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The Unified Theory of Acceptance and Use of Technology:
A New Approach in Technology Acceptance

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ABSTRACT

Recently, the unified theory of acceptance and use of technology has taken place as one of the most developed and intensive models to test technology adoption and acceptance. This research article reviews this model by presenting a description of its development and structure. Additionally, this article compares it with other former theories and models in this field. It studies the evolution stages of these theories and classifies them depending on their development method and the scientific field which they were developed in. Moreover, the model's determinants were classified depending on their influence on technology adoption. This model has been reported as robust and trusted for application on different technologies and viable after doing any modification operation over it. It also has the minimum amount of complexity according to its limited number of constructs and moderating variables that make it more applicable and understandable to study the acceptance behavior to any new technology.

KEYWORDS

Behavioral Intention, Technology Acceptance, Technology Adoption, Usage Behavior, UTAUT

1. INTRODUCTION

The evolution of technology acceptance theories and models have been initiated since the beginning of the 20th century and it is still evolving. This evolution took place in different theoretical perspectives, such as: cognitive, affective, motivational, and behavioral intentions and the reactions of individuals (Hernandez 2017b; Weeger and Gewald, 2013). As a part of the software quality activities in the software engineering field, information systems' adoption, acceptance, and usage behavior have been started to attract attention since the 1970s as an initial step for technologies' utilization and realization. Currently, to understand the cause of users' accepting/rejecting any new technology has become an integral task in any information system's life cycle (Silva and Dias, 2007; Sivathanu and Pillai, 2019).

Technology acceptance theories and models had been constructed as a framework to study the method of understanding and accepting new technologies by users, how they could use it, and what could be the effect on continuing using it. Some factors such as usefulness, ease of use, complexity, and social influence can affect the users' decision against any technology and the method of its usage

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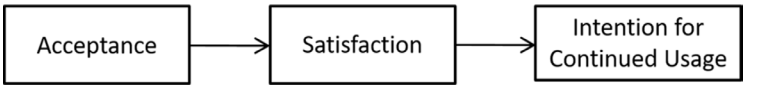
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(Fishbein and Ajzen, 1975). These factors have been adopted in different theories and studies in several research works (Ajzen and Fishbein, 1980; Ajzen, 1985; Bandura, 1986; Davis, 1986; Deci and Ryan, 1985; Rogers, 1983; Taylor and Todd, 1995a; Triandis, 1979; Venkatesh and Davis, 2000; Venkatesh, Morris, Davis, and Davis, 2003), in addition to a lot of works that have been done up to date.

The actual use of any information system implicitly relies on the existence of intention towards using it. But, the continuation of using the information system depends on two beliefs: In the first stage, the information system has to be accepted by the users. Then, continuing usage which comes after acceptance depends on users' satisfaction with the system. In the organizational environment, it means continuing in increasing the investment in information technology (Hong, Thong, and Tam, 2006). Figure 1 shows the relation between the acceptance and the satisfaction, and their influence

Figure 1. The influence of acceptance and satisfaction on continued usage intention (Momani, 2018)



on the intention for continuous use of the system. Ajzen (1985) explained that the users' successful controlling the factors means successful actual usage behavior. These factors could be previous experiences and skills, willpower, abilities, or any workable plans that may control the factors. Accordingly, the successful behavior is not only depending on a favorable intention, but it is also depending on the behavioral control.

Several research works had been done up-to-date in order to address the most important and effective limitations of technology acceptance theories and models depending on wide reviews for prior researches (Lee, Kozar, and Larsen, 2003; Moghavvemi, Salleh, and Abessi, 2013; Williams, Rana, and Dwivedi, 2015). The research study that was done by Venkatesh et al. (2003) aimed to define a unified form of technology acceptance theories. It identified five major limitations of studies and comparison operations done over the older theories and models. Therefore, the unified theory of acceptance and use of technology (UTAUT) becomes one of the most integrated and developed technology acceptance theories by adopting the most advantage constructs from other older theories and models. These limitations are summarized as follows:

1. The information technologies which have been studied by the older theories were simple and individual-oriented, and faraway from complexity and sophisticated organizational technologies.
2. The majority of the previous studies on older theories were done on the academic setting by participating students, rather than the participation of more accurate users such as employees in organizations.
3. Most of the testing operations applied via the older theories were picked up after the participants' decision to accepting or rejecting the technology, while it should be applied during the technology adoption stage. So, the adoption decision was retrospective.
4. The majority of comparative studies of theories were cross-sectional.
5. Most of the testing operations have been picked up in the voluntary usage contexts, were unable to generalize their results on the mandatory usage settings.

In this scope, this research paper reviews the UTAUT model as one of the most powerful technology acceptance theories which were developed to examine the ability of users to accept technology and their intention to adopt new technologies. This theory has been developed by adopting the most important characteristics of eight old theories over the past years so as to be as a unified

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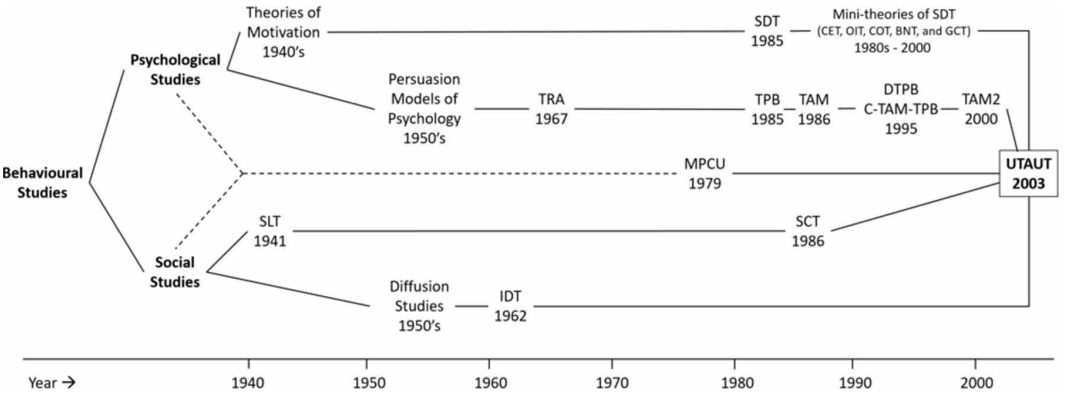
form to all of them. Within this context, and for more understanding of the UTAUT concept, there is a need to compare it with other theories in order to clarify the typical utilization of it according to the types of individuals' usage. In addition to explaining the effect of its determinants on the usage. Thus, this article would be able to answer the following questions through its sections: (1) How can the UTUAT model become one of the most powerful models by comparing it with other technology acceptance theories and models? (2) How can the UTAUT's determinants be classified by their effects on technology adoption and their relation to the software quality requirements?

