GENDER EFFECT ON CLOUD COMPUTING SERVICES ADOPTION BY UNIVERSITY STUDENTS: CASE STUDY OF SAUDI ARABIA

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EFEITO DE GÊNERO NA ADOÇÁO DE SERVIÇOS DE COMPUTAÇÃO EM NUVEM POR ESTUDANTES UNIVERSITÁRIOS: ESTUDO DE CASO DA ARÁBIA SAUDITA

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Abstract: Cloud computing isastate of the arttechnology that provides services toindividuals and organizations on demand via the Internet. Implementation of cloud services in an organization will lead to improved performance and reduced cost related to computing services. A number of previous studies suggest that there is aneed to further investigate the role of gender on the adoption of cloud computing, especially in developing countries. The aim of this paper is to investigate the role of gender in the adoption of cloud computing services by university students in KSA. To meet the research objective a SEM study was conducted using responses from 451 Saudi higher education students to determine the role of gender on could computing acceptance in KSA context. The findings of this research show that there is a settle difference between female and male students where trust was found to be a significant determinant of behavioural intention for female students but not for their malecounterparts.Ontheotherhand,image was found tobe asignificant determinant of PU for male students but not for female students.

Keywords: Cloud Computing, University Students, Acceptance Model, TAM, Adoption.

Resumo: A computação em nuvem é uma tecnologia de ponta que fornece serviços a indivíduos e organizações sob demanda pela Internet. A implementação de serviços em nuvem em uma organização levará a um melhor desempenho e a custos reduzidos relacionados aos serviços de computação. Diversos estudos anteriores sugerem que é necessário investigar melhor o papel do gênero na adoção da computação em nuvem, especialmente nos países em desenvolvimento. O objetivo deste artigo é investigar o papel do gênero na adoção de serviços de computação em nuvem por estudantes universitários da KSA. Para atingir o objetivo da pesquisa, um estudo de SEM foi conduzido usando respostas de 451 estudantes do ensino superior da Arábia Saudita

para determinar o papel do gênero na aceitação da computação no contexto da KSA. Os resultados desta pesquisa mostram que há uma diferença de equilíbrio entre estudantes do sexo feminino e masculino, onde a confiança foi encontrada para ser um determinante significativo da intenção comportamental para estudantes do sexo feminino, mas não para os seus homólogos masculinos. Por outro lado, a imagem foi considerada um determinante significativo para estudantes do sexo masculino, mas não para estudantes do sexo feminino.

Palavras-chave: Computação em Nuvem, Estudantes Universitários, Modelo de Aceitação, TAM, Adoção.

INTRODUCTION

Cloud computing is an advanced technology that transformed different areas specifically education, healthcare, government, and commerce. This technology improves the organizational performance and lowers cost related to hardware and software procurement and maintenance by providing various services on demand. Recently, organizations in the Middle East have started using cloud computing services as a means to achieve a high level of operational efficiency while providing cost-effective outcomes. The Kingdom of Saudi Arabia (KSA) is among the first Arab countries that focus on using cloud computing due to its benefits and their extensive use of Information and Communication Technology (ICT) in various organizations (Alsanea & Wainwright, 2014; Ministry of Communications and Information Technology, 2014). The Government of KSA jointly with the United Arab Emirates are set to lead the adoption of cloud services in Middle East with an initial total expenditure of $280- $324 million (Ministry of Communications and Information Technology, 2015). It was revealed that,in KSAcloudservicesusagebyorganizations will rise with an increase in spending by 35% in 2016 as a result of benefits such as "operational efficiency" and "cost savings" (Ministry of Communications and Information Technology, 2014). However, many of theseorganizations are still at the beginning stage of using cloud computing particularly in education context (A. N. Tashkandi & I. M. Al-Jabri, 2015).

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

expressed they would be willing to adopt and use these technologies in the future.

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

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

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

of the technology for Male and female (Behrend, Wiebe, London, & Johnson, 2011).

This research extends Technology Acceptance Model 3 (TAM3) to determine factors affecting the adoption of cloud computing applications by students in KSA universities. This model will help university decision makers and cloud application providers better understand the gender factor that affect students' adoption of cloud computing applications in higher education institutions especially in country like KSA where male and family campus are segregated.

The rest of the paperis organized as follows. Section 2 presents a review of studies on cloud computing adoption in general and gender in particular. Section 3 justifies selection of Technology Acceptance Model 3 (TAM3) as the research framework. Section 4 presents the research model, Section 5 presents the study findings and finally section 6 concludes the paper.

Previous Studies on Cloud Computing Adoption

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

The adoption of cloud computing applications can be promoted if factors that affect the adoption areidentified andexamined. There are many different theories and models that researchers use or extend to study technology adoption by organizations and end users. The popular ones include Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), Theory of Planned Behaviour (TPB), Diffusion of Innovations (DOI) Theory, and Technology- Organization-Environment (TOE) Framework (Al- Jabri, 2014; Alharbi, 2012; Cao et al., 2013; Coursaris et al., 2013; Li & Chang, 2012). Table 1 illustrates previous studies on cloud computing services adoption conducted in the context of organization, education and end users.

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Table 1

Summary of the previous studies on cloud computing services adoption

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

Table 1. Cont.

