

# Technology Acceptance Models and Adoption of Innovations: A Literature Review

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**Abstract:** *This paper reviews the main models and theories that used in previous studies to study the adoption of innovations in different areas such as online banking, mobile banking, E-learning and E-health care systems. Despite of the increasing development of technology and its incorporation into users' privacy and professional life, a decision regarding to adopt or reject it remains an open question. Thus, a well thought-of amount of research work dealing with the technology acceptance models was conducted among various disciplines.*

*Such research work originated in the psychological theories such as theory of reasoned action and theory of planned behaviour. The models Technology acceptance have evolved to become a mix of psychology, sociology and Information Technology. These models assist in understanding predictors of human behavior toward potential adoption or rejection of the innovation / technology.*

*The overall aim of this paper is to provide an up-to-date, well-researched resource of past and current references to related literature of technology acceptance models and to identify possible directions for future research in this regard. The paper presents a comprehensive literature review of the technology acceptance models and its applications across different areas and to highlight the main factors that influence the adoption of new technologies. The previous studies have been selected and classified according to which model they used to study the adoption / acceptance of specific technology.*

*In order to identify relevant studies which addressed the main dominant technology acceptance models, a structured approach followed by searching on particular keyword(s) in the leading journal databases, then selection of publications with a matching criteria and quick scan of the selected studies by reading their titles, abstracts, and full text to select those relevant to technology acceptance models research; and finally detailed process of reading and analyzing a full text of the selected research publications.*

**Keywords:** TRA, TPB, UTAUT, TAM, Mobile Banking.

## Introduction

The success of a new system or innovation depends on the extent of acceptance of such new technology among its users (Al-Tarawneh, 2016, Al-Tarawneh et al., 2017). Therefore, there is a need to understand the initial decision that is made by individuals to accept or reject new technologies (Venkatesh et al., 2003). This need of deep understanding about user's acceptance has led to the development of several theories and models that are used to explain and forecast the adoption of new products, systems, innovations, technologies, etc., which help to explain why individuals adopt or reject them. After reviewing the literature related to this field of study, the researcher found there are many models and theories used to examine and explain people's behaviour relating to technology adoption (Benbasat & Barki, 2007; Venkatesh et al., 2012). Moreover, there are some theories in

the field of human behaviour, such as the theory of reasoned action (TRA) (Ajzen & Fishbein, 1975) and the theory of planned behaviour (TPB) (Ajzen, 1985) that, while not directly related to technology adoption, have been adapted by researchers to fit the technology adoption sphere (e.g. Shih & Fang, 2006).

Each model has developed over time and each addition is a result of each era of which they are representative. As mentioned before, the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1975), in which psychology was a factor, was essentially developed to predict human behaviour. It was further evolved into the Theory of Planned Behaviour (TPB), (Ajzen, 1985), and later extended to the Decomposed Theory of Planned Behaviour, (DTPB) (Taylor & Todd, 1995). Another example, this time with information systems being a contributory factor, is the Technology Acceptance Model, (TAM) (Davis, 1986), which developed from the Theory of Reasoned Action. TAM further developed into TAM2 (Venkatesh & Davis, 2000) and the Unified Theory of Acceptance and Use of Technology, (UTAUT) (Venkatesh et al., 2003). In addition to these, other combinations of theories and models include Rogers' Diffusion of Innovations, (DOI) (1983), Bandura's Social Cognitive Theory, (SCT) (1989), Deci and Ryan's Motivational Model, (MM) (1985), and Triadis's Model of PC Utilization. Therefore, models that are applied to the acceptance of technology are not necessarily concerned with technology specifically and must also be considered chronologically, as this enables the tracking of how each model evolved and how they are interconnected. The next section will explain the main theories that have been researched by this paper to determine the relevant factors that affect the adoption of innovation.

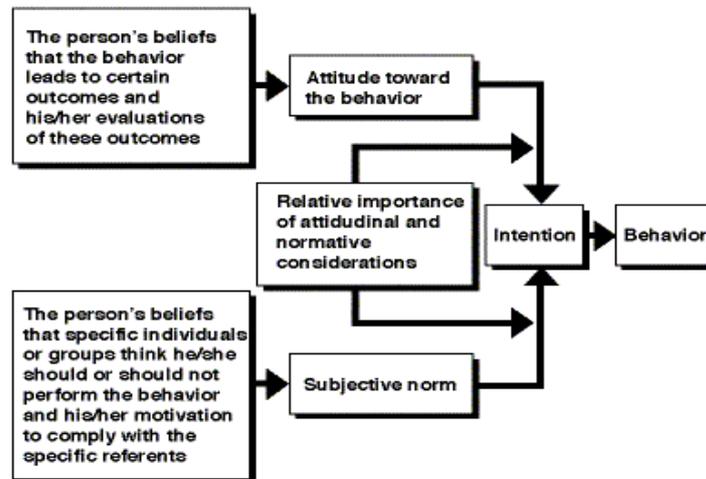
### **1.1 Theory of Reasoned Action (TRA)**

This theory was developed in the social science field of social psychology and is the earliest model used to explain technology acceptance. Fishbein and Ajzen's (1975) work focussed on the prediction behaviour undertaken in both laboratory and applied settings and their work was a result of a research programme that began in the latter years of the 1950s. The approach they used was a juxtaposition of diverse theories and research regarding attitudes, including learning and expectancy-value theories, balance theory, theory of cognitive dissonance and theories of attribution (Sheppard et al., 1988). Their aim was to develop a theory that could predict, explain, and influence human behaviour (Ajzen & Fishbein, 1980).

This theory since has been redeveloped and refined as well as put to the test within different disciplines and domains such as consumer behaviour, the industrial sector, education and technology adoption. TRA has been used as base-theory for many models and theories in the fields of human behaviour and technology acceptance such as TPB, TAM, and UTAUT (Davis et al., 1989; Ajzen, 1991; Venkatesh et al., 2003). TRA assumes that all individuals are systematic in their use of information that is available to them and that they are all rational in how they use this information when taking action: in other words, they consider the implications before engaging in a particular behaviour (Ajzen & Fishbein, 1980).

This theory focuses on behavioural intention rather than attitude and considers it as the main predictor of behaviour. An individual's behaviour is determined by behavioural intentions, according to TRA, and is the most important factor. Behaviour, and the intention to perform or act on behaviour, is a mixture of attitude towards performance of the behaviour and subjective norms. The theory is presented as a model in Figure (1).

**Figure 1: Factors determining a person's behaviour**



Source: Ajzen & Fishbein (1980, p.8)

To explain the main factors of TRA (behavioural intention, attitudes toward behaviour and subjective norms), theoretically Fishbein and Ajzen, (1980) defined behavioural intention as an indicator of a person's readiness to perform certain behaviour. Intention is considered to be the immediate antecedent of behaviour. According to the TRA, there are two determinants to behavioural intentions: personal or attitudinal factors and social or normative factors. Attitudes toward behaviour refers to the degree to which performance of behaviour is positively or negatively valued (Fishbein & Ajzen 1975). If an individual's beliefs and their attitude toward an object are known, then their behaviour and attitude can be predicted with accuracy and this has been demonstrated by Ajzen and Fishbein (1980).

In the same way that Subjective Norms refers to the way in which the social environment influences behaviour, so an individual perceives that the people who are important to them will decide if they should or should not act out the behaviour in question. General subjective norms are a result of expectations held by groups and individuals and of an individual's motivation to observe these expectations, according to TRA.

Across the studies and applications of TRA within the context of electronic banking solutions, some researchers have applied TRA to predict customers' adoption of such e-solutions in the banking sector (Al-Majali, 2011; Yousafzai et al., 2010; Shih & Fang, 2006). For example, Shih and Fang' study in 2006 showed results that the TRA explained 46% variance in behavioural intention while only 20% of variance in usage behaviour. However, Wan et al. (2005) claimed that adoption of online banking solutions cannot be clearly explained by TRA. Likewise, Yousafzai et al. (2010) claimed that TRA provided less accurate predictions of users' intention and adoption of online banking comparing with TAM and TPB models; it explained only 37% of variance in intention towards adoption of Internet banking.

There are several criticisms of TRA from different perspectives. For example, Ajzen (1985) realised that TRA was restricted by correspondence, because action, target, context, timeframe and specificity must be in agreement with attitude and intention in order to predict behaviour (Sheppard et al., 1988). The assumption that behaviour is under conscious control is a limitation of the theory, therefore the theory cannot account for any behaviour that is not conscious, such as irrational decisions and habitual actions (Sheppard et al., 1988). Moreover, there are some doubts about the applicability of TRA to explain users' behaviour in the context of technology acceptance (Hale et al., 2002; Davis et al., 1989; Sheppard et al., 1988).