This study presents a systematic review of several previous research works starting from the development of the UTAUT in 2003, and some succeed review operations done over it by other researchers till recent years. All references are derived from high-quality international academic journals. This review includes a comparison and classification operations of the most famous and widely used technology acceptance theories and models and their effect on the development of UTAUT with a detailed description of its development and structure. This paper contributes to classifying the other theories that the UTAUT derived from them and states the chronological order of their evolution. This study compares the UTAUT model with a group of the most essential and widely utilized older theories, in addition to studying the effect of its moderators on these theories. Furthermore, it links the UTAUT constructs with the principles of the software engineering and software requirements concepts, as well.

2. DEVELOPMENT OF UTAUT

In 2003, Venkatesh and his research group reviewed the following eight theories of technology acceptance: Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Technology Acceptance Model (TAM), the combination form of TAM and TPB (C-TAM-TPB), Model of PC Utilization (MPCU), Innovation Diffusion Theory (IDT), Motivational Model (MM), and the Social Cognitive Theory (SCT). As a result, they proposed a new theory named as the unified theory of acceptance and use of technology (UTAUT) to be as a unified form benefiting from the unique characteristics of all other older mentioned theories and models. For more understanding of the development stages that lead to developing the UTAUT, the evolution stages of all aforementioned theories have been summarized in the form of a chronological graph, as shown in Figure 2. This graph illustrates the evolution and the development stages chronologically in four major paths according to the behavioral field and the timeline of this evolution. These theories have resulted from the human behavioral studies since the beginning of the 20th century which were later branched out into two streams, the psychological and sociological studies (Momani and Jamous, 2017).

Figure 2. The evolution of technology acceptance theories that lead to developing UTAUT (Momani and Jamous, 2017)



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Technology acceptance theories and models have discussed the individuals' behaviors and their acceptance ability to adopt new technologies according to some constructs and variables. These theories have been focused on the psychological and behavioral viewpoints of the users of technology. But each theory has its own limitations and frameworks which are considered as the main reason for the development operations of them. As an example, the theories of TPB, DTPB, and TAM are developed from the TRA. But there are some problems still exist within these theories. According to Qingfei, Shaobo, and Gang (2008), there are two major issues related to acceptance theories; first, each theory uses different terminologies in their constructs, but they are essentially within the same concepts. Second, according to the complexity of behavior research and the limitation of the researchers, there is no single theory that covers all behavioral factors. In other words, each theory has its own limitations and does not complement each other. Table 1 summarizes the major strengths and weaknesses points of the most important technology acceptance theories along with their development information.

In that context, Venkatesh et al. (2003) applied an empirical comparison for the eight older theories. This comparison was conducted in four different organizations through participants who introduced new technology in their workplaces. The testing operation has been conducted in three different time-points in order to measure the difference in the degree of acceptance: post-training (*T1*), after one month of implementation (*T2*), and after three months of implementation (*T3*). While the actual usage was tested over a period of six months of post-training. The collected data were classified into two sections depending on the style of usage settings (voluntary or mandatory). Additionally, the researchers examined the influence of the moderating variables of the eight theories on the decision of information technology usage and summarized them in four moderators as follows: gender, age, experience, and voluntariness of use. They noted that the predictive capability of the theories has been increased after including the moderating variable for the majority of the theories. For instance, age got very little attention in the previous research literature on older theories and models, while the findings from Venkatesh et al. (2003) showed that age moderates all of the relations in the UTAUT model between the key-constructs and behavioral intention and usage behavior. Furthermore, it is also found that gender which takes attention in sociology and social psychology studies, influences the relations between key-constructs and behavioral intention in the UTAUT model.

After that, the researchers also tested a total number of 32 constructs stated in the eight tested theories. They examined the common characteristics relating to all of them and found the most seven constructs may determine the behavioral intention or usage behavior. Thus, they hypothesized four of them as the most significant and direct effect on behavioral intention and usage behavior, and therefore the user acceptance. These constructs were: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. The rest of the seven constructs were hypothesized that they do not have a direct effect on behavioral intention or usage behavior (Fuksa, 2013). These constructs were: the attitude toward behavior, computer self-efficacy, and anxiety (Hauser, Paul, and Bradley, 2012). The researchers mentioned that the attitude towards behavior is defined as an emotional reaction of users to use the technology or the information system. They noted that the attitude factor has an indirect effect on all four determinants of the UTAUT. In addition, self-efficacy and anxiety are already included in the concept of effort expectancy.

3. STRUCTURE OF UTAUT

UTAUT model was designed to have three direct effects from three determinants on the behavioral intention, which are: performance expectancy, effort expectancy, and social influence. In addition to the effect of two direct determinants on usage behavior: the intention of use and facilitating conditions. Figure 3 illustrates the model of UTAUT with all its constructs (determinants) and moderating variables. Table 2 shows the definitions of these constructs.