Summary of the previous studies on cloud computing services adoption

					performance expectancy, privacy, and behavioural intention.
A. Tashkandi and I. M. Al-Jabri (2015)	Saudi Arabia	IT decision makers/31	Education	TOE	Relative advantage, compatibility, privacy concerns, complexity, vendor lock-in, top management support, regulatory policies, government pressure, and peer pressure.
Abu-Shanab and Qasem (2014)	-	Individuals/ 120	End-user	-	Information security, information privacy, online experience, brand reputation, trust in brand, brand equity, and intention to use.
Burda and Teuteberg (2014)	German	Students and staff/229	End-user	TAM	Perceived usefulness, perceived ease of use, risk, trust, satisfaction, reputation, familiarity, and intention to use.
Al-Jabri (2014)	Saudi Arabia	IT managers, IT consultants, and IT professionals/ 106	Organization	TOE	Relative advantage, complexity, compatibility, top management support, organizational readiness, competitive pressure, and business partner pressure.
Alotaibi (2014)	Saudi Arabia	IT professionals and end users/ 770	End-user	TAM	Perceived usefulness, perceived ease of use, trust, anxiety, perceived risk, attitude, behavioural intention, and actual use.
Nguyen, Nguyen, Pham, and Misra (2014)	Vietnam	Users and potential users of cloud based e-Learning systems/282	Education	Unified Theory of Acceptance and Use of Technology 2 (UTAUT2)	Performance expectancy, effort expectancy, social influence, facilitating conditions, price value, hedonic motivation, habit, innovativeness, behavioural intention, and technology usage.
Opala and Rahman (2013)	USA	Chief information officers, operational managers, and other IT directors and managers/282	Organization	-	Cloud security, cost effectiveness, and IT compliance.
Alshamaileh (2013)	England	SMEs adopters and non-adopters of cloud computing services / 184	Organization	TOE	Technological (relative advantage, uncertainty, compatibility, complexity, and trialability), organizational (size, top management support, innovativeness, and prior IT experience), and environmental (competitive pressure, industry, market scope, supplier efforts and external computing support)
Trenz, Huntgeburth, and Veit (2013)	German	Students /143	End-user	Principal-Agency Theory	Trust, peer adoption, switching costs, information privacy concerns, information security concerns, availability concerns, perceived uncertainty, and satisfaction.
Gupta, Seetharaman, and Raj (2013)	Various countries in Asia Pacific region	SMEs/211	Organization	-	Cost reduction, ease of use and convenience, reliability, sharing and collaboration, and security and privacy.
Borgman	-	IT executives and	Organization	TOE	Relative advantage, technology

Table 1. Cont.

Summary of the previous studies on cloud computing services adoption

et al. (2013)		decision makers/669			compatibility, technology complexity, firm size, top management support, IT expertise of business users, competition intensity, and regulatory environment.
Coursaris et al. (2013)	USA	Non-cloud application note-taking users /402	End-user	DOI	Relative advantage, complexity, compatibility, observability, triability, risk, social influence, past experience, and knowledge.
Cao et al. (2013)	China	College students, faculty members, and other people/225	End-user	UTAUT	Perceived risk, perceived cost, personal innovativeness, performance expectancy, effort expectancy, social influence, facilitating conditions, adoption intention, and adoption behaviour.
Shin (2013)	Korea	Users/ 93	End-user	TAM	Perceived usefulness, perceived ease of use, perceived availability, perceived security, perceived reliability, perceived access, subjective norm, behavioural intention, and usage behaviour.
M. Tan and Lin (2012)	Singapore	Chief Executive Officers, Chief Information Officers, and IT managers / 43	Organization	TOE and DOI	Complexity, compatibility, relative advantage, demonstrable results, technology-sensing sensing capability, technology - response capability, and perceived industry pressure.
Alharbi (2012)	Saudi Arabia	Employees of an IT organizations/ 171	Organization	TAM	Perceived usefulness, perceived ease of use, attitude, gender, age, education level, job domain, nationality, and behavioural intention to use.
Li and Chang (2012)	Taiwan	Students/222	End-user	TAM, TPB, computer learning theories, and social and economic exchange theories	Security concerns, privacy concerns, vendor lock-in, skills transfer, perceived risks, vendor reputation, perceived usefulness, subjective norm, perceived ease of use, attitude, perceived behavioural control, and behavioural intention.
Behrend et al. (2011)	USA	Student /760	Education	Technology Acceptance Model 3 (TAM3)	Access to software, ease of travel to campus, personal innovativeness, technology anxiety, instructor support, reliability, usefulness, ease of use, intentions for future use, future usefulness, and actual usage.
Low et al. (2011)	Taiwan	IT staff and managers/111	Organization	TOE	Relative advantage, compatibility, complexity, top management support, firm size, trading partner pressure, competitive pressure, and technology readiness.

Cloud computing services adoption studies were extensively reviewed and a number of gaps were observed from the review. First, most of the cloud computing services adoption studies conducted in both developed

and developing countriesincluding KSAfocused onorganizations and end users. Second, there were few studies in the context of higher education.

Last, studies identifying the factors that affect cloud computing applications adoption by university students in KSA are generally lacking. In fact, this is supported by Alsaeed and Saleh (2015) who identified around 40 exploratory studies on the adoption of cloud computing from Google Scholar, Elsevier Science direct, Springer Link and IEEE published between 2009 and 2014. Therefore, this study aims at filling these gaps by identifying and assessing factors affecting cloud computing applications adoption by higher education students in KSA.

