopt cloud computing is influenced by Attitude (ATT). Table 5.9 presents that in predicting behavioral intention (BHI), the t-value and p-value of attitude (ATT) were 8.301 and 0.000 respectively. This indicates that the probability of obtaining a t-value with a magnitude of 8.301 in absolute value is 0.000, which means that the regression weight of ATT in predicting BHI significantly differs from zero at the level of 0.001 (two-tailed). Therefore, H12 was supported and because the path coefficient was 0.319, the relationship was positive. This also means that with an increase in standard deviation of ATT by 1, Behavioural Intention (BHI) increases by 0.319 standard deviations. Furthermore, the value of F-squared was 0.109, showing that the effect size of Attitude (ATT) on Behavioural Intention (BHI) was small. The result means IT professionals have positive behavioral intention to adopt cloud computing. This result is consistent with previous studies Al-Somali et al (2009) , Y. Li and Chang (2012) and Shiau and Chau (2016).

H13) Perceived Usefulness (PU) mediates the relationship between Perceived Ease of Use (PEU) and Attitude (ATT)

As shown in Table 5.9, the result showed that there was a significant relationship between Perceived Ease of Use (PEU) and Attitude (ATT) in the absence of Perceived Usefulness (PU), with the standardized total effect of 0.182, T-value=4.046 and P-value=0.000. Thus, the total effect of Perceived Ease of Use (PEU) as IV, on Attitude (ATT) as DV, without the inclusion of Perceived Usefulness (PU) as M, was statistically significant at 0.001 level. This relation was still significant even after including Perceived Usefulness (PU) into the model, with the standardized direct effect of 0.168, T-value=3.520 and P-value=0.001. Thus, the direct effect of Perceived Ease of Use (PEU) as IV, on Attitude (ATT) as DV, with the inclusion of Perceived Usefulness (PU) as M, was statistically significant at 0.01 levels.

As depicted in Table 5.10, the effect of Perceived Ease of Use (PEU) as IV on Perceived Usefulness (PU) as M (path b) was statistically significant at 0.01 level, with the standardized effects of 0.123 and T-value of 3.159. Conversely, the effect of Perceived Usefulness (PU) as M, on Attitude (ATT) as DV (path c), was statistically significant at 0.001 level with the standardized effect of 0.180 and T-value of 3.685. This result indicates that Perceived Usefulness (PU) mediates the relationship between Perceived Ease of Use (PEU) and Attitude (ATT). The degree of mediation was partial since the paths a, a’, b and c were all statistically significant. The result supported hypothesis H13. This result gives HEIs the motivation to adopt cloud computing higher education institutions.

Further, the result revealed that Perceived Ease of Use (PEU) has a significant indirect positive effect on Attitude (ATT) through Perceived Usefulness (PU) with the standardized indirect effect of 0.014, p-value < 0.05. The results mean that PU is an important indicator of cloud computing adoption as IT professionals are willing to adopt cloud computing when they are aware about its use can improve productivity, efficiency and performance. The result consistent with previous studies by Chi (2011).

H14) Subjective Norm (SN) moderates the relationship between Perceived Usefulness (PU) and Attitude (ATT)

As shown in Table 5.11, the influence of Subjective Norm (SN) interaction with Perceived Usefulness (PU) on Attitude (ATT) was statistically significant; Coefficient Path = 0.123, T-value = 2.392, p-value = 0.017, F-square = 0.019. This result indicated that Subjective Norm (SN) moderates the relationship between Perceived Usefulness (PU) and Attitude (ATT). Thus, hypothesis H14 was supported. Figure 5.5 shows the graph of moderating effect of Subjective Norm (SN) on the relationship between Perceived Usefulness (PU) as IV, and Attitude (ATT) as DV.

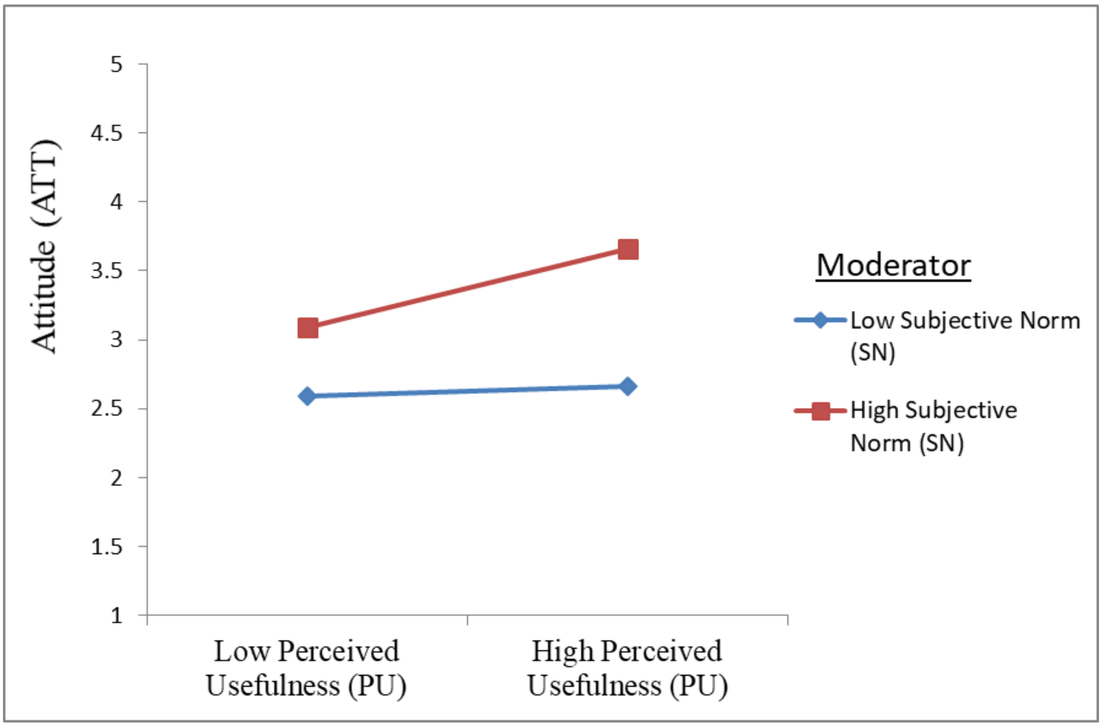

Figure 5.5 Moderation Effect of Subjective Norm (SN)

As shown in Figure 5.5, the two (2) lines pointed to a positive relationship between Perceived Usefulness (PU) and Attitude (ATT). The two lines were not parallel, which implied the existence of moderation. However, the relationship was greater for the high level of Subjective Norm (SN) compared to the low level. Hence, it could be concluded that the Subjective Norm (SN) positively moderates the relationship between Perceived Usefulness (PU) and Attitude (ATT). It means that with an increase in the level of Subjective Norm (SN) as moderator, the effect of Perceived Usefulness (PU) as IV on Attitude (ATT) as DV will increase. This result confirms that Subjective Norm (SN) significantly influences decision makers' attitudes (Nysveen et al., 2005; Schierz et al., 2010), which could reduce the negative influence of low usefulness and moderate attitude towards behavioral intention (BI). This result is consistent with previous study by Mohammadi, (2014).

5.9 Chapter Summary

Data analysis was presented in this chapter in two (2) major phases; first, preliminary analysis of data was conducted. Such analysis is significant in ensuring that data sufficiently meets the basic SEM assumptions. Generally, the data set of the entire items had normal distribution and was failure-free, with no presence of missing values and uni-variate outliers. In the second phase, the two (2) stages of SEM were conducted. First, the measurement model of the latent constructs was established. And following the confirmation of the constructs uni-dimensionality, reliability and validity, the second stage involved the testing of the proposed hypotheses in the structural model. The structural model examined 20 hypothesized direct effects (i.e., H1a, H1b, H2a, H2b, H3a, H3b, H4a, H4b, H5a, H5b, H6a, H6b, H7a, H7b, H8, H9, H10, H11a, H11ab and H12), a hypothesized mediation effect of Perceived Usefulness (i.e., H13) and a hypothesized moderation effect of Subjective Norm (i.e., H14). These were done by conducting the path analysis using SMART-PLS 2.0 and testing the significance of the path coefficients for each hypothesized path.

The findings indicated that Relative Advantage (RA), Compatibility (CMT), Top Management Support (TMS) and Technology Readiness (TR) have significant positive effects on Perceived Usefulness (PU). The results also indicated that Top Management Support (TMS), Technology Readiness (TR) and Skill of IT Professional (ITSK) have significant positive effects on Perceived Ease of Use (PEU). Complexity (CMX) and Data Concern (DC) were found to have significant negative effects on Perceived Usefulness (PU) and Perceived Ease of Use (PEU). Regulatory Policy (RPL) have significant negative effect on Behavioral Intention (BHI), while the effect of Awareness (AW) on Behavioral Intention (BHI) is significantly positive. Perceived Usefulness (PU) and Perceived Ease of Use (PEU) have significant positive effects on Attitude (ATT). The effect of Perceived Ease of Use (PEU) on Perceived Usefulness (PU) is also found as significantly positive. Finally, the results indicated that Attitude (ATT) have significant positive effect on Behavioral Intention (BHI). Thus, hypotheses H2H1a, H2a, H3a, H3b, H4a, H4b, H5a, H5b, H6a, H6b, H7b, H8, H9, H10, H11a, H11ab and H12 are supported. The results also indicated that Technology Readiness (TR) is the most important predictor of Perceived Usefulness (PU). Complexity (CMX) is found as the most important determinant of Perceived Ease of Use (PEU). The most important predictor of Attitude (ATT) is Perceived Usefulness (PU). In addition, Attitude (ATT) is detected as the most important determinant of Behavioral Intention (BHI).

From the results of mediation analysis, it was found that Perceived Usefulness (PU) partially mediates the relationship between Perceived Ease of Use (PEU) and Attitude (ATT). Therefore, the hypothesis H13 is supported. Finally, from the results of moderation analysis, it was found that Subjective Norm (SN) positively moderates the relationship between Perceived Usefulness (PU) and Attitude (ATT) toward intention to adopt cloud computing.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS FOR FUTURE WORK

6.1 Introduction

This chapter summarizes the achievement of the objectives. The chapter also explains how the results of the research contribute to both theory and practice. Then, it demonstrates how the final outcome of this research can be useful to both researchers and practitioners alike. Finally, the chapter enumerates the limitation of this research and suggests direction for future research.

6.2 Study Achievements

The main objective of this research is to investigate how cloud computing can be adopted in higher education institutions in developing countries. To achieve this main objective, research questions and objectives were formulated in Chapter I. The following paragraphs discuss the achievement of each objective.

Objective 1: To determine the factors that affect cloud computing adoption in higher education institutions in developing countries.

