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A review of technology acceptance and adoption models and theories

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Abstract

Recognition the needs and acceptance of individuals is the beginning stage of any businesses and this understanding would be helpful to find the way of future development, thus academicians are interested to realize the factors that drive users' acceptance or rejection of technologies. A number of models and frameworks have been developed to explain user adoption of new technologies and these models introduce factors that can affect the user acceptance. In this paper, an overview of theories and models regarding user acceptance of technology has been provided. The existing review will emphasize literature that tries to show how developers and researchers presage the level of admission any information technology will attain.

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1. Introduction

It is significant to note that user acceptance and confidence are crucial for the further development of any new technology. Besides, acceptance has been viewed as a function of user involvement in systems development.

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In general, acceptance is defined as “an antagonism to the term refusal and means the positive decision to use an innovation” [1]. Decision makers need to know the issues that influence on users’ decision to use a particular system so they would be able to take them into account during the development phase [2]. It is the common question of both practitioners and researchers that why people accept new technologies. Answering this question may help them to better methods for designing, evaluating and predicting the response of the users to the new technologies [3]. Technology acceptance models and theories have been applied in a wide variety of domains to understand and to predict users’ behavior such as voting, dieting, family planning, donating blood, women’s occupational orientations, breast cancer examination, choice of transport mode, turnover, using birth control pills, education, consumer’s purchase behaviors, and computer usage. Several researched in the field of technology acceptance, developed frameworks to assess the usage of particular developed and implemented technology.

A number of models and frameworks have been developed to explain user adoption of new technologies and these models introduce factors that can affect the user acceptance such as Technology Acceptance Model [4-6], Theory of Planned Behavior [7] and Diffusion of Innovation theory [8], Theory of Reasoned Action [9], Model of PC Utilization [10], Motivational Model [11], Unified Theory of Acceptance and Use of Technology [12] and Social Cognitive Theory [13-16] and many studies have used these traditional frameworks to conduct their researches and the rest combined previous models or add new constructs to developed models to carry out their study.

More than one theoretical approach is necessary for complete understanding of the issues involved, and for clarity, approaches are treated independently. However, various theoretical complete understandings of involved issues require approaches. Therefore, an overview on available general adoption model is necessary in this field. In this paper adoption theories and models are presented to give an overview for better understanding of these models and theories.

2. Literature Review

Figure 1 presents a quick view on the most popular theories and models of technology acceptance. As seen, some theories are extended from other theories and models.

2.1. *Theory of Reasoned Action (TRA)*

Although TRA model is firstly developed in 1975 by Fishbein and Azjen’s for sociological and psychological researches, it is recently became foundation to investigate individuals’ IT usage behaviour [17]. In this model, any human behaviour is predicted and explained through three main cognitive components including attitudes (unfavourableness or favourableness of person’s feeling for a behaviour), social norms (social influence), and intentions (individual’s decision do or don’t do a behaviour). This human behaviour should be volitional, systematic and rational. Moreover, three boundaries factors, volitional control; intention stability over time; and measurement of 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 improve the robustness between corresponding intention and attitude. On the other hand, the main disadvantages of TRA are the lack of addressing the role of habit, the cognitive deliberation, misunderstanding through a survey (attitudes, subjective norms, and intention of the respondents) and the moral factors. In addition, usage voluntariness is a crucial issue for validation of TRA.

2.2. *Theory of Planned Behavior (TPB)*

In this model, perceived behavioural control (PBC) as a new variable is added to extend TRA model. Basically, PBC is determined by the availability of resources, opportunities and skills, as well as the perceived significance of those resources, opportunities and skills to achieve outcomes [18]. Although both TPB and TRA assumed person’s behavioural intention (BI) is affecting individual’s behaviour, TPB is using the PBC for individual’s actions which are not under volitional control. By adding PBC, not only realistic limitations is composed but also, a self-efficacy type factor is achieved [19, 20]. Moreover, PBC has the direct influence on actual behaviour as well as the indirect affect through the behavioural intentions. Therefore in TPB model, three main factors are affecting BI including

perceived behavioural control, subjective norm, and behavioural attitude. However, there are two main problems with TPB model [21, 22]. First, the one's attitudes towards information technology will not be largely relevant if a computer system is not accessible. Second, the revised TPB may be viewed as the more suitable theoretical framework which is influenced the degree of individual's voluntariness that choose or not to choose the use of information technology in the workplace.

