ISSN: 2454-9940

# INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

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www.ijasem.org

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

ISSN2454- 9940www.ijsem.org
Vol 6, Issuse.1 March 2018

# A review of technology acceptance and adoption models and theories

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**Abstract;**Academics are curious to learn what elements influence users' acceptance or rejection of technologies since recognizing the demands and acceptance of people is the first step in any organization and this information would be important to determine the road to future growth. Many theories and frameworks have been proposed to explain why and how people embrace new technologies, and all of these models and frameworks bring additional considerations into the mix that might influence users' decisions. In this work, we give a survey of the literature on theories and models of technology acceptability among end users. Literature that attempts to demonstrate how developers and researchers predict the amount of acceptance of any information technology will be highlighted in the present review.

***Keywords***:Adoption Model, Adoption Theory, User Acceptance, User Adoption, User Acceptance Model, and User Adoption Theory.

## Introduction

Having users believe in and embrace a new technology is essential to its success and growth. On top of that, it has been speculated that user participation in system design increases the likelihood of adoption.

In contrast to refuse, acceptance refers to a positive choice to implement a new idea [1]. It is important for decision-makers to understand the factors that users consider when deciding whether or not to adopt a new system [2]. Researchers and practitioners alike wonder what factors influence people's willingness to adopt cutting-edge technology. Finding the answer to this issue may lead to improved techniques for creating, analyzing, and anticipating consumers' reactions to new technology [3]. Voting, dieting, family planning, donating blood, women's occupational orientations, breast cancer examination, choice of transport mode, turnover, birth control pill use, education, consumer purchase behaviors, and computer use are just a few examples of the many domains where technology acceptance models and theories have been applied to understand and predict users' behavior. A number of studies in the area of technology adoption have produced assessment frameworks for determining how often a certain piece of technology is really used.

Numerous models and frameworks, including the Technology Acceptance Model [4-6], the Theory of Planned Behavior [7], the Diffusion of Innovation theory [8], the Model of PC Utilization [10], the Motivational Model [11],

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the Unified Theory of Acceptance and Use of Technology [12], and the Social Cognitive Theory [13-16], among others, have been developed to explain user adoption of new technologies.

Because of the complexity of the problems involved, it is essential to consider several theoretical perspectives. Theoretically, there are many different ways to handle the thorny problems at hand. For this reason, it is important to provide a broad perspective on the many models of widespread adoption now in use in this sector. Adoption models and theories are offered in this work to provide a high-level introduction to the subject.

**LiteratureReview**

Figure 1 presents a quick view on the most popular theories and models of technology acceptance. As seen, sometheoriesare extendedfromother theoriesandmodels.

*TheoryofReasonedAction(TRA)*

Although TRA model is firstly developed in 1975 by Fishbein and Azjen's for sociological and psychologicalresearches, it is recently became foundation to investigate individuals' IT usage behaviour [17]. In this model, anyhumanbehaviourispredictedandexplainedthroughthreemaincognitivecomponentsincludingattitudes( unfavourableness or favourableness of person's feeling for a behaviour), social norms (social influence), andintentions (individual's decision do or don't do a behaviour). This human behaviour should be volitional, systematicandrational.Moreover,threeboundariesfactors,volitionalcontrol;intentionstabilityovertime;and measurementof intention in terms of target, time, context, action and specificity, are defined to test and evaluate the TRA.Furthermore, some methods such as generality, target, action, context, and time horizon are established to improvethe robustness between corresponding intention and attitude. On the other hand, the main disadvantages of TRA arethe lack of addressing the role of habit, the cognitive deliberation, misunderstanding through a survey (attitudes,subjectivenorms, and intention of the respondents) and themoralfactors. In addition, usagevoluntariness is acrucialissueforvalidationofTRA.