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Table 1. Summary of the strengths and weaknesses points of the most important technology acceptance theories

Theory	Developer and year	Field of development	Strength	Weaknesses
TRA	Ajzen and Fishbein, 1980	Social Psychology	It is one of the most fundamental theories of human behavior and is designed to explain virtually any human behavior.	It is general, corresponded, and doesn't refer to other variables that affect behavioral intention like fear, threat, mood, or previous experience.
TPB	Ajzen, 1985	Social Psychology	It is successfully applied to the understanding of individual acceptance and usage of many different technologies.	It suggests that the behaviors are already planned and it doesn't refer to other variables that affect behavioral intention.
DTPB	Taylor and Todd, 1995	Social Psychology	It is expanded by including some factors from the IDT model. This expansion makes the model more managerially relevant in influencing adoption and usage.	It is identical to TPB. It decomposes the constructs of TPB and still suggests that the behaviors are planned before.
TAM	Davis, 1986	IT Field	It is a powerful model for technology applications. It replaced TRA's attitude toward behavior with two technology acceptance measures: perceived usefulness and perceived ease of use. It is less general than TRA and TPB.	It doesn't include the TRA's subjective norms. It doesn't provide any feedback on some factors like integration, flexibility, completeness of information, and information currency. It doesn't specify how expectancies are influencing the behavior.
TAM2	Venkatesh and Davis, 2000	IT Field	It explains perceived usefulness and perceived ease of use in terms of social influence. It includes subjective norms. It explains the changes in acceptance over time as users gain experience in using technology.	As an extension to TAM, it doesn't specify how expectancies are influencing the behavior. Also, it cannot predict the user's behavior within culture.
C-TAM-TPB	Taylor and Todd, 1995	IT Field	It combines the TPB model from the social psychology field with TAM from the IT field in order to get better use of TPB in technology acceptance.	TAM constructs are not fully reflected. The factor of behaviors' planning is not stated. It still doesn't pay attention to fear or threat concerning use.
MPCU	Triandis, 1979	IT Field	It is suitable to predict individual acceptance of many technologies. It is successful in understanding and explaining the usage behavior with a voluntary causative.	The complexity factor has computer and technology usage and an indirect impact on perceived short-term consequences.
IDT	Rogers, 1983	Social Science	It has the ability to study any kind of innovations. It explains and predicts the rates of the adoption factors of innovation.	It is general. It doesn't indicate how the attitude impacts on accepting or rejecting the decisions, or how innovation factors effect on decisions.
MM	Deci and Ryan, 1985	Social Psychology	It has many applications on motivational studies, learning, and health care. It can be applied for understanding new technology adoption and use.	It still needs many factors to be adopted by it so as to become more suitable to study technology usage.

* References: (Ajzen and Fishbein 1980; Ajzen 1985, 1991, 2002; Davis, Bagozzi, and Warshaw 1989; Davis 1986; Fishbein and Ajzen 1975; Karahanna, Straub, and Chervany 1999; Katta and Patro 2017a; Katta and Patro 2017b; Kim and Crowston 2011; Pavlou and Fygenson 2006; Rogers 1983, 2003; Sheppard, Hartwick, and Warshaw 1998; Taylor and Todd 1995b, 1995c; Thompson, Higgins, and Howell 1991; Triandis 1979; Venkatesh and Davis 2000; Venkatesh 2000)

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Figure 3. The UTAUT Model (Venkatesh et al., 2003)

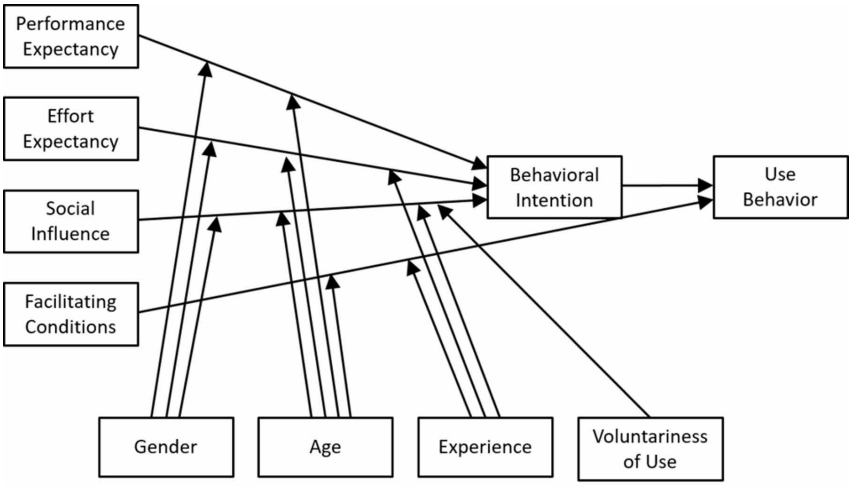


Table 2. Definitions of constructs of the UTAUT model

Constructs	Definition
Performance Expectancy	The capability of the technology to providing benefits and enhancing the performance to the user according to his/her expectations (Venkatesh et al. 2003, p 447).
Effort Expectancy	User expectations about the ease of use of technology (Venkatesh et al. 2003, p 450).
Social Influence	The expected influence of others on the user to start and continue using the technology (Venkatesh et al. 2003, p 451).
Facilitating Conditions	The expected level of organizational and technical infrastructure that can support the use of technology (Venkatesh et al. 2003, p 453).
Behavioral Intention	The expectation of the user's intention to perform plans and decisions regarding the use of technology (Venkatesh et al. 2003).

According to Figure 3, the four moderating variables are assumed to moderate the influence of the four core constructs on behavioral intention and usage behavior. These relations can be summarized from the hypotheses of Venkatesh et al. (2003) research work as follows:

- Performance expectancy influences the behavioral intention and moderated by gender and age, with a stronger effect for younger men.
- Effort expectancy influences the behavioral intention and moderated by gender, age, and experience, with a stronger effect for young women and older workers at the early stages of experience.
- Social influence influences the behavioral intention and moderated by all of the moderation variables, with a stronger effect for older women, particularly in mandatory usage in early stages of experience.
- Facilitating conditions construct does not have an influence on behavior intention, whereas, it influences the behavior of usage that moderated by age and experience, with a stronger effect for older workers, particularly with increased experience.

