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Research Article

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Extending Technology Acceptance Model (TAM) by Incorporating Organizational and Individual Variables for Enterprise Resource Planning Systems (ERP) Adoption in Higher Education Institutions (HEIs)

Mohammed AlBarghouthi*

Management Department, Community College of Qatar, Doha-Qatar

Abstract

Adopting information systems within the higher education sector is critical towards its effectiveness and success of services. However, Enterprise Resource Planning (ERP) systems in the Higher Education sector is less accepted and research in this area remains at its infancy. The present study has extended previous research by examining factors that may affect the adoption of ERP systems, based on the Technology Acceptance Model (TAM). The proposed model is validated by a survey of 394 ERP users. The results have shown that organizational variables (top management support and user training) and individual variables (computer self-efficacy and computer anxiety) have significant effects on ERP adoption in higher education institutions. It explores the association of the factors at various layers that influence the adoption of ERP in Saudi educational institutes. All the data used in the study have been acquired from authentic and reliable sources. The research work is original which provides an extended TAM for ERP adoption in the Saudi higher educational institutes. The study has its major implications in the organizational development as well as in various educational institutions to facilitate learners with information regarding education resource planning for future developments.

Keywords: *Adoption; enterprise resource planning; higher education institutions; technology acceptance model.*

1. Introduction

The implementation of ERP systems is always considered as a complex, costly, and time-consuming approach for project management [1]. Past studies have been carried out in universities that have indicated that the ERP adoption failure among HEIs is greater than among businesses [1]. Moreover, businesses are challenged with creating different types of systems that are capable of working together to seamlessly share and exchange information in the current information age. One way to overcome this problem is to employ enterprise applications. Enterprise Resource Planning (ERP) systems are used in educational, service, manufacturing, non-manufacturing, government, and not-for-profit organizations [2]. The aim is to facilitate the procedures for all business roles within the precincts of the company and manage links to external firms [3]. This is particularly true since the complexity of both the implementation and integration of information systems at HEIs is considerably higher [4]. Generally, HEIs are more opposed to change than private firms because of the loosely integrated and autonomously functioning administrative and academic units [5] alongside a decentralized authority structure [6].

***Corresponding author:**
Mohammed AlBarghouthi

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It is observed that difficulties encountered in ERP systems during their implementation usually stem from users' unwillingness for using the technology [7]. Thus, higher education institutions can only benefit from their ERP systems, if the systems' users accept and utilize them effectively. The education systems in Saudi Arabia are still reluctant towards the adoption of technology. The traditional education system of Saudi Arabia lacks relevant experience in the field of technology which obstructs teachers to incorporate technological systems in higher education. These are a few factors that need to be addressed for the proper implementation of ERP in higher education institutions. To this end, the study aims to assess the impact of these factors and propose a model that will prove to be essential for the implementation of ERP in HEIs.

The technology acceptance model (TAM) proposed by Davis et al. [8] was utilized by different research studies to understand and examine users' acceptance of new technologies [9]. Operations in higher learning institutions have continuously changed due to technological advancements that have continued to empower and change various methods of higher education institutions (HEI). Given the current dynamics of the world and technology, the information systems within the higher education sector are critical for the effectiveness and success of services, since information systems are important factors that have influenced quality outcomes, services, and tasks [10]. These advantages include a reduction in paper usage, better information flow, enhanced efficiency, more accessibility for administrative services, improved services for learners and faculty, and improved access to data [11].

Additionally, Saudi Arabia's Vision 2030 incorporates reforming its education in an attempt to provide a better employment basis for the individual, necessitating adaptation of ERP at different levels for enhancing the performance [12]. Therefore, the in-depth analysis contributes to the existing knowledge and attempts to introduce a new perspective on the subject. It assists the education sector for the creation of a research-conducive environment and improves international academic performance. Nevertheless, it is worth noting that there is a lack of research studies that have explained the acceptance of ERP systems in HEIs using TAM especially about ERP perceived usefulness and perceived ease of use. None of the prior research has provided clear instructions for the effective adoption of ERP systems in HEIs. Also, the existing research studies never attempt to develop a conceptual framework for ERP adoption in HEIs even though they are still adopting ERP systems. Furthermore, the majority of these studies focus only on behavioral intentions or attitudinal as the determining variables of ERP system usage.

The researcher was unable to locate one research study that examined the adoption of ERP systems in HEIs using TAM in Saudi Arabia. This is the first study that has examined factors that affect ERP adoption in higher education institutions in a developing country rather than a developed one. Therefore, this research study may generate contemporary research strands of ERP implementation theory and adoption by extending the TAM model in an uninvestigated area with positive outcomes. Hence, there is a necessity to examine ERP adoption in HEIs by the use of TAM in developing countries.

2. Theoretical Background

2.1. Technology Acceptance Model (TAM)

Davis et al. [8] is a proponent of TAM, which is a derivative of the Theory of Reasoned Action (TRA) purposely fashioned to generate user acceptance of information technology (IT). TRA asserted that beliefs sway attitudes, which then bring about intentions, and finally generate behavior. TAM adopted this belief attitude-intention-behavior relationship to model user acceptance of IT. As illustrated in Figure 1, the TAM model hypothesizes that two specific beliefs, i.e. perceived usefulness (PU) and perceived ease of use (PEOU), are of the utmost significance in the determination of computer acceptance behaviors.

TAM model has received significant support from various empirical research studies [13] as compared with other models; such as Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), and innovation diffusion theory (IDT). A significant variation has existed about IT acceptance. Major users are not consulted, when investing in IT, for instance, ERPs. Nah et al. [14] have shown that the variation, which characterizes technology acceptance within mandatory contexts, has not been explained by the Davis et al. [8] TAM model or Venkatesh and Davis [13] expanded TAM model. Additionally, fairly simple technologies such as e-mail and word processors have been adopted [15], with a relative lack of attention being given to complex and mandatory technologies such as ERP systems. ERP systems are very complex systems and such complexity may negatively affect an individual's perceive ease of use as well as perceive usefulness. Therefore, developing a conceptual model to guide higher education institutions in ERP adoption is very important for researchers as well as managers to help them overcome the complex nature of ERP systems. A review of prior ERP studies regarding TAM indicated that few studies have investigated ERP user acceptance and usage, and only a small number of articles have been published [16]. Nevertheless, most of the existing models, theories, and frameworks have failed to completely explain the reasons why a certain technology is unacceptable or acceptable by its users [17].

