

# APPLYING TAM IN CUSTOMER ADOPTION OF U-COMMERCE: AN EXTENDED MODEL

Reham Al-Haidary , Heba Mohammad<sup>2</sup>

College of Computer and Information Sciences - Al Imam Mohammad Ibn Saud Islamic University  
Reham.alhaidary@gmail.com

<sup>2</sup> Faculty of Computer and Information Science, Information System Department  
Al Imam Mohammad Ibn Saud Islamic University  
Riyadh 11432 - Saudi Arabia  
hkmohammad@ccis.imamu.edu.sa

## ABSTRACT

Ubiquitous commerce provides great business opportunities for companies and personalized services for customers. Though, customers have some concerns that affect the adoption of this new technology. In the prior literature, many researchers have studied the user's concerns and issues regarding u-commerce adoption. However, there was no enough research on customers' acceptance of u-commerce. This paper proposes a framework to identify the factors that impact the customers' behavior towards u-commerce services in Saudi Arabia. It extends TAM with extra constructs such as: privacy, subjective norm and trust. We found out that perceived usefulness, perceived ease of use, privacy, trust and subjective norm have direct impact on the user's intention to use u-commerce services. This research contributes to existing literature by investigating the factors that influence customer's adoption of u-commerce in Saudi Arabia. The implications of the findings need to be considered before the implementation of u-commerce services on a mass scale.

**Keywords:** Ubiquitous commerce, U-commerce adoption, TAM.

## 1 INTRODUCTION

Technology is changing rapidly, introducing new aspects and innovations in life and businesses. Internet and mobile technologies change the way people interact and communicate with each other. People with advancement of mobile technologies are surfing the internet regardless of time and place constraints, to get, retrieve and share information. They are using new technologies to get more customized and personalized information, products and services. Thus, a new wave in commerce has risen, which called ubiquitous or ultimate commerce or sometimes called u-commerce. Ubiquitous simply means being available anywhere at any time. Watson et al. (2002) described u-commerce as "*the use of ubiquitous networks to support personalized and uninterrupted communications and transactions between a firm and its various stakeholders to provide a level of value above and beyond traditional commerce* [1 p.336]." The use of u-commerce enables people to carry out transactions and communicate regardless of their location [2]. U-commerce has four features that distinguish it from e-commerce and m-commerce. These features or sometimes called u-constructs are ubiquity, uniqueness, universality, and

unison [3]. Ubiquity means that users can access networks from anywhere at any time. Uniqueness allows users to be uniquely identified and information is easily customized based on time and location. Universality means that every device is being universally usable and incompatibility is eliminated. Unison means that data is being integrated through applications [3]. Hence, u-commerce can be seen as an application of ubiquitous computing. Weiser (1991) introduced this new concept, that "*allows computers themselves to vanish into the background*", "*they weave themselves into the fabric of everyday life until they are indistinguishable from it* [4]." In ubiquitous computing environment, devices are everywhere and embedded transparently in everyday life [5].

There are number of technologies that form the basis for u-commerce. These technologies are: wireless technology, voice recognition, radio frequency technologies, digital television technologies, and microprocessor technologies [6]. Electronic commerce uses Internet and web to transact business. Wireless commerce extends e-commerce with additional features such as reachability, accessibility, localization, identification, and portability. It provides

great benefits for companies and consumers such as managing remote employees, improving customers' service, and capturing new markets. The main technology used in wireless commerce products is wireless technology, which can be combined with any device like computers, PDAs, mobile phones. Voice commerce uses voice technologies such as automated speech-recognition, voice identification, and text-to-speech. It cuts the phone calls costs and provides better service [7]. Television commerce provides a two-way personalized communication with the use of interactive digital television. It uses television shopping channels to broadcast the products information. Television commerce uses the new digital television technology and delivers interactivity into houses. Silent commerce uses advanced tagging and sensor technologies in order to make everyday objects intelligent and interactive. It called silent because objects can communicate without any human interaction [8]. Radio frequency identification (RFID) has been used in silent commerce to allow tagging, tracking, and monitoring objects in supply chain process. RFID tags are small computational devices that embedded in objects to transfer the identity of the object wirelessly by using radio frequencies [9]. Furthermore, microprocessor technology can be used to monitor products and increase the level of automation in the manufacturing processes [6].

The combination of these technologies has enabled u-commerce to provide great opportunities for both, customers and companies. It intends to provide unique and personalized services to customers by discovering customer's characteristics and preferences. In addition, it offers great advantages for companies such as building long-term relationships with consumers, improving consumer loyalty, greater customer satisfaction, and generating a measurable value for the company such as higher profits [10], [11]. Diao and Lu argue that personalization benefits for customers and the additional value of personal information for firms will increase the adoption rate. However, people have some concerns towards adopting this new technology. There is a trade-off between privacy concerns and the expected value derived from u-commerce. These personalized services provide great value to customers, but customers need to give up some of their personal information in order to benefit from these services [12]. In addition, Hong et al. argued that privacy is the greatest barrier to the success of ubiquitous computing [13]. Sheng et al. have found that the intention to use the u-commerce services is influenced by situational factors. For instance, customers' intentions to adopt personalized services in emergency situations are higher than non-emergency situations [14].

Trust is an important factor when dealing with

participants especially in the electronic environment that has brought further issues of risk and uncertainty [15]. Businesses have to assure to customers that the gathered information will be limited to what is necessary to deliver the service [16]. Furthermore, Little and Briggs have done a study on the privacy factors and how it influence users decisions to use certain u-commerce systems. They found that trust is an essential element that influences the adoption and use of such systems. They highlighted that user decisions will be varied based on the design, need and context of using u-commerce systems [17].