Gender is one of the factors that attracted the attention of variousresearchers especiallyin the context of developing countries and KSA is no exception, a number of enquiries were conducted in the KSA context, for instance a technology acceptance study in KSA context found that there is a significant difference between male and female acceptance on technology where malecitizens werefoundtobe more accepting to technology compared to their female counterparts. ((Said S. Al-Gahtani, 2004). In contradiction, another study reports that gender has no significant impact on technology acceptance in KSA context (White Baker, $A1$ - Gahtani, & Hubona, 2007).

Another study used TAM found no difference between male and female attitude toward the adoption of cloud computing (Alharbi, 2012). Given the lack of available literature consensus on the effect of gender on technology acceptance in KSA context, this research is set to investigate the influence gender factor on cloud computing acceptance among Saudi Arabia higher education students.

Overview of Technology Adoption Models

IS researchers deal with different theories and models that can be used to study human behaviour towards acceptance and use of technologies. The models identify and explain factors that influence users to either accept or reject a technology. These models, which emerged from different fields such as sociology, psychology, and IT have been in existence for decades. Researchers from different disciplines continue to validate and extend the models in order tofit intovarious situations and contexts.

The models are: Theory of Reasoned Action (TRA), Diffusion of Innovations (DOI) Theory, Technology Acceptance Model (TAM), and Theory of Planned Behaviour (TPB). This research willuse Technology Acceptance Model 3 (TAM3).

Technology Acceptance Model 3 (TAM3)

Venkatesh and Bala (2008) proposed a comprehensive version of TAM with a focus on influence of interventions on acceptance and successful use of IT. The proposed model called TAM3, which is presented in Figure

1, is a product of merging TAM2(Venkatesh & Davis, 2000)with the model of the perceived ease of use predictors (Venkatesh, 2000).

Venkatesh and Bala (2008) categorized the determinants of perceived ease of use and perceived usefulness into four differentgroups which are individual differences, social influence, system characteristics, and facilitating conditions. Individual differences are "personality and/or demographics (e.g., traits or states of individuals, gender, and age) that can influence individuals' perceptions ofperceived usefulness and perceived ease of use" (Venkatesh & Bala, 2008, p. 276).

They include computer self-efficacy, computer anxiety, and computerplayfulness from the determinants of perceived ease of use (Venkatesh, 2000). System characteristics represent "those salient features of a system that can help individuals develop favourable (or unfavourable) perceptions regarding the usefulness or ease of use of a system" (Venkatesh & Bala, 2008, p. 276). System characteristics comprise perceived ease of use, output quality, job relevance, and result demonstrability. Social influence "captures various social processes and mechanisms that guide individuals to formulate perceptions of various aspects of an IT" (Venkatesh & Bala, 2008, p. 276). Social influence variables are subjective norm and image. Facilitating conditions or perceptions of external control is "the degree to which an individual believes that organizational and technical resources exist to support the use of the system" (Venkatesh & Bala, 2008, p. 279).

Experience and voluntariness are two moderator factors that moderate the relationships in the TAM3. Venkatesh and Davis (2000) hypothesized and proved that experience moderates the subjective norm and behavioural intention relationship, and the subjective norm and perceived usefulness relationship. Voluntariness on the other hand moderates the effect of subjective norm on behavioural intention based on the type of system usage (mandatory or voluntary) (Venkatesh & Davis, 2000). In addition, Venkatesh (2000) hypothesized that the impact of computer playfulness on perceived ease of use becomes weak eventually when experience increases, whereas the impact of perceived enjoyment and objective usability on perceived ease of use becomes stronger with increase in experience. TAM3 does not define a new pattern of relationships between the constructs, but rather maintains the same pattern with the two models (TAM2 and the model of determinants of perceived ease of use). Likewise, it suggests that the predictors of perceived usefulness have no impact on perceived ease of use. Furthermore, the predictors of perceived ease of use have no influence on perceived usefulness. Interestingly, three new relationships moderated by experience were proposed in TAM3, which are the moderating effect of experience on the influence of perceived ease of use on perceived usefulness; that of computer anxiety on perceived ease of use; and that of perceived ease of use on behavioural intention. Therefore, for the new relationships, TAM3 suggests that when experience increases the influence of perceived ease of use on perceived usefulness will be stronger; computer anxiety on perceived ease of use will be weaker; as well as

perceived ease of use on behavioural intention will be weaker (Venkatesh & Bala, 2008).
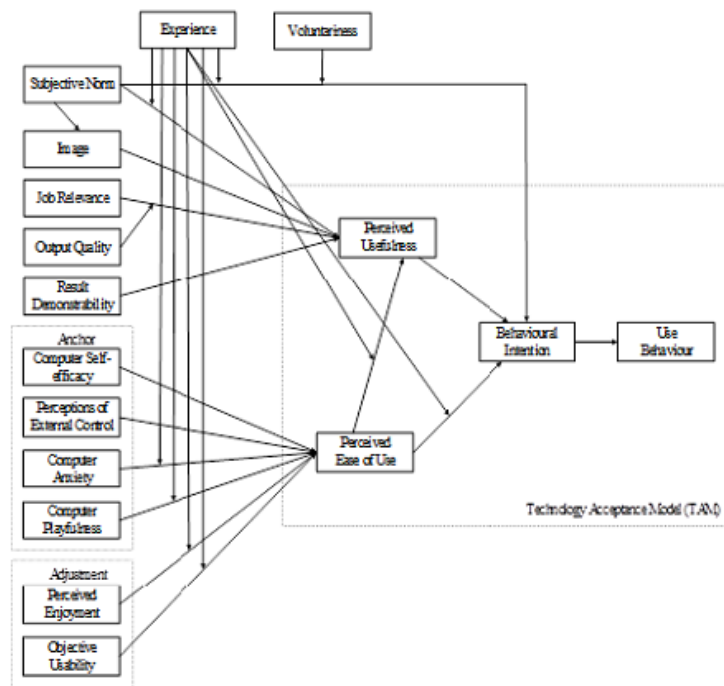

Figure 1.
Technology Acceptance Model 3 (TAM3).