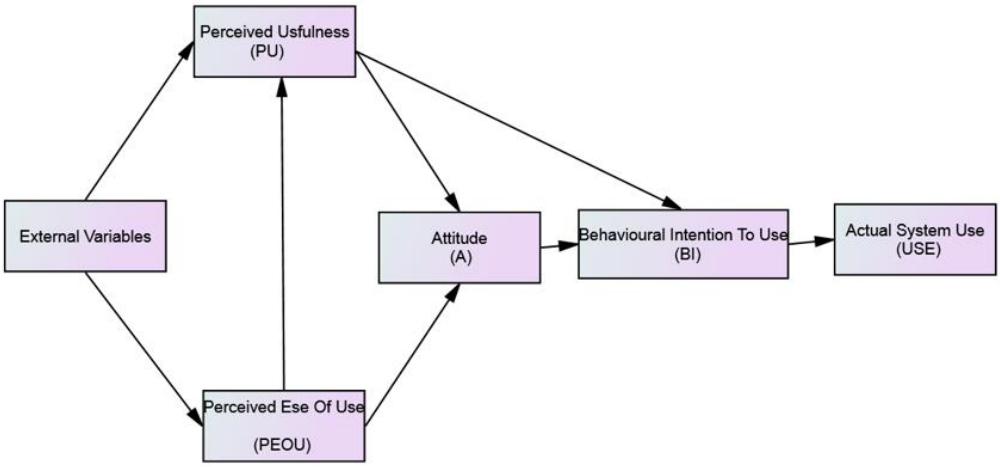

Figure 1: Technology Acceptance Model (TAM).

Several research studies with positive results have been conducted on ERP systems with the use of TAM. Bradley and Lee [18] examined the relationship between training satisfaction and PU, PEOU, and perceived effectiveness and efficiency on the adoption of ERP systems in one university. The findings indicated that training satisfaction influences ERP ease of use.

Whereas, both training and user participation is influenced by the perceived effectiveness and efficiency of the ERP systems. In a similar context, Shih and Huang [19] attempted to explain the behavioral intention and actual use through incorporated additional behavioral constructs including; top management support, computer self-efficacy, and computer anxiety.

Lee et al. [20] examined factor organizational support (formal and informal) on original TAM factors. The outcome of the study revealed that subjective norms, perceived usefulness (PU), and education level are determinants of behavioral intention. Moreover, organizational support influenced ERP perceived ease of use and perceived usefulness.

2.2 Development of a Theoretical Framework for ERP Adoption

Technology adoption is not entirely dependent on the technical aspect of IT. External aspects inclusive of organizational and individual characteristics are also important to facilitate technology adoption [21]. As ERP systems implementation is complex, their adoptions are prone to major problems that are related to organizational and individual issues rather than technical issues [22]. Therefore, ERP systems require individual perspectives coupled with organizational viewpoints. According to Gefen et al. [23], when organizations make their ERP systems useful and easy to be used by the employees, it renders both organizational and individual strategic issues. Several surveys and researches showed that the requirements in the HEIs differ from companies and firms. This is because organizational and individual factors are given a special preference [24].

Different research studies have used TAM and applied it to ERP systems by incorporating new factors to gain a better understanding of the determinants of technology acceptance and to increase TAM's predictive validity. For instance, some research studies incorporate external factors such as computer anxiety, self-efficiency, user training and top management support to predict perceive ease of use and perceive the usefulness of the technology [16],[18]. Davis et al. [8] reckoned that TAM should include other external variables when evaluating the acceptance of a specific technology because they may affect technology's PU and PEOU. Extensive research has been undertaken by numerous authors that affect the adoption of information technology in different business sectors. However, there is no general unanimity regarding the precise factors that may affect the adoption of information technologies. Other incorporating factors from various frameworks of technology acceptance model; such as subjective norm is to increase TAM' predictive validity, while, others incorporate the actual usage of technology to measure technology usage [18].

Based on the above discussion, two main categories of variables have been adopted. The first category is construed as organizational variables (top management support and user training); whereas, the second category comprises of individual variables (subjective norms, computer self-efficacy, and computer anxiety). These external factors (organizational and individual) have been validated in different empirical studies and have strong support in the literature.

2.3. Hypotheses Development

2.3.1 User Training

When organizations change the course of their business through the adoption of new technology, they must prepare and help their employees in the transition process through comprehensive training. Effective training can develop a positive attitude regarding the system among the employees since ERP users are unlikely to have any programming or system analysis expertise [25]. This broadens the users' acquaintance of the system as well as their skills in operating it. Based on the technology acceptance model (TAM), user acceptance is fundamental for the successful implementation of new technologies. Because ERP systems are a potentially disruptive and complex technology, organizations must carry out training in a bid to establish acceptance of the technology among users [26]. A large number of previous studies [27]-[29] on ERP systems point out that training is an indispensable factor for the successful implementation of ERP. User training/education is regarded as the third most important factor that has the potential to influence ERP implementation particularly because it not only supports the adaption of the new ERP system but also facilitates the process of change in an organization [30]. Inadequate training for ERP users decreases ease of use and increases users' resistance, which may have major consequences on ERP system success and usage [31]. The study conducted by Amoako-Gyampah and Salam [32] suggested that both perceived usefulness and perceived ease of use of ERP systems were influenced by training that was indicative of the significance of training in the acceptance of new technologies.

Based on the technology acceptance model (TAM) user acceptance is fundamental for the successful implementation of new technologies. Because ERP systems are potentially a disruptive technology transformation, organizations must carry out training in a bid to establish acceptance of the technology among their users. System users need to understand how the information system can help them to achieve their work [33]. This fact was explained by different research studies [34],[35] that confirm the direct effects of training on ERP perceived usefulness. User training may also affect usage through perceived usefulness [36]. Since training provides users with information regarding the new system (e.g. ERP system), users may have the opportunity to compare a new system with the old one and to identify the value and the benefits of a new system. Therefore, it is predicted that training allows the system's users to shape the perceived usefulness of the new system links to their work relevance.