In u-commerce environment, individuals have their own perspectives regarding privacy issues when it comes to deal with u-commerce systems. The variation on their perspectives had been visible in reporting different scales for the designed measurements, which had been used to measure user's privacy in u-commerce context [17].

However, Tran and Wei have found that privacy and security concerns positively affect user's trust and user's trust positively affects the intention to use. In addition, it found that technology familiarity, social presence, and legislation and policy are influences the u-commerce adoption [18].

Another factor that had been recognized as influencer on the technology acceptance and usage is the social influence [19]. Studies in innovation diffusion show that the users of technology will be affected by the behavior of social group which they belong to. Hence, observers will imitate the behavior of their groups, which eventually contribute to the adoption behavior of users. For instance, the opinion of important individuals in your social group regarding the use of certain technology might form the "*the basis for a user's feelings concerning the utility of an innovation* [19 p.67]".

Previously, several researchers have studied the users concerns and issues regarding u-commerce adoption. However, there was no enough research on customers' acceptance of u-commerce application. This research is trying to fill in this gap by looking into the factors that affect the customers' behavior in Saudi Arabia towards u-commerce services. Thus, this study extends TAM to develop a research model on u-commerce adoption.

This paper proceeds as follows. First, the related work in u-commerce adoption is presented. Second, the proposed research model and the hypotheses are shown. Third, an overview of scenario-based methods is presented. Fourth, the research methodology is discussed. Fifth, the instrument development is presented. Sixth, the process of instrument validation is discussed. Seventh, the hypotheses testing and

results will be discussed. Finally, this paper ends with the conclusion and the implication of this study.

## 2 RELATED WORK

In u-commerce environment, privacy considered as the main risk. Different models have studied the influence of privacy in the user's intention to adopt u-commerce. Tran and Wei have developed a model to measure the adoption of u-commerce focusing on privacy and security. They found out that privacy and security concerns positively affect user's trust which positively affects the intention to use. In addition, there are other factors that influence the privacy and security includes technology familiarity, social presence, and legislation and policy [18]. Xu et al. have developed a model to explore the personalization–privacy paradox in location-aware marketing (LAM). In their framework, personalization has a relation on the perceived benefits and perceived risks which both have influence on the willingness to disclose personal information in LAM. They concluded that the privacy risks towards location-aware marketing will be high if the information were taking secretly [20]. Sheng et al. have introduced a model to study how personalization and context (emergency and non-emergency) can impact customers' privacy concerns and their intention to adopt u-commerce services. The study showed that the intention to use the u-commerce services is influenced by situational factors. For instance, customers' intentions to adopt personalized services in emergency situations are higher than non-emergency situations [14]. Diao and Lu have developed a model to explore what factors impact the adoption of u-commerce. They highlighted that the personalization benefits for customers and the additional value of personal information for firms will increase the adoption rate [12].

Junglas & Watson have developed a model called the technology impact model (TIM). It extends the technology acceptance model (TAM) and task-technology fit model (TTF) and includes two of u-constructs (ubiquity and uniqueness). It aims to examine how u-constructs impact user's task performance, perceptions of usefulness and ease of use of u-commerce technology. In the model, the fit construct of the TTF model affects both constructs of the TAM model, usefulness and ease of use. The results showed that people with technology under-fit perceived their technology to be less useful and less easy to use than those with technology ideal fit or over-fit. However, the integrated u-constructs will enhance the understanding of technology characteristics and task characteristics [21]. In addition, Yu et al. have extended TAM to study the adoption of television commerce. T-commerce uses interactive television technology in order to enable the

purchase of goods and services at home. They have extended the model by adding additional constructs such as perceived enjoyment, trust, normative belief of family and friends, and subjective norm. The findings suggest that perceived enjoyment and perceived usefulness are the most significant factors that affect users' attitude towards t-commerce [22].

Hung et al. have constructed a model for the adoption of new technologies of u-commerce by customers and organization. They identified three constructs as independent variables which are dimensions of consumers' adoption of u-commerce (ubiquity, universality, ultra-yield, ultimacy, usefulness and uniformity), type of new technologies for u-commerce and competitive advantages of u-commerce. The dimensions of u-commerce adoption have a relationship with the new technologies and competitive advantages of u-commerce. In addition, the new technologies have an influence on the competitive advantages of u-commerce to organizations. They have developed the model's constructs by relying on the options model and TAM [23]. Kim et al. have developed a model to investigate the factors that affect the use of ubiquitous computing and the value of u-business. The model consists of three main factors. First, system quality includes accessibility, stability, and ease of use. Second, information quality includes relevance, accuracy, and timeliness. Third, service quality includes reliability, quickness, and secrecy. The results of the study shows that the major factors affecting the use of ubiquitous computing are: system accessibility in the system quality, information accuracy and timeliness in the information quality, and service quickness in the service quality [24].

## 3 RESEARCH MODEL

The proposed model, presented in Fig. 1, has been divided into two sections. First, the proposed attributes by TAM, which are: perceived usefulness, perceived ease of use and intention to use the system. Second, other attributes taken from the literature of u-commerce adoption, which are: trust, privacy and subjective norm [14], [18], [20]. The aim of this research is to develop a theoretical model of user's acceptance of u-commerce systems.