Adoption of a new technology by large organizations or institutions, such as higher education institutions (HEIs) are affected by a set of factors, depending on the technology to be adopted, the context or the environment. A systematic literature review was conducted to identify the factors that affect cloud computing adoption (as elaborated in Section 2.6 in Chapter 2 and Appendix A). Based on the literature, it can be seen that factors that affect cloud computing adoption in HEIs can be grouped into four (4) main perspectives, which are (1) technological - looking at factors that are related to technological context to gain clear understanding of the technology and its advantage in educational organizations., (2) organizational - looking at factors that are related to the organization and willingness to use the new technology, (3) environmental - looking at external factors such as awareness and regulations that may affect the decision to adopt the new technology, and lastly (4) individual - looking at factors from the personal or individual perspective in light of their readiness and willingness to adopt the new technology. 14 factors from total of 51 factors were shortlisted and deemed to be relevant in Yemeni context and included in Part C of the survey questionnaire (see Appendix D for complete survey questionnaire). The results of the survey questionnaire indicated that only 14 factors were significant in affecting cloud computing adoption Yemeni HEIs.

As such, it can be concluded that in ensuring the successful adoption of cloud computing in Yemeni HEIs, a number of initiatives and measures to address the most important factors from the technological, organizational, environmental and individual perspectives must be addressed and fulfilled.

Objective 2: To examine the effects of technological, organizational, environmental, and individual factors on cloud computing adoption intention.

Based on the proposed conceptual model analysing the collected data obtained from nine (9) public universities and (14) community colleges, the cloud computing adoption model was formulated. The model was tested and validated by applying the SEM technique. As elaborated in Section 3.3 of Chapter 3, 22 hypotheses were tested in this research and 19 hypotheses are supported and three (3) hypotheses are not supported. Based on this, it can be observed that from the technological perspective, factors such as data concern, complexity, and relative advantage are important in determining whether cloud computing will be adopted or not by the HEIs. Thus, it is important for HEIs to understand the various approaches that cloud computing can be used to improve productivity and perceived as being beneficial and easy to be used.

In addition, from the organizational perspective, factors such as top management support and technology readiness are important in determining whether cloud computing for will be adopted or not by the HEIs. Thus, it is important to assess the organization’s capabilities and readiness in order to help decision makers in HEIs to decide whether or not to adopt cloud computing. Actually, top management support is an indication to HEIs staff of the importance of cloud computing.

On the other hand, from the environmental perspective, factors such as regulatory policy and awareness are important in determining whether cloud computing will be adopted or not by the HEIs. Thus, it is crucial to comprehend the perceptions of the existence and enforcement of rules and regulations for users' protection when it comes to cloud computing adoption in campus and off campus of HEIs.

From the individual perspective, factors such as perceived usefulness, perceived ease of use, attitude and subjective norm are important in determining whether cloud computing will be adopted or not by the HEIs. Thus, it is crucial because adoption of enterprise level innovations is largely dependent on functional and emotional perceptions of decisions makers that constitute their attitudes, and perceptions.

6.3 The Study Implications

This research achievement is discussed by presenting several outcomes towards adopting cloud computing in higher education. The main outcome of this research is the conceptual model for adopting cloud commuting in HEIs in developing countries especially in Yemen. This research has several theoretical and practical implications. The following section addresses these contributions.

6.3.1 Theoretical Implications

Many researchers have called for integrating various theoretical models to understanding the adoption of different pioneering technologies in organizations. This research makes a significant contribution towards enriching the body of knowledge related to the adoption of new technologies like cloud computing from the perspective of higher education in developing countries, majority of which, are lacking in the technological infrastructure and minimal financial resources. This research contributes to the body of knowledge from three (3) different aspects:

- Four (4) theoretical models (TAM, TRA, DOI and TOE) are integrated and adopted in this research to strengthen the predictive power of the resulting model. The conceptual model was developed by integrating all theories that are appropriate to address the problems in Yemen for the successful adoption of cloud computing in higher education. The integration of constructs was conducted in both non-human (technical) and human (social) to offer an enriching theoretical framework for predicting and explaining adoption behavior. The model combines individual context (perceived ease of use, perceived usefulness, subjective norm) from the perspective of IT professionals, technological context (relative advantage, complexity, compatibility, data concern), organizational context (top management support, technology readiness, and IT skills), and environmental context (regulatory policy and awareness).

- This research examined Subjective Norm (SN) as the moderating variable between perceived usefulness and attitude. It confirms that SN significantly influences the decision makers' attitudes (Nysveen et al., 2005; Schierz et al., 2010), which could reduce the negative influence of low usefulness and moderate Attitude towards Behavioral Intention (BI) to adopt cloud computing.

- This research is considered as one of the first empirical studies in the field of cloud computing in the context of HEI in Yemen.

The final conceptual model of this study is shown in Figure 6.1

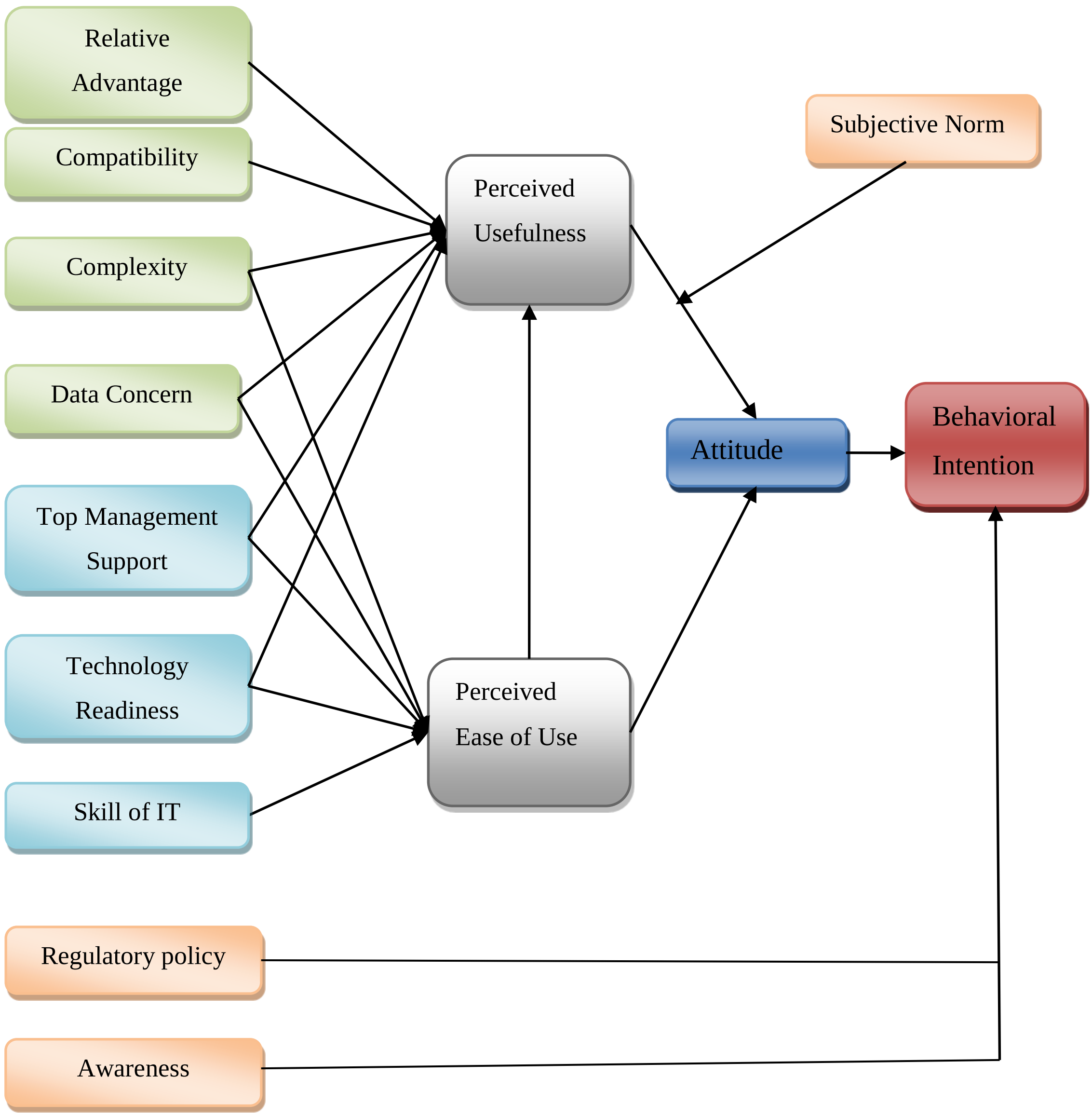

Figure 6.1 Final Model

6.3.2 Practical Implications

The investigation of challenges and understanding of the opportunities presented by cloud computing provide higher education a comprehensive picture of adopting cloud computing to improve educational delivery. By developing a conceptual model for cloud computing adoption in higher education, evidence related to the factors from the technological, organizational, environmental, and individual perspectives were identified and validated in this research. The research findings may facilitate HEIs in having better understanding on strategizing and making optimize decisions towards cloud computing adoption in improving educational delivery in the developing countries.

Based on the final model shown in Figure 6.1, a five-phase strategy adapted from Onyango and Omwenga (2016) and M. Masud, Huang, and Ong (2012) can be used to assist in adopting cloud computing for in HEIs in Yemen (as shown in Figure 6.2).

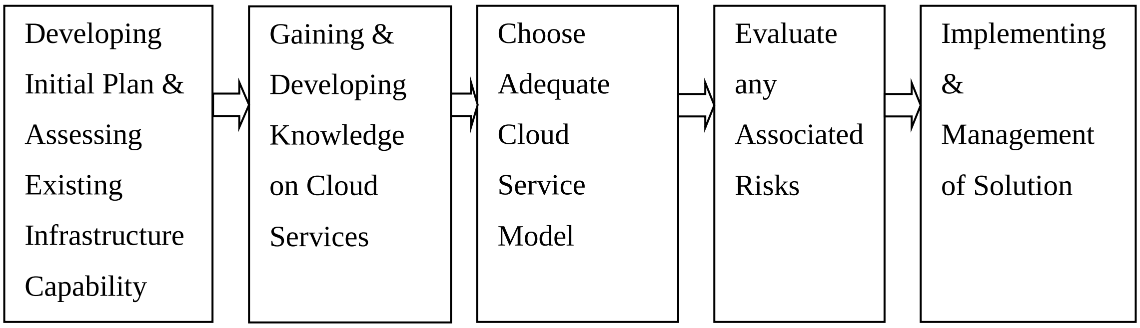

Figure 6.2 Cloud Computing Adoption Strategy /Road map

Phase 1: Developing Initial Plan and Assessing Existing Infrastructure

In this stage, the initial plan and requirements have to be formulated and developed. Strength, Weakness, Opportunities, Threat (SWOT) tool analysis maybe used to evaluate the strength, weakness, opportunities, and threats of resources and infrastructure are reviewed in this phase.