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4. APPLICATION OF UTAUT

UTAUT model has been discussed, reviewed, and utilized in several research works and studies on many technologies within the two styles of usage settings since its introduction till present, and the quantity of researches on this model is increasing rapidly day by day. Within this section, a number of these researches have been thoroughly reviewed.

AbuShanab and Pearson (2007) applied the UTAUT model to study the key factors affected Internet banking adoption in Jordan. They investigated the suitability of the UTAUT application on Internet banking technologies. The researchers made a survey questionnaire and distributed it to 940 customers through three banks in Jordan. By applying the ANOVA test, the study found that performance expectancy, effort expectancy, and social influence have a significant effect on behavioral intention. They found that these constructs explained the variance in predicting the intention to adopt Internet banking. The authors also found that gender moderates the relation between the three mentioned constructs and behavioral intention.

An application of the UTAUT had been done by Koivumäki, Ristola, and Kesti (2008) for the purpose of studying the perceptions of mobile services' usage. The researchers applied their study on 243 individuals in northern Finland in order to investigate their usage of mobile services and technology. The results showed that the increase in users' skills will cause a more positive understanding towards the mobile services, and would increase the intention to continue use. The researchers found that the device usage time has no effect on the consumers' usage intention, while the familiarity with the devices and the usage skills made an impact.

Curtis et al. (2010) utilized the UTAUT model for social media adoption by examining 409 U.S. non-profit organizations. It was the first time to apply UTAUT for testing social media in public relations. They indicated that the tools of social media are becoming beneficial methods to communicate among public relations practitioners in the non-profit sector. Their findings concluded that the ability to adopt social media is increasing within organizations that have public relations departments. Furthermore, they noted that men showed more confidence in using social media, while women considered social media to be beneficial.

An examination of the relationships of UTAUT constructs was done by Im, Hong, and Kang (2011) to study how the culture influences the model's constructs. They applied their study on two samples from the United States and Korea by examining the MP3 player and Internet banking technologies. They tested their hypotheses using data collected from undergraduate and graduate students from both countries. A confirmatory factor analysis (CFA) was conducted to check the statistical validity of the constructs, in addition to utilizing the structural equation modeling (SEM) by checking the fit-indices to test the whole model. Their results showed that UTAUT was the best technology acceptance theory fitted to their study. The researchers found from their empirical study that the comparison between the two countries showed that the U.S. sample has greater effects of effort expectancy on behavioral intention and behavioral intention on usage behavior than the Korean sample.

Internet banking adoption in Jordan is also examined by the UTAUT model in the study of Al Mashagba and Nassar (2012) in the context of mobile banking. They added some factors to the model such as: security, design issues, and reliability as determinants for the behavioral intention. Their model was moderated by one moderator only which was the level of education. They noted that the effort expectancy has an insignificant effect on behavioral intention. By using PLS path modeling and Varimax procedure, they found that the level of experience, in addition to the level of education, have an impact on the relation of performance expectancy with behavioral intention, and the relation of facilitating conditions with the usage behavior.

Alshehri, Drew, and Alghamdi (2012) utilized the UTAUT model in order to investigate the acceptance of e-government services within Saudi citizens. A survey of 400 participants was applied. By utilizing the SEM technique, the results showed that the performance expectancy, effort expectancy, and facilitating conditions are affecting behavioral intention to use e-government services, while

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the social influence has an insignificant effect on behavioral intention. The authors proposed three moderating variables that may affect the behavioral intention: gender, age, and users' experience. The results showed that only the experience factor has a significant effect on the relation of effort expectancy and facilitating conditions with the behavioral intention to use e-government services.

An application of the UTAUT model that was done by Akbar (2013) investigated the effective factors of students' technology acceptance and use at a higher-education institution in Qatar. This exploratory longitudinal study examined the UTAUT's constructs and moderators and its applicability for the academic environment and introducing educational technologies to students. The results showed that all the constructs and moderating variables have significant influences, except the level of experience. Furthermore, the researcher reported that the UTAUT model could be utilized to test technologies in the educational setting, with a probable need to be modified in order to fit the context.

The research work of Tan (2013) studied Taiwanese college students' needs for English language e-learning systems. The researcher used the UTAUT model for investigating Taiwanese students' acceptance of English language e-learning websites. This study applied over 176 Taiwanese college students. The results showed that performance expectancy, effort expectancy, and social influence have positive effects on behavioral intention and facilitating conditions. Also, the behavioral intention has a positive effect on usage behavior. Depending on those findings, to increase the intention to use English e-learning systems, the students should believe that these systems are easy to use and they can help them in developing their level in English.

Jaradat and Al Rababaa (2013) presented the UTAUT model to examine key factors that impact the acceptance of use for m-commerce among Jordanian consumers. 447 participants for a survey questionnaire from Jordanian undergraduate university students.

By utilizing the SEM technique, the results showed that the consumers' behavioral intentions and the m-commerce services acceptance are affected by performance expectancy, effort expectancy, and social influence. Social influence was the most significant determinant and showed a direct effect on the behavioral intention to adopt m-commerce, followed by effort expectancy, then, performance expectancy. Furthermore, the study found a direct effect of the behavioral intention on the actual use of m-commerce. The researchers noted that the facilitating conditions and moderating variables have an insignificant effect on behavioral intention to adopt m-commerce within the Jordanians.