As training could be the users' first experience when their organizations adopt ERP systems. Therefore, it is possible that training would enhance the users' computer self-efficacy that influences their attitude toward ERP by changing the users' perceived ease of use of the system. According to Bradley [31], inadequate training for ERP users decreases ease of use and increases users' resistance, which may have major consequences on ERP system success and usage. According to Ruivo et al. [37], when users have a good understanding of the system because they endowed with an adequate training program, such training improves users' perceptions regarding how easy it is to use the system.

Amoako-Gyampah and Salam [32] conducted a study on the effects of training, communication and "belief construct" (defined as the shared convictions regarding the benefits of technology) on the perceived usefulness and the perceived ease of use of an ERP system during its adoption and implementation in a large international conglomerate. The results suggested that both perceived usefulness and perceived ease of use of ERP systems were influenced by training and that was indicative of the significance of training in the acceptance of new technologies. This was also supported by Lee et al. [20] study who concluded that UT has positive effects on perceived usefulness and perceived ease of use of ERP systems. Another study conducted by Rajan and Baral [35] that examined the effects of external factors on ERP by the use of TAM indicates that UT has a significant positive effect on perceived usefulness and perceived ease of use of ERP systems.

H1: User training will have a positive effect on perceived ease of use of ERP systems
H2: User training will have a positive effect on perceived usefulness of ERP systems

2.3.2. Top Management Support (TMS)

The importance of support from top management in the success of ERP implementation has been underscored by several researchers especially when the results are dynamic and uncertain [38],[39]. Lee et al. [20] have shown the influence of top management support on the behavior intention of ERP systems. The finding indicated that top management support is a critical factor for perceived ease of use and perceived usefulness. Top management support strongly and positively affected the perceived ease of use and usefulness of ERP systems [19]. Sternad and Bobek [40] have indicated that ERP support as the degree to which individual views adequate ERP support as the reason for his or her successful ERP usage. Previous studies have confirmed that support from top management has a positive effect on the attitudes and performance of users especially during the adoption of new ERP technologies. Support from top management improves the users' attitudes toward using the system and reduces computer anxiety [41].

Costa et al. [42] examined the main determents of ERP satisfaction and adoption. The results of their study show that TMS significantly and positively affects ERP perceived usefulness and perceived ease of use. This was also supported by Lee et al. [20] who examined the influence of TMS on the behavior intention of the ERP system's users. The findings of their study indicated that TMS is positively associated with ERP perceived usefulness and perceived ease of use. Moreover, Shih and Huang [19] and Ngai et al. [43], concluded that TMS strongly and positively affects ERP perceived usefulness and perceived ease of use.

H_3: Top management support will have a positive effect on perceived ease of use of ERP systems
H_4: Top management support will have a positive effect on perceived usefulness of ERP systems

2.3.3. Computer Self-Efficacy (CSE)

Self-efficacy implies the belief in one's capacity to perform a given task, or an individual's belief in his capacity to successfully undertake an activity [44]. Various studies have established that perceptions of self-efficacy may influence decisions towards certain behavior, as well as an individual's actual performance accomplishments about behavior [45],[46]. According to Agarwal and Karahanna [47], computer self–efficacy can be considered a strong predictor of behavioral intention through perceived usefulness.

Self-efficacy could be an important factor when considering a new process [48]. Venkatesh and Davis [13] explored the effect of self-efficacy on perceived ease of use in email and Gopher. Their studies revealed that perceptions regarding a new system's ease of use were dependent on an individual's CSE. This was also supported by Davis et al. [8] and Hasan [49], who concluded that self-efficacy is an antecedent of perceived ease of use, as well as the ability to use a particular technological tool. However, other studies show that the effects of CSE on perceived ease of use is a week, as individuals believe that they can master the needed skill and achieve the objective [50]. Furthermore, According to Rajan and Baral [35], CSE positively affects perceived ease of use of ERP systems. Additionally, they found that CSE is the main determinant of perceived ease of use and this was also supported by Venkatesh and Davis [13].

Generally, users who possess high levels of CSE are more likely to be competent in using various systems [51]. Such high levels of CSE may allow users to explore various features of the systems and discover their usefulness. Kwahk and Ahn [52] stated that "when individuals believe that they will be able to use computers and IT with great skill, they are more likely to expect beneficial outcomes from using computers and IT compared to when they doubt their 'computer related-capabilities". According to their study, CSE significantly and positively affects the ERP system's perceived usefulness. Therefore, it's worthy to examine the positive effects of CSE on

perceived ease of use and perceived usefulness of the ERP system.

H_5: Computer self-efficacy will have a positive effect on perceived ease of use of ERP systems
H_6: Computer self-efficacy will have a positive effect on perceived usefulness of ERP systems

2.3.4. Computer Anxiety (CA)

Computer anxiety refers to apprehension or even fear experienced by some people when they are faced with the prospect of using computers. Shu and Wang [53] define computer anxiety as the inability of an individual to deal with the emerging and developing ICT usage trends both in professional or social realms. Computer anxiety has been found to cause reduced use and even total avoidance of information technology [41]. Gelbrich and Sattler [54] stated that technology anxiety has a direct negative effect on the intention to use, which is greater than the indirect effect through the reduction of ease of use. Perceived ease of use of information technology is affected by technology anxiety [55]. Computer anxiety is an individual characteristic that impacts user perceptions of perceived ease of use and perceived usefulness [13],[56].

Previous research studies showed that CA facilitates the intention to use IT [57]. ERP system is a complex technology and such complexity may negatively influence users' perceptions of ERP perceived usefulness and perceived ease of use especially users with high level of CA [58]. Shih and Huang [19] stated that "individuals with lower anxiety are much more likely to interact with computers than people with higher anxiety".

H_7: Computer anxiety will have a positive effect on perceived ease of use of ERP systems
H_8: Computer anxiety will have a positive effect on perceived usefulness of ERP systems

2.3.5. Subjective Norms (SN)

According to Venkatesh [59], social influence is a function of two factors, including subjective norms and social factors. Subjective norms were described as a person's perception that most people who are important to him/her think that he/she should or should not perform the behavior in question [60]. Early TAM researchers [8] abandoned subjective norms as a study subject on the realization that there were no significant results as far as intentions were concerned. However, Lee [61] and Lu et al. [62] established that the effects of subjective norms have a considerable influence on perceived usefulness. Additionally, Chung et al. [63] and Schepers and Wetzels [64] argued that subjective norms could have a positive and considerable effect on the intention to use in mandatory situations.