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

Venkatesh and Bala (2008) further found that experience had a moderating effect on influence of computer anxiety onperceived ease of use, perceived ease of use on perceived usefulness, as well as perceived ease of use on behavioural intention as hypothesized. It was also revealed that perceived ease of use was significantly determined by computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and objective usability. Additionally, perceived ease of use and perceived usefulness were found to have significant influence on behavioural intention with perceived usefulness being the strongest predictor at all the three time periods, and perceived

ease of use only significant at time 1 and time 2. The three-way interaction between subjective norm, experience, and voluntariness on behavioural intention was also found to be significant in such a way that the influence of subjective norm on behavioural intention weakened when the experience increased especially in the voluntary setting. On the other hand, a two-way interaction between subjective norm and voluntariness showed that the influence of subjective norm on behavioural intention was stronger in a mandatory setting.

Finally, behavioural intention was found to be significant determinant of use at all points of measurements. The model accounted for 67%, 52%, and 53% of the variance in perceived usefulness, perceived ease of use, and behavioural intention respectively for the three time intervals when combined. Additionally, the model explained 35% of the variance in use behaviour.

Justification for Selecting Technology Acceptance Model 3 (TAM3)

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

However, in an effort to improve TAM and address its limitations, the model has been adapted in various works and three extended versions (TAM2 by Venkatesh and Davis (2000), model of determinants of perceived ease of use by Venkatesh (2000), and TAM3 by Venkatesh and Bala (2008)) were proposed and validated. Thus, TAM3 is the latest and comprehensive version of the original TAM, which identifies and describes antecedents of the two main TAM determinants which are perceived usefulness and perceived ease of use. TAM3 provides valuable insights into how technology can be adopted and used by categorizing the factors into social influence, system characteristics, individual differences, and facilitating conditions (Said S Al-Gahtani, 2014). In addition, the model has been evaluated and validated across multiple settings (Agudo-Peregrina, Hernández-García, & Pascual-Miguel, 2014; Said S Al-Gahtani, 2014; Chang & Im, 2014; Faqih & Jaradat, 2015; Huang,

Liu, & Chang, 2012)For instance, Chang and Im (2014) developed and evaluated TAM3-based modelinastudy that investigates Internethealth information seeking behaviours. Theyfound that perceived usefulness and perceived ease of use have indirect effect on Internet health information seeking behaviours through behavioural intention; perceived usefulness mediated the effects of health relevance and perceived ease of use on behavioural intention; computer self-efficacy, perceptions of external control, computer anxiety, and perceived enjoyment have indirectly influenced Internet health information seeking behaviours through perceived ease of use, and behavioural intention. Finally, Internet health information seeking behaviours is directly determined by prior experience with Internet use and behavioural intention.

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

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

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

to use e-Learning system. The model explained 42%, 45%, and 42% of variance in perceived usefulness, perceived ease of use, and intention to use the e-Learning system, respectively.

Research Model

This research extends Almazroi's (2017) model by examining the role of gender in influencing end-users acceptance of cloud computing in KSAcontext. Asindicated insection 2, a number of previous technology adoption literature in KSAcontextindicated thatthereare differences in the factors influencing users acceptance of technology between male and female in KSA context; there for the need for this study. The theoretical model for this study (shown in Figure 1) is adapted from Almazroi (2017) and which is based on TAM3, however the modelhas thefollowingfivedifferencesfrom TAM3:
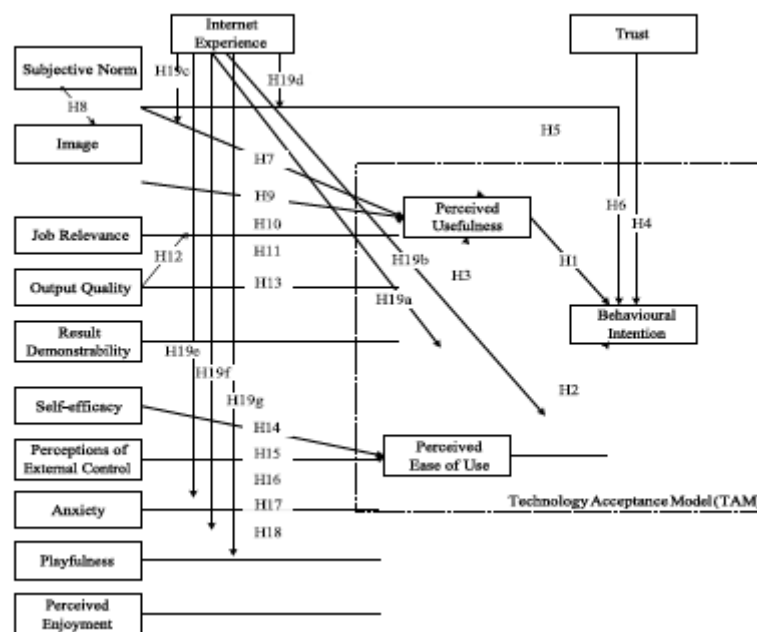