In two separate studies of Al-Qeisi and Al-abdallah (2013, 2014), their studies extended the UTAUT model and tested it in the United Kingdom and Jordan so as to study the individuals' usage of Internet banking in different environments. The proposed model was examined through CFA by using SEM. Their findings supported the influence of the proposed extension with the website quality perceptions on usage behavior in both countries. The main impact of this model enhanced the website quality perceptions which are the most effective determinant of the usage behavior. According to that, the performance expectancy was in the second. Another research work of Al-Qeisi et al. (2015) was to study the viability of applying the UTAUT model over non-western cultures. The researchers examined the model in predicting Internet banking behavior in three countries: Jordan, Saudi Arabia, and Egypt. Their study found that social influence is a weak determinant of behavioral intentions. In addition, facilitating conditions has an insignificant effect on usage behavior. Moreover, they noted that the effort expectancy is the key determinant of Internet banking usage behavior in the examined countries that moderated by the users' experience.

Another utilization of the UTAUT model on e-government services done by Rodrigues, Sarabdeen, and Balasubramanian (2016). They applied the model over a group of expected and current users of e-government services in the United Arab Emirates. They applied the ANOVA test and found that confidentiality and users' trust, and attitudes toward using technology are key determinants of overall satisfaction of e-government services. The results showed that gender has a significant effect on the decision of e-government services adoption.

From a different perspective, an application of the UTAUT on one of the most modern technologies was done by Momani, Jamous, and Yafooz (2018) to study the acceptance of social commerce. Their

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study verified the expected effect of the enjoyment factor on the adoption and acceptance of social commerce by extending the model by adding the enjoyment expectancy as a new construct to the UTAUT structure. By utilizing the SEM testing technique, the results showed a significant effect of the enjoyment on adopting and accepting social commerce. The proposed model indicated that it is a valid measurement tool to predict the behavioral intentions to use social commerce.

5. DISCUSSION

5.1 Comparing UTAUT with Other Theories

According to Taylor and Todd (1995b), their study and the related comparison work resulted that the evaluation of technology adoption theories should be made through two main factors. The first one is their level of parsimony, which means the fewest possible and effective number of constructs. The second factor is their contribution to understanding. In order to have a good prediction, the parsimony level is important, but if we are looking for the most complete understanding of an information system, the level of parsimony may be sacrificed (Kripanont 2007; Samaradiwakara and Gunawardena 2014).

To reach the developments of UTAUT which were done by Venkatesh et al. (2003), it is worthy to remind that they profoundly reviewed and compared the eight technology acceptance theories. Their comparison included the core constructs, beliefs, and moderators of the whole eight theories, in addition to the percentage of the variance of users' intentions to use technology. Their study found that these eight theories showed an explanatory power from 17% to 42% for explaining the variance in behavioral intentions to use technology. Their comparison was based on two usage settings (voluntary vs. mandatory). In consideration that some determinants (constructs) of intention are changed from significant to insignificant over the times. Table 3 shows the results of the explained variance (R^2) from this comparison in three-time sets: *T1* (the explained variance in post-training), *T2* (the explained variance after one month of implementation), and *T3* (the explained variance after three months of implementation). The results showed that the UTAUT model is more complete and has the highest power in explaining and understanding the behavioral intention and usage behavior because it can explain 69% of the variance in intention and usage.

Based on the derived relation of the UTAUT with the other theories, each construct in the UTAUT shares in some characteristics with one or more constructs of other theories which have the same context. For instance, performance expectancy represents the usefulness of technology. This determinant was represented in TAM as perceived usefulness and MPCU as job-fit. The same concept for effort expectancy that could be found in TAM as perceived ease-of-use and complexity in MPCU. Table 4 presents the UTAUT constructs, the related constructs from the other theories that reflect the same concept, and the original theory of each construct. This information has been collected, classified and summarized by the researcher from the research work of Venkatesh et al. (2003).

Through this comparison among the aforementioned theories, performance expectancy and its related constructs in other reviewed theories showed strong predictive power in all theories. It was the most significant predictor of the behavioral intention, and it also was significant for the three-time sets of measurement within the voluntary and mandatory usage settings. The effort expectancy construct and its related constructs in other reviewed theories showed a significant effect on intention of behavior in both voluntary and mandatory usage settings. This significant effect was noted within the post-training phase of measurement. Social influence showed some kind of similarity in its reaction and the authors noted that the constructs related to social influence based on voluntary use were insignificant, while the constructs related to social influence based on mandatory use were significant, especially with a low level of experience and when rewards or punishment are applicable. Facilitating conditions construct and its related constructs in other reviewed theories showed the same effect on intention of behavior in both usage settings in the first training time set (post-training phase of measurement). While this influence is disappeared in the second training time set (one month after implementation) by increasing the level of individuals' experience. Venkatesh et al. (2003) noted

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Table 3. The results from the comparison of the theories/models that were done by Venkatesh et al. (2003)*

Theory/Model	(R^2)** Predicting intention in usage setting					
	Voluntary			Mandatory		
	T1	*T2*	*T3*	*T1*	*T2*	*T3*
TRA	0.30	0.26	0.19	0.26	0.26	0.17
TPB	0.37	0.25	0.21	0.34	0.28	0.18
TAM	0.38	0.36	0.37	0.39	0.41	0.36
C-TAM-TPB	0.39	0.36	0.39	0.36	0.35	0.35
MPCU	0.37	0.36	0.38	0.37	0.40	0.37
IDT	0.38	0.37	0.39	0.38	0.42	0.37
MM	0.37	0.36	0.37	0.38	0.40	0.35
SCT	0.37	0.36	0.36	0.38	0.39	0.36
UTAUT	***T1* = 0.35**		***T2* = 0.38**	***T3* = 0.36**		***Pooled* = 0.69**

*Data had been collected and classified by the researcher from Venkatesh et al. (2003).
**R^2 = The explained variance of user intentions to use information technology.
T1 = post-training, T2 = 1 month after implementation, and T3 = 3 months after implementation.