In ICT innovation, cloud computing is deemed to a significant technology to provide strategic and operational benefits, but as yet, HEIs have not totally embraced and accepted its use and adoption. Hence, there is a need to understand the factors that affect such adoption cloud computing among HEIs. Therefore, the present research developed and proposed a conceptual model to examine the drivers of cloud computing adoption among HEIs.

The research managed to obtain major findings and implications concerning the cloud computing adoption determinants in Yemeni HEIs. In fact, cloud computing adoption in this context largely depends on the technological, organizational, environmental and individual aspects. In this background, new technologies are expected to provide advantages and value to HEIs but their adoption is somewhat hindered by several reasons, with one of them being the lack of full awareness of the potential advantages that the innovations can provide. In other words it is important to be aware and to understand such advantages for the adoption decision process. In this research, relative advantage was found to significantly influence PU towards intention to adoption cloud computing in HEIs. This is an indication of the necessity for the decision makers to conduct an evaluation of cloud computing benefits and to maximize awareness on such innovations to mitigate the uncertainty level. Organizations, which are convinced of the benefits offered by the innovation (relative advantage), have a higher likelihood to adopt it (J. Lee, 2004). But such relative advantage has to be known by HEIs. It is thus assumed that universities need to be convinced prior to taking a positive adoption decision that by adopting cloud services (as a computing model), they can enhance their delivery of education and their productivity.

Compatibility was observed to have a significant influence on PU towards intention to adopt cloud computing in HEIs. This implies that IT professionals' decision tended to evaluate whether the adoption cloud computing could meet their job needs or be relevant to their job. If they perceived that the adoption cloud computing could meet their job needs, then they will be more likely to adopt cloud computing. Prior studies support this finding by reporting that compatibility is a crucial attribute of IS innovation and organizations have a higher likelihood of adopting them if there is compatibility between them and the work practices. According to Rogers (2003), enhanced rate of adoption of a certain innovation can be facilitated when the organizations are convinced of its compatibility with the practice and needs within them. As such, decision makers tend to assure themselves first of the compatibility of certain ICT services with job responsibility and value systems prior to their adoption.

Moving on to complexity, it was found to significantly influence intention towards adopting cloud computing via PU and PEU. This finding is aligned with the reported prior findings that revealed complexity to be a significant factor in making decisions towards new technologies adoption(Alshamaila et al., 2013; Gamage, 2019; Gangwar et al., 2015b; Parveen & Sulaiman, 2008; Sabi, Uzoka, Langmia, Njeh, et al., 2016). The findings confirm that complexity is a hindrance to cloud computing. This might be due to lack of technical skills needed to implement and use cloud computing. The findings support the argument that complexity can hinder cloud computing adoption and this may be attributed to the lack of technical skills required for cloud computing implementation.

Top managers are in the position of authority to influence their subordinates' behavior and based on prior studies, top management support and motivation positively affects their subordinates' behavior towards IT adoption and use (Han, 2003). Top management can promote or hinder innovation adoption and it is notable that the factor was found to be statistically significant on intention towards adopting cloud computing in HEIs through PU and PEU. This indicates that top management support (TMS) can enhance adoption of new technology and in this study's case, can support the education process development and enhancement.

Phase 2: Gaining and Developing Knowledge on Cloud Computing Services

This phase entails acquiring knowledge on cloud computing service types via conferences, workshop, seminars, and benchmarking with other IT experts. In this phase, knowledge base warehouse for sharing information on technology trend is created.

Moreover, new technology implementation in an organization calls for skilled IT staff to increase the chance of successful implementation. Majority of studies deemed IT staff skills as one of the top factors in cloud computing adoption. In fact, both IT skill and awareness are significant predictors of the adoption of cloud computing as revealed by the findings of this research. This confirms that awareness of IT and IT skill possession are considered as a motivating constructs that encourage decision makers' intention to adopt cloud computing in higher education institution in Yemen.

Aside from the above factors, educating decision makers in HEIs concerning the best practices and strategies to implementing cloud computing may also facilitate high rate of adoption. Despite the security vulnerabilities of technology, security enhancements have shown leaps and bounds over the years. Development of cloud services in higher education may provide benefits to education stakeholders particularly because online education is expected to grow after learners are provide the benefit of on-demand education services furnished by the cloud. Additionally, management of HEIs will have a bigger pool of diverse educators to choose from all over the globe to provide an enriching experience and culture into education provision.

The adoption of cloud computing in HEIs will enable the institutions to share their knowledge and expertise in countries that they can only visit through virtual realm. Added to this, learners may also reap the benefits of learning and participating in novel educational experiences that can only be possible through cloud computing.

Phase 3: Choosing an Adequate Cloud Computing Service Model

Owing to the hesitant adoption of cloud computing because of security issues in higher education, private cloud usage can provide administrators more confidence in using it. Private cloud usage allows decision makers to use cloud computing systematically making it more acceptable. Community clouds form another alternative that could be deployed to a single department at a time, with security and reliability ensured. This allows decision makers to experience the different levels of cloud computing applications.

Phase 4: Assessing any Associated Risks

Assessment of risk is considered as a key process in identifying cloud service providers' capability. Assessment of contractual, compliance and legal details is very relevant. Carry out source audits of the cloud provider facility will help with transparency; analyze service provider privacy policy critically to determine any possible exposure to risks.. Pertinent and specific metrics should be provided in the cloud-Service - Level-Agreements (SLA) for monitoring purpose.

Data concern has a significant influence on intention to adopt cloud computing through Perceived Usefulness (PU) and Perceived Ease of Use (PEU) in HEIs in Yemen. With more and more data stored in the cloud, it is natural for HEIs to be concerned about data privacy and thus, data concern is assumed to hinder the adoption of cloud computing. Based on this result, data concern involving the possibility of attacks affect the perceptions of IT professionals of the usefulness of cloud computing. In other words, to improve the perception of IT professionals in this regard, cloud computing security needs to be improved and supported.

Phase 5: Implementing and Management of Solution

In this phase, documentation of the processes is significant for the team to adopt cloud computing. Internal skills are required for first level support and resource has to be empowered to support solution. Any feedback should be made under this phase.

6.4 Limitations

The first limitation of this research is the scope of the study, which is confined to public higher education institutions in Yemen. The data survey was collected only from IT professionals which consist of IT managers, IT staff, and IT lecturers in public higher education institutions in Yemen. The questionnaire design was catered towards individuals who hold the knowledge and authority for making decisions regarding the adoption of cloud computing services or resources in public higher education institutions in Yemen. That means that the research only reflects the reality of the Yemeni case. Furthermore, the unit of analysis of this research is an individual level and needs to use organizational level analysis.

The next limitation concerns the use of a cross-sectional approach in this research rather than a longitudinal one. In effect, a cross-sectional approach tests the relationships among constructs at a certain point in time, rather than their causal associations throughout a significant period. The employment of a conceptual framework, such as, TOE and DOI to study innovation adoption of technology, requires the testing of the characteristics of innovation before adoption and after implementation, and this calls for a longitudinal study (L. G. Tornatzky & Klein, 1982). Furthermore, it is noted that factors of innovation adoption may change over time (Tornatzky & Klein, 1982). Thus, a longitudinal study can be conducted to determine the variation in adoption constructs in the future work.

6.5 Recommendations

Many recommendations for continuing research in the cloud computing adoption can be concluded from this research. First, this research can be extended to higher education institutions in other developing countries to assess factors effecting cloud computing adoption in different geographical environments or governmental administrations. Second, the integration of conceptual model can be examined in other contexts of cloud computing in organizations such as banks, hospitals, and small and medium enterprises (SMEs). Third, use of technology, such as cloud computing, will help HEIs in Yemen to improve education and keep abreast with educational approaches such as blended learning, distance and online education learning, mobile learning and e-learning with minimum cost. Finally, it is recommended that an evaluation is conducted before and after the implementation of cloud computing adoption constructs in higher education institution to assess the weaknesses and strengths .

6.6 Chapter Summary

In conclusion, to assist adoption of cloud computing in higher education institutions in Yemen, this research identified the main barriers and challenges that HEIs in developing countries face as they seek to improve the quality of education as well as the drivers of cloud computing. The effecting factors were tested via developing conceptual model of cloud computing adoption. This conceptual model contributes to cloud computing in theory and practice. Although, this research has some limitations, recommendations for future studies were suggested.

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APPENDICES A-G

APPENDIX A

INFLUENCING FACTORS OF CLOUD COMPUTING ADOPTION

Author	Factors				Approach	Results
	Technological (T)	**Organizational (O)**	**Environmental (E)**	**Individual (I)**		
(Sabi, Uzoka, Langmia, Njeh, et al., 2016)	• Relative advantage • Complexity • Compatibility • Trailability • Observability • Result demonstrable • Cost • Risk • Data security • Infrastructure	• university size • university age	• Socio-cultural • Awareness • University location	• Perceived Usefulness (PU) • Perceived Ease Of Use (PEOU) • Individual age	**Method:** A quantitative study using questionnaire **Respondents:** (355) respondents from public and private universities in four SSA countries (Cameroon, Ghana, Nigeria, and Uganda) , as well as members of the Association of Information Systems Southern African Chapter (AISSAC). **Theories used:** -Diffusion of Innovation (DOI) -Technology Acceptance Model (TAM).	The results show that data security, result demonstrable, use fullness, Socio-cultural, age of university, size of university, and individual age have a most significant effect on intent to adopt cloud computing .
(Yuvaraj & Yuvaraj, 2016)	• Scalability • Availability • Security risk • Privacy risk	• Return on time		• Perceived Usefulness (PU) • Perceived Ease Of Use (PEOU) • Attitude	**Method:** A quantitative study using questionnaire **Respondents:** Library professionals in 28 central universities in India. **Theories used:** -Technology Acceptance Model (TAM).	The results show that PEOU, PU, availability have significant towards behavior intention to adopt cloud computing in libraries.
(Bhatiasevi & Naglis, 2015)	• Perceived Convenience • Trust • Software Functionality			• Subjective norm • Computer self-efficacy • PU • PEOU	**Method:** A quantitative study using questionnaire **Respondents:** (393) from Mahidol university international college, and Thammasat university in Thailand.	The results showed that PU, PEOU, Perceived Convenience, Trust, Software Functionality have a positive relationship to intention to adopt cloud computing