Technology acceptance model (TAM) was first proposed by Davis in 1985 and became one of the most widely used theories in information systems research. It uses the Theory of Reasoned Action as a foundation. TAM has been used to study the factors that affect the acceptance of any technology. It has two main constructs: the perceived usefulness and the perceived ease of use [25]. TAM is able to explain up to 40% of the variance in intention to use [26]. Number of researches has omitted actual system use

because TAM proposes behavioral intention as the determinant of usage behavior rather than the actual use. In addition, actual system use is a self-reported measure which its subjectivity has been criticized [27]. In this research, actual system use is omitted since users haven't experienced u-commerce yet.

Number of studies have extended TAM to include trust in predicting user's intention towards e-commerce [28]–[31]. Squicciarini et al. have developed a model to support privacy in online social networks. They included four factors for indicating users' adoption of collaborative privacy management tools: perceived usefulness, perceived ease of use, likeability and privacy concerns [32]. In addition, Fang et al. have extended TAM for wireless technology adoption. This model consists of four factors of intended use of handheld devices: perceived usefulness, perceived ease of use, perceived playfulness, and perceived security [33]. Pavlou has proposed a model based on TAM to predict consumer acceptance of e-commerce. The model included two extra constructs: trust and perceived risk to be an additional driver of e-commerce acceptance [34]. In addition, Shin has included trust, perceived risk, and subjective norm to study Web 2.0 acceptance [31].

#### **Perceived Usefulness:**

According to TAM, perceived usefulness is defined as "*the degree to which a person believes that using a particular system would enhance his or her job performance* [25 p.26]." Perceived usefulness or the benefit delivered to the users by the system has been a strong determinant of usage intention [26]. U-commerce provides a high level of personalization, which provides additional benefits and values to customers [5]. Number of studies have found that personalization benefits will increase the customers' adoption rate [12], [35].

#### **H1: Perceived usefulness has a positive impact on the intention to adopt u-commerce in Saudi Arabia.**

#### **Perceived Ease of Use:**

Perceived ease of use is defined as "*the degree to which a person believes that using a technology will be free from effort* [25 p.26]." According to TAM, perceived ease of use is considered an important factor that affects the acceptance of information systems. In other words, the more the user is familiar with the system is the more he or she will use the system [18].

#### **H2: Perceived ease of use has a positive impact on the intention to adopt u-commerce in Saudi Arabia.**

According to TAM, perceived ease of use has direct effect on perceived usefulness. If the system is easy to use, users will more likely benefit from the services [25].

#### **H3: Perceived ease of use has a positive impact on**

#### **perceived usefulness.**

#### **Privacy:**

Privacy is defined as "*the claim of an individual to determine what information about himself or herself should be known to others* [36 p.3]." Customers' privacy considered as a major concern in the context of adopting u-commerce. According to Sheng et al., customers' intention to adopt u-commerce is affected by the perceived benefits and risk exposure such as privacy concerns. In u-commerce applications, customers are concerned that they will be tracked and their private information will be spread and illegal used [37]. Recent studies on u-commerce have showed that consumer's privacy concerns negatively affect the adoption of personalized products [12], [38], [16].

#### **H4: Privacy concerns have a negative impact on the intention to adopt u-commerce in Saudi Arabia.**

#### **Trust:**

Trust is defined as "*the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party* [39 p.712]." Users' trust plays positive role in their intention to use a system. When the user trust the system; he or she will likely use the system [18], [40]. Lee et al. (2007) argue that the use of RFID in u-commerce products will increase consumers' trust, which leads to high level of u-commerce adoption [38].

#### **H5: Trust has a positive impact on the intention to adopt u-commerce in Saudi Arabia.**

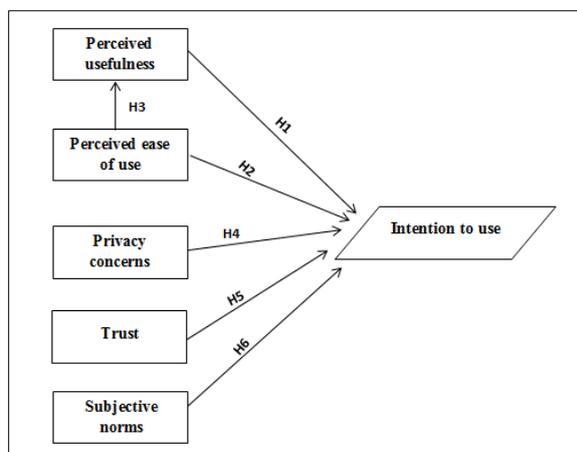
#### **Subjective norm:**

Subjective norm is defined as "*person's perception that most people who are important to him think that he should or should not perform the behavior in question* [41 p.302]". Subjective norm is composed of two components: societal norm and social influence. Societal norm refers to "*adhering to the larger societal fashion (large circle of influence)* (p.244)", and social influence refers to "*adhering to opinions from family, friends, and peers (small circle of influence)* (p.244)" [42].

Subjective norm has a great influence on the behavioral intention because people may choose to do a behavior if important people believe they should do it even when they do not have positive feelings toward the behavior [26]. In addition, Venkatesh and Morris in their study concluded that subjective norm has a potential to influence the user's behavior and decisions to use a certain technology [43]. Galanxhi-janaqi and Nah argue that subjective norm will influence the adoption rate of u-commerce [16].

Recent study found that subjective norm has a positively direct effect on intention to use mobile services in Saudi Arabia [44].