Table 4. The relation of UTAUT constructs with other theories constructs*

UTAUT Core Constructs	Related Constructs	Theories
Performance expectancy	• Perceived usefulness • Extrinsic motivation • Job-fit • Relative advantage • Outcome expectations	TAM and C-TAM-TPB MM MPCU IDT SCT
Effort expectancy	• Perceived ease of use • Complexity • Ease of use	TAM MPCU IDT
Social influence	• Subjective norm • Social factors • Image	TRA, TPB, and C-TAM-TPB MPCU IDT
Facilitating conditions	• Perceived behavioral control • Facilitating conditions • Compatibility	TPB and C-TAM-TPB MPCU IDT

*Data had been collected and classified by the researcher from Venkatesh et al. (2003)

that by the existence of performance expectancy and effort expectancy, the facilitating conditions become insignificant. So, the influence of the facilitating conditions hypothesized to be on usage by moderation from age and experience, with a stronger effect for older workers, particularly with the increased level of experience.

It is worth to mention here that the UTAUT was developed in the organizational context within a mandatory usage environment. Venkatesh, Thong, and Xu noted in 2012 that the perceived enjoyment is an important factor in controlling the degree of satisfaction of using the technology, especially if the intentions to use the technology is voluntary, while users are motivated to do so (Martins, Farias, Albuquerque, and Pereira, 2018). Thus, hedonic motivation had been added to the structure of the UTAUT along with the price value and habit factors for a more effective perceiving of the behavioral

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intentions to adopt and accept new technologies. The same technique used in Venkatesh et al. (2003) while developing the original UTAUT, Venkatesh et al. (2012) used the longitudinal study in two steps for testing the acceptance of mobile Internet technology within the voluntary usage environment.

5.2 The Effect of UTAUT Moderators on the Other Theories

As mentioned before, the UTAUT model as a unified technology acceptance theory is supposed to be able to apply over both usage settings (voluntary and mandatory). Its moderating variables impact the influence of the constructs on the behavioral intention, and as a result, on the usage behavior, as well. Some of these moderating variables were supposed that they may have an impact on the relation in some technology acceptance theories and models, while some others were presented without any moderating impact. The following is discussing the effect of the UTAUT moderators on the other theories:

Gender: Many research works mentioned the impact of the gender type on the influence of the subjective norm, attitude, and perceived behavioral control (Venkatesh, Morris, and Ackerman 2000; Venkatesh et al. 2003; Venkatesh and Morris 2000). These studies and others found that the moderating for attitude is better by men, while women are better in moderating the subjective norm and perceived behavior control, especially women in their early stage of experience.

Age: Similar to gender, age influences the subjective norm, attitude, and perceived behavioral control (Baker, Al-Gahtani, and Hubona 2007; Lu, Yu, and Liu 2006; Venkatesh et al. 2000, 2003; Venkatesh and Morris 2000). Within the mandatory usage setting, attitude is better moderated by younger workers, while perceived behavioral control is better moderated by older workers. Subjective norm is better moderated by older workers, especially older women.

Experience: The level of experience is an important determinant of behavior. Even that TPB did not include the experience as a moderator, but, it moderates the relation between subjective norms and behavioral intention, by taking into account that the importance of subjective norms will decrease by increasing the level of experience (Alotaibi and Wald, 2013; Venkatesh et al., 2003; M. Wu, Yu, and Weng, 2012). Karahanna, Straub, and Chervany (1999) also noted that for TRA. For experienced users, behavioral intention controls the relationship between the perceived behavioral control and the actual usage behavior of some theories such as TAM. In addition, it also has a strong influence on perceived usefulness and attitude on the behavioral intention. On the other hand, for inexperienced users, perceived behavioral control has a direct influence on actual behavior, such as C-TAM-TPB (Taylor and Todd, 1995a). According to Fishbein and Ajzen (1975), the relationship between behavioral intention and behavior is strong in its nature for the experienced users, because of their prior experiences. They employ their knowledge that grew by the prior experiences to control their usage intentions. In some theories, which have perceived usefulness as a construct, it is the strongest predictor of the behavioral intention for inexperienced users, but it has less influence for experienced users. So, the behavioral intention mediates the relation between the perceived behavioral control and actual behavior for experienced users. Accordingly, the relation of the behavioral intention with the actual behavior is stronger for experienced users more than inexperienced users (Hussein, Rosita, and Ayuni, 2019; Kripanont, 2007).

Voluntariness: TAM assumes that the usage of technology is voluntary, while some other theories proposed that voluntariness is an important moderator that impacts on the usage intention. For voluntary usage, the subjective norms influence the behavioral intention (such as TRA and TPB), that significantly moderated by both voluntariness and experience. But in mandatory usage, there is no effect for voluntariness, because subjective norms directly influence the intention. Agarwal and Prasad (1997) noted that voluntariness has a significant impact on clarifying the current usage, but it does not have the same impact on the intention to continue using the technology.

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Similar to subjective norms in TPB for instance, in the UTAUT model, the voluntariness of use only moderates the social influence and its relation with the intention of behavior.

5.3 Technology Acceptance Theories' Classification

The design of technology acceptance theories, in general, was to predict the behavior of expected users and their acceptance of using new technologies and their usage application for personal purposes or in working environments. This mission could be done through several directions according to the determinants or the variables which determine the testing criteria and the scientific direction that the testing operation has been done through, with taking into consideration the massive evolution that had been done on the technology acceptance theories over the years and the deep understanding of the concept of technology acceptance by this evolution. Therefore, and for more understanding of the concept of technology acceptance, the technology acceptance theories and models can be classified into two streams:

1. The development method
2. The scientific field in which the theories have been developed

The author reached this classification through a previous research work depending on reviewing the origin of each theory, the evolution stages and the evolution in the structure, and the effect of psychology, sociology, information technology on the human behavior pertaining to the usage of technology and the intention to adopt it (Momani, Jamous, and Hilles, 2017).