Figure 2.
The research model

First, trust construct is introduced as a direct determinant of perceived usefulness and behavioural intention. Trust is defined as "the belief that the other party will behave in a socially responsible manner, and, by so doing, will fulfil the trusting party's expectations without taking advantage of its vulnerabilities" (P. A. Pavlou, 2003, p. 106). The integration of trust is as a result of its influence in technology adoption process as claimed in various studies (Alharbi, 2014; Mary & Pauline, 2004; P. Pavlou, 2001; P. A. Pavlou, 2003; Van der Schyff & Krauss, 2014). For instance, Alharbi (2014)found that establishing trust was one of the challenges facing cloud services adoption by users. Likewise, scholars have identified trust as one of the key aspects in virtual teams like cloud computing, e- Commerce and e-Government (Carter & Campbell, 2011; Lai, Kan, & Ulhas, 2013; Li & Chang, 2012; P. A. Pavlou, 2003).

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

Third, objective usability is omitted because it was typically operationalized in accordance with keystroke model, which is used to measure the novice-to-expert ratio of effort. This is achieved by computing time taken to carry out series of tasks with the system "in an error-free situation" by an expert and compare it with that of a beginner (Venkatesh, 2000). The cloud application that is used in this study, which is Google Docs, does not support keystroke model to measure objective usability. Therefore, the objective usability construct is dropped. Fourth, voluntariness construct which is a moderator factor in TAM3 is eliminated because of the fact that the use of cloud services by students is voluntary. Fifth, experience moderator construct is modified to Internet experience to reflect the context of our study. Internet experience is described as "the extent of a person's experience to perform specific tasks using the Internet"(Alenezi, Karim, Malek, & Veloo, 2010, p. 25).There are various studies that have shown the influence of experience on perceived usefulness and perceived ease of use which as a result influences the behavioural intention or actual usage of some systems (Agarwal & Prasad, 1999; Jiang, Hsu, Klein, & Lin, 2000). Thus, considering Internet experience in this study may help explain the behavioural intention better since cloud computing applications are Internet based applications that are more likely to be used by users with Internet experience.

Overall, the research model has 14 constructs. The constructs are perceived usefulness, trust, and perceived ease of use, behavioural intention, output quality, job relevance, result demonstrability, self-efficacy, and anxiety, perceptions of external control, playfulness, perceived enjoyment, subjective norm, and image. The next section describes the instrumentusedtocollectthestudyquantitative data.

Study Instrument

This empirical study used the quantitative approach in order to achieve the objective of the study. The data for this study were collected by usingasurveyquestionnaire that was distributed to undergraduate students. The items in the questionnaire were adapted from prior studies as shown in table 2.

Table 2
Study Construct And Measurement Used

Study Construct	Measurement Items Used	Literature Source(s)
Perceived Usefulness (PU)	Subjective Norm (SN) - Image (IMG) Job Relevance (JR) Output Quality (OUT) Result Demonstrability (RES)	Davis (1989), Davis et al. (1989), and Venkatesh and Bala (2008) Taylor and Todd (1995), Mathieson (1991) Moore and Benbasat (1991), Davis, Bagozzi, and Warshaw (1992).
Perceived Ease of Use (PEOU)	Self-efficacy (SE) Perceptions of external control (PEC) Playfulness (PLAY) Anxiety (ANX) Perceived enjoyment (ENJ)	Compeau and Higgins (1995) Mathieson (1991), Taylor and Todd (1995), Venkatesh and Bala (2008), and Venkatesh (2000) Webster and Martocchio (1992) Heinssen, Glass, and Knight (1987), and Venkatesh, Morris, Davis, and Davis (2003) Davis et al. (1992), and Venkatesh and Bala (2008)
Trust (TR)	Trust (TR)	P. A. Pavlou (2003), and Pikkarainen, Pikkarainen, Karjaluoto, and Pahnila (2004).
Behavioural intention (BI)	Perceived Usefulness (PU) Perceived Ease of Use (PEOU) Trust (TR)	Davis (1989), and Venkatesh and Bala (2008)

All the factors and items used in the survey were checked and verified by nine technology adoption and research experts. Minor changes were made to the survey based on the feedback gained from the expert prior administering the survey.

The study employed a 5-point Likert scale instrument to measure the study items. The instrument was originally developed in English language then it was translated into Arabic language since Arabic is the official language in Saudi Arabia and most students do not speak English language. The two versions were checked by language experts for the consistency, clarity of the instrument, the authenticity of the translation, and the lack of differences between the two versions.

The survey instrument was distributed to 527 undergraduate KSA students. Out of the 527 questionnaires distributed 451 (86%) were deemed usable the remaining 76 were deemed unusable because 1) missing data (54); and 2) unengaged responses (22). More than half of the study sample 242 (53.7%) were males and the remaining 209 (46.3%) were females. The majority of the study participants 371 (82.3%) were in the age group of 18-22 years and the remaining 80 (17.7%) were in the age group of 23-27 years. The majority of the study participants were in their second year of study (40.8%), and those who were in their first year, third year, fourth year of study represented 17.3%, 27.9%, and 7.5% respectively. The remaining 6.4% did not specify at what year of study they are.

The number of useable questionnaires, sample balance and diversity, and the reasonably high response rate (86%) warranted further analysis of the study data (Nulty, 2008; Saunders, Lewis, & Thornhill, 2009).