*TheoryofPlannedBehavior(TPB)*

This model expands the TRA framework by include the concept of perceived behavioral control (PBC). The perceived importance of available resources, opportunity, and abilities in achieving objectives [18] are the primary determinants of PBC. While both TPB and TRA presume that an individual's BI influences their behavior, TPB makes use of the PBC to account for behaviors that are beyond of the person's control. Incorporating PBC into the mix not only helps to create realistic restrictions, but also yields a self-efficacy type component [19, 20]. PBC also has an indirect effect on behavior through behavioural goals. This means that there are primarily three elements influencing BI, as outlined by the TPB model:

attitude toward behavior, personal standards for acceptable conduct, and the sense of agency one has over one's own actions. The TPB model, however, has two major flaws [21, 22]. First, if there is no way to use a computer, a person's feelings about computers are mostly irrelevant. Secondly, the updated TPB might be seen as the more appropriate theoretical framework that influences the degree of individual voluntariness that chooses or does not choose to employ

information technology in the workplace.

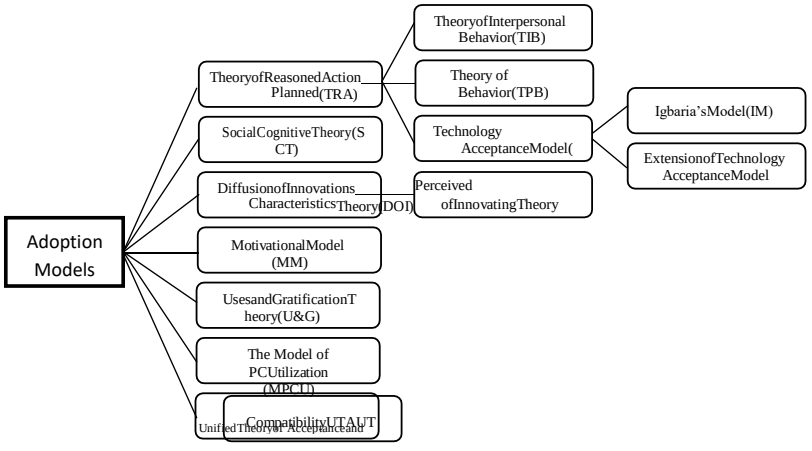


Fig.1.An overviewof Adoption/AcceptanceModels.

*TheoryofInterpersonalBehavior(TIB)*

This model is clarifying mainly the human's behaviourcomplexity which are effected by social and emotionalfactors. Therefore, this model not only contains all aspect of TRA and TPB but also, adding habits, facilitatingconditions and affect in order to improve the prediction power. The concept of social factors which is similar to thesubjective norms construct in TRA [9, 23] contain roles, norms and self-concept. In brief, in TIB, individual isneither fully deliberative nor fully automatic, further, neither fully autonomous nor entirely social. TRA differs fromTIB, in the sense that TRA interests in accounting for the most variance with the fewest variables, whereas TIBinterests in accounting for the most variance in total, because even a small amount of variance may be sociallyimportant, if the behaviour in question is critical. In this model, emotions, social factors (like subjective norms inTRA), and habits are identified as the main factors to form the intention. TIB has three levels to argue the behaviour.In the first level, personal beliefs, attitudes and social factors related to the behaviour is shaped by personalcharacteristics and previous experiences. The second level describes how affect, cognition and social determinantsplus personal normative beliefs effect on intentions to a particular behaviour. In the third level, possibility ofperforming a specific behaviour is predicted by behavioural intentions, situational conditions and past experience[24]. Themain disadvantageof TIBis complexity and lack of parsimony compared to TRA and TPB. Also, TIBisn't providing simple procedure for the operational definition of the variables among model and it is left to theresearcher.

*TechnologyAcceptanceModel(TAM)*

The TRA model serves as the basis for this one. User subject norms and interests [25] exclude the TAM model because of the TRA model's shaky theoretical and psychometric standing. Perceived utility, perceived ease of use, and attitude toward usage are the three pillars upon which TAM rests to explain user motivation. As a result, TAM would not only include BI but also the two principal beliefs like perceived utility and ease of use, all of which have major effect on the user's attitude. These may be categorized as either antipathy or favorability to the system. TAM model [26] sometimes takes into account other aspects known as external variables (user training, system features, user engagement in design, and the nature of the implementation process). The Technology Acceptance Model (TAM) is one of the most often referenced models in the study of how people interact with new technologies [27]. This area of study has gotten a lot of attention during the last several decades.

backed up by solid evidence. TAM's applicability is limited outside of business settings since it fails to account for the impact of culture on people's propensity to embrace new technologies. TAM also requires the inclusion of certain additional factors in the form of external variables in order to provide more reliable forecast of system utilization [19, 28]. TAM's inability to apply in a customer setting where adoption and use of information technologies is not just to fulfill tasks but also to meet emotional demands is a result of TAM's failure to include customers' intrinsic motives is a major flaw in the theory.