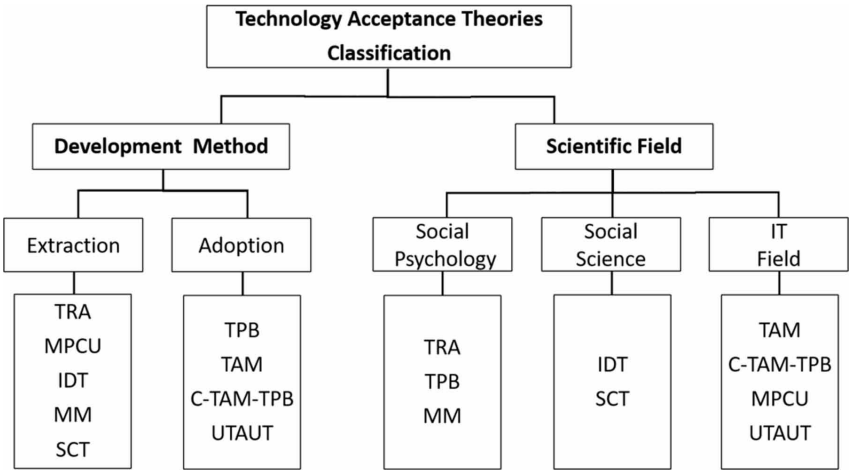
In the first classification, the theories have been studied depending on their method of development. By research, it was found that there is a group of theories had been developed depending on some former studies. These studies were either theoretical or conceptual research works done by former researchers. The developers of this kind of theories extracted the raw knowledge from the older theoretical and conceptual studies in order to develop their new theories. On the other hand, there is another group of theories had been developed depending on some other older theories. This kind of theories adopted the concept or the structure of some other older theories, one or more, in order to develop a new advanced theory that aimed to solve problems in a more professional and creative way. For instance, the UTAUT has been developed and tested by the adoption of the most effective determinants of other older eight theories that were reviewed in the study of Venkatesh et al. (2003). UTAUT brought its constructs from the older (or the base) theories and restructured them in a new form in order to enhance the acceptance test operation (Davis et al., 1989; Venkatesh and Davis, 2000).

The second classification stream classifies the theories according to the scientific field in which they have been developed. By returning to the beginning, to the1910s, it can be found that the behavioral studies are the base to what known now as acceptance and satisfaction theories, as clearly shown in Figure 2 previously. Human behavioral studies were comprised later of the social psychology and social science (Hernandez, 2017a; Wu, 2012). Originally, the current technology acceptance theories were developed in different scientific fields with one common goal which is to study the individuals' usage behavior and examine their acceptance of adopting technologies (Rondán-Cataluña, Arenas-Gaitán, and Ramírez-Correa, 2015). Therefore, this stream classifies the theories according to their scientific field of development.

UTAUT development was in the field of IT in a later stage of technology prevalence. It is worth to mention here that the theories which developed in psychology and sociology fields focus on the behavior of technology acceptance, while the theories which developed in IT focus on systems' characteristics and their effect on technology acceptance (Momani, Jamous, and Hilles, 2017). For more understanding of this classification, Figure 4 illustrates this classification and provides it with some examples of technology acceptance theories related to each type.

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Figure 4. Technology acceptance theories' classification (Momani, Jamous, and Hilles 2017)



5.4 User Acceptance and Software Quality

If fact, the user acceptance test is one of the software quality activities in the software engineering field. Sommerville (2011) defined software quality as; the ability of software products to meet the declared requirements that determined with specific conditions. Also, it was defined by McConnell (2004) as; the degree to which a software product fulfills stated requirements, so that, the level of quality depends on the degree of requirements' fulfillment and meets the needs, wants, and expectations of stakeholders. Accordingly, technology acceptance tests can be considered as a phase of the whole life cycle of the software product (Wrycza, Marcinkowski, and Gajda, 2017). While the technology acceptance tests activity is a part of the Software Requirements Validation, it can be reported that the constructs, or the determinants, of any conceptual model related to this test, are software quality requirements. As well as, the conceptual modeling, itself, is a software requirement analysis activity (Abran, Bourque, and Dupuis, 2004). The authors concluded that the requirements validation is an examination process for the software requirements. It aims to guarantee that these requirements are specifying the right system and that the software engineer understands the requirements depending on the users' needs, in order to validate their acceptance and satisfaction. According to Bourque and Fairley (2014), the requirements validation process contains the requirements reviews, model validation, prototyping, and acceptance tests. Depending on the previous knowledge, the technology acceptance test is an important task across the software life cycle. It concerns in planning how to verify each requirement. Whereas the difficulty of identifying and designing technology acceptance tests is increasing for non-functional requirements, while the importance of the technology acceptance theories is shining-up.

Thus, each construct in the UTAUT model refers to one of the software quality requirements. All these requirements are attributes of non-functional requirements to the information system, or constraints imposed on it. The software quality requirements which appeared in the UTAUT are: usability, reliability, efficiency, and adaptability. Each one of these attributes or constraints refers to a construct of the model. In the following, these attributes were defined and discussed along with clarifying the relations between each one of them with the UTAUT model constructs.

Software usability represents the degree of ease of use for end-users' interaction with an information system and their ability to learn using it (Bourque and Fairley, 2014). One of the usability tasks is testing the functions of the information system that supports user tasks and its capability to correct run-time faults. While the effort expectancy represents the degree of ease associated with the use of technology, software usability reflects the effort expectancy concept in the UTAUT model.