H_9: Subjective norms will have a positive effect on perceived usefulness of ERP systems
H_{10}: Subjective norms will have a positive effect on the intention to use ERP systems

2.3.6. TAM's Factors

Davis [65] concluded that there is a strong significant relationship between intention to use and usage behavior. The relationships between the TAM constructs have been replicated in the proposed research model. The newly developed model in this study proposed factors (organizational and individual) that are not presented in the TAM. This may help in providing a better understanding of ERP systems and its usage in HEIs, particularly in Saudi Arabia. The proposed model (Figure 2) has been revised and examined using Structural Equation Modelling (SEM). Based on this literature and TAM model, this study encompassed the testing of the following hypotheses;

H_{11}: Ease of use will have a positive effect on perceived usefulness of ERP systems
H_{12}: Perceived ease of use will have a positive effect on the attitude to use ERP systems
H_{13}: Perceived usefulness will have a positive effect on the attitude to use ERP systems
H_{14}: Perceived usefulness will have a positive effect on the Intention to use ERP systems
H_{15}: Attitude will have a positive effect on the Intention to use ERP systems
H_{16}: Intention to use will have a positive effect on the actual use of ERP systems

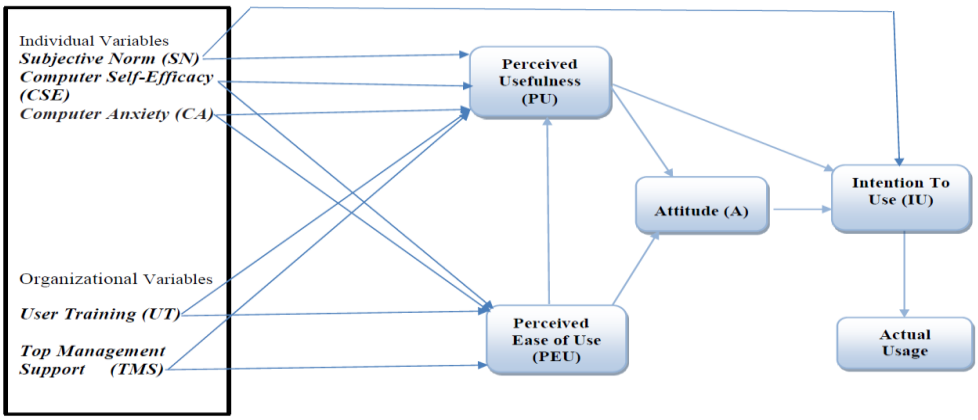

Figure 2: Proposed model for ERP adoption in HEIs.

3. Methods

3.1. Questionnaire Design

The study has utilized instruments that were validated and applied by previous empirical research studies [19,],[20],[55] to add face validity to this research. However, some questions were altered to suit the research study. Table 1 presents the articles for summarizing the items (indicators) that are employed to measure every latent variable. These indicators will be adapted to the present context by specifying the desired target (using ERP systems). The elements of the proposed model are perceived ease of use, perceived usefulness, attitude, intention, and actual use of ERP systems.

The questionnaire is composed of two parts. The first part includes the measures of the theoretical constructs of the research model: individual variables (subjective norms, computer self-efficacy, and computer anxiety), organizational variables (top management support and user training), and TAM's factors (attitude towards system use, behavioral intentions, and actual use). The second part collects demographic and organizational information of the respondents. All items were measured using a rating scale from (1) strongly disagree to (7) strongly agree. Moreover, the research design allows the effective and effectual collection of data. Regarding the present study, the selected research design was most appropriate due to the adequacy of results obtained through it.

Table 1: Factors with indicators of the survey instrument.

Factor	Indicators	Previous studies
	Organizational Variables	
User Training (UT)	The training provided to me was complete	Amoako-Gyampah and Salam [32], Bradley and Lee [18]
	The training gave me confidence in the system	
	The trainers were knowledgeable and aided me in my understanding of the system	
	The training on the operation of the ERP was sufficient	
	Overall, my level of understanding substantially improved after going through the training program	
Top Management Support (TMS)		Lee et al. [20]
	I felt that they supported the system	
	I felt that they were having highly intention to change	
	The company promoted the system before implementation	
	Our top management supported the ERP implementation project well.	
	The company provided training courses	
	Individual Variables	
Subjective Norms (SN)	My peers believe in the benefits of the ERP	Ajzen [66]
	My management team believes in the benefits of the ERP	
	Senior management strongly supports my using the ERP system	
	I would like very much to use the ERP system because senior management thinks I should use it	
Computer Anxiety (CA)	Working with a computer makes me nervous	Venkatesh and Bala [55] and Shih and Huang [19]
	Computers make me feel uneasy	
	Computers make me feel uncomfortable	
	Computers scare me	
	I feel comfortable with ERP	
Computer Self-efficacy (CSE)	I am confident of using the ERP even if there is no one around to show me how to do it	Venkatesh and Davis [13], Venkatesh and Bala [55] and Shih and Huang [19]
	I am confident of using the ERP even if I have never used such a system before	
	I am confident of using the ERP as long as someone shows me how to do it	
	I am confident of using the ERP as long as I have a lot of time to complete the job for which the software is provided	

	TAM's Factors	
Perceived Usefulness (PU)	Using the ERP system would allow me to accomplish my tasks more quickly	Davis et al. [8]
	Using the ERP would improve my performance	
	Using the ERP would enhance my effectiveness at work	
	Using the ERP would increase my productivity at work	
	Using the ERP would make it easier to do my job	
	Overall, I find ERP useful in my work	
Perceived Ease of Use (PEU)	Learning to use the ERP is easy for me	Venkatesh and Davis [13], Davis et al. [8]
	I find it easy to get the ERP to do what I want it to do	
	My interaction with ERP is clear and understandable	
	Getting the information from ERP is easy	
	It is easy for me to become skillful at using ERP	
	Overall, I find ERP easy to use	
Attitude (A)	ERP is important to me	Nah et al. [14], Davis et al. [8], and Fishbein and Ajzen [60]
	Using ERP is a good idea	
	ERP provides a good communication environment	
	I like using ERP	
Intention to Use (IU)	I intend to use the ERP to do my work	Venkatesh and Davis [13], Davis et al. [8]
	I intend to use the ERP in other jobs in the future	
	I intend to increase my use of the ERP in the future	
	Having used the ERP, I would recommend it to my colleagues to use for work purposes	
Usage	How many times do you believe you use ERP a week?	Davis et al. [8]
	How many hours do you believe you use ERP System per week?	