### 1.2 Theory of Planned Behaviour (TPB)

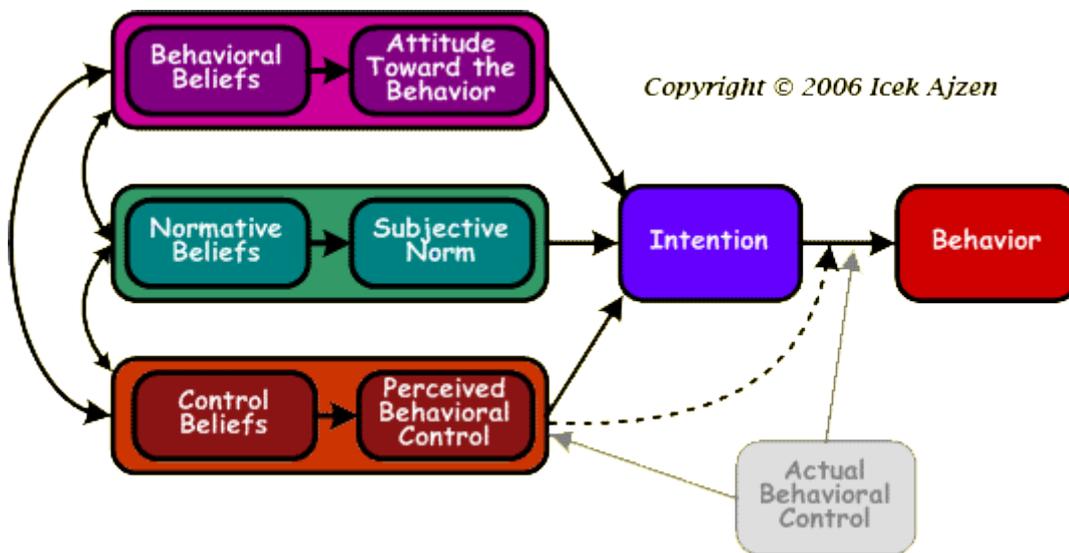
Ajzen (1985) put forward the Theory of Planned Behaviour due to the shortcomings of TRA. Ajzen (1985) extended TRA by adding the construct of perceived behavioural control (PBC) as a key factor affects both of behavioural intention and actual behaviour. TPB considers unconscious behaviour that is out of an individual's control and differs from TRA due to the addition of PBC. PBC accounts for behaviour where individuals have less control over their actions in certain situations and includes variables according to the situation and the actions involved (Ajzen, 1991).

PBC is viewed in general as the perception of simplicity or difficulty to perform a particular behaviour by the individual, which interrelates with belief, intention, behaviour and attitude within the TPB and accordingly influences intention and behaviour (see Figure 2). Its effect can be either direct or interactive. When an individual has control over their behaviour then objectives are all that are needed to predict behaviour, as the TRA states. Ajzen (1991) also debates that in situations where there was a small variance in behaviour that PBC should be independently predictive. Intentions and PBC have equal relevance when foretelling behaviour, but in certain conditions one may have a greater importance over the other.

In order for an accurate prediction, certain conditions must be apparent. Firstly, compatibility must be met between the measures of intention, PBC, and the behaviour to be foretold. Secondly, PBC must be stable in addition to intentions remaining stable between assessment and the observation of behaviour. Changes in behaviour control and intentions can alter if events intervene. The third condition necessary to gain an accurate prediction is accuracy of behavioural control. PBC and the resultant prediction of behaviour from it should improve to the extent that perception of behavioural control realistically reflects actual control (Ajzen, 1991).

TPB examines the originators of attitude, subjective norms and PBC to predict and explain behaviour. It assumes behaviour is a function of beliefs and therefore those beliefs are relevant to that behaviour and are predominant causes of a person's intentions and actions, Figure (2) illustrates these main beliefs:

Figure 2: Theory of Planned Behaviour



Source: Aizen (2006)

Aizen (2006) summarises these originators as behavioural beliefs; in other words, they are assumed to influence an individual's attitude towards behaviour, and the idea that the behaviour will determine a set outcome becomes a subjective probability. In terms of research, only a small number of behavioural beliefs are accessible at a time, regardless of the fact that an individual may hold many beliefs regarding a particular behaviour.

Normative beliefs are perceived behavioural expectations of important individuals or groups. When combined with motivation to comply with different referents it is assumed that this determines the subjective norm. Therefore, the incentive to conform to each referent contributes to the

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subjective norm in direct proportion to the person's subjective probability as to whether they should or should not perform the behaviour in question. Control beliefs are the perceived presence of factors that may facilitate or impede performance of behaviour; each control factor enjoys a certain power. It is this recognised power that contributes to PBC and the amount contributed is determined by the factors that are present in a situation requiring certain behaviour.

Ajzen (2002) also recognises at the general level differences of self-efficacy and PBC and previous ambiguous mistakes of PBC in terms of being able to effectively interchange with self-efficacy. He also acknowledged the difference between self-efficacy and PBC at the general level and recognised the misleading effect of the previous use of PBC interchangeably with self-efficacy. Furthermore, he mentioned that perceived control over performance of behaviour should be the term used for perceived behavioural control, to avoid further misinterpretation. However, he did argue that Bandura's (1977) theory regarding self-efficacy belief is restricted to internal factors and he claimed that PBC in TPB refers to expectations an individual has of the ability to perform a behaviour as well as whether they have the required resources, both internal and external.

TPB has been adapted and extended by numerous studies to predict the individuals' behavioural intention and actual usage across different technological contexts including banking solutions (Al-Lozi and Papazafeiropoulou, 2012; Lee, 2009; Chen et al., 2009; Choudrie and Dwivedi, 2006). for example, Lee (2009) adapted a theory of planned behaviour to fit with a technology acceptance model (TAM) to explain the adoption of Internet banking, while Chen et al. (2009) proposed TPB alongside with the technology readiness and TAM in a unified combined model to predict the users' satisfaction and continual intention toward using self-service technology. TPB combined with the diffusion of innovation (DOI) model by Liao et al. (1999) in order to examine the users' intention to adopt different channels of online banking in Hong Kong, and they reported that TPB can predict the intention to adopt such technologies with high variance in explaining the behavioural intention.

Yousafzai et al. (2010), compared the prediction power of TPB to TAM, which revealed that TAM was able to predict the behavioural intention by 75% of variance, while TPB explained only 39% of variance to predict the behavioural intention to use Internet banking. Likewise, Shih and Fang (2004) argued that even supposing TPB was capable to sufficiently fit the observed data, the path coefficient analyses showed that the attitude had significant impact over the behavioural intention whereas individuals' behavioural intention was not significantly related with both PBC and subjective norm.

It must be noted that models such as TRA and TPB are not without criticism. Both TRA and TPB are criticised by Taylor and Todd (1995a). They state that both required certain behaviours to be displayed when individuals are motivated to perform them. However, this can be a problem when examining consumer adoption behaviour, in addition to the supposition that respondents share an identical belief structure when performing behaviour.

Armitage and Conner (2001) mentioned that despite of the advanced improvements of TPB to modify TRA by including PBC, such limitations have been raised due to the fact that the TBP excepted some important scopes such as personal, motivational and psychological scopes and related factors. As an examples of such related factors; moral obligation, self-identity, and habit are not comprehended by TPB, which could have crucial role in predicting the behavioural intention and actual behaviour (Bamberg et al., 2003; Armitage & Conner, 2001; Sparks et al., 1995; and Sparks and Shepphard, 1992).

Other examples of important factors they have not been encompassed in TPB (perceived risk, performance expectancy, perceived usefulness, perceived ease of use, intrinsic motivation, technology readiness,) which, sequentially, raised some concerns about the capability of TPB to provide clear understanding regarding the individual's behavioural intention and actual behaviour toward new innovations and technologies (Chen et al., 2009; Davis et al., 1992; Liao et al., 1999; Taylor and Todd, 1995a; Yousafzai et al., 2010; Venkatesh et al., 2012).

Furthermore, a meta-analysis consisted of 185 researchers revealed that TPB usually explains 39% and 27% of variance to predict individuals' intention and actual behaviour respectively which considered as a small percentage of variance (Armitage & Conner, 2001).