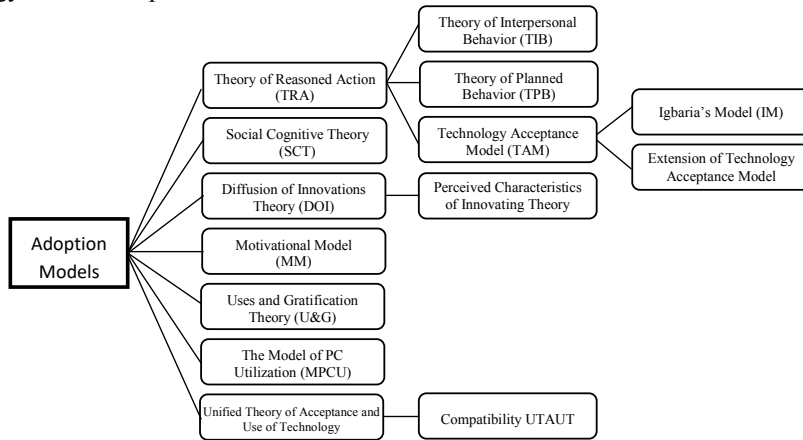


Fig. 1. An overview of Adoption / Acceptance Models.

2.3. Theory of Interpersonal Behavior (TIB)

This model is clarifying mainly the human's behaviour complexity which are effected by social and emotional factors. Therefore, this model not only contains all aspect of TRA and TPB but also, adding habits, facilitating conditions and affect in order to improve the prediction power. The concept of social factors which is similar to the subjective norms construct in TRA [9, 23] contain roles, norms and self-concept. In brief, in TIB, individual is neither fully deliberative nor fully automatic, further, neither fully autonomous nor entirely social. TRA differs from TIB, in the sense that TRA interests in accounting for the most variance with the fewest variables, whereas TIB interests in accounting for the most variance in total, because even a small amount of variance may be socially important, if the behaviour in question is critical. In this model, emotions, social factors (like subjective norms in TRA), 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 personal characteristics and previous experiences. The second level describes how affect, cognition and social determinants plus personal normative beliefs effect on intentions to a particular behaviour. In the third level, possibility of performing a specific behaviour is predicted by behavioural intentions, situational conditions and past experience [24]. The main disadvantage of TIB is complexity and lack of parsimony compared to TRA and TPB. Also, TIB isn't providing simple procedure for the operational definition of the variables among model and it is left to the researcher.

2.4. Technology Acceptance Model (TAM)

This model is derivate from TRA model. Due to uncertain theoretical and psychometric status in TRA model, TAM model is eliminated user's subject norms and interestingly [25]. TAM explains the motivation of users by three factors; perceived usefulness, perceived ease of use, and attitude toward use. Therefore, not only BI would be contained in TAM but also, two chief beliefs like perceived usefulness and ease of use have considerable impact on attitude of the user. These can be determined as an unfavourableness and favourableness toward the system. Sometimes, other factors known as external variables (user training, system characteristics, user participation in design and the implementation process nature) are considered in TAM model [26]. TAM is probably one of the most widely cited model in the field of technology acceptance [27]. During the past decades, it received substantial

empirical support. Since TAM ignored the social influence on adoption of technology so it has limitations in being applied beyond the workplace. Besides, some variables as external variables need to be added to TAM to provide more consistent prediction of system use [19, 28]. Since the intrinsic motivations are not addressed in TAM so the ability of TAM to apply in a customer context where the acceptance and use of information technologies is not only to achieve tasks but also to fulfil the emotional needs may be limited .

2.5. Extension of TAM (ETAM)

In ETAM, some new factors are added to TAM in order to improve adaptively, explanatory power and specificity of TAM [29]. ETAM has been proposed in two separate studies. The first study focused on antecedents of perceived usefulness and BI which known as TAM2. TAM2 was proposed by adding two groups of constructs; social influence (image, subject norms and voluntariness), and cognitive (result demonstrability, job relevance and output quality) to TAM, to improve the predictive power of perceived usefulness. Therefore, for both voluntary and mandatory environments, TAM2 is outperformed. The only exception is related to subjective norm which have influence in mandatory settings in but do not in voluntary settings. The second study identified constructs that influence 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 in anchors group (enjoyment and objective usability) while beliefs that are formed on the basis of direct experience of given system are included in adjustments set (external control, computer self-efficacy, computer anxiety, and computer playfulness).