3.2. Sample and Data Collection

Data were obtained from six higher educational intuitions in Saudi Arabia who are using ERP systems in their daily work, between November 2016 and February 2017. No differentiation was taken into consideration between mature or new adopters of ERP systems. Despite the different types of systems, all selected institutions have utilized ERP systems in similar administrative departments (registration and administration, financial and human resource departments) and have similar features/characteristics such as several departments, staff, and students. A total of 600 self-administrated questionnaires were distributed to the targeted universities and their branches. Only 463 were returned giving a response rate of 77.1%. However, 69 responses were excluded as they represented either incomplete answers or missing data values leaving a total of 394 final analysis. Table 2 has provided a summary of the demographic data, indicating 62.9% of respondents as male and 37.1% as female.

Table 2: Demographic data summary.

Variable	No. of Respondents	Percent (%)
Gender		
Male	248	62.9
Female	146	37.1
Experience		
Less than 1 year	51	12.9
1-3 years	63	16.0
3-6 years	113	28.7
More than 6 years	167	42.4
Department		
Finance Department	93	23.6
Registration Department	113	28.7
HR Department	102	25.9
Other	86	21.8
Education		
High School or less	55	14.0
Diploma	105	26.6
University Degree (BA)	190	48.2

Master or PhD	44	11.2
Age		
Under 20	20	5.1
20- under 30	160	40.6
30- under 40	155	39.3
Above 40	59	15.0
Place of Residence		
Riyadh	158	40.1
Jeddah	25	6.3
Dammam	55	14.0
Other	156	39.6
Status		
Single	160	40.6
Married	223	56.6
Other	11	2.8

3.3. Data Analysis

A two-stage process was used to evaluate the research model. The first stage incorporated confirmatory factor analysis (CFA) that was applied to confirm or reject the proposed model for sustaining the validity of the hypothesized measurement model via convergent validity, Cronbach's alpha, and discriminate validity tests during the CFA stage. The next stage encompassed the application of structural equation modeling (SEM) to examine the relationships between unobserved and observed variables.

4. Results and Discussion

This study consists of 10 variables and 43 items. According to Hair et al. [67], to achieve generalizability in a research study, the sample size should be between 15 to 20 observations for each variable. Therefore, a sample size of 394 responses can be considered sufficient for this study with 43 observed variables. The item (variable) ratio to sample size for this study is 1:9.

4.1 The Bartlett Test of Sphericity and Kaiser-Meyer-Oklin's (KMO)

Kaiser-Meyer-Oklin's (KMO) measure of sampling adequacy (MSA) test was applied to determine the appropriateness of factor analysis. This measure has examined the partial correlations among variables and it ranges between 0 and 1, where values > 0.5 can be considered acceptable [68] and values > 0.9 can be considered perfect [69]. Table 2 shows the current value for KMO (0.922) is greater than what was recommended by Hutcheson and Sofroniou [69] indicating the strong validity of the sample as well as a small correlation among variables. Table 3 shows that the overall results of Bartlett's test investigation are appropriate for factor analysis with $\chi^2 903 = 18591.172$ and $P < 0.001$.

Table 3: KMO and Bartlett's test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.922
Bartlett's Test of Sphericity	Approx. Chi-Square	18591.172
	df	903
	Sig.	0.000

4.2 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) was applied to examine the validity of the hypothesized measurement model [70]. The following analysis model has been used due to its rigidity in confirming and rejecting a particular measurement theory.

4.3 Goodness of Fit Improvements

The first attempt to measure the model indicated a poor fit. All recommended cut-off value for model fit indices (GFI, NFI, CFI and, RMSEA) was below the acceptance level. To achieve an acceptable model fit, several modifications were performed on items with standardized residuals greater than (3) on the measurement model as suggested by the modification indices. Thus, 18 items out of 45 items from the finalized questionnaire were deleted to achieve the recommended cut-off value for model fit indices (Table 4). Different steps were used for item deletion. For instance, items with the highest Chi-square and factor loadings were deleted first. Consequently, a new acceptable model fit was obtained from these modifications. As illustrated in Table 5, the ratio Chi-square/df decreased from 5.943 to 2.163, which is within the range recommended by Segars and Grover [71] with 281 degrees of freedom. AGFI (0.868) was above the recommended threshold value 0.80, CFI (0.962), GFI (0.902), and NFI (0.931) were all above 0.90. The RMSEA's value for the hypothesized model was (0.054) with 90% confidence ranging from 0.048 to 0.060, which was less than the recommended value 0.08. Therefore, the CFA's results confirmed that the research participants' responses support the conceptual as well as the theoretical uniqueness of all the factors (dependent and independent variables) used in this study. Thus, the data seem appropriate and can be utilized for further analysis.

Table 4: Remaining items based on the modification indices.

Factor	Item	Survey Instrument
Perceived Usefulness -(PU)	PU1	Using the ERP system would allow me to accomplish my tasks more quickly
	PU5	Using the ERP would make it easier to do my job)
	PU6	Overall, I find ERP useful in my work
Perceived Ease of Use – (PEU)	PEU4	Getting the information from ERP is easy
	PEU5	It is easy for me to become skillful at using ERP
	PEU6	Overall, I find ERP easy to use
Intention to Use-(IU)	IU1	I intend to use the ERP to do my work
	IU2	I intend to use the ERP in other jobs in the future
Attitude-(A)	A1	Using ERP is a good idea
	A2	like the idea of using the ERP system to accomplish my tasks
	A3	ERP provides a good communication environment
	A4	I have a positive mindset towards the ERP system
Usage	Use-ERP/week	How many times do you believe you use ERP System per week?
	H-Use-ERP/week	How many hours do you believe you use ERP System per week?
Organizational Variables		
User Training-(UT)	UT1	The training provided to me was complete
	UT2	The training gave me confidence in the system
	UT4	The training on the operation of the ERP was sufficient
Top Management Support-(TMS)	TMS1	I felt that they supported the system
	TMS2	I felt that they were having highly intention to change
Individual Variables and Computer Literacy		
Computer Anxiety-(CA)	CA1	Working with a computer makes me nervous
	CA2	Computers make me feel uneasy
	CA3	Computers make me feel uncomfortable
Subjective Norms-(SN)	SN1	My peers believe in the benefits of the ERP
	SN3	Senior management strongly support my using the ERP system
	SN4	would like very much to use the ERP system because senior management thinks I should use it
Computer Self-efficacy-(CSE)	CSE3	I am confident of using the ERP even if I have never used
	CSE4	I am confident of using the ERP as long as someone shows me how to do it

Table 5: CFA Statistics of Model Fit.