### **1.3 The Decomposed Theory of Planned Behaviour (DTPB)**

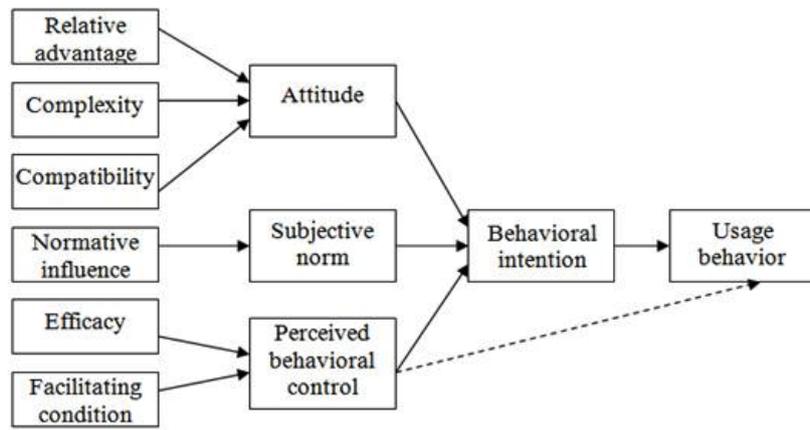
Taylor and Todd (1995a) anatomised the structure the TPB and specifically the part beliefs factors (behavioural beliefs, Normative beliefs and Control beliefs) to improve the explanation power of the TPB to predict customer's behavioural intention and actual behaviour towards a new system. Therefore, Taylor and Todd (1995a) introduced a decomposed model of TPB which is called DTPB as depicted in (Figure 3). Precisely, Taylor and Todd (1995a) itemised the behavioural beliefs into (relative advantage, complexity, and compatibility) and they hypothesised this new attitudinal belief dimension based on the innovation diffusion literature (Rogers, 1983).

With respect to normative beliefs, Taylor and Todd (1995a) suggested the normative influences to be the main factor to determine the normative belief over the subjective norms. Regarding to control beliefs, Taylor and Todd (1995a) classified this factor into: internal factors which is (self-efficacy) (Triandis, 1980) and external factors which is (facilitating conditions) (Bandura, 1982). Taylor and Todd's intention in this study was to take TRA, TPB and DTPB and examine their abilities to predict consumer behaviour and assess how appropriate each model was. They found that TRA and TPB were both capable, providing each model was used in its totality.

They were able to prove this using the structural equation model. However, they also found that whilst these two models were able to predict consumer behaviour, the decomposed model had advantages and was able to predict behaviour and explain the behaviour in a better way. As a result, DTPB was advocated as a better model if changes were required to marketing strategies or system designs by managers who wanted to change certain behaviours. Regarding to results of Taylor and Todd (1995a), DTPB shows better prediction power to user's adoption behaviour than TRA and TPB. Later TPB decomposed again by or disintegrated by Taylor and Todd (1995b) to create new model after combination of TPB and TAM.

It was coalesced due to the predictable nature of TPB and the constructs of TAM, which are perceived usefulness and ease of use. The model was developed by Taylor and Todd (1995a) and their intention was to break down or 'decompose' the concepts of TPB to include concepts from Diffusions of Innovation (DOI). Attitude, according to them, becomes decomposed to merge and include perceived usefulness, perceived ease of use and compatibility. They suggest that through decomposing TPB other components could be expanded. For example, included in the normative belief structure are the influences of peers and superiors, the control belief structure holds self-efficiency and the facilitating conditions of resources and technology as a core theme. The decomposition of TPB is shown in Figure 3.4.

**Figure 3.3: Theory of Planned Behaviour with beliefs decomposed.**

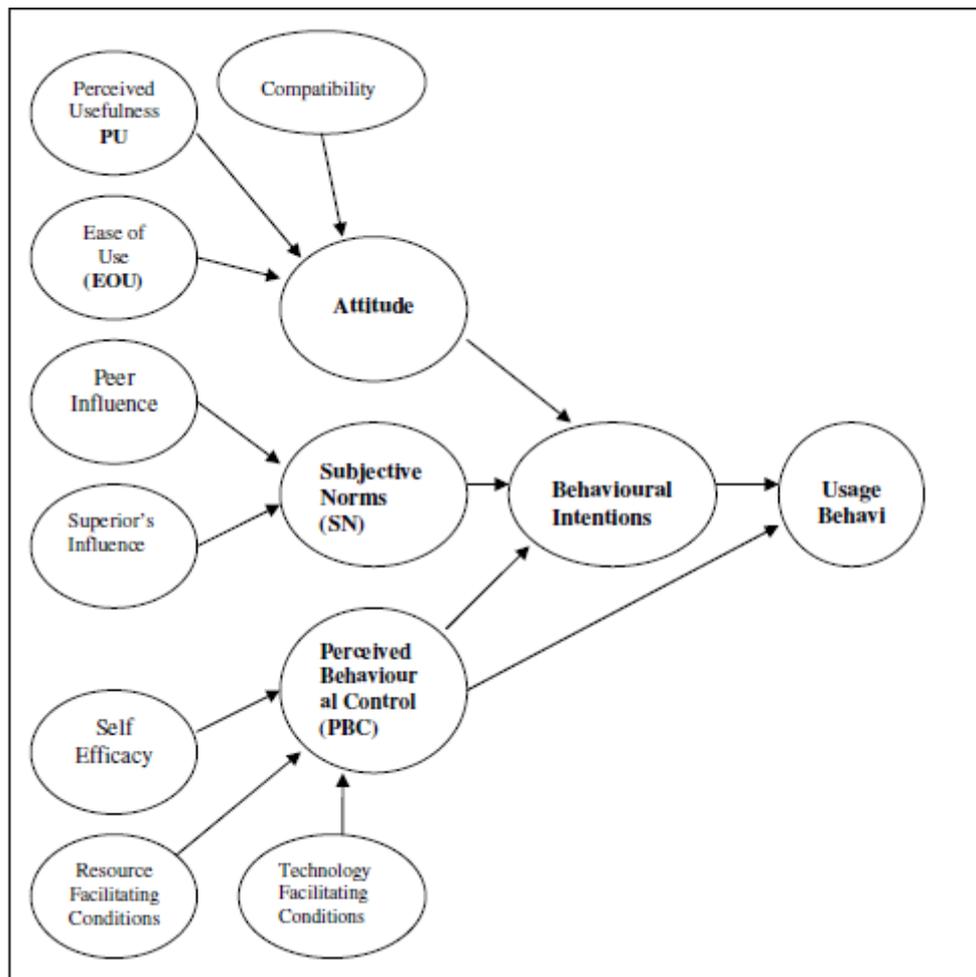


Source: Taylor and Todd (1995a)

Taylor and Todd (1995b) compiled a field study over twelve weeks with business school students. It was a comparative study concerned with the contribution of the models TAM, TPB and DTPB in relation to understanding IT usage (see Figure 6 for the decomposed version of TPB that Taylor & Todd used). In order to measure the attitude concepts of TPB they combined the DOI and TAM variables. They found with all models that measurements of constructs were similar; therefore, analysis reporting was compiled in identical formats for each model.

All three models were compatible for a comparative study as their ability to clarify IT usage was suitable with regards to statistical measurements that fitted the bill for assessing the data. However, DTPB had an advantage in terms of its ability to predict in comparison to TPB and TAM. Moreover, TPB had a better explanatory power than TAM in its original and decomposed forms when behavioural intention was measured. There were several factors that initiated Taylor and Todd (1995b) to come to this conclusion; firstly, the study and conclusion of decomposing SN to peer and supervisor influence was included through a number of theoretical based belief concepts, including PBC and the efficiency and resource features for this. Secondly in previous comparative studies shared constructs had not been measured in the same way across all three models.

**Figure 3.4: Theory of Planned Behaviour decomposed.**



Source: Taylor and Todd (1995b)

Due to the additions of DTPB the model is far more multifaceted and intricate than TPB, for instance. However, through the decomposition of the belief structure the BI model's power as an explanatory model increased. In the comparative study of DTPB and TAM both behaviour intention and the behaviour surrounding IT usage were able to be identified and explained due to the specific concepts within both models. Diagnostic value for managers was found by Taylor and Todd (1995b) to be better explained with the decomposed TPB model due to its belief structures being unidimensional. However, Taylor and Todd (1995b) criticised the DTPB as it is more complicated than TAM, which is comprised of eleven constructs comparing to Davis' (1989) model that consists of five constructs.

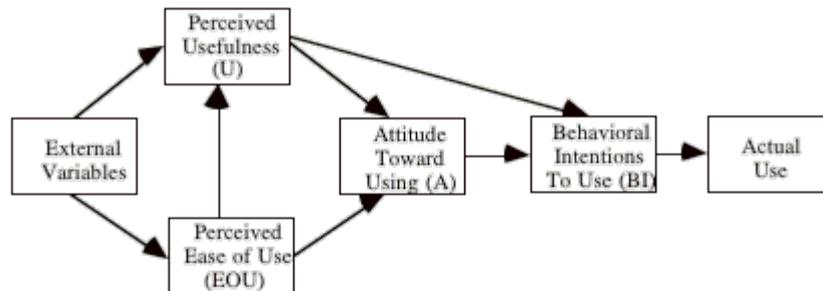
There are some of previous studies have used DTPB to explain the customers' behavioural intention and usage of such self-service technologies. For example, Shih and Fang (2004) reported in their study about the adoption of Internet banking that DTPB explained a 66% of variance in behavioural intention towards using such technology which is higher than the variance that given by both of TRA and TPB.