2.6. Igbaria's Model (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 which influence on behaviour (computer usage) and attitude (computer satisfaction). Apart from these factors, user acceptance (actual behaviour) is directly and indirectly affected by perceived usefulness, computer anxiety, computer satisfaction, and perceived fun. Also, perceived fun and perceived usefulness have both direct and indirect (via satisfaction) influence on adoption. Besides, perceived usefulness effects on perceived fun. Additionally, computer anxiety negatively affects two factors perceived fun and perceived usefulness. Also, it has been confirmed that satisfaction of computer has a direct influence on usage.

2.7. Social Cognitive Theory (SCT)

Inspired from social psychology, SCT was proposed based on three main factors; behaviour, personal, and environment which are interacted bi-directionally in order to predict both group and individual behaviour. Moreover, it can identify methods which can change and modify behaviour [31]. In SCT model, behaviour factor is chiefly focused on usage, performance and adoption issues. However, personal factor is any personality, cognitive and demographic aspects characterizing a person. On the other hand, environmental factor includes physical and social factors which both are physically external to the individual. SCT is an inseparable triadic structure that all three factors constantly influence one another, reciprocally determining each other. SCT model is integrated to evaluate the information technology usage by using some constructs including self-efficacy, outcome expectations performance, anxiety, affect, and outcome expectations personal .

2.8. Diffusion of Innovations Theory (DOI)

DOI model examines a diversity of innovations by introducing four factors (which are the time, channels' communication, innovation or social system) which influence the spread of a new idea. DOI not only has been used at both organizational and individual levels but also, offers a theoretical foundation to discuss adoption at a global level. DOI model integrates three major components: adopter characteristics, characteristics of an innovation, and innovation decision process. In innovation decision step, five steps namely confirmation, knowledge,

implementation, decision, and persuasion have took place through a series of communication channels among the members of a similar social system over a period of time. In characteristics of an innovation step, five main constructs; relative advantage, compatibility, complexity, trialability, and observability have been proposed as effective factors on any innovation acceptance. In adopter characteristics step, five categories; early adopters, innovators, laggards, late majority, and early majority are defined [32]. In conclusion, DOI more focus on the system characteristics, organizational attributes and environmental aspects, it has less power in explanatory and less practical for prediction of outcomes compared to other adoption models.

2.9. Perceived Characteristics of Innovating Theory (PCIT)

This model is expanded the DOI theory by identifying three additional features as: Image, voluntariness, and behaviour. The behaviour is influenced by the perception of voluntariness which has effect on actual behaviour compare to voluntariness. Result shows that adoption rate and demonstrability are much related to each other and while demonstrability increase the adoption rate rapidly increase too. Furthermore, observability has actually composed of two sub characteristics which are visibility and result demonstrability. Also in PCI model, voluntariness affects users' decision to reject or accept an innovation [33].

2.10. Motivational Model (MM)

Basically, system use is determined by two intrinsic motivation and extrinsic motivation. The extrinsic motivation is defined as the perception that users will want to perform an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, such as improved job performance. The intrinsic motivation is defined as the perception that users will want to perform an activity for no apparent reinforcement other than the process of performing the activity per se. Davis, Bagozzi [11] proposed that perceived usefulness as an extrinsic motivation and perceived enjoyment as an intrinsic motivation. Generally, the output 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 and perceived enjoyment.

2.11. Uses and Gratification Theory (U&G)

This model seeks to analysis the reason for involvements of people for certain communication medium compare to others. The use of media has gained by which particular gratifications. The main focus of U&G is on the social and psychological aspects of users use in their quest for motivation and satisfaction [34]. U&G includes three main constructs; motivations, behavioural usage and gratifications/satisfaction. Motivation is referred to the overall dispositions which influence on actions of people for their requirements [35]. Behavioural usage refers to “patterns of exposure of use (such as amount of use, duration of use, and type of use)”. U&G is unique framework to be applied in all kinds of media in compare to other models such as TPB and DOI. U&G model not only can apply in media environment for communication purposes but also, it can be utilized where the media is used for play and work process.

2.12. The Model of PC Utilization (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 behaviour intention from the proposed model. Furthermore, habits also are not included in the model because habits have a tautological relationship with current use in the context of PC utilization. MPCU specifically evaluates the direct influence of affect, facilitating condition, long-term consequences of use, perceived consequences, social influences, complexity and job fit on behaviour. Results confirm that job fit, social factors, long term consequences and

complexity have strong influences on PC usage. However, facilitating condition and affect do not have significant effect on PC use. Although habits are a strong predictor of behaviour, it has been excluded from MPCU [36].