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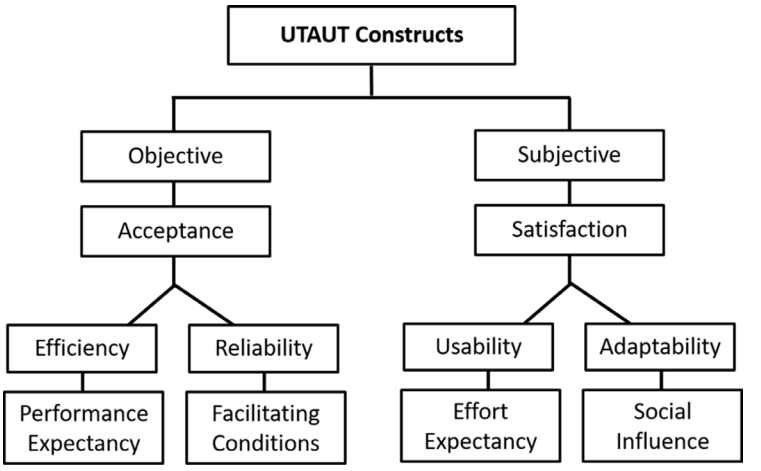
Software reliability represents the capability of an information system to implement its required functions r failure-free operation for a specified period of time in a specified environment (ANSI, 1990). It is important to understand the information systems very well in order to measure and evaluate their reliability. While the facilitating conditions represent the degree of users' belief that an organizational and technical infrastructure exists to support the use of the technology, software reliability reflects the concept of the facilitating conditions in the UTAUT model.

Software efficiency represents the degree of performance that the information system can perform its stated functions with minimum consumption of resources (ANSI, 1990). Software efficiency is the degree of performance which describes the information system's process that used to create the greatest amount of outputs by entering the lowest amount of inputs to the system. Software efficiency reflects the performance expectancy concept in the UTAUT model while using the system will help users attain gains in job performance.

Software adaptability represents the ability of the information system to be modified in order to use its applications in different environments rather than those which it was originally designed for (ANSI, 1990). Software adaptability was explained as a process, in which an information system adapts its behavior to end-users based on information acquired about its users and its environment. Accordingly, software adaptability reflects the concept of social influence in the UTAUT model.

These software quality attributes and their belonging UTAUT's determinants could be classified into two major types according to their effect on technology adoption: objective and subjective. While any other thing depending on a fact and not influenced by opinions, emotions, or personal feelings can be called objective. The objective effect on technology adoption is led to accept or deny this technology. Therefore, the technology acceptance decision is an objective behavior. Efficiency and reliability are respectively representing the objective effect for performance expectancy on behavioral intention and facilitating conditions on the usage behavior. On the other hand, the subjective is anything that embodies the sense of probabilities and influences opinions, emotions, or personal feelings. The subjective effect on technology adoption is related to the degree of user satisfaction with the technology. Usability and adaptability are representing, respectively, the subjective effect on technology adoption for effort expectancy and social influence on behavioral intention to adopt any technology. Figure 5 represents the four constructs of the UTAUT model and the software quality attributes related to each one of them, in addition to their objective and subjective effects on technology adoption.

Figure 5. The objective and subjective effects on technology adoption



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6. CONCLUSION

The successful and significant empirical comparison and validation of Venkatesh et al. (2003) were depending on reviewing the most widely used eight technology acceptance theories in the field of IT. The theories were reviewed by collecting longitudinal data from four organizations that using new technology. UTAUT was tested by the data collected from the four organizations, in addition to two more. This testing was through three-time sets as explained before. UTAUT combined all strength points and disappoint the weaknesses of the previously mentioned theories.

UTAUT model is like any older model that got a number of extension operations by researchers around the world. The most important extension is the one that had been done by Venkatesh et al. (2012) in the form of UTAUT2. This extension had been reported as consumer acceptance and use of information technology. The researchers added hedonic motivation, price value, and habit as new determinants to the structure of the original UTAUT in order to test the acceptance of new technologies within the consumers. From a different perspective, another extension had been done by the author of this paper under the name TAUSC "*Theory of Acceptance and Use of Social Commerce*" which extends the original UTAUT by including the enjoyment factor as a significant determinant for the acceptance of adopting social commerce by consumers as a development of the traditional e-commerce (Momani, 2018).

This paper along with its related reviews and comparisons shows the UTAUT model powerful and flexible to enable studying the adoption of any new technology, in addition, to being viable after extension as needed. It is robust, not much general, and good in prediction for usage behaviors and applicable to evaluate an individual's perception of technology usage. Thus, all of these advantages with the fewest number of predictors (constructs) reinforce the preference for adopting and utilizing this theory. Therefore, it can be reported that this paper answered the first research question through its discussions. According to Hennington and Janz (2007), the reason for the vantage of UTAUT over other technology acceptance theories is that the UTAUT emphasizes contextual factors, while other theories more general and lack objective variables (Hennington and Janz, 2007; Khan and Woosley, 2011). Through this paper, it can be conclude that the theories of technology acceptance can be found into two types: (1) limited and restricted theories that cannot be considered as comprehensive or complete according to its limited constructs (TAM as an example), and (2) comprehensive theories because of containing a lot of constructs that cause much of complexity and difficulty to apply (MPCU as an example).

Additionally, this review showed a significant relationship between the UTAUT determinants and the major software quality requirements. This model not only had been designed to test the acceptance of adopting technologies, but it had been designed to test the satisfaction from the usage experience as well. Thus, it can be reported that this paper answered the second research question, too.

Depending on that, it can be concluded that the UTAUT can be considered as the most comprehensive model which was designed to examine the technology's actual usage behavior, however, it is not much general. Furthermore, it was designed with the minimum amount to complexity according to its limited number of constructs and moderating variables that make it more applicable and understandable especially by its utilization in studying the acceptance of applying any new technology or information system. Besides, it is viable after any modification operation that could be done over it (Momani et al. 2018).

Finally, the importance of this research work can be lied in providing researchers in the field of technology acceptance with the necessary and primary background for their studies. As a result, this review points out to the road which leads to this research for the purpose of extending the model depending on its tested technology and the proposed research sample.

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