					Theories used: -Technology Acceptance Model (TAM).	
(Klug & Bai, 2015b)	• Relative advantage • Complexity • Compatibility	• Technology readiness • Institutional size • Perceived barriers	• Regulatory polices • Service provider support		**Method:** • A quantitative study using questionnaire **Respondents:** (119)CIO and IT managers in U.S universities **Theories used:** -Technological, Organizational and Environmental (TOE) framework	The findings showed that all factors are statistically significant in determining cloud computing adoption except relative advantage, regulatory policy, and service provider support.
(Dawson, 2015)	• Perceived security • Perceived Reliability • Perceived benefits			• PU • PEOU	**Method:** A quantitative study using questionnaire **Respondents:** (217) higher education in USA **Theories used:** -Technology Acceptance Model (TAM).	The results showed that all factors have a significant correlation to cloud computing adoption
(A. Tashkandi & I. Al-Jabri, 2015)	• Relative advantage • Compatibility • Privacy Concerns • Vendor lock- in • Complexity	• Top management support	• Regulatory policies • Government pressure • Peer pressure		**Method:** A quantitative study using questionnaire **Respondents:** (33) responses of IT decision maker in higher education in KSA. Theories used: -Technological, Organizational and Environmental (TOE)	Three Factors were found significant in this context study: Relative Advantage, Data Privacy and Complexity are the most Significant factors.
(Y. Li & Chang, 2012)	• security concerns • privacy concerns • vendor lock-in	• Transfer skill	• vendor reputation	• attitude • perceived behavioral control(PBC) • subjective norm • PEOU	**Method:** A quantitative study using questionnaire **Respondents:** (225) students at a leading private university in Taiwan.	The results shows that a person's attitude toward cloud applications, subjective norm, and perceived behavioral control have direct impacts on the person's behavioral intention to

				• PU • voluntariness	**Theories used:** -Theory Planed Behavior (TPB). -Technology Acceptance Model (TAM).	use the applications. Meanwhile, privacy and security concerns, concerns about vendor lock-in, perceived vendor reputation, perceived usefulness, perceived ease of use, and perceived transferability of previously learned computer skills, have indirect impacts on behavioral intention.
(Shiau & Chau, 2016)	• Trialability • Result demonstrable • Visibility • Compatibility • cloud service quality • Applications service quality			• voluntariness • self-efficacy • cloud self-efficacy • PBC • PEOU • PP • PU • Attitude • Subjective norms	**Method:** A quantitative study using questionnaire **Respondents:** (478) students at medium size university in Taiwan **Theories used:** -Service Quality Model(SQ). -Motivational Model (MM). -Technology Acceptance Model (TAM). -Theory of Reason Action(TRA) -Theory of Planed Behavior (TPB). -Innovation diffusion Theory (IDT).	The results found that all factors have significantly positive effects on the intention to use cloud computing
(Senyo et al., 2016)	• Relative advantage • Security concern • Compatibility	• Top Management support • Firm Size • Firm Scope	• Competitive pressure • Trading partners' pressure • Regulatory support		**Method:** A quantitative study using questionnaire **Respondents:** (305) organizations from different industries in Ghana. **Theories used:** -Technological, Organizational and Environmental (TOE).	The results showed that all factors have significant effect on adopt cloud computing except compatibility, firm size, scope size and regulatory support.
(Smith Jr, 2016)	•	• Top Management support • Technology readiness		• monetary incentive • advancement opportunities • Recognition and	**Method:** A quantitative study using questionnaire **Respondents:**	The result revealed that advancement, recognition and satisfaction from accomplishments, top

				satisfaction • Job terminator • Diminishment of personal image	(189) IT executes of companies in USA. **Theories used:** -Technological, Organizational and Environmental (TOE). - Transaction Cost Theory (TCT). - Agency Theory. -Motivation theory.	management support, diminishment of personal image, and pattern of technology readiness have a positive influence on business intentions to adopt cloud computing services.
(Isma'ili, Li, He, & Shen, 2016)	• Security Concern • Relative advantage • Compatibility • Complexity • Uncertainty • Trailability	• Top Management support • Firm Size • Innovativeness of firm • IT experience	• Competitive pressure • Industry • Market Scope • External Computing support		**Method:** A qualitative study using Semi-structured Interviews. **Respondents:** (15) Firms in Australia. **Theories used:** -Technological, Organizational and Environmental (TOE). -Diffusion of Innovation theory (DOI). -Actor Network Theory (ANT).	The results showed that all factors have significant effect on adopt cloud computing except complexity and competitive pressure.
(Asadi et al., 2016)	• Security & Privacy • Trust • Perceived benefit	• Cost		• Social influence • PU • PEOU	**Method:** A quantitative study using questionnaire Respondents: (192) Malaysian banking customers which already using online banking services. **Theories used:** -Technology Acceptance Model (TAM). Diffusion Theory Model (DTM).	The results show that PU, PEOU, attitude toward cloud, reduce cost, and trust have a significant influence customers' behavioral intention to adopt cloud computing.
(C.-L. Hsu & Lin, 2016)	• Relative advantage • PEOU • Compatibility • Trailability • Observability • Security	• Firm size • Global Scope • Financial Costs • Satisfaction with existing IS •	• Competition intensity • Regulatory environment		**Method:** A quantitative study using questionnaire **Respondents:** (1000) president companies in Taiwan. **Theories used:** -Technological, Organizational and Environmental (TOE).	The results showed that all factors were positively related to intention to adopt cloud computing.

(Alharbi, Atkins, & Stanier, 2016)	• Relative advantage • Technology readiness • Compatibility • Complexity	• Top Management Support • Hard financial analysis • Soft financial analysis	• Regulatory compliance • Business ecosystem partner pressure • external expertise	• COI innovativeness • internal expertise • prior technology experience	**Method:** A quantitative study using questionnaire **Respondents:** (201) IT specialists, health professional, and administrative in Saudi health care organization. **Theories used:** -Technological, Organizational and Environmental (TOE). -Human, Organization, Technology (HOT-fit).	The results showed that all technology, organizational, environment, and human have a significant influence on adoption cloud computing in healthcare organization in KSA.
(Polyviou, Pramatari, & Nancy, 2016)	• Reduction cost • Remote access • security	• Managerial innovativeness • Personnel innovativeness			**Method:** A quantitative study using questionnaire **Respondents:** (74) CIO in Greek firms. **Theories used:** -Diffusion of Innovation (DOI). -Organizational Capability.	The results indicated that reduction cost, remote access and personnel innovativeness had a significant effects towards intention to adopt cloud computing while security and managerial innovativeness had insignificant effect to intent to adopt cloud computing.
(Osman, 2016)	• Relative advantage • Complexity • Security	• Top management support • Funding • Firm size			**Method:** A quantitative study using questionnaire **Respondents:** (326) out of (347) consisting (Directors, IT staff, and middle manager IT) in 9-1-1 dispatch center in USA. **Theories used:** -Technological, Organizational and Environmental (TOE).	The result indicated that all factors had significant determinants of adoption cloud computing except complexity and security.
(T. H. Lee, 2015)	• Relative advantage • Complexity • Compatibility	• Organizational size • structure	• culture		**Method:** A quantitative study using questionnaire **Respondents:** (118) information technology manager from qualified USA	The findings revealed that all factors had significant correlation with public cloud adoption intent.

					hospitals **Theories used:** -Technological, Organizational and Environmental (TOE). -Diffusion of Innovation (DOI).	
(Kyriakou & Loukis, 2015)	• complexity • telework • IT infrastructure • electronic interconnection • data warehouse and mining • mobile service • IT outsourcing	• IT investment reduction strategy • Innovation orientation strategy • Process innovation strategy		• Skill of IT personnel	**Method:** A quantitative study using questionnaire. **Respondents:** (676) European firms from six European countries (Germany, France, Italy, Poland, Spain , UK . **Theories used:** - Leavitt's Diamond framework.	The result indicated that all factors had a significant effects on the propensity to adopt cloud computing.
(Gangwar et al., 2015b)	• Complexity • Compatibility -Relative advantage • Cloud concern security	• Top management support • Technology readiness • Training and education	• Trading partner pressure • Competitive pressure	• PU • PEOU	**Method:** A mix method using interview and questionnaire **Respondents:** (280) companies in IT, manufacturing and finance sectors in India. **Theories used:** -Technological, Organizational and Environmental (TOE). -Technology Acceptance Model (TAM)	The results showed that relative advantage, compatibility, complexity, Technology readiness, top management , 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 intention of cloud computing adoption .
(LAL, Bharadwaj, Irani, & Irani, 2016)	• Relative advantage	• Top management support	• Vendor credibility	• PU • PEOU	**Method:** A qualitative study using interview. **Respondents:** (21) Indian cases were studied by interacting with respondents having similar profiles (i.e. CIOs, CTOs, systems managers and technology	The study showed that all factors have a significant influence on the adoption of cloud – base services.

					heads. **Theories used:** -Diffusion of Innovation theory (DOI). -Technological, Organizational and Environmental (TOE). -Technology Acceptance Model (TAM).	
(Scholtz, Govender, & Gomez, 2016)	• availability • privacy • Lack of control of data • Multitenancy • Cyber attacks • System performance • Difficulty to integrate with in-house system • Not enough ability to customize • Difficult to bring back in-house • Lack of support from vendors • Lack of compatibility with proprietary software • Poor IT infrastructure currently in place		• Lack of approved cloud standard. • No national cloud computing policy. • No national, local l or agency cloud adoption strategy. • Regulatory requirements. • Trans-border information flow. • Lack of specialist public sector local vendors. • Electricity availability. • Broadband connectivity. • Sustainability and carbon efficiency.		**Method:** A quantitative study using questionnaire. **Respondents:** (51) Respondents comprising of government CIO, government senior management and IT decision makers in South Africa. **Theories used:** -None	The findings revealed that the majority of the respondents showed concern regarding the availability and privacy of data. The environmental factors that were of the most importance to respondents were adoption strategies of cloud computing implementations as well as the provision of usage guidelines and regulatory requirements in organizations.
(Gutierrez, Boukrami, & Lumsden, 2015)	• Relative advantage • Complexity • Compatibility	• Top management support • Firm size • Technology Readiness	• Trading partner pressure • Competitive pressure		**Method:** A quantitative study using questionnaire. **Respondents:** (257) mid-to-senior level decision –making business and IT professionals from arrange of UK	The results showed that competitive pressure, complexity, technology reediness, and trading partner pressure have a significant effect on adopt cloud computing.

					end user organizations. **Theories used:** -Technological, Organizational and Environmental (TOE).	
(Polyviou & Pouloudi, 2015)	• Relative advantage • Compatibility • complexity	• Interoperability • Focus on key • business processes • More organization • Meet security • standards • Meet • environmental • standard • Transparency of • processes standards	• Bureaucracy • Political matters • Legal issues		**Method:** A qualitative study using Semi-structured Interviews. **Respondents:** (21) Participants in public sector in six European countries (UK, Greece, Germany, Italy and Poland. **Theories used:** -Technological, Organizational and Environmental (TOE). -Diffusion of Innovation theory (DOI).	The results showed the technological factors (except complexity) and organizational nature seem to be positively Influencing the adoption of cloud in the public sector whereas environmental factors seem to be making the adoption decision difficult and lengthy.
(Aharony, 2015)	• Threat • challenge	• computer use	• social media use	• openness to experience • self-efficacy • personal innovativeness • self-efficacy • PEOU	**Method:** A quantitative study using questionnaire. **Respondents:** (140) librarian & information specialist from 700 members in Israeli library and information science. **Theories used:** -Technology Acceptance Model (TAM).	The results showed that all factors have significant correlations towards behavior intention to use cloud computing except threat.
(Lian, 2015)	• Trust in e-government • Security concern • perceived risk		• social influence	• performance expectancy • Effort expectancy • facilitating condition	**Method:** A quantitative study using questionnaire. **Respondents:** (251) valid responses for adoption cloud computing based e-invoicing, a novel e-government service in Taiwan. **Theories used:** -Unified Theory of Acceptance and Use of Technology (UTAUT).	The findings indicate that effort expectation, social influence, trust in e-government, and perceived risk have significant effects on the intention to use cloud computing.