**H6: Subjective norm has a positive impact on the intention to adopt u-commerce in Saudi Arabia.**



**Figure 1.** The conceptual model

#### 4 SCENARIO-BASED METHODS

In this study, we used scenario to describe u-commerce to participants. Scenario is defined as the "description of a possible future situation [45 p.3]". It aims to obtain some insights about the future through observing certain factors. Scenario-based methods provide a scientific basis for describing future situations and evaluating them from the present-day perspective [46]. Therefore, scenario-based methods considered suitable for uncertain, complex and fast evolving situations where we cannot predict the future [45]. Scenarios are considered an alternative way to study the associated legal challenges for ubiquitous commerce since there is little experience with ubiquitous commerce applications [47]. In addition, Gray and Hovav have recommended the use of scenarios in uncertain future of IS services or applications [48].

Scenario-based methods were used in many researches. Camponovo et al. have conducted a descriptive and comparative analysis of published scenarios planning studies in relation to mobile business [45]. In addition, scenarios have been used by Sheng et al. in u-commerce research. They have used it to study how personalization and context influence customers' perceived benefits and privacy concerns. They suggested that scenario-based methods are suitable for u-commerce researches since most applications of u-commerce are not available yet for customers. "The use of scenarios makes it possible for researchers to study the emerging u-commerce phenomenon without being constrained by the timing of the study or the state-of-the-art of technology [14 p.355]."

#### 5 METHODOLOGY

This study was done in several phases. In the first phase, the literature has been analyzed in order to find the factors that influence the adoption of u-commerce. As a result, the factors are: perceived ease of use, perceived usefulness, privacy, trust and subjective norm. Next, the theoretical framework was constructed. In the second phase, the questionnaire was created based on questions derived from past studies. Since Arabic is the first language of Saudis, the questionnaire was translated into Arabic. In order to improve instrument validity, two pilot studies were conducted to check the validity and reliability of the Arabic questionnaire. According to Straub, instrument validation consists of 3 fundamental steps. First: content validity, which is a representation of the full content of a definition in a measure. The questionnaire was evaluated by experts to check the measures. Second: construct validity which is a measurement for multiple indicators. Third: reliability which is an evaluation of measurement accuracy [49]. After that, the final questionnaire was created. In the third phase, the questionnaire was distributed to participants. After collecting data, data was prepared and pre-analyzed. Then, data was processed and analyzed. Finally, the factors that affect u-commerce adoption were identified based on the results of the analysis.

#### 6 INSTRUMENT DEVELOPMENT

The items used to construct each variable were adopted from previous studies. Since u-commerce may not be known to a lot of people, we used scenario-based method to describe it. We presented a brief educational piece in the beginning of the questionnaire about u-commerce. Then, we used a descriptive scenario as an example of u-commerce. This method was used in u-commerce context by Sheng et al. in their research. The scenario used in the questionnaire was adopted from Roussos and Moussouri application (MyGrocer) and Sheng [35], [50]. The scenario described as follows: "Suppose that you want to do grocery shopping. Once you are at the supermarket, you receive an SMS on your mobile telling you that there is a discount on the product you like and always buy (based on your previous purchase history stored in your discount card that contains RFID tag to uniquely identify you). Then, you take a smart shopping cart that contains a screen and RFID reader. Once you enter your discount card and type your password, the system welcomes you and presents a suggested shopping list based on your previous purchase history and preferences. So, each time you put an item in the cart, the RFID reader reads the item and store it in your account in order to collect information about your preferences and suggest a list for the next time".

The questionnaire first gathers the demographic information of the respondents such as age, gender, education level, and occupational status. Then, it asks about respondent attitudes regarding adoption of u-commerce. The questions used in the questionnaire to measure these variables were derived from prior studies, as presented in Table 1 [18], [26], [34], [52]–

[56]. The questionnaire uses a five-point Likert scale ranging from “Strongly Agree” (= 5) to “Strongly disagree” (= 1) to indicate the degree of user's agreement to the proposed questions. This scale was used in previous TAM research [57]. Since Arabic is the first language of Saudis, the questionnaire was translated into Arabic.

**Table 1:** Measurements

Factors		Measure items	Source
Perceived usefulness	PU1	1. Overall, I think u-commerce will be useful.	Pavlou (2003)
	PU2	2. I think u-commerce will be valuable to me.	
Perceived ease of use	PEOU1	1. I think u-commerce will be clear and understandable.	Davis (1989)
	PEOU2	2. I think u-commerce will not require a lot of mental effort.	Pavlou (2003)
	PEOU3	3. Learning how to use u-commerce would be easy for me.	Davis (1989)
	PEOU4	4. It will be easy for me to become skillful at using u-commerce.	
Privacy	P1	1. I think privacy violation is a major problem for conducting u-commerce transactions.	Al-muhtib (2011)
	P2	2. I think there is a high potential for loss involved in sharing personal information on u-commerce.	Tran & Wei (2011)
	P3	3. I think vendors may exploit useful information through u-commerce technology.	
	P4	4. I am concerned about the privacy of my personal and financial information during u-commerce transactions.	Roca(2008)
Trust	T1	1. I think u-commerce will be trustworthy.	Pavlou (2003)
	T2	2. I think u-commerce will keep promises and commitments.	
	T3	3. I will trust u-commerce because it keeps my best interests in mind.	
	T4	4. I will trust the information provided during the u-commerce process.	
Subjective norm	SN1	1. People who influence my behavior will think that I should use u-commerce.	Venkatesh and Davis (2000)
	SN2	2. People who are important to me will think that I should use u-commerce.	
	SN3	3. People around me (e.g. friends or family) will recommend the use of u-commerce.	Verkasalo (2008)
	SN4	4. Experts whose comments I rely on for the use of u-commerce system will provide supporting evidence for use.	Song and Kim (2006)
Intention to use	IU1	1. Given the chance, I intend to use this u-commerce system.	Pavlou (2003)
	IU2	2. It is likely that I will transact with this u-commerce system in the near future.	
	IU3	3. I will recommend others to use u-commerce system.	Davis (1989)