*ExtensionofTAM(ETAM)*

In ETAM, some new factors are added to TAM in order to improve adaptively, explanatory power and specificityof TAM [29]. ETAM has been proposed in two separate studies. The first study focused on antecedents of perceivedusefulnessandBIwhichknownasTAM2.TAM2waspropose dby addingtwogroupsofconstructs;socialinfluence (image, subject norms and voluntariness), and cognitive (result demonstrability, job relevance and outputquality) to TAM, to improve the predictive power of perceived usefulness. Therefore, for both voluntary andmandatory environments, TAM2 is outperformed. The only exception is related to subjective norm which haveinfluence in mandatory settings in but do not in voluntary settings. The second study identified constructs thatinfluence on perceived ease of use. The antecedents of perceived ease of use have been divided to two major groups,namely, adjustments and anchors. The general beliefs regarding the use of computer systems have been put inanchors group (enjoyment and objective usability) while beliefs that are formed on the basis of direct experience ofgiven system are included in adjustments set (external control, computer self-efficacy, computer anxiety, andcomputer playfulness).

*Igbaria'sModel(IM)*

According to IM, both extrinsic and intrinsic motivators effect on the new technology acceptance or rejection[30]. This model posited perceived fun as intrinsic motivator and perceived usefulness as extrinsic motivator

whichinfluenceonbehaviour(computerusage)andatti tude(computersatisfaction).Apartfrom thesefactors,useracceptance(actualbehaviour)isdirec tlyandindirectlyaffectedbyperceivedusefulness,com puteranxiety,computer satisfaction, and perceived fun. Also, perceived fun and perceived usefulness have both direct and indirect(via satisfaction) influence on adoption. Besides, perceivedusefulness effects on perceivedfun.Additionally,computer anxiety negatively affects two factors perceived fun and perceived usefulness. Also, it has been confirmedthatsatisfactionofcomputerhasa direct influenceonusage.

*SocialCognitiveTheory(SCT)*

Inspired from social psychology, SCT was proposed based on three main factors; behaviour, personal, andenvironmentwhichareinteractedbi-directionallyinordertopredictbothgroupandindividua lbehaviour.Moreover, it can identify methods which can change and modify behaviour [31].In SCT model, behaviour factor ischiefly focused on usage, performance and adoption issues. However, personal factor is any personality, cognitiveand demographic aspects characterizing a person. On the other hand, environmental factor includes physical andsocial factors which both are physically external to the individual. SCT is an inseparable triadic structure that allthree factors constantly influence one another, reciprocally determining each other. SCT model is integrated toevaluate the information technology usage by using some constructs including self-efficacy, outcome expectationsperformance, anxiety,affect, andoutcome expectationspersonal .

*DiffusionofInnovationsTheory(DOI)*

The Dissemination of Ideas (DOI) model analyzes many innovations by focusing on four variables (i.e., time, communication channels, invention, and social system) that affect the rate at which a concept spreads. In addition to its practical use in both institutional and personal contexts, DOI also provides a theoretical basis for addressing questions of global adoption. Adopter traits, innovation features, and the choice to implement an invention are all intertwined in the D.O.I. model. There are five stages in the innovation decision-making process:

Over time, individuals of a social system with shared characteristics have used a variety of channels of communication to coordinate actions, make decisions, and influence one another. The relative benefit, compatibility, complexity, trialability, and observability of an invention are the five primary constructions given as effective elements on any innovation's adoption in the characteristics of an innovation phase. Characteristics of adopters phase [32] defines five groups: early adopters, innovators, laggards, late majority, and early majority. In conclusion, compared to other adoption models, DOI's weaker explanatory power and impracticality in result prediction are due to its greater emphasis on system features, organizational traits, and environmental variables.PerceivedCharacteristicsofInnovatingTheory (PCIT)