(Hutchison, 2014)			• Social influence	• Performance expectancy • Effort expectancy • Facility condition • voluntariness • Experience • Gender	**Method:** A quantitative study using questionnaire. **Respondents:** (381) Health care IT professionals in hospitals in USA. **Theories used:** - Unified Theory of Acceptance and Use of Technology (UTAUT).	The results found that performance expectancy and effort expectancy have a significant and positive influence on behavioral intent to adopt cloud computing based file storage and that facilitating conditions has a significant and positive influence on use behavior. The experience moderator had moderating effects on performance expectancy and social influence and the gender moderator had a moderating effect on facilitating conditions.
(Alkhater et al., 2014)	• Availability • Reliability • Trust • Security • Privacy • Relative advantage • Compatibility • Complexity •	• Top management support • Organizational size • Technology readiness	• Compliance with regulation, • Competitive pressure • Trading partner pressure • Physical location		**Method:** A qualitative study using semi-structured interviews. **Respondents:** (20) IT experts at different organizations in Saudi Arabia. **Theories used:** -Technological, Organizational and Environmental (TOE). -Diffusion of Innovation Theory (DOI).	The results showed that all factors have a significant effect to adopt cloud computing except trading partner.
(Tehrani & Shirazi, 2014)	• Relative advantage • cost • Security • Privacy • Trailability • Complexity • compatibility	• Employees IS knowledge • information intensity	• External support • Competitive pressure	• -decision maker innovativeness (H) • -cloud knowledge of decision maker (H)	**Method:** A quantitative study using questionnaire and developed and modified by a panel of experts. **Respondents:** Decision makers of 101 SMEs agreed to participate in this survey. **Theories used:** -Diffusion of Innovation Theory (DOI). - Technological, Organizational and Environmental (TOE).	The results of regression analysis reveal that decision maker's knowledge about cloud computing is the main influential factor in adopting this technology.

Ibrahim, 2014)	• Performance (PRF) • -Security (SEC) • Adaptability (ADP) • Compatibility (CMP)			• Perceived ease of use (PEOU) • Perceived usefulness (PU) •	**Method:** A quantitative study using questionnaire. **Respondents:** (153) respondents in IT organization in US. **Theories used:** -Technology Acceptance Model (TAM)	The results showed that all external variables have a significant correlation to PU, thus, The variables of performance and security have significant correlation to PEOU. Furthermore PU and PEOU showed a significant correlation with the Behavioral intention to use cloud computing.
(Cohen, Mou, & Trope, 2014)	• Compatibility • Complexity	• Top management support • Absorptive capacity	• Mimetic pressure • Normative pressure		**Method:** A quantitative study using questionnaire. **Respondents:** (87) firms in south Africa by targeting decision makers with IT responsibilities in their firms **Theories used:** -Instructional theory. -Absorptive capacity theory.	The results showed that all factors have significant influence on adoption cloud computing except normative pressure.
(Lian et al., 2014)	• Complexity • Compatibility • Data Security • Relative advantage	• Top Management Support • Adequate Resource • Costs	• Government policy • Industry pressure	• CIO Innovativeness • Technical competence	**Method:** A quantitative study using questionnaire. **Respondents:** (106) medical centered and metropolitan hospitals in Taiwan by targeting CIOs. **Theories used:** -Technological, Organizational and Environmental (TOE). -Human, Organization, Technology (HOT-fit).	The findings showed that the most critical factors are: data security, Technical competence, Costs, Top Management Support and complexity toward adoption cloud computing. Among four dimensions, the most important one is Technology followed by Human (individual), organizational and environment.
(Sulaiman & Magaireah, 2014)	• Relative advantage • Complexity • Compatibility	• Top Management Support • Firm size • Technology Readiness	• Competitive pressure • Trading partner pressure		**Method:** A qualitative study using interview. **Respondents:** (5)IT experts in the healthcare sector in Jordon.	The results found that there are a technological, organizational and environmental factors affect adoption of integrated cloud-based E-health record.

					Theories used: -Technological, Organizational and Environmental (TOE).	
(Kuiper, Van Dam, Reiter, & Janssen, 2014)	• Relative advantage • Compatibility • Complexity • Trailability • Observability • Security • Risk	• Traceability • Auditability •	• perception of term cloud	• Convincing IT manager	**Method:** A quantitative study using questionnaire. **Respondents:** Respondent survey in Spain ,Netherlands, Austria, Norway, Portugal and Belgium **Theories used:** - Diffusion of Innovation theory	The findings showed that all factors were the most important factors for cloud computing adoption.
(Oliveira et al., 2014)	• Relative advantage • Security concern • Cost saving • complexity • Compatibility	• Technology readiness • Top management support • Firm size	• Competitive pressure • Regulatory support		**Method:** A quantitative study using questionnaire. **Respondents:** (369) firms in Portugal by targeting (CIOs, directors, Senior IS manager). **Theories used:** -Diffusion Innovation Theory (DOI). -Technological, Organizational and Environmental (TOE).	The result show that relative advantage, complexity, technological readiness, top management support and firm size have a direct effect on a firm's adoption cloud computing while security concern and cost saving have indirect effect.
(Shin, 2013)	• Availability • Security • Reliability • Access			• PU • PEOU • SN	**Method:** A quantitative study using questionnaire. **Respondents:** 23 government central ministries, 39 regional government offices and 31 government supported research in south Korea **Theories used:** - Technology Acceptance Model (TAM) - Theory of Reason Action (TRA).	The findings showed that user intention and behavior is affected by perceived feature of cloud service.

(Alshamaila et al., 2013)	• Relative advantage • Uncertainty • Compatibility • Complexity • Trailability	• Size firm • Top management Support • Innovativeness • prior IT experience •	• Competitive pressure • Industry • Market scope • Supplier effort and external computing support		**Method:** A mix method using questionnaire and interview. **Respondents:** (15) different SMEs and service providers in the north east of England. **Theories used:** -Technological, Organizational and Environmental (TOE).	The finding showed that all factors have a significant effect to adopt cloud computing except competitive pressure.
(Gupta et al., 2013)	• Ease of use and Convenience • Reliability • Sharing and collaboration • Security and privacy	• Cost reduction			**Method:** A mix method using interview and questionnaire. **Respondents:** (30) Respondents in small and medium businesses in Singapore. **Theories used:** -Non	Findings showed that cost reduction, Ease of use and convenience and privacy and security are supported whereas reliability and sharing and collaboration are not supported.
(Borgman et al., 2013)	• Relative advantage • Complexity • Compatibility	• Firm Size • Top management support • IT expertise of business users	• Competitive intensity • Regulatory environment		**Method:** A quantitative study using questionnaire. **Respondents:** (669) global IT executives and other senior executive decision makers from24 global enterprises. **Theories used:** -Technological, Organizational and Environmental (TOE).	The results indeed indicate that the technology and Organization context affect implementation decisions to adopt cloud computing.
(Ekufu, 2012)				• PEOU • PU • Attitude • PBC • SN	**Method:** A quantitative study using questionnaire. **Respondents:** (105) out of 250 IT managers and decision makers in organizations that have implemented or were in the process of implementing cloud computing in USA. **Theories used:**	The results show that there is a positive relationship between five factors and Behavioral intention to adopt cloud computing.

					-Technology Acceptance Model (TAM). -Theory Behavioral Planed (TBP).	
(Opala, 2012)	• cloud security	• cost effectiveness	• IT compliance		**Method:** A quantitative study using questionnaire. **Respondents:** (282) IT leader of companies in US including CIO, CTO, Director of IT, and IT enterprises managers. **Theories used:** -Non	The results indeed indicate management's perception of security, cost-effectiveness and IT compliance factors significantly influence the decisions to adopt cloud computing.
(Bharadwaj & Lal, 2012)	• Relative advantage • PU • PEOU	• Organization's attitude toward using technology	• Vendor Credibility		**Method:** Case study approach was used for this study. **Respondents:** (10)from 25 IT professional from different company in India **Theories used:** - Technology Acceptance Model (TAM). - Dynamic Capability Theory(DCT) -Diffusion of Innovation (DOI).-Contingency Theory.	The results suggest that decision to adopt cloud computing depend on factors such as relative advantage, PU, PEOU, vendor credibility, organization's attitude toward using technology.
(Opitz et al., 2012)	• Result demonstrability • output quality	• experience	• subjective norms	• Image • PU • PEOU • Job relevance	**Method:** A quantitative study using questionnaire. **Respondents:** (100)CIOs and IT managers stock indexed Companies in Germany. **Theories used:** - Technology Acceptance Model (TAM2).	The results of study showed that all factors have significant effect to intent to use cloud computing.
(Malak, 2016)	• Compatibility	• Top management	• Coercive pressure		**Method:**	The results indicated that all