## 7 INSTRUMENT VALIDATION

In this research, we have conducted two pilot studies to check the internal validity of the instrument. Pilot study is defined as the “*pre-testing or 'trying out' of a particular research instrument* [58 p.182-183].” It has major advantages especially in developing and testing the research instruments in order to reveal any shortcomings in the instrument before distributing it on a large scale. In addition, it helps in assuring that the questions are understood by a small number of

respondents before administering the questionnaire to the actual sample and reducing the bias [58]. According to Hertzog, the recommended sample size for pilot studies is about 10% of the final study size [60]. Since the sample size is 384, the sample size will be 40 participants for each pilot study.

### 7.1 Pilot Study One

The study was conducted with 40 computer science students (graduate and undergraduate). They were chosen because of their familiarity with technology. The

questionnaire was distributed to computer science students from different universities in Saudi Arabia. The questionnaire asked about their perceptions toward u-commerce and their opinion on each question in order to find ambiguities and difficult questions.

The sample shows that all the respondents were from age 18-30. About 92.5% of respondents were undergraduate students and 7.5% graduate. Most of the respondents were students (72.5%), 25% were employed and 2.5% were unemployed. The respondents' characteristics are shown in Table 2.

**Table 2:** Respondents' characteristics of pilot study 1

		Frequency	%
Age	18-30	40	100
	Total	40	100.0
Gender	Female	36	90
	Male	4	10
	Total	40	100.0
Education	Undergraduate	37	92.5
	Graduate	3	7.5
	Total	40	100.0
Occupational status	Student	29	72.5
	Unemployed	1	2.5
	Employed	10	25
	Total	40	100.0

**7.1.1 Reliability Analysis**

We tested the responses for the reliability with Cronbach's alpha test. In the test, the items that have a high Cronbach's alpha are considered homogeneous. According to Hair et al., the lower limit for Cronbach's alpha is 0.7 and it may decrease to 0.6 in exploratory research [61].

Table 3 shows the Cronbach's alpha levels for pilot study 1. First, Cronbach's alpha for Perceived Usefulness is 0.735, which is sufficient. Perceived Ease of Use has a Cronbach's alpha of 0.857, which is sufficient. Conversely, Privacy has shown a Cronbach's alpha less than 0.7 (0.462). Therefore, the translation of Privacy items need to be reformed and it will be tested again in pilot study 2. Trust construct is responsible of Cronbach's alpha of 0.858, which is sufficient. The Cronbach's alpha for subjective norm items is 0.881, which is sufficient. The Intention to Use construct consist of 3 items, the Cronbach's alpha of items together is 0.899, which is sufficient.

**Table 3:** Cronbach's alpha for pilot study 1

Construct	Cronbach's Alpha	N of items
PU	.735	2
PEOU	.857	4
P	.462	4

T	.858	4
SN	.881	4
IU	.899	3

**7.1.2 Validity Measurement**

Factor Analysis was conducted using Principal Axis Factoring with Varimax rotation with Kaiser Normalization. It was used to confirm the construct validity of the scales and to test if all the questions in a single construct measure the same aspect.

The factor loadings are displayed in Table 4. Loadings above 0.60 are considered to be high and strong, whereas loadings between 0.60 and 0.40 are considered acceptable [62]. Perceived Usefulness was loading on factor 1 with no significant loadings on other factors. Perceived Ease of Use has high loading in factor 2 with PEOU2, PEOU3 and PEOU4 above 0.6 and PEOU1 0.494. Privacy items were loading highly on factor 3 with all values above 0.6 except for item P3 (0.589). Trust items were loading highly on factor 1 along with Perceived Usefulness items. In addition, Subjective Norm items, SN2, SN3 and SN4, were loading on factor 4 and SN4 were loading highly on factor 5 (0.791).

**Table 4:** Rotated Factor Matrix for pilot study 1

	Factor				
	1	2	3	4	5
PU1	.499				
PU2	.453				
PEOU1		.494			
PEOU2		.685			
PEOU3		.605			
PEOU4		.700			
P1			.715		
P2			.905		
P3			.589		
P4			.679		
T1	.768				
T2	.548				
T3	.743				
T4	.602				
SN1					.791
SN2				.679	
SN3				.700	
SN4				.735	

Note: eigenvalues less than 0.4 were removed

Afterward, the questions were reworded based on the respondent's feedbacks. In addition, Trust and Perceived Usefulness were loading on one factor, which means there is a problem with the translation. We formulated the questions again and had been tested in pilot study 2.

**7.2 Pilot Study 2**

We choose to educate the participants by using a graphical representation to describe the scenario's steps in order to provide more concert explanation. The second pilot study was conducted with 40 participants that represent the target population. The participants have different characteristics to capture the variety in the population. The sample consists of 40 participants, 75% of whom were women and 25% of whom were male. Most of the respondents were in age 18-30 (70%), 27.5% of the respondents were 31-40 and 2.5% were above 51. About 12.5% of the sample was high school students, undergraduate 60%, and graduate 27.5%. Most of the respondents were students (52.5%), 32.5% were employed and 12.5% were unemployed. The respondents' characteristics are shown in Table 5.