Goodness-of-fit measures	Recommended Value	Author/s	Value obtained from Initial Model	Value obtained from Result Model
Chi-square			5349.072*	607.712*
Degree of freedom			900	281
Chi-square/df	≤ 3.00	Hair et al. [72]	5.943	2.163
Goodness-of-fit index (GFI)	≥ 0.90	Segars and Grover [71]	0.706	0.902
Adjusted goodness-of-fit index (AGFI)	≥ 0.80	Hair et al. [67] and Hu et al. [73]	0.662	0.868
Normalized fit index (NFI)	≥ 0.90	Tate [74]	0.743	0.931
Comparative fit index (CFI)	≥ 0.90	Kelloway [75]	0.775	0.962
Root mean square error of approximation (RMSEA)	≤ 0.08	Kelloway [75] and Hair et al. [72]	0.112	0.054

4.4. Measurement Model

Three types of tests were used to examine the reliability and validity of the measurement model: convergent validity, Cronbach's alpha, and discriminate validity tests, respectively. As per Table 6, all items of construct loading satisfy the minimum factor loading (0.707) suggested by Gefen et al. [23] and can be an indicator of convergent validity. Additionally, in terms of composite reliability value (CR), each construct's CR

is higher than the cutoff value of 0.7 and each construct's average variance extracted (AVE) is higher than the 0.5 suggested by different researchers [72],[76],[77]. Cronbach's alpha value is greater than the recommended value (0.7) indicated a high reliability of the questionnaire. Subsequently, all of the above results of items measured indicated that the convergent validity of the questionnaire was satisfied. The result of discriminant validity as shown in Table 7 indicated that the ten constructs were unique and distinct constructs and the factor correlation coefficient for all constructs ranging from 0.010 to 0.837 satisfy the recommended value (>0.85). As a result, all constructs support discriminant validity.

Table 6: Reliability and Convergent Validity Tests.

Factor	Item	Standardized Loadings (> 0.707)[a]	AVE (>0.5)	CR (>0.7)	Cronbach's Alpha (>0.7)
IU	IU1	0.851	0.774	0.873	0.871
	IU2	0.908			
UT	UT1	0.854	0.695	0.872	0.869
	UT2	0.903			
	UT4	0.735			
TMS	TMS1	0.823	0.612	0.729	0.743
	TMS2	0.721			
CSE	CSE3	0.805	0.643	0.783	0.783
	CSE4	0.799			
SN	SN1	0.710	0.608	0.820	0.811
	SN3	0.774			
	SN4	0.896			
CA	CA1	0.915.	0.880	0.957	0.957
	CA2	0.961			
	CA3	0938			
PU	PU1	0.803	0.701	0.875	0.873
	PU5	0.885			
	PU6	0.822			
PEU	PEU4	0.852	0.710	0.880	0.880
	PEU5	0.821			
	PEU6	0.854			
A	A1	0.866	0.768	0.930	0.929
	A2	0.896			
	A3	0.858			
	A4	0.885			
Usage	H-Use ERP/week	0.931	0.837	0.912	0.945
	Use-ERP/week	0.899			

Table 7: Factor Correlations.

	IU	UT	TMS	CSE	SN	CA	PU	PEU	A	Usage
IU	1									
UT	0.607	1								
TMS	0.487	0.482	1							
CSE	0.695	0.715	0.459	1						
SN	0.474	0.500	0.693	0.491	1					
CA	0.047	0.195	0.065	0.102	0.134	1				
PU	0.784	0.691	0.537	0.705	0.499	0.010	1			
PEU	0.759	0.713	0.535	0.781	0.514	0.055	0.812	1		
A	0.803	0.712	0.512	0.760	0.464	0.015	0.837	0.784	1	
USAGE	0.698	0.443	0.326	0.555	0.341	0.226	0.613	0.558	0.676	1

4.5 The Structural Model

Table 8 shows the existence of slight variations in loading estimates between the two models (CFA and SEM). However, the maximum variation between standardized loadings for the models was only 0.007, which was acceptable.

Table 8: CFA and SEM Loading Estimates Comparison.

Factor	Item	Standardized Loadings-CFA	Standardized Loadings-SEM	Variation
IU	IU1	0.851	0.851	0.000
	IU2	0.908	0.908	0.000
UT	UT1	0.854	0.850	0.001
	UT2	0.903	0.900	0.003
	UT4	0.735	0.728	0.007
TMS	TMS1	0.823	0.823	0.000
	TMS2	0.721	0.721	0.000
CSE	CSE3	0.805	0.805	0.000
	CSE4	0.799	0.799	0.000
SN	SN1	0.710	0.780	0.002
	SN3	0.774	0.774	0.000
	SN4	0.896	0.891	0.001
CA	CA1	0.915.	0.910.	0.050
	CA2	0.961	0.958	0.050
	CA3	0938	0938	0.000
PU	PU1	0.803	0.803	0.000
	PU5	0.885	0.885	0.000
	PU6	0.822	0.822	0.000
PEU	PEU4	0.852	0.852	0.000
	PEU5	0.821	0.818	0.030
	PEU6	0.854	0.850	0.004
A	A1	0.866	0.861	0.050
	A2	0.896	0.896	0.000
	A3	0.858	0.858	0.000
	A4	0.885	0.882	0.003
Usage	H-Use ERP/week	0.931	0.97	0.040
	Use-ERP/week	0.899	0.899	0.000

Presented in Table 9, the structure model showed an acceptable level of fit to the data (RMSEA=. 058, Chi-square/df=2.316, NFI= 0.921, GFI= 0.889, AGFI= 0.861, and CFI= 0.954). The table also showed slight variations between the values obtained from the SEM model and the CFA model. All values for the hypothesized structural model indicated an acceptable fit to the data.