	• Relative advantage	support • Organizational readiness • Organizational size	• Normative pressure • Mimetic pressure		A quantitative study using questionnaire. **Respondents:** (136) Decision makers included CTOs, CIOs, IT VPs and directors, data center managers, and network managers, in addition to other IT operations and from different U.S. industries **Theories used:** -Technological, Organizational and Environmental (TOE). -Diffusion Innovation Theory (DOI).	independent factors have a positive impact on predictors of IT decision makers' intent to adopt cloud computing except organizational size.
(Tweel, 2012)	• Compatibility • Relative advantage	• top management support • Organizational readiness • Organizational size	• Coercive pressure • Normative pressure • Mimetic pressure		**Method:** A quantitative study using questionnaire **Respondents:** (221) expert IT decision makers from different U.S. industries **Theories used:** -Technological, Organizational and Environmental (TOE). -Diffusion Innovation Theory (DOI). - Institutional Theory.	The results revealed that these factors emerged as significant determinants of IT managers' interest in adopting cloud computing Except organizational size
(Stankov et al., 2012)	• Scalability • cost savings • Technological flexibility • high level of functionality • access to advanced technology • security and privacy of customer data • integration with		• location of data storage		**Method:** A quantitative study using questionnaire. **Respondents:** (327) companies in Germany. **Theories used:** Non	The results showed that 39% of German Internet start-up companies currently use cloud computing in their business activities. Another 56% of respondents are familiar with cloud computing technology, but do not use in practice. Only 5% have never heard of cloud computing and 3% heard about CC but don't know what it is

	current systems • performance •					
(Lin & Chen, 2012)	• Compatibility • Complexity • Relative advantages • Observability • Trialability				**Method:** A qualitative study using semi-structured interview. **Respondents:** (19) professionals IT in organization in Taiwan **Theories used:** -Diffusion Innovation Theory (DOI).	The result showed that the primary concern of IT professionals were on IT development environment, compatibility of cloud computing adoption with companies' existing policy, relative advantage and business need. The results also suggested that most of IT companies in Taiwan would not adopt cloud computing until uncertainties associated with cloud computing.
(Powelson, 2011)	• Compatibility • Complexity • Relative advantages • Observability • Trialability • Demonstrable Result			• Voluntariness	**Method:** A quantitative study using questionnaire. **Respondents:** 151 from (3,897) small business leaders in U.S. **Theories used:** -Diffusion Innovation Theory (DOI).	The results of the study indicated a high correlation between all of the predictor variables and the intent to use cloud computing, except for voluntariness.
(Low et al., 2011)	• Relative • advantage • Compatibility • Complexity	• Top management support • Technology readiness • Firm size	• Trading partner pressure • Competitive pressure		**Method:** A quantitative study using questionnaire. **Respondents:** (111) firms belonging to the high-tech industry in Taiwan. **Theories used:** -Technological, Organizational and Environmental (TOE).	The results showed 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.
(Saya, Pee, & Kankanhalli, 2010)	• Perceived accessibility • Perceived scalability • Perceived security	•	• Institutional influences • Growth options • Abandonment options		**Method:** A quantitative study using questionnaire. **Respondents:** (101) IT professional from	The results showed that institutional influences had a significant effects on the technological characteristics factors towards intention cloud

	• Perceived cost-effectiveness		• Deferral option •		(124) participants who were employed in managerial positions in Singapore. **Theories used:** -Institutional theory - Real Option Theory (ROT).	computing.
(Ross, 2010)	• The need of cloud computing • Security effectiveness • Reliability	• cost effectiveness			**Method:** A quantitative study using questionnaire. **Respondents:** (30) Managers of information technology in organization in USA. **Theories used:** -Non	the A strong positive relationship was found between each of these four independent variables: and the dependent variable: the management interest in adopting cloud Computing technology.

APPENDIX B

CATEGORIZING AND SIMILARITY OF FACTORS

Appendix B Categorizing and Similarity of Factors

Context	Factors	Sub-Factors
Technological	Relative advantages	IT flexibility, ease of access, scalability, cost saving, technological flexibility, cost reduction, direct benefits, sharing and collaboration.
	Compatibility	Integration with current systems, support and integration with university service, Convenience.
	Complexity	
	Data concern	Risk, privacy risk, Security concern, data security.
	Quality services	Bandwidth, Availability, Quality of Internet connection, cloud service quality
	Reliability.	
	Trust	
	Uncertainty	
	Vendor lock-in	
	Need of technology	The need of cloud computing
	Performance	Performance related to connectivity
	Trailability	
	observability	
	Adaptability	
	Result demonstrable	Demonstrable results,
	Output quality	information quality
	Visibility	
Organizational	Top management support	
	Technology Readiness	IT infrastructure readiness, Technology Sensing capability, Technology Response capability.
	Firm size	Organizational size , institutional size
	Global scope!	
	perceived barriers	
	Skill of IT human resource	IT expertise of business users, Training and education, employee IS knowledge , prior IT experience, experience, transfer skill, computer use
	Information intensity	
	Focus on key business	
	feasibility	
Environmental	Trading partner pressure	Normative pressure , coercive pressure, , perceived industry pressure , external pressure
	Competitive pressure	peer pressure ,Mimetic pressure , competitive intensity, perceived industry pressure
	Government pressure	
	Regulatory Policies	Compliance with regulation, Regulatory support, regulatory environment, Bureaucracy political matters, Legal issues, firm structure , organization meet security standard, meet environmental standards, more organization, transparency of process standards.

Context	Factors	Sub-Factors
	Physical location	Location of data storage
	Service provider support	Supplier effort, vendor reputation
	Green computing	
	Culture	Firm culture
	Awareness	
	External support	Government support ,External computing support and supplier effort , External support, External computing support and supplier effort , External support
	Social media use	
	Industry type (d)	
	Industry	Industry type
	Market scope!	Global Scope
Individual	Perceived usefulness	Perceived benefits, Performance Expectancy
	Perceived Ease of Use	Effort expectancy
	Perceived behavioral control	Facilitating condition, Self-efficacy, Cloud self-efficacy
	attitude	
	Performance	
	Subjective norm	Social influence, social factors, Image.
	decision maker	Cloud knowledge of decision maker, Decision maker innovativeness
	voluntariness	
	Job relevance	
	Perceived playfulness	
	Personnel innovativeness	

APPENDIX C

INSTRUMENT VALIDATION FACTORS

Cloud Computing Adoption Factors

The proposed instrument includes items replied on constructs related to adoption cloud computing in higher education.
Please use the following form to guide your review of items. Please take consideration:

- If each items related to terms of domain
- Whether there are any necessary changes in the wording of items.
- If the items comprehensively represent the total domain.

There is a space at the end of each factor for additional comments. Please make certain revision recommendations, if it is necessary.

Representativeness

1= The Item is not representative.

2= The Item requires revision to be representative.

3= The Item is representative.

Items	**1**	**2**	**3**	**Comments**
Relative advantage				
Adoption cloud computing in HEIs will lower the cost.				
Adoption Cloud computing in HEIs will improve the facility of education.				
Adoption of cloud computing can shorten Information Systems deployment time.				
Adoption cloud computing will offer new educational and research opportunities				
Additional comments:				
Compatibility				
Adopting cloud computing will fit into the work style of our academic institutions.				
Adopting cloud computing will be compatible with our academic institution's operations.				
Adopting cloud computing will be compatible with our IT infrastructure of academic institution.				

Items	1	2	3	Comments
Adopting cloud computing will be compatible with our academic institution's culture and values.				
Additional comments:				
Data Concern				
There are potential privacy concerns of using cloud computing				
There are concerned about the leakage of confidential data.				
There are concerned that unauthorized people may access our student and research data				
There are concerned about storing our data in the cloud.				
Additional comments:				
Complexity				
The skills needed to adopt cloud computing are too complex for our university/community college.				
The skills necessary to adopt cloud computing are too complex for our employees.				
Integrating cloud computing in our current work practices will be a challenge				
Adoption of cloud computing will require a lot of mental effort.				
Additional comments:				
Top Management Support				
Top university/college management understands the benefits of adopting cloud computing.				
Top management is interested in the adopting of cloud computing technologies in our operations.				
The university's top management provides strong leadership and engages in the process when it comes to information systems computing.				
Top management seeks to maintain competitive advantage through the adoption of new technologies, and its uses in its operations.				

Items	1	2	3	Comments
Top management supports the transition to the adoption and use of cloud computing.				
Additional comments:				
Technology Readiness				
Our institution has a good internet connection speed.				
Our institution is mature in using the Internet and related technology.				
University/college needs to improve its computational capabilities.				
University/ college needs cloud-computing technology to meet its IT needs.				
Additional comments:				
Skill of IT Staff				
The University/ college provides training programs for employees relating to the new technologies (such as Cloud Computing Technology).				
This university/ college has high level of IT related skill and technical knowledge.				
IS management knows the business process well enough to identify the required applications				
IS staff has ability in supporting cloud computing system development.				
` **Additional comments:**				
Regulatory Policy				
There is a lack of security rules, policies and privacy laws.				
Due to differences in legislation, university /community colleges might lose control of data if it used cloud computing services provided from a supplier hosting data outside the country technology				

Items	1	2	3	Comments
There is no legal protection in the use of cloud computing.				
Additional comments:				
Awareness				
University/ college provide enough information about cloud computing services.				
University/ college provide enough information about the benefits of cloud computing service.				
University/ college provide enough information about using cloud computing applications.				
University/college hold workshop and conference to increase the awareness of the benefits of cloud computing.				
Additional comments:				
Perceived Usefulness				
Adopting cloud computing will improve the quality of work at the university /community college.				
Adopting cloud computing would enable our staff to accomplish their tasks more quickly.				
Adoption cloud technology would be cost effective.				
Adoption cloud computing will increase productivity of our staff at the university/ community college.				
Overall, adopting cloud computing will be advantageous.				
Additional comments:				
Perceived Eased of Use				
Learning to use cloud computing would be easy for our staff.				
It would be easy for our staff to become more skilful and experienced with cloud technology.				
the interaction with cloud computing services will not require a lot of mental effort				

Items	1	2	3	Comments
Overall, cloud computing will be easy to use for our staff.				
Additional comments:				
Attitude				
Adoption cloud computing technology is a good idea.				
Adoption cloud technology in our environment is a wise idea.				
Adoption cloud technology would be pleasant.				
Overall, the attitude towards cloud computing technology for our staff is positive.				
Additional comments:				
Subjective norm				
People who are important to university/ community college Such as consultants would think that it should adopt cloud technology.				
People who influence university/ community college Such as experts would think that it should adopt cloud computing technology				
People whose opinions are valued to university/ community college would prefer that it should adopt cloud technology.				
Additional comments:				
Additional comments:				
Cloud Computing Adoption Intention				
It is recommended to adopt cloud computing at university/community college				
It is expected that the university/ community college will adopt cloud computing in the near future.				
The university/ community college plans to adopt cloud computing.				

APPENDIX D

THE QUESTIONNAIRE (ENGLISH & ARABIC VERSION)

The Development of A Framework For The Adoption of Cloud computing in Higher Education of Yemen.

Study Objective

The research objective is develop conceptual model for higher education of Yemen to adopt cloud computing by finding and analyzing the significant Technological, Organizational Environmental and individual factors that influence the adoption of Cloud Computing by Higher education organizations in Yemen.

Cloud computing solutions being addressed by this study are organizational level solutions such as library systems, ERP, learning management systems and research solutions.

This research is part of P.h.D Degree requirements in Information Communication Technology (ICT) at University Tenaga National (UNITEN).

Confidentiality

The data collected in this study are confidential. Only the researchers in this study will see the collected data. As indicated above, the study targets all Yemeni higher education (colleges and universities). Results will be published in anonymous format without providing any sort of indication of specific answers or responses that are provided by specific college or university.

Thank you in advance for your valuable contribution.

For any question or comment, please contact us on the following addresses

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Definition of Cloud Computing

Based on the American National Institute of Standard and Technology, the term cloud computing is defined as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction".

"Cloud computing consists of three primary service models: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). The main deployment models are private clouds, public clouds, community clouds, and hybrid clouds."

Based on your position in the organization, experience and knowledge about the subject, please provide your responses to the attached questions and statements.