This model is expanded the DOI theory by identifying three additional features as: Image, voluntariness, andbehaviour. The behaviour is influenced by the perception of voluntariness which has effect on actual behaviourcompare to voluntariness. Result shows that adoption rate and demonstrability are much related to each other andwhiledemonstrability increasetheadoptionraterapidlyincreasetoo.Further more,observabilityhasactuallycomposedoftwosubch aracteristicswhicharevisibilityandresultdemonstrabi lity.AlsoinPCImodel,voluntarinessaffectsusers'deci siontorejectoraccept aninnovation[33].

*MotivationalModel(MM)*

Basically,systemuseisdeterminedbytwointrinsic motivationandextrinsicmotivation.Theextrinsicmoti vation is defined as the perception that users will want to perform an activity because it is perceived to beinstrumentalinachievingvaluedoutcomesthataredi stinctfromtheactivityitself,suchasimprovedjobperfor mance. The intrinsic motivation is defined as the perception that users will want to perform an activity for noapparent reinforcement other than the process of performing the activity per se. Davis, Bagozzi [11] proposed thatperceived usefulness as an extrinsic motivation and perceived enjoyment as an intrinsic motivation. Generally, theoutput quality and perceived ease of use have impact on perceived enjoyment and perceived usefulness. Moreover,they introduced task importance as a moderator of the ease of use and output quality influences on usefulness.Therefore, the output quality and perceived ease of use influence BI

indirectly through perceived usefulness andperceived enjoyment.

*UsesandGratificationTheory(U&G)*

This model seeks to analysis the reason for involvements of people for certain communication medium compareto others. The use of media has gained by which particular gratifications. The main focus of U&G is on the socialand psychological aspects of users use in their quest for motivation and satisfaction [34]. U&G includes three mainconstructs;motivations,behaviouralusageandgratifications/satisfaction.Motivation is referredtotheoveralldispositionswhichinfluenceonactionsofpeoplefortheirrequirements[35].Behavioural usagerefersto"patternsof exposure of use (such as amount of use, duration of use, and type of use)". U&G is unique framework to beapplied in all kinds of media in compare to other models such as TPB and DOI. U&G model not only can apply inmedia environment for communication purposes but also, it can be utilized where the media is used for play andworkprocess.

*TheModelofPCUtilization(MPCU)*

The Model of PC Utilization fits the IS perspective to forecast individual acceptance and personal computer (PC)utilization. Since MPCU model assesses actual behaviour (personal computer usage) so they excluded behaviourintention from the proposed model. Furthermore, habits also are not included in the model because habits have apresent usage is a tautology when used within the context of computer use. Affect, enabling situation, long-term usage effects, perceived consequences, social influences, complexity, and work fit are only few of the factors that are directly evaluated by MPCU. Job-related variables, societal considerations, outcomes over time, and

use of computers is affected by factors of varying complexity. However, there is no correlation between favorable environmental and emotional conditions and PC usage. Despite the fact that habit formation is an excellent predictor of behavior, it has been left out of MPCU [36].

*UnifiedTheoryofAcceptanceandUseofTechnology(UTAUT)*

Venkatesh, Morris [12] compared the similarities and differences among the eight models which previously usedin the context of information system, all of which had their origins in sociology, psychology and communications.These models are Technology Acceptance Model, Theory of Reasoned Action, combined TAM and TPB, Theory ofPlanned Behaviour, Model of PC Utilization, Diffusion of Innovation, Motivational Model and Social CognitiveTheory. UTAUT identified four antecedents of the acceptance of information systems. They were developed bytailoring the fourteen initial constructs from eight acceptance theories [12]. The significant constructs are effortexpectancy, performance expectancy, social influence and facilitating conditions. Furthermore, four significantmoderatingvariableswereidentified; gender, experience, age and voluntarinessofuse.