**Table 5:** Respondents' characteristics of pilot study 2

		Frequency	%
Age	> 51	1	2.5
	18-30	28	70.0
	31-40	11	27.5
	Total	40	100.0
Gender	Female	30	75.0
	Male	10	25.0
	Total	40	100.0
Education	High school	5	12.5
	Undergraduate	24	60.0
	Graduate	11	27.5
	Total	40	100.0
Occupational status	Student	21	52.5
	Unemployed	5	12.5
	Employed	13	32.5
	Others	1	2.5
	Total	40	100.0

**7.2.1 Reliability Analysis**

Table 6 shows the Cronbach's alpha levels for pilot study 2. All the constructs have Cronbach's alpha > 0.6 which demonstrates adequate construct reliability. Privacy construct showed a high increase with a Cronbach's alpha of 0.761.

**Table 6:** Cronbach's alpha for pilot study 2

Construct	Cronbach's Alpha	N of Items
PU	.745	2
PEOU	.837	4
P	.761	4
T	.875	4
SN	.813	4
IU	.724	3

**7.2.2 Validity Measurement**

The results of the Rotated Factor Matrix in Table 7 show that Perceived Usefulness was loading on factor 3. Perceived Ease of Use was loading on factor 4. Privacy items were loading highly on factor 5. Trust construct has significant loadings on factor 1. In addition, Subjective norm items were loading on factor 2.

**Table 7:** Rotated Factor Matrix for pilot study 2

	Factor				
	1	2	3	4	5
<b>PU1</b>			.873		
<b>PU2</b>			.749		
<b>PEOU1</b>				.732	
<b>PEOU2</b>				.490	
<b>PEOU3</b>				.870	
<b>PEOU4</b>				.513	
<b>P1</b>					.554
<b>P2</b>					.582
<b>P3</b>					.782
<b>P4</b>					.797
<b>T1</b>	.590				
<b>T2</b>	.802				
<b>T3</b>	.852				
<b>T4</b>	.828				
<b>SN1</b>		.478			
<b>SN2</b>		.848			
<b>SN3</b>		.810			
<b>SN4</b>		.543			

Note: eigenvalues less than 0.4 were removed

**8 MAIN STUDY**

After validating the instrument, the questionnaire was distributed to participants in order to test the hypotheses. We used a cross-sectional study in which data is gathered once. The sample size for this research is 384 subjects [63]. In this study, we had a total of 387 responses. The respondents' characteristics are shown in Table 8. The sample shows that the number of female respondents as 77.8% and 22.2% males. The largest age group (69.7%) was between 18 and 30, 19.9% were between 31 and 40, 7.8% were between 41 and 50 and 2.6% were above 51. Most of the respondents were undergraduate (65.4%) followed by high school students (9.3%), 20.9% were graduate and 3.1 were intermediate school students. Most of the respondents were employed 38%, students 36.2%, unemployed 22.2%.

**Table 8:** Respondents' characteristics of main study

		Frequency	%
Age	18-30	270	69.7
	31-40	77	19.9
	41-50	30	7.8
	> 51	10	2.6
	Total	387	100.0
Gender	Female	301	77.8
	Male	86	22.2
	Total	387	100.0
Education	Intermediate school	12	3.1
	high school	36	9.3
	Graduate	81	20.9
	Undergraduate	253	65.4
	Others	5	1.3
Occupational status	Total	387	100.0
	Employed	147	38.0
	Student	140	36.2
	Unemployed	86	22.2
	Others	14	3.6

**8.1 Reliability Analysis**

The instrument was initially examined for reliability by using Cronbach's alpha coefficient. From Table 9, Perceived Usefulness items are responsible for Cronbach's Alpha of 0.806, which is sufficient. Perceived Ease of Use items have Cronbach's Alpha of 0.870, which is sufficient. Privacy items are responsible for Cronbach's Alpha of 0.699, which is sufficient. Trust items have Cronbach's Alpha of 0.875, which is sufficient. Subjective Norm items have Cronbach's Alpha of 0.871. Intention to Use items have Cronbach's Alpha of 0.849. The Cronbach's alpha coefficients exceeded the recommended value of 0.6. This means that the scales indicate good internal consistency.

**Table 9:** Cronbach's Alpha for main study

Construct	Cronbach's Alpha	N of Items
PU	.806	2
PEOU	.870	4
P	.699	4
T	.875	4
SN	.871	4
IU	.849	3

**8.2 Validity Measurement**

Principal Axis Factoring with Varimax rotation was used to test if the empirical data reflects the model. The result of Rotated Factor Matrix, Table 10, shows that five factors emerged from the analysis. Perceived Usefulness items were loading on factor 5. Perceived Ease of Use items were loading highly on factor 1 with all values above 0.6. Privacy items were loading on factor 4. Trust items were loading on factor 2. Subjective Norm items were loading on factor 3.