2.13. Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh, Morris [12] compared the similarities and differences among the eight models which previously used in 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 of Planned Behaviour, Model of PC Utilization, Diffusion of Innovation, Motivational Model and Social Cognitive Theory. UTAUT identified four antecedents of the acceptance of information systems. They were developed by tailoring the fourteen initial constructs from eight acceptance theories [12]. The significant constructs are effort expectancy, performance expectancy, social influence and facilitating conditions. Furthermore, four significant moderating variables were identified; gender, experience, age and voluntariness of use.

2.14. Compatibility UTAUT (C-UTAUT)

Bouten [37] integrated compatibility beliefs developed by Karahanna, Agarwal [38] into the UTAUT model developed by Venkatesh, Morris [12] to improve the explanatory power of the UTAUT model. Additionally it aims at providing a more thorough understanding of how the cognitive phenomena of the UTAUT model are formed by identifying and testing new boundary conditions [37]. Since the study planned to investigate the relationship between compatibility beliefs and behavioural perceptions, thus measuring actual usage behaviour was not of significance. Furthermore, it was cross sectional, measuring behavioural intention instead of use behaviour circumvents the potential problem of retrospective analysis. Since the research was cross-sectional and did not test different time periods, thus the relationships proposed by Venkatesh, Morris [12] relating to experience could not be copied exactly.

3. Discussion

Adoption models rooted on a diversity of theories for example, Innovation Diffusion Theory (IDT). Is from sociology, Theory of Reasoned Action (TRA) is from social psychology [37], TIB, TPB and SCT are psychosocial theories [39]. All three theories have proven their effectiveness in predicting and explaining a variety of human behaviours in differing contexts. On the other hand, TRA and TPB differ from DOI in the sense that the former focuses on explaining the behaviour of individuals. The latter concentrates on adoption decisions in which the organizational characteristics play a key role, not the individual. SCT and TPB integrate the notion of perceived outcomes when forecasting behaviour while DOI and TAM focus solely on beliefs about the technology. DOI, TAM and TPB adopt a unidirectional perspective towards causal relationship, in which environmental constructs affect cognitive beliefs, which affect attitudes and behaviours whereas SCT relies on the bidirectional nature of causation in which behaviour, emotional and cognitive factors and environment constantly and mutually affect each other [40].

Another model, rooted in the theory of human behaviour is the Model of PC Utilization (MPCU) introduced by [10]. On the other viewpoint, TIB, TPB and SCT theories are similar and conceptually overlap, however, SCT and TPB have been used more frequently in the study of behaviour than has Triandis' TIB. The TIB includes all aspects of the TPB model, however it includes additional components that add to its predictive power, namely that of habits and facilitating conditions [41, 42]. Similarly, there are some overlapping factors between DOI and TAM such as complexity and perceived ease of use, relative advantage and perceived usefulness [43]. Likewise, facilitating condition used by Venkatesh, Morris [12] captures notions of Ajzen [44]'s perceived behavioural control, Thompson, Higgins [10]'s facilitating conditions and Moore and Benbasat [45]'s compatibility construct.

Most information system researchers have not made a distinction between the affective component of attitudes (which have a like/dislike connotation) and the cognitive component or beliefs (which are the information a person holds about an object, issue, or person). Perlusz [46] argued that both cognitive processes and emotional and affective elements influence behaviours. Accordingly, he stated that models and theories of technology adoption

have been so far largely agnostic about feelings and emotions. With few exceptions such as Venkatesh [47], technology acceptance models make use of predictors that are exclusively cognitive, relating the adoption and actual behaviour of a new technology to attitudes, beliefs and perceptions [5, 11, 44, 48]. Technology adoption researches often conceptualized emotions as negative effects such as computer anxiety [46, 47, 49], fears [50] and worries [51, 52]. In contrary, positive emotions like happiness, interest, joy, contentment and enthusiasm have been largely neglected [46]. Some of the previous models focus on internal antecedents of behaviour like attitudes, values and intentions while others focus more on external issues such as norms, incentives and institutional constraints. Besides, a quantity of models does not provide clear guidelines for the operational definition of the variables within the model such as TIB [53]. In this paper, the most popular and used theories and models of user technology acceptance were discussed. UTAUT, TAM, and DOI seem to be the most common approaches in the field of Information Management.

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