عنوان البحث:

تبني الحوسبة السحابية في مؤسسات التعليم العالي في الجمهورية اليمنية

هدف الدراسة

يهدف هذا البحث تطوير اطار لتبني الحوسبة السحابية لموسسات التعليم العالي في اليمن بواسطة معرفة وتحليل العوامل التقنية والتنظيمية والبيئية والفردية الهامة التي تؤثر بشكل مباشر على تبني الحوسبة السحابية من قبل مؤسسات التعليم العالي في اليمن

محور هذه الدراسة هو حلول الحوسبة السحابية التي يتم استضافتها خارج مقر الكلية أو الجامعة. الدراسة تستهدف حلول الحوسبة السحابية على مستوى الشركات مثل نظم إدارة المكتبات, نظم إدارة الموارد, ونظم إدارة التعليم والحلول البحثية. الحوسبة السحابية الشخصية هي خارج نطاق هذه الدراسة.

هذا البحث هو جزء من درجة الدكتوراه في تكنولوجيا المعلومات والاتصالات.

تعريف الحوسبة السحابية

يعرف المعهد الوطني الأمريكي للمقاييس والتقنية مصطلح الحوسبة السحابية بأنها "نموذج لتمكين الوصول الى النظام عن طريق الشبكة من أي مكان, بعيدا عن التعقيد, ويتم حجز النظام من قبل المستخدم لفترات محددة حسب الاحتياج. هذا النموذج يعمل على مجموعة مشتركة من موارد الحوسبة (على سبيل المثال: الشبكات والخوادم والتخزين والتطبيقات). باستخدام هذا النموذج فانه بالامكان توفير أنظمة حاسوبية مع الحد الأدنى من الجهد والإدارة من قبل مزود الخدمة في وقت زمني قصير."

هناك ثلاثة انواع من الحوسبة السحابية: البرمجيات كخدمة, البيئة التطويرية للبرمجيات كخدمة, والبنية التحتية والأجهزة كخدمة. الحوسبة السحابية يمكن بناؤها كسحب خاصة (بالجامعة), أو كسحب عامة مشتركة مع اكثر من مستخدم, أو سحب مجتمعية لمؤسسات ذات هدف مشتركة, أو سحب هجينة.

بناء على مركزك في الجامعة /الكلية والخبرة والمعرفة حول هذا الموضوع, يرجى تقديم إجاباتكم على الأسئلة

والعبارات في الملف المرفق.

شكرا لكم مقدما على مساهمتكم القيمة.

Measurement	Scale					Measurement
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
	لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة	
A: The most common challenges in HEIs						**ا/ التحديات التي تواجه مؤسسات التعليم العالي**
Lack of IT infrastructure						عدم وجود او ضعف البنية التحتية لتكنولوجيا المعلومات
Lack of IT expertise						نقص الخبرات في تكنولوجيا المعلومات
Lack of funding						نقص التمويل
Lack of employees with IT skills						قلة عدد الموظفين الذين لديهم مهارات في الحاسوب
High cost of professional and consultancy						ارتفاع تكلفة الاستشارات واستقدام الخبراء
Others:						أخرى :
B :Cloud Ccomputing Adoption Driver						**ب :دوافع تبني واعتماد الحوسبة السحابية**
Improve the educational processing and its efficiency						تطوير العملية التعليمية وتحسين الكفاءة
Cost saving						تخفيض التكلفة
Need for scalability						الحاجة الى التطوير والمواكبة
Improve transparency and participation						تحسين الشفافية والمشاركة
Disaster recovery and availability						التوافر والتعافي من الكوارث
Others:						أخرى :

C: Cloud Computing Adoption factors						ج/ عوامل تبني واعتماد الحوسبة
Measurement	**Scale**					**Measurement**
	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**	
	لا أوافق بشدة	**لا أوافق**	**محايد**	**أوافق**	**أوافق بشدة**	
Adoption cloud computing will lower the cost.						تبني الحوسبة السحابية سوف يقلل التكلفة
Adoption cloud will improve the facility of education.						تبني الحوسبة سوف يحسن ويسهل العملية التعليمية .
Adoption cloud computing can shorten information systems deployment time						تبني الحوسبة السحابية يقلل الفترة الزمنية لبناء نظم المعلومات
Adoption cloud computing will offer new educational and research opportunities.						تبني الحوسبة السحابية الحوسبة السحابية سوف يفتح فرصا بحثية وتعليمية جديدة.
Adoption Cloud Computing will fit into the work style of our university/college.						تبني واعتماد الحوسبة االسحابية سوف يتوافق مع طبيعة عملنا الاكاديمي.
Adoption Cloud Computing will be compatible with our academic institution's operations.						تبني واعتماد الحوسبة السحابية سوف يتوافق مع عملياتنا التشغيلية.
Adoption cloud computing will be compatible with our IT infrastructure of academic institution.						تبني واعتماد الحوسبة السحابية سوف يتوافق مع البنية التحتية لتكنولوجيا المعلومات لدى موسستنا التعليمية
Adoption Cloud Computing will be compatible with our academic institution's culture and values.						تبني واعتماد الحوسبة السحابية سوف يتوافق مع قيمنا وثقافتنا الاكاديمية.

Measurement	Scale					Measurement
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
	لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة	
There are potential privacy concerns of using cloud computing						هناك مخاوف محتملة متعلقة بالخصوصية في حال استخدام الحوسبة السحابية.
There are concerned about the leakage of confidential data .						هناك قلق من تسرب البيانات السرية.
There is concerned that unauthorized people may access our student and research data.						هناك قلق من وصول أشخاص غير مصرحين لبيانات الطلاب و الأبحاث
We are concerned about storing our data in the cloud.						هناك قلق من تخزين بياناتنا في الحوسبة السحابية.
The skills needed to implement cloud computing are too complex for our institution						المهارات اللازمة لتطبيق الحوسبة السحابية هي معقدة للغاية بالنسبة لمؤسستنا.
The skills needed to adopt cloud computing are too complex for our employees						المهارات اللازمةلتبني الحوسبة السحابية هي معقدة للغاية بالنسبة لموظفينا.
Integrating cloud computing in our current work practices will be a challenge						دمج الحوسبة السحابية مع عملنا الحالي في الموسسات الاكاديمية معقدا وسيكون تحديا
Adoption cloud computing will require a lot of mental effort.						استخدام الحوسبة السحابية سيتطلب الكثيرمن المجهود الذهني.
Top university/college management understands the benefits of adopting cloud computing.						الإدارة العليا للجامعة/الكلية تدرك فوائد استخدام الحوسبة السحابية.
Top management is interested in the use of cloud computing technologies in our operations.						الادارة العليا مهتمة باستخدام تقنية الحوسبة السحابية في عمليات الجامعة /الكلية
The university's top management provides strong leadership and engages in the process when it comes to information systems						الادارة العليا للجامعة تقود وتشارك بقوة في العملية عندما يتعلق الامر بنظم المعلومات

Measurement	Scale					Measurement
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
	لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة	
Top management seeks to maintain competitive advantage through the adoption of new technologies, and its uses in its operations.						تسعى الادارة العليا في الجامعة /الكلية على المحافظة على الميزة التنافسيه من خلال تبني التقنيات الحديثة واستخدامها ضمن عملياتها
Top management supports the transition to the adoption and use of cloud computing.						تدعم الادارة العليا الانتقال إلى التعليم المختلط من خلال تبني واستخدام الحوسبة السحابية
Our institution has a good internet connection speed.						موسسستنا التعليمية تملك سرعة انترنت جيدة
Our institution is mature in using the Internet and related technology.						تعتبر الموسسة التعليمية ناضجة في استخدام الانترنت والتكنولوجيا ذات الصله
University/college needs to improve its computational capabilities.						تحتاج الجامعة /الكلية الى تحسين وتطوير قدراتها الحاسوبية
University/ college needs cloud-computing technology to meet its IT needs.						تحتاج الجامعة / الكلية الحوسبة السحابية لتلبية احتياجات تكنولوجيا المعلومات
The University/ college provides training programs for employees relating to the new technologies (such as Cloud Computing.						توفر الجامعة البرامج التدريبية للموظفين في الامور المتعلقة بالتقنيات الحديثة مثل تقنية الحوسبة السحابية
This university/ college has high level of IT related skill and technical knowledge.						تمتلك الجامعة / الكلية مستويات عالية من المهارات المتعلقة بتكنولوجيا المعلومات
IS management knows the business process well enough to identify the required applications						إدارة نظم المعلومات في الجامعة / الكلية تعرف الاعمال جيدا بما يكفي لتحديد التطبيقات المطلوبه.
IS staff has ability in supporting cloud computing system development.						موظفي نظم وتفنية المعلومات في الجامعة / الكلية لديهم القدرة على دعم وتطوير نظام وخدمات الحوسبة السحابية

Measurement	Scale					Measurement
	Strongly Disagree	Disagree		Strongly Disagree	Disagree	
	لا أوافق بشدة	لا أوافق		لا أوافق بشدة	لا أوافق	
The staff is sent to scientific missions to take advantage of technological developments surrounding						يتم ارسال الموظفين الى بعثات علمية للاستفادة من التطورات التكنولوجية المحيطة
There is a lack of security rules, policies and privacy laws .						هناك غياب لقواعد الامن وسياسات وقوانيين الخصوصية
Due to differences in legislation, university /community colleges might lose control of data if it used cloud computing services provided from a supplier hosting data outside the country technology.						بسبب الاختلافات في التشريع قد تفقد الموسسة التعليمية السيطرة على البيانات اذا كانت تستخدم خدمات الحوسبة السحابية المقدمة من مزود يستضيف البيانات خارج البلاد
There is no legal protection in the use of cloud computing.						لا توجد حماية قانونية في استخدام الحوسبة السحابية
University/ college provide enough information about cloud computing service						توفر الجامعة /الكلية المعلومات الكافية عن خدمات الحوسبة السحابية
University/ college provides enough information about the benefits of cloud computing service						توفر الجامعة /الكلية المعلومات الكافية عن فوائد الحوسبة السحابية
There is enough information about using cloud computing applications.						توفر الجامعة /الكلية المعلومات الكافية عن تطبيقات الحوسبة السحابية وكيفية استخدامها
University/college hold workshop and conference to increase the awareness of the benefits of cloud computing.						تعقد الجامعة ورش عمل وموتمرات لزيادة الوعي بفوائد الحوسبة السحابية.