**Table 10:** Rotated Factor Matrix for Main Study

	Factor				
	1	2	3	4	5
<b>PU1</b>					.492
<b>PU2</b>					.735
<b>PEOU1</b>	.661				
<b>PEOU2</b>	.713				
<b>PEOU3</b>	.782				
<b>PEOU4</b>	.753				
<b>P1</b>				.535	
<b>P2</b>				.679	
<b>P3</b>				.617	
<b>P4</b>				.607	
<b>T1</b>		.736			
<b>T2</b>		.594			
<b>T3</b>		.730			
<b>T4</b>		.657			
<b>SN1</b>			.659		
<b>SN2</b>			.760		
<b>SN3</b>			.626		
<b>SN4</b>			.504		

Note: eigenvalues less than 0.4 were removed

**8.3 Correlation Analysis**

The most used method for measuring the degree of relationship between two variables is Karl Pearson's coefficient of correlation. It indicates the direction, strength and significance of the relationships between variables. It used to measure variables in interval or ratio level [58].

Table 11 shows the correlations between variables. When Pearson's r is close to 1 that means there is strong relationship between the two variables. On the other hand, when Pearson's r is close to 0 that means there is weak relationship between the two variables. Positive values of r indicate positive correlation between the two variables, then the correlation is considered to be significant and we can be 95% confident that the relationship between these two variables is not due to chance. While negative values of r indicate negative correlation [64].

The correlation table shows that there are strong positive relationships between Perceived usefulness (0.652), Perceived Ease of Use (0.609), Trust (0.704) and Subjective Norm (0.731) with Intention to use and significant at the 0.01 level. In addition, the relationship between Privacy and Intention to use is significant at the 0.05 level (-0.113). We can note that the strongest positive correlations were obtained between subjective Norm (0.731) and Trust (0.704) with Intention to use.

Furthermore, the correlation table shows some other significant relationships between the variables. For instance, Perceived usefulness has positive correlation with Perceived Ease of Use (0.638), Trust (0.565) and

Subjective Norm (0.605). Perceived Ease of Use has positive correlation with Trust (0.555) and Subjective Norm (0.572). Trust has a strong positive correlation with subjective Norm (0.736).

**Table 11: Correlations**

		PU	PEOU	P	T	SN	IU
PU	Pearson Correlation	1	.638**	-.028-	.565**	.605**	.652**
	Sig.		.000	.588	.000	.000	.000
	N	387	387	387	387	387	387
PEOU	Pearson Correlation	.638**	1	.014	.555**	.572**	.609**
	Sig.	.000		.791	.000	.000	.000
	N	387	387	387	387	387	387
P	Pearson Correlation	-.028-	.014	1	-.090-	-.063-	-.113-
	Sig.	.588	.791		.075	.217	.026
	N	387	387	387	387	387	387
T	Pearson Correlation	.565**	.555**	-.090-	1	.736**	.704**
	Sig.	.000	.000	.075		.000	.000
	N	387	387	387	387	387	387
SN	Pearson Correlation	.605**	.572**	-.063-	.736**	1	.731**
	Sig.	.000	.000	.217	.000		.000
	N	387	387	387	387	387	387
IU	Pearson Correlation	.652**	.609**	-.113-	.704**	.731**	1
	Sig.	.000	.000	.026	.000	.000	
	N	387	387	387	387	387	387

\*\* Correlation is significant at the 0.01 level (2-tailed).  
 \* Correlation is significant at the 0.05 level (2-tailed).

**8.4 Hypothesis Testing: Regression Analysis**

Multiple regression analysis is a multivariate technique that is used when two or more independent variables are hypothesized affect the dependent variable. It used to examine the empirical relationships between the independent variables and the dependent variable [58].

In this research, we have two regression models to test the proposed hypotheses. First, we conducted Multiple Regression analysis in order to identify the factors that affect the adoption of u-commerce on Saudi Arabia. Second, we conducted Multiple Regression analysis to test the hypotheses, if Perceived Ease of Use has an influence on Perceived Usefulness. Tables 12 and 13 present the results of multiple regression analyses and hypothesis testing for the relationship between Perceived Ease of Use, Perceived Usefulness, Privacy, Trust and Subjective Norm toward Intention to Use.

**Table 12: Model 1 Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.809a	.655	.650	.54628

a. Predictors: (Constant), Perceived Ease of Use, Perceived Usefulness, Privacy, Trust, Subjective Norm

**Table 13: ANOVA for Model 1**

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	215.621	5	43.124	144.508	.000 <sup>b</sup>
	Residual	113.698	381	.298		
Total	329.318	386				

a. Dependent Variable: Intention to Use

b. Predictors: (Constant), Perceived Ease of Use, Perceived Usefulness, Privacy, Trust, Subjective Norm

In table 14, the model fit as the model is tested significant (p<0.001) with F-value for the model is F=144.508 and the p-value associated with this F value is (0.001) significant level. The F-value is used to test the overall significance of the regression model. The regression test had presented a strong inference with R-Square value is 0.655 which indicates that 65.5% of the variance in the intention to use can be predicted from perceived usefulness, perceived ease of use, privacy, trust, and subjective norm.

**Table 14: Multiple Regression Coefficients**

Model 1	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.417	.253		1.649	.100
PU	.210	.041	.218	5.109	.000
PEOU	.146	.043	.142	3.404	.001
P	-.112-	.052	-.065-	-2.150-	.032
T	.292	.053	.257	5.548	.000
SN	.371	.055	.325	6.796	.000

The p-value of the model is a measure to explain the significant of the model. The model is considered significant when the p-value is less than 0.05. A p-value between 0.05 and 0.10 is considered weakly significant, and a p-value above 0.10 is considered not to be statistically significant. Table 18 shows the p-value for each variable. The p-value of Perceived Usefulness is 0.001 which considered significant. This indicates a direct relationship between intention to use and perceived usefulness. Perceived Ease of Use has p-value= 0.001 which considered significant.