Prior to assessing the structural model of for this study, the measurement items' reliability were assessed by evaluating the internal consistency of each measure. Cronbach's alpha reliability coefficients

were used to measure the internal consistency of the scales in the research model (Creswell, 2009). Sekaran (2003) suggested that reliability coefficients below 0.60 is deemed poor, 0.70 is considered acceptable, and above 0.80 is considered good. In addition, Hair, Black, Babin, and Anderson (2010) recommend that Cronbach's alpha valueequal to or greater than 0.70 indicates adequate internal consistency. Thus, 0.70 value was considered as the threshold in this study. Furthermore, Hair et al. (2010) recommended that item-to-total correlation among all items should be above 0.50. Item-to-total correlation gives "an indication of the degree to which each item correlates with the total score" (Pallant, 2011, p. 100). Therefore, these two metrics (Cronbach's alpha and item-to-total correlation) were used in this study to measure the reliability of the scales in the research model. Table 3 shows the Cronbach's alpha and item-to-total correlation results for all the constructs of the research model that were examined using SPSS version 22.

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

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

The results shown in Table 3 indicates that the measurement scale items were reliable consequently, all the survey items were retained.

The Study Results

The structural model is assessed by examining the structural model fit and the standardized path coefficients to find out if the hypothesized relationships are supported or not. Hair et al. (2010) states that the aim of conducting hypotheses testing is to determining the independent variables that contribute significantly to explaining the dependent variables To answer the research question set by this paper (i.e. is there a difference between male and female attitudes towards cloud computing

acceptance in KSA), the study model was tested using a) dataset collected from both genders; b) the dataset for male participants; and c) the dataset for the female participants.

This study used the GOF indices recommended by Hair et al. (2010). The structural model indices obtained shows that all major goodness of fit indices were within the recommend range (see table 4).

Table 4
Goodness of fit indices for the structural model

Fit Measure	Recommended	Structural Model
X2/df	< 3	1.538
CFI	> 0.90	0.914
TLI	> 0.90	0.907
RMSEA	< 0.08	0.024

The results of testing the main 14 constructs in the structural model reveal that ten out of the seventeen hypotheses are statistically significant as shown in Figure (3a, b, & c) and Table 5.
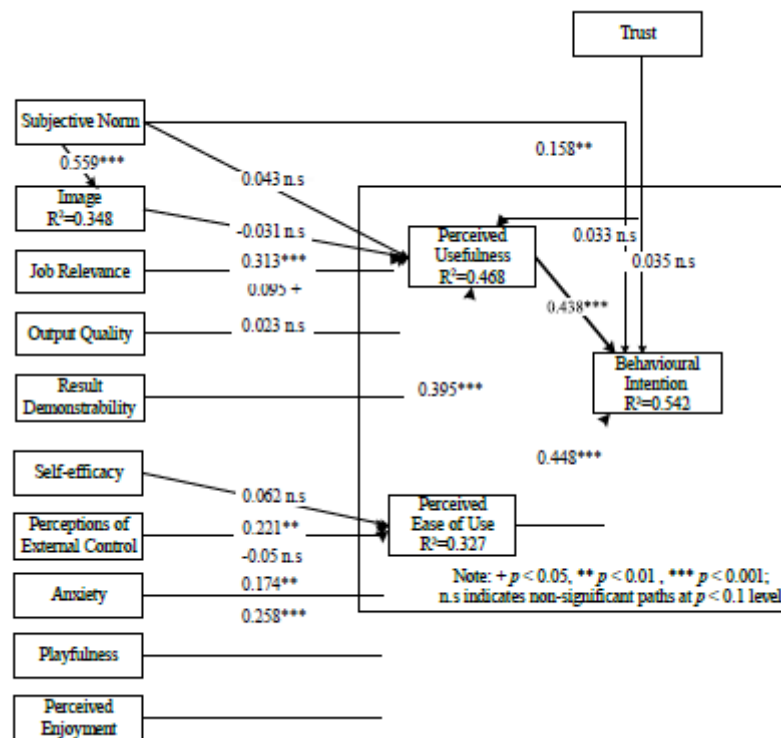