#### 1.4 Technology Acceptance Model (TAM)

Davis et al. (1989) developed the Technology Acceptance Model, which was based on the Theory of Reasoned Action. It was developed in order to discover what influences cause people to accept or reject an information technology (Figure 3.3). Davis suggests the most significant individual beliefs about using an information technology are perceived usefulness and perceived ease of use. Perceived usefulness (PU) is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (p. 320).

The definition of perceived usefulness is based on the expectancy-value model underlying the Theory of Reasoned Action. Perceived ease of use (PEOU) is defined as “the degree to which a person believes that using a particular system would be free of effort” (p. 320). Accordingly, these two behavioural beliefs lead to individual behaviour intention (BI) and actual behaviour. He found that PU was the strongest predictor of an individual’s intention to use an information technology.

**Figure 4: Technology Acceptance Model (TAM)**



Source: Davis et al. (1989)

TAM does not include TRA’s subjective norms (SN) as a determinant of Behavioural Intention (BI). Figure 3.3 demonstrates the original theoretical conceptualisation of TAM, including the attitude construct. However, regarding to empirical evidence, the last version of TAM model exempted the attitude construct because it’s weak mediating effect between PEOU and behavioural intention and the relation between PU and BI seemed more significant (Davis et al., 1989). TAM hypothesises that PU is influenced by PEOU because, the ease of the use of particular technology makes it more useful (Davis et al., 1989). In accordance with TRA, TAM model proposes that the influence of external factors on BI is mediated by PU and PEOU.

Within this model the set of variables such as design characteristics, objective system, computer self-efficacy, user involvement in design, training, and the nature of the implementation process are all external variables (Davis, 1996). However, as TAM evolution progressed with new variables were emerged, for example: compatibility, computer anxiety, system quality, enjoyment, experience and computing support (Lee et al., 2003). These are the most referenced variables that affect PU, PEOU, BI and B.

The relationship between the four main variables and TAM is conjectured as using PU as a dependent variable that affects BI directly and also as an independent as it is anticipated by PEOU. The amount of time, how frequently and actual amounts of usage and diversity of usage are all used to measure actual Use or Behaviour.

TAM considered as one of the most used and acceptable models within the field of technology acceptance (Eriksson et al., 2005; Venkatesh et al., 2003; Davis and Venkatesh, 1996). By 2010, report published by Google scholar showed that 7,714 citations have been referred for the original TAM model (Bradley, 2012). As mentioned before there is a continual evolution on the TAM model over the last decade. Wixom and Todd (2005) has seen the evolution of TAM from its original status, and they explained how TAM has extended through three perspectives. Firstly, the extended model included features from other models; for example, SN and PBC from TPB. The second extension saw the introduction of additional or alternative beliefs.

Most of these derived from the diffusion of innovation theory and included ideas such as compatibility, trialability, or visibility. The third extension examined PEOU and PU and the external variables that affected them, such as demographic characteristics and personality traits.

This model has progressed among three main phases of development: adoption, validation and extension (Han, 2003). TAM being tested through some simple information systems or technologies such as Fax database systems, Word, Excel, Emails, voice mail, also it has been tested among such technologies that related to internet applications, for example: World Wide web (www) services, online services, E-libraries (Han, 2003).

Davis et al. (1989) compared the TRA with the TAM over two time periods: the first immediately after their introduction, and the second 14 days later. The study was with MBA students and word processors. The result was that the objectives of the users were explained by the TAM better than the TRA. The TAM has been validated by many studies, for example, Adams et al. (1992) extended the Davis's (1989) study through the two-factor model PU and PEOU. Two communication systems, email and voice mail, were examined in ten varying organisations. Study one had 118 users and in study two 73 students were monitored using Lotus1-2-3, WordPerfect, and Harvard Graphics systems.

Venkatesh (2000) worked on a recommended control and adjustment based model as another extension in order to investigate the causes of PEOU in relation to a particular system. His model recommended a set of anchors, including: emotion conceptualised as computer anxiety; intrinsic motivation conceptualised as computer playfulness; and control processes (internal and external) conceptualised as computer efficacy; and facilitating conditions. The model was tested over three months in three organisations using three measurements. The anchors influenced early PEOU; however, with increased experience individuals were seen to change their PEOU concerning the system. Sixty per cent of the variance in PEOU was explained to be as a result of the proposed model of causes of PEOU after the study.

This implied that system specific PEOU are mainly individual difference variables and characteristics of situations that get stronger with understanding. Three years later, in 2003, Venkatesh et al. developed a model that combined all eight models used to explain technology acceptance behaviour. They called the new model the Unified Theory of Acceptance and Use of Technology (UTAUT) and this is will be discussed later in this section.

However, PEOU e and PU individually does not have the ability to clearly explain the individual's intention and such actual behaviours to adopt the technology (Lee et al., 2011; Kim and Forsythe, 2009; Eriksson and Nilsson, 2007; Agrawal and Prasad, 1999; Legris et al., 2003; Lu et al., 2009; Schwarz and Chin, 2007). Hence, the TAM has been extended by adding new factors such as perceived risk (Curran and Meuter, 2005), trust (Eriksson et al., 2005) and quality of Internet connection, perceived enjoyment, privacy and security (Pikkarainen et al., 2004). Al-Somali et al. (2009) extended TAM model by including social influences, resistance to change, quality, trust, awareness, and self-efficacy.

Sun and Zhang (2006) looked at fifty-five different articles and determined two deficiencies in TAM studies: firstly, the explanatory power of the model and secondly the inconsistent relationship among constructs. The data they deduced from the articles highlighted susceptibility of TAM's explanatory power from two viewpoints. One was that sixty per cent of the data did not explain the explanatory power of the model (Sun & Zhang, 2003; Venkatesh et al., 2003), and the second concerned the amount of variations used to explain the different methods used.

The studies also failed to represent the workplace; field studies were cross-sectional and were those that took part in the experiment were mainly students (Sun & Zhang, 2003). From the starting point of the introduction of technology to actual usage opinions change, so these limitations within the studies highlighted the need for these types of technology acceptance findings to be a longitudinal process. TAM was shown to be a vigorous model in some studies whilst in others it was highlighted as being weak; as a result, variable patterns emerged from the studies. For instance, there were discrepancies on how opinion and behaviour intentions were affected by PEOU.

The type of users also affected the relationship between PEOU and PU and whilst this relationship was considered in most studies, the differences between users were ascribed as exceptional because the effect of PEOU on PU was less likely with the most experienced users. Limitations such as a single information system, one organisation or a certain demographic group, a singular study, and not amalgamating tasks were all cited in the meta-analysis completed by Lee et al. (2003). After reviewing the Tam's literature, it is obvious that this model tailored to predict the behavioural intention and the actual behaviour from sole dimension, which is the employee perspective, and excluded the other scopes such as customers and users of other technologies.

### **1.5 Diffusion of Innovation Theory (DOI)**

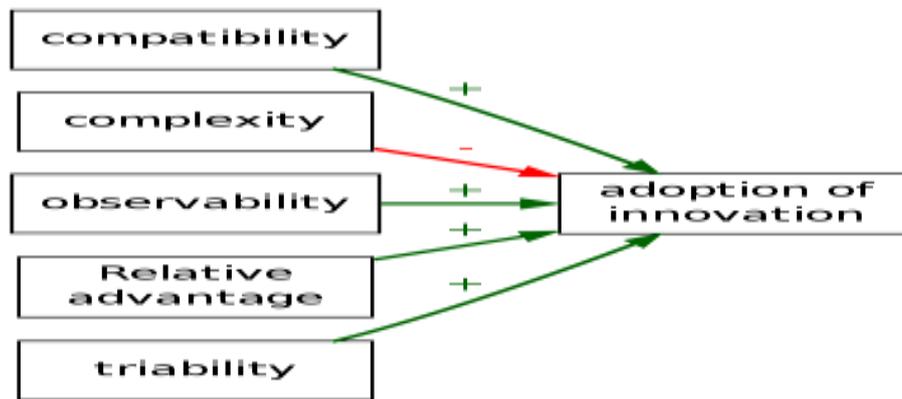
There was a need to understand how society accepts or does not accept innovation (Rogers, 2003), which inspired Rogers to establish the Diffusion of Innovation Theory (DOI) in 1962. This is considered one of the most important theories in the field of sociology and has been used within many innovations and inventions in different disciplines to evaluate their spread among the surrounded social system (Rogers, 2003). Rogers (2003, p.11) defined diffusion as "the process by which an innovation is communicated through certain channels over a time among members of the social system."