*CompatibilityUTAUT(C-UTAUT)*

Bouten [37] integrated compatibility beliefs developed by Karahanna, Agarwal [38] into the UTAUT modeldeveloped by Venkatesh, Morris [12] to improve the explanatory power of the UTAUT model. Additionally it aimsat providing a more thorough understanding of how the cognitive phenomena of the UTAUT model are formed byidentifying and testing new boundary conditions [37]. Since the study planned to investigatethe relationshipbetween compatibility beliefs and behavioural perceptions, thus measuring actual usage behaviour was not ofsignificance.Furthermore,itwascrosssectional,measuringbehaviouralintentioninsteadofusebehaviourcircumvents the potential problem of retrospective analysis. Since the research was cross-sectional and did not testdifferent time periods, thus the relationships proposed by Venkatesh, Morris [12] relating to experience could not becopied exactly.

**2. Discussion**

Adoption models rooted on a diversity of theories for example, Innovation Diffusion Theory (IDT). Is fromsociology, Theory of Reasoned Action (TRA) is from social psychology [37], TIB, TPB and SCT are psychosocialtheories [39]. All three theories have proven their effectiveness in predicting and explaining a variety of humanbehaviours in differing contexts. On the other hand, TRA and TPB differ from DOI in the sense that the formerfocuses on explaining the behaviour of individuals. The latter concentrates on adoption decisions in which theorganizational

characteristics play a key role, not the individual. SCT and TPB integrate the notion of perceivedoutcomes when forecasting behaviour while DOI and TAM focus solely on beliefs about the technology. DOI, TAMand TPB adopt a unidirectional perspective towards causal relationship, in which environmental constructs affectcognitivebeliefs,whichaffectattitudesandbehaviourswhereasSCTreliesonthebidirectionalnatureofcausationinwhichbehaviour,emotionalandcognitivefactorsandenvironmentconstantlyandmutuallyaffecteachother[40].

The Model of PC Utilization (MPCU) is another model that has its foundation in the study of human behavior and was developed in [10]. Although there is some conceptual overlap between TIB, TPB, and SCT, the latter two have been used much more often in the study of behavior than Triandis's TIB. All of the elements of the TPB model are present in the TIB, but the inclusion of habits and supportive environments increases the model's predictive potential [41, 42]. Complexity, perceived ease of use, relative benefit, and perceived utility are all characteristics that may influence both DOI and TAM [43]. Facilitating condition, which is employed by Venkatesh and Morris [12], incorporates ideas from Ajzen's [44] perceived behavioral control, Thompson and Higgins' [10] facilitating circumstances, and Moore and Benbasat's [45] compatibility construct. There has been no differentiation between the like/dislike connotation of emotional attitudes and the cognitive component of beliefs in the realm of information system research (which are the information a person holds about an object, issue, or person). According to Perlusz [46], it's not only rational thought processes but also feelings and motivations that shape people's actions. Therefore, he concluded, models and theories of technological adoption

had, up to this point, shown little interest in or understanding of the emotional lives of others. For the most part (Venkatesh [47] being an exception), when it comes to predicting whether or not people would embrace a new technology, models rely only on the individual's thoughts and opinions (as shown in [5, 11, 44, 48]). Anxiety [46, 47, 49], "fear" [50], and "worry" [51, 52] about using new technology have all been seen negatively in studies of its adoption. On the other hand, researchers have paid less attention to the positive feelings that contribute to a fulfilled life, such as joy, curiosity, satisfaction, and excitement [46]. Previous models have either emphasized the importance of internal factors like attitudes, beliefs, and intentions, or external factors like incentives and institutional restrictions in explaining behavior. However, many models, TIB included [53], do not give clear criteria for the operational specification of the variables inside the model. In this work, we looked at the most well-known and widely used models and theories for understanding how users take in new technologies. It seems that the most often used methods in the area of Information Management are UTAUT, TAM, and DOI.

**Acknowledgements**

This researchhas been preparedandsupported by Research &DevelopmentDepartment of Ahoora Ltd|Management Consultation Group and Hamta Business Solution SdnBhd | Business Development and InternationalTrade.

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