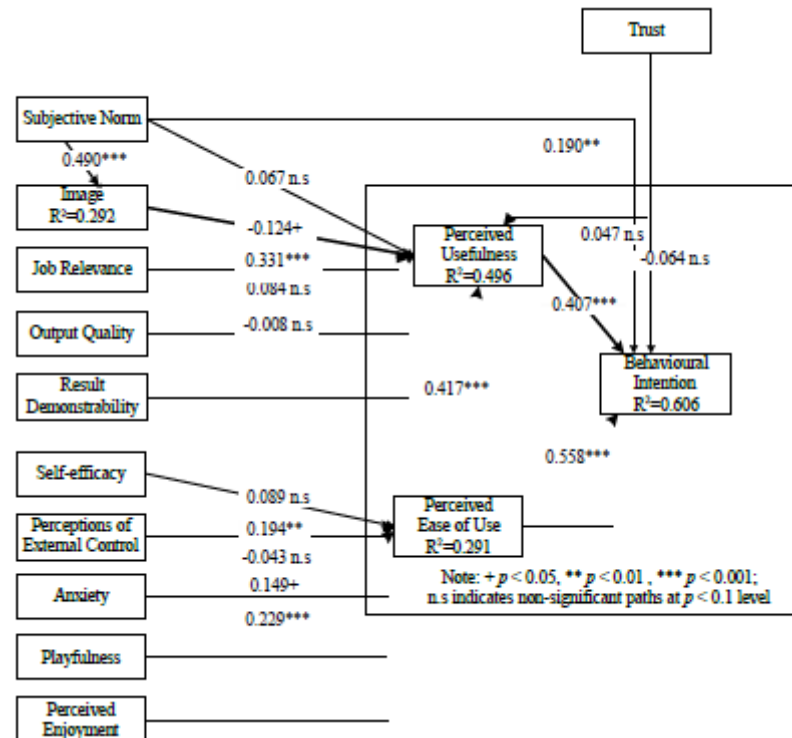**Figure 3a:**
Structural model - ALL

Figure 3b:
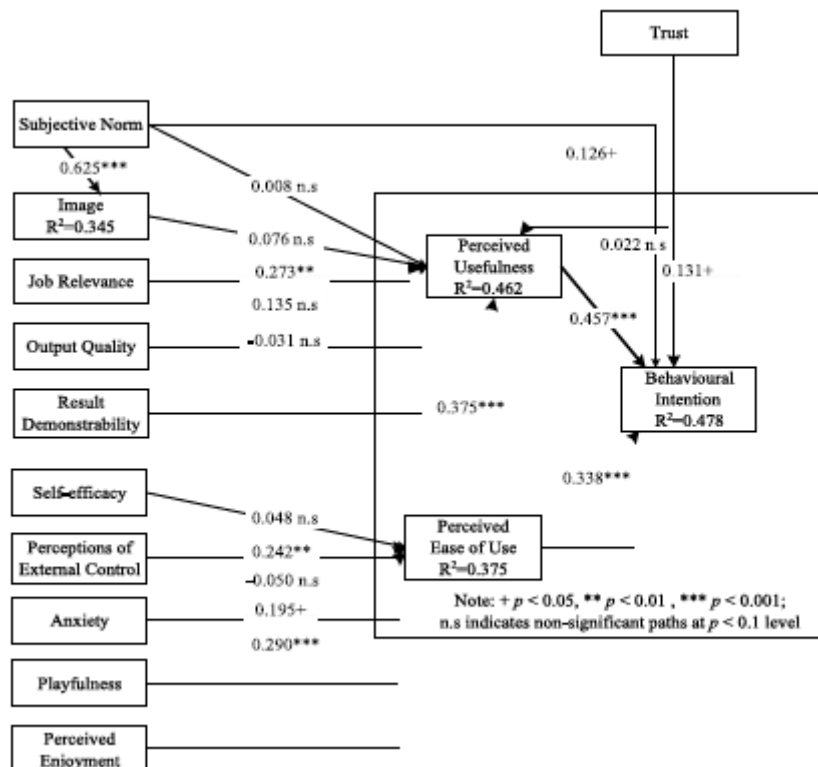Structural model – Male

Figure 3c:
Structural model - Female

The findings showed that perceived usefulness of the cloud computing applications had a strong positive effect on behavioural intention (β =

0.419, p< 0.001), which supported H1. Perceived ease of use had a strong positive influence on behavioural intention (β = 0.360, p< 0.001), and perceived usefulness (β = 0.360, p< 0.001), thus, supporting H2 and H3. In addition after examine these hypothesis for the male and female group, the results indicated that H1, H2 and H3 are supported for both groups as both the β and p values shows positive indicators (see Table 5 for more details).

Trust had a non-significant influence on behavioural intention (β = .032, p = 0.490), while it positively predicted perceived usefulness (β = 0.162, p< 0.01). Hence, H4 was rejected and H5 was accepted. However, when H4 was tested using the male and female datasets, the hypothesis was accepted for the female group (β= 0.126, p = 0.096) but rejected for the male group (β = -.054, p = 0.355) indicating that trust in a determining factor for female behavioural intention but not for males.

Subjective norm had a non-significant influence onbehavioural intention (β = 0.040, p= 0.412), and perceived usefulness (β = 0.053, p = 0.444); therefore, both H6 and H7 wererejected. In addition, both H6 and H7 were also rejected for both the female (β = 0.022, p = 0.783; β = 0.010, p= 0.931) and malegroups ((β= 0.050, p = 0.341; β = 0.081, p = 0.344). However, the results obtained indicated that Subjective norm had a strong positive influence on image (β = 0.590, p< 0.001), which supported H8. In addition, H8 was also supported for both female and male groups as both the β and p values for both groups were significant (see table 5 for more details).