The adoption of a particular innovation is described as: "the process through which an organisation passes from first knowledge of an innovation, to forming an attitude towards the innovation, to a decision to adopt or reject, to implementation of the new idea" (Rogers 1983, p.21). Rogers (1995) also posited that the awareness of the innovation's features has an influence on the users' behavioural intention toward adopting the technology. According to Rogers (2003) oversimplification of previous research studies has led to incorrect analysis. He justifies this through stating that previous research has focussed on the differences between people, the users of innovations, as opposed to the differences between innovations.

According to Rogers (2003) there was a need for a classification structure of the perceived attributes to innovation that could be applied to all studies. However, he also noted and stressed the importance of the development of measures of perceived attributes to be individualised to each study as opposed to any prior investigations' scales of measurement. This would in turn affect the rate of innovation adoption, as instead of the perceived perceptions of an innovation belonging to experts; it would be an individual's perception of the attributes that would have influence on adoption.

Based on the DOI, there are five perceived attributes of an innovation hypothesized to predict the adoption of innovation, as explained in figure 3.6 (Rogers, 2003). According to Rogers, these attributes have the ability to explain 49 to 87 percent of variance in predicting the rate of adoption of innovations. The first of these attributes is relative advantage, which is the scale of perceived attributes of an innovation that displaces another. The second is compatibility, how an innovation is perceived to be well-matched with the values, experience and the needs of the prospective adopters. The third is complexity, how difficult an innovation is perceived to be to understand and use. Trialability is the fourth perceived attribute, in other words how can an innovation be experimented with on a trial basis before entering into full adoption. Finally, observability or how visible are the results of the innovation. These five attributes are interlinked whilst being individually distinct of each other.

**Figure 5: Diffusion of innovation theory**



Source: (Rogers, 2003).

The attributes discussed above have been central to much of both empirical and theoretical research through applying or examining the DOI and its validity to predict adoption in terms of technology acceptance (Oni and Papazafeiropoulou, 2012). For example, Tomatzy and Klein (1982) conducted a meta-analysis of 75 studies, they reviewed the characteristics of innovation and theories that were able to predict the adoption of innovations. In the articles they reviewed there were ten innovation attributes that appeared most frequently. The ten included Rogers' five but in addition were: cost, communicability, divisibility, profitability, and social approval. The study resulted in the suggestion that to clearly establish that perceived characteristics of an innovation are consistently related to innovation adoption and the implementation of any given innovation that measurement of various attributes had to be improved.

Karahanna et al. (1999) developed a theoretical framework that encompassed the DOI and other attitude-related theories to examine both beliefs and attitudes across pre/post adoption stages.

They provided empirical examination to explain the effects of some innovations' attributes on actual behaviour. They modified Roger's model by replacing the PU with relative advantage and PEOU with complexity. Another application of the DOI was in the model developed by Gerrard and Cunningham (2003), which combined the risk within the DOI to predict the adoption of Internet banking services by Singaporean banks' customers. In the same context, Liao et al. (1999) mixed some extracted constructs from the DOI and TPB to examine the adoption of Internet banking services in Hong Kong.

Despite of the adoption of applying the DOI to predict the acceptance of innovation in some literature, it also has been criticised in some quarters. For example, Wolfe (1994) claimed that DOI assumes that a single model is able to predict the adoption of diverse types of innovations among different kinds of individuals and contexts. Downs and Mohr (1976) debated that such important details as those related to the required cost and special facilities have been disregarded by the DOI. Additionally, Rogers (1976) criticised The DOI as disregarding social factors, such as how a social system could affect or foster the adoption of new innovations.

Despite the different disciplines that TAM and DOI came from there are similarities in the two theories, suggesting that they complement each other (Chen et al., 2002). The PU concept in TAM is considered to be the advantage attribute of an innovation. It is also considered that the complexity attribute has similarities with PEOU within TAM. Social cognitive theory (SCT) is discussed in the next section. SCT in this instance is reliant on concepts introduced by Rogers (2003) focussing on creating changes in individual behaviour.

### 1.6 The Social Cognitive Theory (SCT)

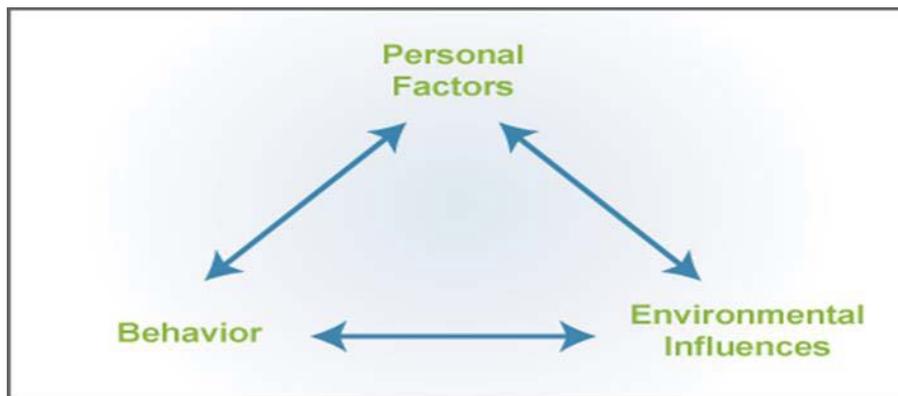
Social Learning Theory (SLT) developed in 1941 by Miller and Dollard is the basis of social cognitive theory (SCT), which is considered as the offspring of SLT. SLT has been modified over time and one such author of SLT is Albert Bandura, who introduced the concept of Vicarious

learning as a form of social learning. He is recognised as the first to lead on the development of cognitive SLT. Bandura renamed his variant of SLT as Social Cognitive Theory (SCT) (Brown, 1999).SCT assumes that the way individuals learn is influenced by their thoughts, feelings, and the environmental factors around them (Bandura et al., 1977). SCT focuses mainly on how social learning affects human behaviour and has been widely applied and examined in term of human behaviour by many studies (Bandura, 1986).Furthermore, SCT is often considered a very powerful theory of human behaviour (Beekens, 2011).

SCT has been developed based on ‘reciprocal determinism’, which means mutual interactions. SCT theorizesthere are three main factors: environmental factors, personal factors, and behaviour, as shown in Figure 3.7 (Bandura, 1986).In SCT Bandura introduced concepts such as reciprocal determinants, self-efficacy, as well as his idea that temporal variation (time lapse) could occur between cause and effect. He noted that there was analysis of learning through one’s own behaviour before Miller & Dollard’s 1941 study on behaviourism, and that finding a connection through reward and punishment systems as well as stimulus and response enabled an explanation mechanism.

The key features of SCT are as follows: Reciprocal Determinism states that human behaviour results from a triadic, dynamic, and reciprocal interaction of environment and also personal factors. Some influences are stronger than others, as argued by Bandura. He also claims that interaction differs between individuals and also is dependent on the situation (Pajares, 2002). Biological properties such as gender and ethnicity influence personal factors and behaviour; therefore, behaviour will differ between groups and individuals and is dependent on expectations, belief, self-perception and so on.

**Figure 6: The social cognitive theory (SCT)**



Source: (Bandura, 1986)

Which environmental influences are accessed is determined by behaviour and vice versa; therefore, the environment influences which behaviour is displayed and developed (Bandura, 1989). For instance, physical structures and social influences in an environment both play a part in developing expectations, beliefs and cognitive capabilities.

Another key feature of SCT is Vicarious Capacity. This involves learning through experience or studying others people’s learning ideas in order to develop beliefs about behaviours without needing to display them. This has many advantages, including time management and avoiding mistakes, as experience is gained through observation; therefore, there is no need for trial and error. New patterns of behaviour, cognitive competences and rules regarding new behaviours as well as self-evaluation and standards concerning judgements are all learning models, as stated by Bandura (1989).When it comes to studying individual behaviour SCT is considered a worthy model and is also validated (Igbaria & Iivari, 1995; Compeau & Higgins, 1995a).

Self-efficacy judgement has been researched in how it encourages or dissuades particular behaviours concerning adoption of technologies, especially in the IS/IT field. Compeau and Higgins (1995a) completed a pragmatic study to measure and validate the influence of computer self-efficacy. They explained that self-efficacy has three interdependent but separately distinctive dimensions. Firstly, magnitude, referring to the level of a task one is able to complete; for example, the higher the magnitude a person believes they have, the more complex a task can be completed.

The second dimension is strength. Self-efficiency strength concerns an individuals' judgement on their own efficiency; for instance, the higher the self-efficiency strength the more difficult the problems will be faced and solved. However, self-efficiency strength can lead to frustration and not being able to solve an issue. This gives an indication that perceptions of self-efficacy can limit individuals in certain situations whilst others will thrive. Therefore, different behaviours will be displayed. Self-efficacy and its factors were added to TAM by Igbaria & Iivari (1995) as affecting computer anxiety, TAM constructs (PEOU & PU), and usage of computer technology. The results concluded with other research showed high internal consistency of PEOU & PU measures. The results also reinforced SCT perspective of computing behaviour concerning beliefs and behaviours surrounding self-efficiency and supported Bandura's (1986) conjecture of experience as the most influential determinant of self-efficacy.