Measurement	**Scale**					**Measurement**
	Strongly Disagree	**Disagree**		**Strongly Disagree**	**Disagree**	
	لا أوافق بشدة	**لا أوافق**		**لا أوافق بشدة**	**لا أوافق**	
Adopting cloud computing will improve the quality of work at university/colleges.						تبني واعتماد الحوسبة السحابية سوف يودي الى تحسين وتطوير العمل بما يخدم العملية التعليمية .
Adoption cloud computing would enable our staff to accomplish tasks more quickly.						تبني الحوسبة السحابية واستخدامها سيسمح لموظفينا باداء مهامهم بشكل اسرع
Adoption cloud computing technology would be cost effective						تبني الحوسبة السحابية سيكون فعالا من حيث التكلفة
Adopting of cloud computing will increase productivity of staffs at the university/ community college .						تبني الحوسبة السحابية سوف يزيد الإنتاجية للموظفين في الجامعة /الكلية
Cloud technology would be easily available						تبني تقنية الحوسبة السحابية سيكون متوفر وبسهولة
Overall, adoption cloud computing is advantageous.						عموما تبني الحوسبة السحابية مفيد
Learning to use cloud computing would be easy for our staff						تعلم استخدام الحوسبة السحابية سيكون سهلا بالنسبة لموظفينا
It would be easy for our staff to become more skillful and experienced with cloud technology						سيكون من السهل بالنسبة لموظفينا ان يكونوا أكثر مهارة وخبرة مع تكنولوجيا الحوسبة السحابية
The interaction with cloud computing services will not require a lot of mental effort						التفاعل مع خدمات الحوسبة السحابية لن يتطلب الكثير من الجهد الذهني
Overall, cloud computing will be easy to use for our staff .						عموما الحوسبة السحابية ستكون سهلة الاستخدام بالنسبة لموظفينا

Measurement	**Scale**					**Measurement**
	Strongly Disagree	**Disagree**		**Strongly Disagree**	**Disagree**	
	لا أوافق بشدة	**لا أوافق**		**لا أوافق بشدة**	**لا أوافق**	
Adoption cloud computing technology is a good idea						تبني تكنولوجيا الحوسبة السحابية في الموسسة التعليمية فكرة جيدة
Adoption cloud computing technology in our work environment is a wise idea						تبني تقنية تكنولوجيا الحوسبة السحابية في بيئة العمل التعليمي هو فكرة حكيمة
Adoption cloud computing technology would be pleasant						تبني التكنولوجيا السحابية في الموسسة التعليمية سيكون خيارا جذابا
Overall, the attitude towards cloud computing technology is positive						عموما فإن الموقف والسلوك تجاه تبني تكنولوجيا الحوسبة السحابية إيجابي
People who are important to university/ community college such as consultants would think that it should adopt cloud technology						الاشخاص الذين هم مهمين بالنسبة للجامعة او الكلية مثل الاستشاريين يعتقدون أنه يجب تبني تكنولوجيا الحوسبة السحابية
People who influence university/ community college Such as experts would think that it should adopt cloud computing technology						الاشخاص الذين لهم تأثير بالنسبة للجامعة او الكلية مثل الخبراء يعتقدون أنه يجب استخدام تكنولوجيا الحوسبة السحابية
People whose opinions are valued to university / community college would prefer that it should adopt cloud technology						الاشخاص الذين ارائهم قيمة بالنسبة للجامعة يفضلون تبني تكنولوجيا الحوسبة السحابية في التعليم.
It is recommended to adopt cloud computing at university/community college						من المستحسن تبني الحوسبة السحابية في الجامعة / الكلية
It is expected that the university/ community college will adopt cloud computing in the near future.						من المتوقع تبني واعتماد الحوسبة السحابية في الجامعة / الكلية في المستقبل القريب
The university/ community college plans to adopt cloud computing.						تخطط الجامعة / الكلية فعلا لتبني واعتماد الحوسبة السحابية

Demographic Questions						**الأسئلة الديموغرافية**
What is the name of your college/university? (Optional)						**ماهو اسم جامعتكم/كليتكم؟ (اختياري)**
What is your highest qualification?						**ماهو مؤهلك العلمي؟**
Diploma						
degree						
Master						
PhD						
Others						اخرى الرجاء التحديد
What is your position or title at your institution?						**ماهو المنصب الذي تشغله حاليا؟**
IT Manager						مديرنظم المعلومات
VP of IT						نائب مديرنظم المعلومات
Information security manager						مدير أمن المعلومات
Lecturer of IT						محاضر IT
Network engineer						مهندس شبكات
Programmer						مبرمج
Analysis						محلل نظم
Technician						فني
Consultant						مستشار
Other, please specify						منصب آخر، الرجاء التحديد

APPENDIX E

CONTENT VALIDITY

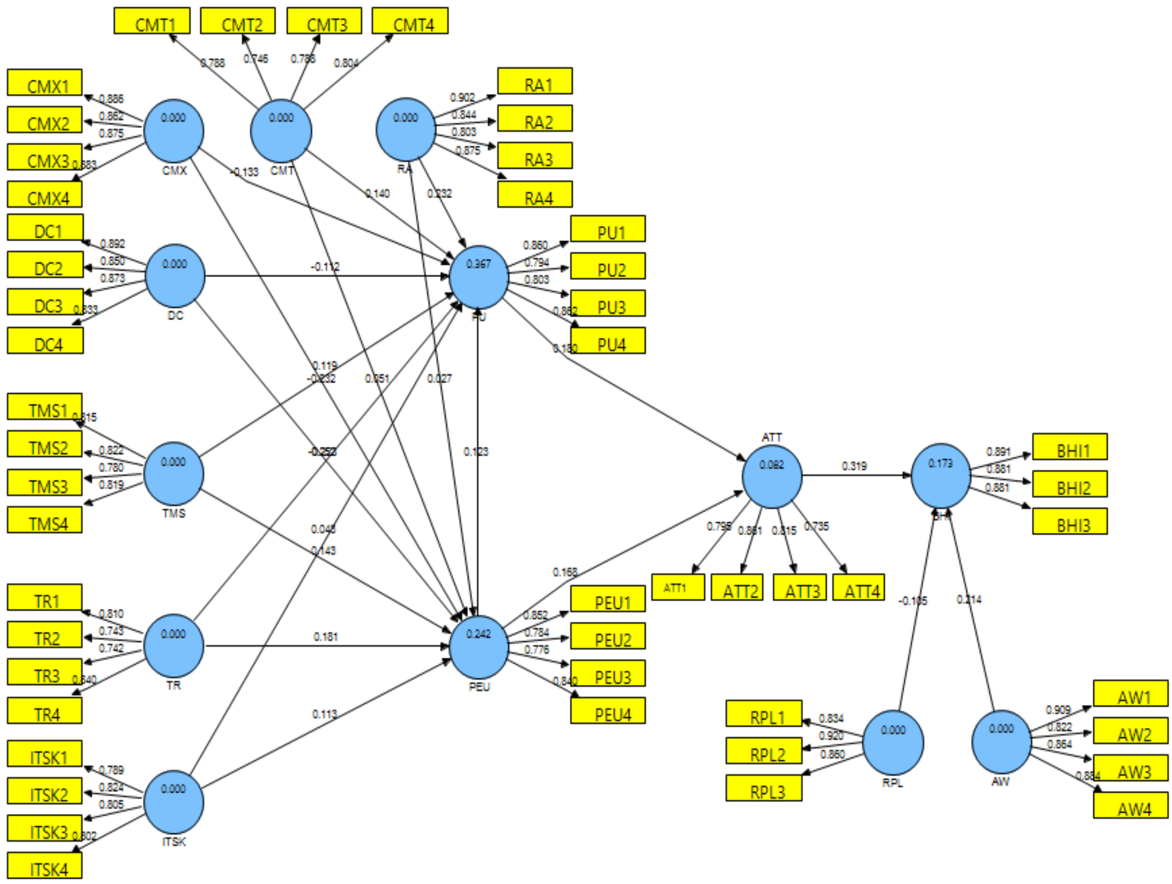
Item	Name	Exp1	Exp2	Exp3	Exp4	Exp5	Number agreement	I-CVI
No	Item	(M)	(S)	(A)	(F)	(P)		
1	RA1	3	3	3	3	3	5	1
2	RA2	3	3	3	3	3	5	1
3	RA3	3	3	3	3	3	5	1
4	RA4	3	3	3	3	3	5	1
5	CMPT1	3	3	3	3	3	5	1
6	CMPT2	3	3	3	3	3	5	1
7	CMPT3	3	3	3	3	3	5	1
8	CMPT4	3	3	3	3	3	5	1
9	DC1	3	3	3	2	3	4	0.8
10	DC2	3	3	3	3	3	5	1
11	DC3	3	3	3	3	3	5	1
12	DC4	3	2	3	3	3	4	0.8
13	CMPLX1	3	3	3	3	3	5	1
14	CMPLX2	3	3	3	3	3	5	1
15	CMPLX3	3	3	3	3	3	5	1
16	CMPLX4	2	1	3	3	3	3	0.6
17	TMS1	2	3	3	3	3	4	0.8
18	TMS2	3	3	3	3	3	5	1
19	TMS3	3	3	3	3	3	5	1
20	TMS4	3	3	3	3	3	5	1
21	TMS5	3	3	3	3	3	5	1
22	TR1	3	3	3	3	3	5	1
23	TR2	3	3	3	3	3	5	1
24	TR3	3	3	3	3	3	5	1
25	TR4	3	3	3	3	3	5	1
26	SKIT1	2	2	3	3	3	3	0.6
27	SKIT2	3	1	3	3	3	4	0.8
28	SKIT3	3	3	3	3	3	5	1
29	SKIT4	2	3	2	3	3	3	0.6
30	RP1	3	3	3	3	3	5	1
31	RP2	3	3	3	3	3	5	1
32	RP3	3	3	3	3	3	5	1
33	AW1	3	3	3	3	3	5	1
34	AW2	3	3	3	3	3	5	1
35	AW3	3	3	3	3	3	5	1
36	AW4	3	3	3	3	3	5	1

37	PU1	3	3	3	3	3	5	1
38	PU2	3	3	3	3	3	5	1
39	PU3	3	3	3	3	3	5	1
40	PU4	3	3	3	3	3	5	1
41	PEOU1	3	3	3	3	3	5	1
42	PEOU2	2	3	3	2	3	3	0.6
43	PEOU3	3	3	3	3	3	5	1
44	PEOU4	3	3	3	3	3	5	1
45	ATT1	3	3	3	3	3	5	1
46	ATT2	3	3	3	3	3	5	1
47	ATT3	3	3	3	3	3	5	1
48	ATT4	3	3	3	3	3	5	1
49	SN1	3	3	3	3	3	5	1
50	SN2	3	3	3	3	3	5	1
51	SN3	3	3	3	3	3	5	1
52	BI1	3	3	3	3	3	5	1
53	BI2	3	3	3	3	3	5	1
54	BI3	3	3	3	3	3	5	1

S-CVI/Ave	0.956
Total agreement	46
S-CVI/UA	0.85185185

APPENDIX F

Smart-PLS Structural Model For Testing The Direct Effects Of The Variables.



APPENDIX G

Smart-PLS Structural Model for Testing The Moderation Effect of Subjective Norm (SN) On The Relationship Between Perceived Usefulness (PU) And Attitude (Att).