This indicates a direct relationship between intention to use and Perceived Ease of Use. In addition, Privacy has p-value= 0.032 which is less than 0.05 and considered significant. Trust has p-value=0.001 which is less than 0.05. This means that Trust have a statistically significant relationship with the dependent variable. In addition, Subjective Norm has p-value= 0.001 which considered significant. This indicates a direct relationship between the intention to use and subjective norm.

The second regression test was conducted to identify the relationship between Perceived Ease of Use on Perceived Usefulness. Tables 15 and 16 present the results of the above hypotheses testing.

**Table 15:** Model 2 Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2	.638 <sup>a</sup>	.408	.406	.73773

a. Predictors: (Constant), PEOU

**Table 16:** ANOVA for Model 2

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	144.164	1	144.164	264.889	.000 <sup>b</sup>
	Residual	209.534	385	.544		
	Total	353.698	386			

a. Dependent Variable: Perceived Usefulness

b. Predictors: (Constant), Perceived ease of use

In table 16, the model is significant as the F-value equals (264.889) and the p-value associated with this F value is (0.001) significant level. The coefficient of determination (R-Square) value is 0.408 which indicates that 40.8% of the variance in the perceived usefulness can be predicted from perceived ease of use.

**Table 17:** Multiple Regression Coefficients

Model 2	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.273	.162		7.842	.000
PEOU	.681	.042	.638	16.275	.000

In Table 17, the p-value of Perceived Ease of Use is 0.001 which considered significant. This indicates a direct relationship between Perceived Ease of Use and Perceived Usefulness. By examining the B value, we found that Perceived Ease of Use has a significant positive relationship with Perceived Usefulness (B= 0.681).

## 9 DISCUSSION

The objective of this research is to study users' perceptions regarding the adoption of u-commerce services in Saudi Arabia. We have defined several factors that act as drivers for u-commerce adoption. In this study, we used a data from web survey of users' perception toward u-commerce service to verify the research model. The analysis showed that the intention to use u-commerce is influenced by Perceived usefulness, Perceived Ease of Use, Privacy, Trust and Subjective Norm.

Perceived usefulness and Perceived Ease of Use are the main constructs in the original TAM. Correlation and multiple regression analysis showed that Perceived usefulness and Perceived Ease of Use are strong determinate for Intention to use (p-value= 0.001). Perceived Usefulness (B= 0.210) and Perceived Ease of Use (B= 0.146) have a positive influences on the Intention to Use. Our findings are consistent with the findings of Davis (1989) in which Perceived usefulness and Perceived Ease of Use have positive relationships with Intention to use.

In addition, the extended constructs in our model have shown significant relationships with Intention to use. Trust plays an important role in the intention to use. The analysis showed positive direction between trust and intention to use (B= 0.292). The intention to use a system increases when the user trusts it. The results from the analysis support the prior literature that investigates user's trust [18], [40].

Privacy has a negative impact on intention to use (p-value= 0.032, B= -0.112). This finding is consistent with prior research in u-commerce context [14]. We suggest that reducing uncertainty in such systems is an important factor in consumer acceptance of u-commerce.

In addition, Subjective norm has significant direct effect on the intention to use and it considered the strongest determinate of intention to use (p-value= 0.001, B= 0.371). This result is supported by TAM2, Venkatesh and Davis found that subjective norm has an influence on the behavioral intention of the customer. People may choose to do a behavior if important people believe they should do it even when they do not have positive feelings toward the behavior [26].

Furthermore, we studied the factors that influence Perceived Usefulness. We found that Perceived Ease of Use has a positive impact on Perceived Usefulness. This relationship is in line with most of previous researches [26], [28], [65].

## 10 CONCLUSION

In this paper, we propose a theoretical framework to identify the factors that influence the user's intention to adopt u-commerce in Saudi Arabia. We suggest that perceived usefulness, perceived ease of use, privacy, trust and subjective norm affect the user's intention to adopt u-commerce services. We make use of the applicability of TAM in the context of u-commerce. We expect that our proposed model can contribute to literature by discovering the most important variables that can affect u-commerce adoption. Future research can examine additional factors that may influence u-commerce such as security concerns and context. In addition, further studies could reveal the attitude of companies in Saudi Arabia in conducting and using u-commerce.

## 11 IMPLICATIONS

Currently, u-commerce has been the new wave in the businesses. It has shown significant potential and promise for future applications and services. This study proposes a model for identifying the factors that influence the user's intention to adopt u-commerce services. This model can provide guidelines and suggestions for u-commerce service providers before implementing a new u-commerce service. In addition, it will help to understand what drives the adoption and evolution of u-commerce services and understand customer's behavior toward u-commerce characteristics.

From a theoretical standpoint, these results contribute to existing literature in many ways. First, this research shed light on the emerging u-commerce phenomenon. It provides rich insights into the understanding of the adoption of u-commerce based on the concerns and perceptions of customers in Saudi Arabia. The results found that Perceived usefulness, Perceived Ease of Use, Privacy, Trust and Subjective Norm are the important factors that drive the adoption of u-commerce.

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### Biographical Notes:

**Heba Mohammad** is an Assistant Professor of Information Systems at the College of Computer and Information Sciences. She received her PhD in E-Business from the University of Salento, Italy. Her research focuses on knowledge management, e-business, e-learning and communities of practice.

**Reham Al-Haidary** holds a Masters’ degree in information systems from Imam Mohammad ibn Saud Islamic University, Saudi Arabia.