There are some The Connexions between SCT and DOI Theory, in reference to Rogers Diffusion of Innovation Theory a chapter on the integration of social cognitive theory and social diffusion theory was written by Bandura in 2006. He states: "Social cognitive theory distinguishes among three separable components in the social diffusion of innovation. This triadic model includes the determinants and mechanisms governing the acquisition of knowledge and skills concerning the innovation; adoption of that innovation in practice; and the social networks through which innovations are promulgated and supported" (Bandura 2006, p 119). The process of social diffusion is varying because, according to Bandura, how knowledge is gained is through advances in communication technologies. Ideas, values and behaviours are now globalised and electronic media has seen observational learning increase as a key tool in innovation diffusion, especially when it was in its infant stages.

### **1.7 The Model of PC Utilization (MPCU)**

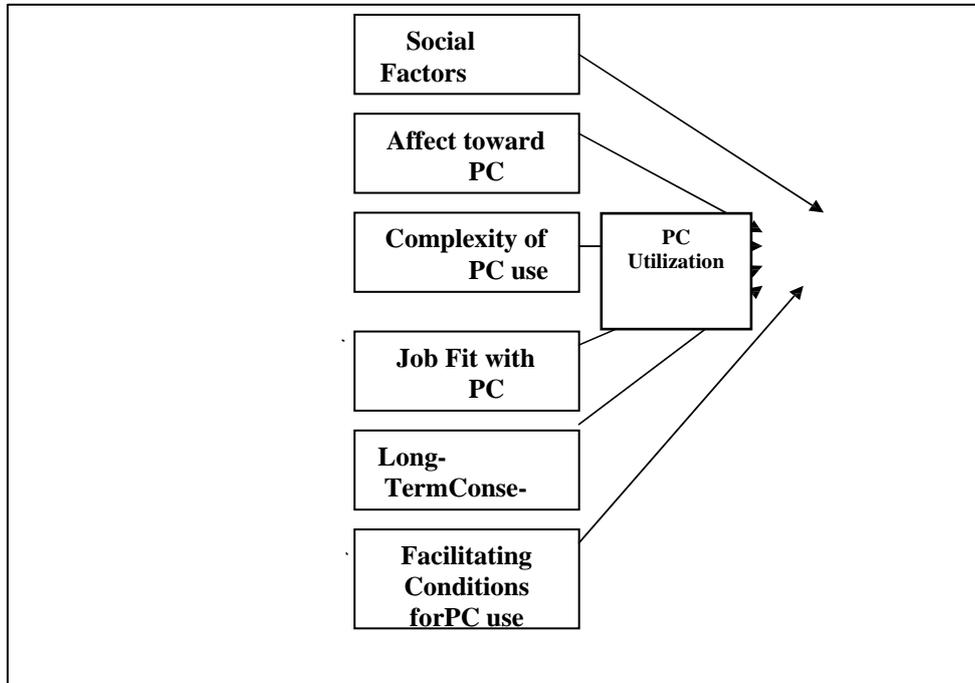
Triandis (1979) developed a framework to highlight variables that trigger behaviour. He was enthused to do so as there was a lack of agreement amongst disciplines. His framework was relevant for research in all cultures as it contained variables that were general and conceptual. He said that people were influenced by behaviour that had objective consequences stating that perceived consequences were affected by reinforcement twofold. Firstly, because a behaviour has consequences, it alters the perceived probabilities of the said behaviour and secondly the value of the probabilities alters. Within the framework habit, facilitating conditions and prior experience as well as cultural variables are also determinants that have an effect on behaviour and behavioural intentions.

Behaviour has consequences, some of which are only perceived by the individual. Triandis made a distinction between perceived and actual consequences stating the perceived are predictable outcomes whilst actual consequence result after a behaviour has been actioned and can be either desirable or undesirable. Triandis claims that the behaviour-consequence reinforcement sequence is susceptible to changes in what the perceived consequences are and the value they hold, with values being interrelated with a given situation and being open to interpretation with regards to consequence.

A person is more likely to connect with behaviour-consequence when consequence is unanticipated. Education, access to resources and complexity of culture are all aspects of the framework that aid the development of behaviour. Triandis (1979) stated that the determinants of behaviour are the attributes of ecology culture-society that determine the attributes of the individual and that attitudes and the values placed on behaviours change in respect of the consequences of a behaviour. Based on Triandis' theory of human behaviour, Thompson et al. (1991) developed a model to predict the actual behaviour to use personal computers. According to Thompson et al. (1991) make up this model as seen in figure 3.8 of six constructs which are: job-fit, social factors, complexity, facilitating conditions, affect towards use, and long-term consequences. Thompson et al.

(1991) theorised a direct relation between individual effect and usage of PC, he assumed that the individual's effect, feeling, or emotion has a direct impact on the usage of PC. Thompson et al. (1991) further proposed the facilitating conditions as a crucial factor to determine the actual usage, which means the required resources and facilities such as the infrastructure, technical support and training to achieve successful use of a particular system.

**Figure 7: the model of PC Utilization MPCU**



Source: Thompson et al. (1991)

Chang and Cheung (2001) proposed a model based upon Triandis' model targeting the users of internet (www). They replaced the usage with behavioural intention, as they believed that the behaviour is result of the intention.

### 1.8 The Motivational Model (MM)

Many of studies in the field of human behaviour consider motivational factors as main determinants among different contexts of individual behaviour (Davis et al., 1992; Vallerand, 1997). There are many theories based on motivation, Deci and Ryan (1985) Self-Determination Theory (SDT) posits that experience of choice is implicated in self-determination. Deci et al. (1991) asserted that STD was able to distinguish between intentional regulation and self-determination and that this set apart SDT from other theories. Actions are controlled, they claimed, when compelled by internal or external forces, whereas motivational actions are set apart as being self-determined as the individual endorses them. Which led to divide the motivational factors into two main classifications: intrinsic motivation and extrinsic motivation (Davis et al., 1992; Vallerand, 1997). Intrinsic motivation as defined by Vallerand (1997) is related to internal or intangible rewarding such as the feeling of pleasure or enjoyment, which affect the individuals' behaviour regardless of the expected outcomes of such performance.

In contrast, extrinsic motivation relates to tangential incentives or rewards that motivate the individuals to behave in order to gain prized outcomes such as time saving, and job efficiency (Davis et al., 1992). The difference between being intrinsically motivated and extrinsically motivated and the behaviours they create is that the first involves gaining satisfaction from engaging in a behaviour without any material gain, whereas extrinsically motivated behaviours are actioned as a means to an end, a necessity not through choice (Vallerand and Bissonnette, 1992). In terms of technology acceptance, Davis, Bagozzi and Warshaw (1992) tested the motivational model of technology acceptance. They found that extrinsic and intrinsic motivations were at the forefront of intentional behaviour regarding technology usage. The study was concerned with the use of computers in the

workplace. In this instance, the extrinsic motivation was that if the technology was perceived as being useful then it would reap financial rewards and the intrinsic motivation was the perceived gratification of using this technology irrespective of outcomes.

The results highlighted that perceptions in the first instance concerned job performance, whether using computers would enhance this and the second perception was the experience and the scale of enjoyment from using them. This highlighted that increasing enjoyment of using a computer system that was useful would be affective to acceptance (Davis et al., 1992). Davis et al. (1992) empirically reported that the predictive power of perceived usefulness and enjoyment to predict the behavioural intention was 62 percent and 75 percent of variance respectively. A later study compiled by Venkatsh, Speier and Moris (2002) developed an integrated model of technology acceptance through reanalysing data from the earlier research studies (Venkatesh 1999; Venkatesh and Speier, 1999). The integrated model took the fundamental ideas of technology acceptance and motivational models and examined them at length. This was done through empirically testing the new model with existing models to discover their explanatory power.

### **1.9 The Unified Theory of Acceptance and Use of Technology (UTAUT)**

As mentioned before in this chapter, there are several models and theories applied in the context of acceptance of technologies and innovations to explain which are the main factors that affect the individual's behavioural intention and actual behaviour (Dwivedi et al., 2011; Venkatesh et al., 2003). The researchers in the field of technology acceptance are more likely to choose a favoured model or theory for study due to the range of choices, and overlook contributions afforded from alternative models as noted by Venkatesh et al. (2003).

Venkatesh and colleagues agreed that a fusion of models was required to attain a unified view of users' technology acceptance. They compared the eight principal models TRA, TPB, TAM, combined TAM - TPB, DOI, SCT, MM, and MPCU that have all been used to explain technology acceptance behaviour and as a result, five limitations of previous comparisons of models was derived from the study.