Table 9: Comparison of CFA and SEM Statistics of Model Fit.

Goodness-of-fit measures	Recommended Value	Value obtained from CFA Model	Value obtained from SEM Model
Chi-square		607.712*	694.713*
Degree of freedom		281	300
Chi-square/df	≤ 3.00	2.163	2.316
Goodness-of-fit index (GFI)	≥ 0.90	0.902	0.889
Adjusted goodness-of-fit index (AGFI)	≥ 0.80	0.868	0.861
Normalized fit index (NFI)	≥ 0.90	0.931	0.921
Comparative fit index (CFI)	≥ 0.90	0.962	0.954
Root mean square error of approximation (RMSEA)	≤ 0.08	0.054	0.058

4.6 Hypotheses Testing

Sixteen casual paths that represent the research's hypotheses were added to the fitting measurement model (Figure 3). Table 10 presents the examination of the sixteen hypothesized relationships (H1: H16) in the structural model as well as the support of such hypotheses related to the proposed model. The table revealed that twelve out of sixteen paths were significant with values exceeding the suggested threshold value (1.96). The variation in R^2 was utilized to estimate the effect size. According to Cohen [78], a standardized path coefficient with an absolute value of less than 0.10 might indicate a small effect, a value around 0.30 a medium one, and a value around 0.50 a large effect.

As indicated in Table 11, intention to use ERP system (IU) scored the highest effect among other constructs, due to the direct effect of (0.731), which can be considered as the major determinant of ERP system usage. Furthermore, the results revealed that among all the exogenous variables, computer self-efficacy (CSE) was the major determinant of ERP usage due to an indirect effect of 0.254.

The predictive power for the structural model was elucidated by variance explained (R^2) of endogenous constructs and the findings confirmed that the structural model explained a great proportion of the variance in the endogenous variables. The results stemmed from Tables 10 and 11 were used to explain the significance of the hypothesized relationships in the structural model.

Table 10: Results of Testing Hypotheses.

Hypothesis	Path	Critical Ratio (C.R.)	Coefficient (β)	P-value	Results
H1	UT - PEU	4.048	0.282	0.001	Supported
H2	TMS - PEU	3.604	0.166	0.001	Supported
H3	CSE - PEU	6.943	0.522	0.001	Supported
H4	CA - PEU	-1.668	-0.063	0.095	Not. Supported
H5	UT - PU	3.241	0.208	0.001	Supported
H6	TMS - PU	2.133	0.113	0.033	Supported
H7	SN - PU	0.102	0.006	0.919	Not. Supported
H8	CSE - PU	1.885	0.159	0.059	Not. Supported
H9	CA - PU	-3.136	-0.111	0.002	Supported
H10	PEU - PU	5.775	0.486	0.001	Supported
H11	PU - A	8.453	0.629	0.001	Supported
H12	PEU - A	4.016	0.288	0.001	Supported
H13	SN - IU	1.678	0.072	0.093	Not. Supported
H14	A - IU	5.6	0.495	0.001	Supported
H15	PU - IU	3.818	0.351	0.001	Supported
H16	IU - USAGE	15.175	0.731	0.001	Supported

Note: Significant relation in bold * $p<0.05$, ** $p<0.001$ [one-tailed test].

Table 11: Direct and Indirect Standardized Effects for the Structural Model.

Factor	Determinant	Direct Effect	Indirect Effect	Total Effect
Perceived Usefulness (PU)	CA	-0.111	-0.031	-0.142
(R2 =0.731)	SN	0.006	------	0.006
	CSE	0.159	0.253	0.412
	TMS	0.113	0.081	0.194
	UT	0.208	0.137	0.345
	PEU	0.486	------	0.486
Perceived Ease of Use (PEU)	CA	-0.063	------	-0.063
(R^2 = 0.704)	CSE	0.522	-----	0.522
	TMS	0.166	-----	0.166
	UT	0.282	-----	0.282
Attitude (A)	PEU	0.288	305	594
	PU	0.629	-----	0.629
(R^2 = 0.776)	CA	------	-0.108	-0.108
	SN	-----	0.004	0.004
	CSE	-----	0.41	0.41
	TMS	-----	0.17	0.17
	UT	-----	0.298	0.298
Intention TO Use (IU)	SN	72	0.004	76
(R^2 = 0.732)	PU	0.351	0.311	0.662
	A	0.495	-----	0.495
	PEU	-----	0.464	0.464
	CA	-----	-0.103	-0.103
	CSE	-----	0.347	347
	TMS	-----	0.152	0.152
	UT	-----	0.269	0.269
	Usage	-----	-----	-----
Usage	IU	0.731	-----	0.731
(R^2 = 0.534)	SN	-----	0.056	. 056

PU	-----	0.484	0.484
A	-----	0.362	0.362
PEU	-----	0.339	0.339
CA	-----	-0.075	-0.075
CSE	-----	0.254	0.254
TMS	-----	0.111	0.111
UT	-----	0.196	0.196