Table 5:
Hypothesis Test Female vs Male

Hypothesis	Hx	All			Female			Male		
		P.Value	Supported?	Sig. Level	P.Value	Supported?	Sig. Level	P.Value	Supported?	Sig. Level
Image <--- Snorms	H8	***	Yes	0.59 ***	***	Yes	0.637 ***	***	Yes	0.541 ***
Easiness<--- Playfulness	H17	0.006	Yes	0.169 **	0.054	Yes	0.174 +	0.07	Yes	0.151 +
Easiness <--- Anxiety	H16	0.054	Yes	-0.092 +	0.214	No	-0.087 ns	0.217	No	-0.082 ns
Easiness <--- Control	H15	0.001	Yes	0.189 **	0.032	Yes	0.19 **	0.024	Yes	0.179 **
Easiness <--- Sefficacy	H14	0.172	No	0.072ns	0.542	No	0.048 ns	0.124	No	0.115 ns
Easiness<--- Enjoyment	H18	***	Yes	0.319***	***	Yes	0.37 ***	***	Yes	0.274***
Intent <--- Snorms	H6	0.412	No	0.04 ns	0.783	No	0.022 ns	0.341	No	0.057 ns
Intent <--- Easiness	H2	***	Yes	0.39 ***	***	Yes	0.298 ***	***	Yes	0.478 ***
Intent <--- Usefulness	H1	***	Yes	0.419***	***	Yes	0.417 ***	***	Yes	0.405 ***
Intent <--- Trust	H4	0.49	No	0.032 ns	0.096	Yes	0.126 +	0.355	No	-0.054ns
Usefulness<--- Snorms	H7	0.444	No	0.053 ns	0.931	No	0.01 ns	0.344	No	0.081ns
Usefulness<--- Relevance	H10	***	Yes	0.329***	0.001	Yes	0.276 **	***	Yes	0.355 ***
Usefulness <--- Image	H9	0.536	No	-0.036 ns	0.299	No	0.096 ns	0.073	Yes	-0.137 +
Usefulness<--- Output	H11	0.1	No	0.098 ns	0.126	No	0.154 ns	0.298	No	0.076 ns
Usefulness<--- Demonstrability	H13	0.513	No	-0.031 ns	0.6	No	-0.044 ns	0.854	No	-0.011 ns
Usefulness<--- Easiness	H3	***	Yes	0.36 ***	***	Yes	0.363 ***	***	Yes	0.359 ***
Usefulness <--- Trust	H5	0.002	Yes	0.15 **	0.082	Yes	0.133 +	0.009	Yes	0.162 **

*** p<.001
** p<.01
* p<.05; + p<.1

Image did not significantly influence perceived usefulness, thus, rejecting H9 (β = - 0.032, p = 0.607). However, when the test was performed on each group separately, the results obtained showed that H9 was accepted for the male group (β = -0.137, p = 0.073) and was rejected for the female group (β = 0.096, p = 0.299). This result again showed a settle difference between the two groups.

Job relevance had a strong positive influence on perceived usefulness (β = 0.232, p< 0.001), hence, supporting H10. In addition testing H10 using the female and male dataset confirm this positive relationship. Output quality and result demonstrability had no significant effect on perceived usefulness (β = 0.087, p = 0.172; β = 0.016, p = 0.752), hence, H11 and H13 were rejected respectively. Similar results were obtained when testing H11 and H13 with the female and male sub-groups. Additionally, self- efficacy did not influence perceived ease of use (β = 0.072, p = 0.172), therefore, H14 was rejected. Similar results were obtained when testing H14 using the female and male datasets indicating no differences between male and female for this structural path (see Table 5 for more details). Perceptions of external control significantly predicted perceived ease of use (β= 0.189, p = 0.001), thus H15 was supported.

Similar results were obtained when testing H15 using the female and male datasets indicating no differences between male and female for this structural path as well (see Table 5 for more details). Anxiety significantly predicted perceived ease of use (β = -0.092, p = 0.054), resulting in the acceptance of H16. However, when the same relationships was examined using the female and male datasets, H16 was rejected for both sub- groups. Playfulness significantly predicted perceived ease of use (β = 0.169, p = 0.006), which supported H17. Similar results were obtained when testing H17 with the female and male sub-groups. Finally, perceived enjoyment had a strong effect on perceived ease of use (β = 0.319, p< 0.001), which resulted in the acceptance of H18. Again, when testing H18 using the female and male datasets, similar results were obtained.

The variance explained by behavioural intention, perceived ease of use, and perceived usefulness were 54%, 33%, and 47% respectively for the overall model. However, as shown in Table 6, there are differences in the variance explained by these constructs when comparing the female and male sub-groups as shown in Table 6.

Table 6:
Variance Explained by Constructs

Construct	Female	Male	All
Image	0.406	0.292	0.348
Easiness	0.375	0.291	0.327
Usefulness	0.462	0.496	0.468
Intent	0.478	0.606	0.542

Conclusion

There is a rich body of literature on benefits of cloud computing for higher education institutions, however, studies that investigate the factors affecting cloud computing applications adoption by university students in developing countries especially in the Kingdom of Saudi Arabia (KSA) are lacking. Thus, this research aims to fill in the gap found in the literature by conducting an empirical assessment of factors that determine cloud computing applications adoption by university students in KSA through a quantitative approach.

This paper critically examined technology adoption theories and models regarding their strengths and weaknesses. Each of the models has its own strength and limitations, but generally a researcher will choose a model with minimal limitations whichwillbetter fithisorher study context.

Understanding factors related to users' adoption of a technology is very important. Rejection rate of a technology can be reduced when factors that influence the adoption are identified and examined. Therefore, this study extends TAM3 model to determine and explain the impacts of factors that influence the adoption of cloud computing applications by universitystudents. The TAM3 modelis selected as the base theoretical model for this research due to its comprehensiveness in comparison to other technology acceptance models. Basically, this study is among the few ones that extend TAM3 to develop a model for investigating cloud computing applications adoption by students in academic settings.

After testing the structural model using three datasets (All participants, Male participants and Female participants) it was noticeable that there is a settle difference between male and female behaviouralintention.

This difference was observed in the structural path between Image and Usefulness as the relationship was significant for the females group but not for the male group. Another difference observed was in the structural path between trust and behavioural intention which was significant for the male group but not for the females group.

As a result future studies need to examine these difference in more details especially in a context similar to KSA. The results presented in this study will add to the body of knowledge on cloud computing applications adoption by university students in developing countries especially in Saudi Arabia.

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