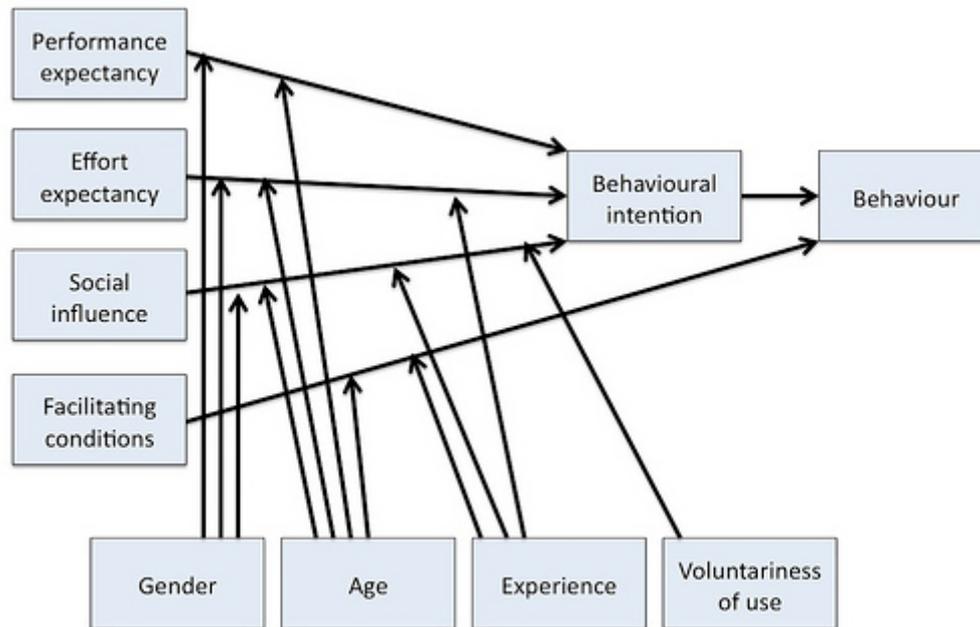
Firstly, the technologies that had been studied were not complex in nature but were simple and individual in nature and did not include sophisticated technology. Secondly, most of the studies had been completed with students as the sole contributors. A third limitation was that in the majority of studies the time of measurement had been generalised and completed long after acceptance or rejection of a technology, and therefore reactions were outdated. Fourthly, Cross-sectional measurement was prevalent, and the fifth limitation was that it was hard to generalise results as the majority of research had been completed in voluntary circumstance of usage rather than compulsory use.

Venkatesh et al. (2003) compared the eight models empirically in longitudinal field studies within four organisations where new technologies were introduced to individuals. Three different times were used for measurement and were post training; this was measured twice after implementation at the one month and three-month point, and usage behaviour was measured over the entire six-month period of implementation. Each of the eight models were then applied to the data that had been divided by two for compulsory and voluntary conditions. Moderating variables that included experience, voluntariness, age, and gender were studied as they had been expected due to prior research to alter usage decisions. After moderators had been included predictive validity increased across six of the eight models, with the exception of MM and SCT.

Venkatesh et al. (2003) reported their statistical findings after a longitudinal empirical study, it shows that the aforementioned eight models had the prediction power as 17 percent to 53 percent of variance to predict the behavioural intention to use the new systems. They found that the predictive power of these models could be enhanced by including some moderating variables through these models (Venkatesh et al., 2003). At that point, UTAUT was applied and examined, and empirically shown 70 percent of variance prediction power as empirically reported by Venkatesh et al. (2003). Venkatesh et al. (2003) proposed three main constructs (performance expectancy, effort expectancy and social influences) as shown in figure

3.8 that directly determine the behavioural intention and two other constructs influence the actual behaviour (usage), which are behavioural intention and facilitating conditions. The relationships between these constructs is shown in Figure 3.8.

**Figure 8: The Unified Theory of Acceptance and Use of Technology**



Source: Venkatesh et al. (2003)

*Performance expectancy* (PE) is defined as “the degree to which an individual believes that applying the technology will help him or her to attain gains in job performance” (Venkatesh et al., 2003, p. 447). Venkatesh et al. (2003) identified that this construct has been derived from other factors in related theories and models which are: perceived usefulness (TAM and C-TAM-TPB), outcome expectation (SCT), relative advantage (IDT), job fit (MPCU), and extrinsic motivation (MM). Performance expectancy was the most significant factor to affect the behavioural intention amongst any individual theory within different contexts (Venkatesh et al., 2003).

According Venkatesh et al. (2003, p.450) *Effort Expectancy* (EE) is defined as the “extent of ease connected with the use of system.” EE has been captured from other related factors from existing theories such as ease of use (Moore and Benbasat, 1991), perceived ease of use (Davis et al., 1989; Venkatesh and Davis, 2000) and complexity (Thompson et al., 1991). EE showed significant impact on the behavioural intention within either mandatory or voluntary contexts either at or at mandatory setting. However, Venkatesh et al. (2003) claimed that the role of this factor is limited by the time after the training-stage of the users.

*Social influence* defined as “the degree to which an individual perceives that others believe he or she should use the new system” (Venkatesh et al., 2003; p.451). Social influence is apprehended from subjective norm in the models of TRA, TAM2, TPB/DTPB and C-TAM-TPB, social factors in MPCU, and image in DOI. Worthwhile to mention that the social influence construct has significant impact on behavioural intention exclusively within mandatory context (Venkatesh et al., 2003).

*Facilitating Conditions* according to UTAUT is “the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system” (Venkatesh et al., 2003, p.453). The construct of facilitating conditions referred to other different factors: compatibility in DOI, perceived behavioural control in TPB, C-TAM, and, DTPB and facilitating conditions in MPCU. All of these constructs have same

influences on the behavioural intention within both of mandatory or voluntary contexts (Venkatesh et al., 2003). However, according to Venkatesh et al. (2003), the impact of facilitating conditions on the behavioural intention could be limited or insignificant after the training stage. Moreover, Ajzen (1985) and Taylor and Todd (1995a) assumed that facilitating may have direct effect on the actual usage behaviour.

It is worth to mention that there is an extension of the UTAUT which has been extended by Venkatesh et al. (2012) by adding three other constructs to the original model of UTAUT (hedonic motivation, price value and habit), this extension is called UTAUT2. Further details about the UTAUT2 later in this section.

### 1.9.1 Applicability of the UTAUT Model

The UTAUT model endeavoured to cope with the drawbacks of other models in technology acceptance. Some older technology acceptance models, such as TAM, did not include other important constructs because they sought after simplicity during the models' development (Benbasat & Barki, 2007). The development of the UTAUT model was premised on the similarities of the constructs from several existing models, which enhanced this model's ability to explain users' behaviours. This could not have been achieved individually by any older model. This trait of Comprehensiveness has led the UTAUT model to be considered by some researchers in the field of technology acceptance as the benchmark of most predictive models (Weerakkody et al., 2013).

Knutsen (2005) used a subdivision of the UTAUT in order to assess a new mobile service performance and its related factors in order to explain the effects of such factors on customer attitudes towards new mobile services. Effort expectancy, performance expectancy and age as an antecedent to the UTAUT constructs, plus the construct of the attitude, were part of the research design. Knutsen (2005) theorised that effort expectancy affected performance expectancy. Again, data was gained in different periods; the first was before the introduction of the trial version and the second after two weeks of the mobile service trial. The results substantiated the relationship that existed between effort expectancy and performance expectancy and attitude and the relationship of only effort expectancy and performance expectancy.

Effort expectancy and performance expectancy were shown to be strong determinants of attitude displayed concerning new mobile services. Moreover, an increase in age correlated to concerns regarding ease of use of new services. Age also affected effort expectancy in a negative capacity but it had a positive effect on attitude towards performance expectancy. This, according to Knutsen (2005), showed that older users of mobile services had higher expectations. The eight dominant models had influenced this model's structure due to the similarities they shared. Therefore, the power of UTAUT should not be underestimated simply because published studies utilising it are rare.

Li and Kishore (2006) studied the new measurement scale of the UTAUT in order to test for invariances. Their quest was to test whether the key constructs in the UTAUT model were invariant across different population subgroups. They chose web log system users as their group for research and the subgroups were split according to demographics, including user's gender, user's general computing knowledge, user's specific Web log-related knowledge, user's experience with Web logs, and user's usage frequency of Web logs. They theorised that UTAUT had four main constructs that would not vary across subgroups including gender, low and high computing general knowledge users, users with or without particular Web log knowledge/ experience, and users with low and high frequency use of Web logs.