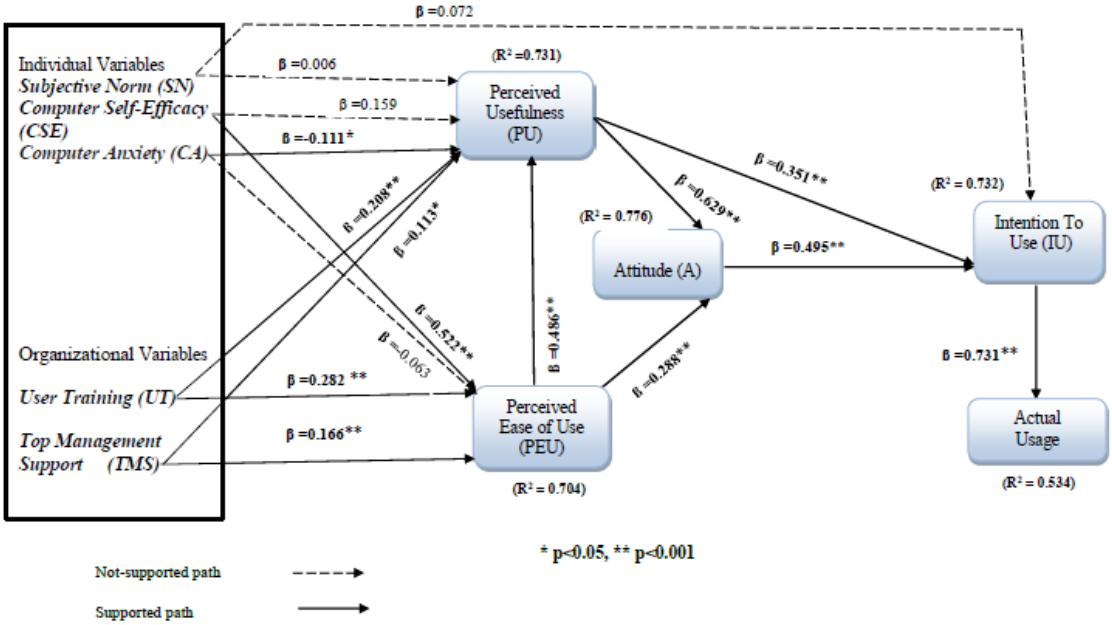

Figure 3: Results of Structural Model.

The research findings showed that organizational variables were positively related to ERP system perceived eases of use and perceived usefulness. User training was found to have a positive influence with a direct effect on ERP system perceived ease of use (β = 0.282, P< 0.001**)** and perceived usefulness (β = 0.166, P< 0.001). This is consistent with the study conducted by Bradley [31] and Amoako-Gyampah and Salam [32]; therefore, hypotheses H_1 and H_2 were supported. Top management support was found to have a positive influence with direct effect on ERP system perceived ease of use (β = 0.166, P< 0.001) and perceived usefulness (β = 0.113, P < 0.05). Such finding is in conformance with prior research findings [20]. Therefore, hypotheses H_3 and H_4 were supported.

Of the three individual variables, only computer self-efficacy was found to have a strong positive influence with a direct effect on ERP system perceived ease of use (β = 0.522, P < 0.05), which is consistent with different empirical research studies [49],[79]. Therefore, H_5 was supported. However, contrary to other research studies [47],[80], computer self -efficacy was found to not influence ERP system perceived usefulness (β = 0.006, P-value (0.919) >0.05) supporting H_6. A possible explanation for this is that the complex nature of ERP systems that may reduce user's self-efficacy and consequently limit the amount of understanding regarding the usefulness and the benefits of the technology during the adoption phase.

Subjective norms were found to have an insignificant effect on ERP system perceived usefulness (β = 0.006, P-value (0.919) >0.05) and behavioral intention (β = 0.072, P-value (0. 093) >0.05), which is consistent with previous research studies [8],[13],[81] and inconsistent with other research studies [63],[82]. Therefore, H_9 and H_{10} were rejected. There were several possible explanations for this difference. First is that an increase in the time of ERP implementation increases decreases the impact of subjective norms on users' perceived usefulness and intention to use the ERP systems. Moreover, the diverse culture and the advanced level of education of users in higher education institutions contexts may develop independent thinking and evaluation that may overweight others' opinions and their peers' expectations.

The results show that perceived usefulness and users' attitudes towards ERP systems are the dominant factors affecting users' intention to use ERP systems (H_{14} and H_{15}). Finally, the intention to use variable has a significant and direct effect on the ERP system's actual use (H_{16}). In summary, hypotheses H_1, H_2, H_3 H_5, H_6, H_{10}, H_{11}, H_{12}, H_{14}, H_{15}, and H_{16} were supported; while, H_4, H_7, H_8, and H_{13} were not supported.

4.7. Research Implications and Contributions

This study can be helpful to many decision-makers in HEIs as the model of this study predict' users' adoption of ERP systems. The results of this research study would enable the adoption of HEI's teams and technology developers to better understand the key determinants of user acceptance of a new system. It would

provide an understanding of how different key decisions of the adoption teams and technology developers may influence the success of new systems they produce. Therefore, the proposed model serves as a framework for thinking and establishing different requirements and development criteria for the new system. The results of this study showed that both perceived ease of use and perceived usefulness of ERP systems play an important role in ERP adoption. The information obtained from these two factors and the significant relationships between them and with other constructs provides a great advantage to those who are responsible for the adoption process of ERP systems.

The development of a new model has contributed to the understanding of technology adoption in general and more specifically to ERP adoption in higher education institutions. The research model extended prior research by incorporating organizational and individual variables from previous literature and theories. The findings of this research confirmed the significant role that organizational and individual variables play in influencing user's perceptions and acceptance of ERP adoption. Therefore, this study and model contribute to information systems literature by elucidating that user perception is important to ERP adoption and implementation. Moreover, the research model offers a new framework for future research in the adoption arena.

5. Conclusion

This study has identified factors that may affect ERP systems adoption in higher education institutions in Saudi Arabia. The newly developed model was examined from the ERP adoption context. The findings of the current research study clarify that the technology acceptance model (TAM) is a powerful model that can be utilized to understand users' adoption of ERP systems in HEIs. The interesting findings in the current research were the direct effects of organizational and individual variables on ERP perceived ease of use and usefulness and the indirect effects on ERP usage.

5.1. Research Limitations and Future Research

This research study was based on prior research by incorporating organizational and individual variables as the external factors influencing ERP perceived ease of use and perceived usefulness. However, there may be other significant external factors such as technological characteristics (e.g., accessibility, functionality, and design), individual characteristics (computer experience and technological innovativeness) and organizational characteristics (perceived resource, business processes, and communications) that affect higher education adoption of ERP systems to better understand the effects on perceived ease of use and perceived usefulness. Therefore, future work should explore other variables that may have an impact on ERP. The inclusion of relevant factors could help increase the exploratory power of a model and provide further explanation regarding ERP's actual use. Another limitation of this study is related to generalizability as the data for the current research was collected from HEIs operating in a developing country (e.g. Saudi Arabia).

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