There were three stages to the data analysis. The first split the data along the lines of demographics, with two balanced groups in each of the dimensions. The second stage involved measuring equivalent-item-factor loadings or measurement of tau-equivalence. This was measured under each dimension and across the two groups. Full equivalence under each dimension was tested and recognised as the third stage of the analysis. Different experience and knowledge amongst users resulted in the same interpretation of effort and performance expectancy. Social influence was not interpreted in the same way with users having either a high or low frequency of Web log usage. The scores of facilitating conditions with

varying levels of web log experience were also not interpreted in the same fashion from the perspective of statistical significance; however, they were compared for computing and Web log knowledge. This statistical significance is not indicative of a large difference in the score of these subgroups, as the authors argued that gender specific statistics showed that they were comparable when looking at effort expectancy and facilitating conditions.

UTAUT model needed to be either extended or modified in order to explain differences in adoption behaviour concerning mobile devices and services (Carlsson et al., 2006). The results they gained from the study did not support across the board all the cases within the original UTAUT and this is recognised by the authors. Therefore, they were justified in their initial thoughts that UTAUT was not a complete model to explain behaviours of intention and usage of mobile devices and services in a coordinated way.

Moreover, there is moderately a small number of related studies that have adopted and applied the UTAUT model to explain the acceptance and usage of such self-service technologies, particularly within the context of banking electronic solutions such as (Martins et al., 2014; Al-Qeisi & Abdallah, 2013; Riffai et al. 2012; Yu, 2012; AbuShanab et al., 2010). While some studies added external constructs to the UTAUT model such as Perceived risk, Website quality perceptions, Education level and output quality (Martins et al., 2014; Al-Qeisi & Abdallah, 2013; Wang & Shih, 2009; Riffai et al. 2012), others combined the UTAUT model with other models such as the theory of task technology fit (Zhou et al., 2010).

Alalwan et al. (2017) conducted a study based on the UTAUT2, targeting bank customers in Jordan who used Mobile banking services. After analysing the data collected from 334 distributed questionnaires, they reported that the behavioural intention construct was affected significantly and positively by performance expectancy, effort expectancy, hedonic motivation, price value, and trust. Al-Qeisi and Abdallah (2013) extended the UTAUT model by adding the external constructs (Website quality perceptions, education and income). Uniquely, this study focused on the Jordanian bank customers' actual usage of internet banking services rather than their behavioural intention. Another study within the Jordanian context applied by AbuShanab et al. (2010).

They modified the UTAUT model on purpose to explain the acceptance of internet banking by Jordanian bank customers. They added some external factors (self-efficacy, technology anxiety, perceived risk, internal locus of control, trust and innovativeness). AbuShanab et al. (2010) testified the modified model, which resulted in 48% of the variance to explain the intention to use internet banking comparing to 43% of variance to predict the intention of banks customers by the original model.

In the same manner, Riffai et al. (2012) modified the UTAUT model by encompassing other external variables (website design, trust, playfulness, output quality and awareness) to explain the adoption of online banking services by Omani banks customers. Their results showed that the adoption of online banking services was significantly affected by performance expectancy and effort expectancy but the social influences construct had a non-significant effect over the customers' intention to adopt such technology. By contrast, to modifying the UTAUT model, Zhou et al. (2010) combined the UTAUT model with the theory of task technology fit (TTF). They suggested new conceptual model that presented a mix of factors that extracted from both models, their results indicate that the proposed model provided prediction power of 57.5% of variance to adopt Mobile banking services, compared to explanation power of 45.7% and 43.3% percent of variance to UTAUT and TTF respectively.

Martins et al. (2014) formulated an extension of the UTAUT model by including the construct of perceived risk to examine the Portuguese banks customer's behavioural intention and actual usage of Internet banking services. The basic UTAUT model including constructs of (performance expectancy, effort expectancy and social influence) provided 56% of variance to predict the adoption of Portuguese customers toward Internet banking services. However, the extended model with construct of perceived risk showed 60% of variance to predict the customers' behavioural intention and 81% of variance to explain the customers' actual usage towards Internet banking services (Martins et al., 2014). Dwivedi et al. (2011)

provided another evidence to approve the UTAUT's validity. They conducted a meta-analysis of 43 previous studies that applied the UTAUT; the results show that the construct performance expectancy had the most significant effect on the behavioural intention. Additionally, Dwivedi et al. (2011) confirmed that the constructs effort expectancy, social influences and facilitating conditions were crucial factors to predict behavioural intention.

As mentioned before, due to the inclusiveness of the UTAUT model and its high prediction power, it has been applied and adopted by many researchers in the field of technology acceptance (Slade et al., 2014; Alryalat et al., 2012; AbuShanab et al., 2010). This wide utilisation of UTAUT among different kinds of innovations, users, countries and cultures support its validity, applicability and generalisability (Alalwan et al., 2017; Slade et al., 2014; Rana et al., 2013; Al-Qeisi and Abdallah, 2013; Alryalat et al., 2012; Venkatesh et al., 2012; Zhou et al., 2010).

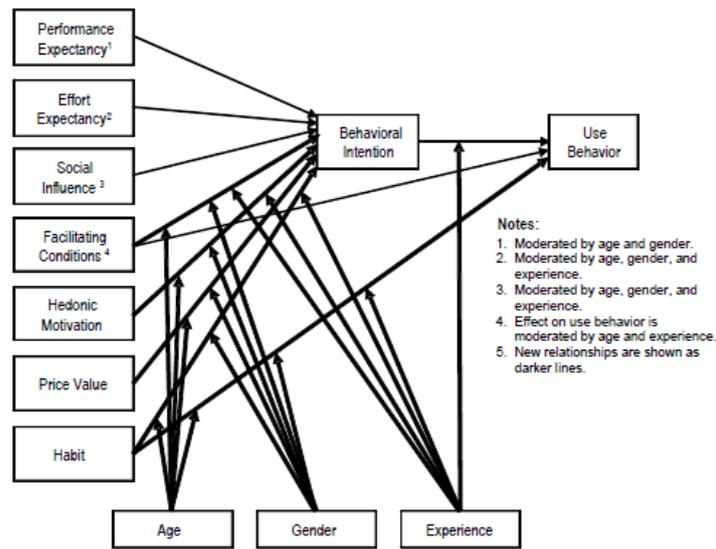
Despite these unique traits and the inclusiveness of the UTAUT model, there are some criticisms of some of its aspects. Primarily, the UTAUT model is applied to explain the adoption of technology from the perspective of employees, so there is some concerns about its applicability within other contexts, such as customers or students (Venkatesh et al., 2012). Additionally, even though the UTAUT authors reviewed the most common constructs from the eight dominant models in technology acceptance, they only selected the four most significant constructs (PE, EE, SI and FC) among 49 constructs that affect both behavioural intention and actual usage; therefore, they neglected the other factors (Venkatesh et al., 2012; AbuShanab et al. 2010). In addition, some studies have contradicted the claim for a high prediction power of the UTAUT model, as their results found this model to have poor prediction power (Chiu et al., 2010).

### **1.9.3 The Extended Unified Theory of Acceptance and Use of Technology (UTAUT2)**

As mentioned before, UTAUT2 was an extension of the original UTAUT, extended by adding three external constructs (Hedonic motivation, Habit and Price value). Venkatesh et al. (2012) modified the UTAUT model with the purpose of validating this model from the perspectives of customers. They assumed that individual differences (age, gender and experience) would have moderating effects over the relations between the constructs and both behavioural intention and the actual usage of the mobile internet, as depicted in figure 3.10 (Venkatesh et al., 2012).

Price value means “consumer’s cognitive trade-off between the perceived benefits of the application and the monetary cost for using it” (Venkatesh et al., 2012, p.161). Hedonic motivation is defined as the enjoyment or joy that is caused by using a particular technology (Venkatesh et al., 2012). This construct is captured from different factors such as enjoyment, playfulness, and joy, which are significant factors to determine the users’ adoption of technology (Brown and Venkatesh, 2005; Van der Heijden 2004). According to Venkatesh et al. (2012, p.161) habit means “the extent to which people tend to perform behaviour automatically because of learning.”

**Figure 9: The extended Unified Theory of Acceptance and Use of Technology (UTAUT2)**



Source: Venkatesh et al. (2012)

Venkatesh et al. (2012) reported their findings after two stages of online survey of 1,512 mobile internet users. The results supported strongly the predictive power of UTAUT2, which revealed 74% and 52% of variance in behavioural intention and actual usage respectively, while the UTAUT provided 56% in behavioural intention and 40 % in the actual usage of mobile internet (Venkatesh et al., 2012).

Morosan and DeFranco(2016)revisited the UTAUT2 model to establish a comprehensive model to explain the acceptance of near field communication (NFC) mobile payments. Based on 794 respondents comprising American hotel customers, they reported that performance expectancy was the strongest construct to predict behavioural intention; while other factors (habit, hedonic motivation, and social influence) had lower effects. In the same manner, Alalwan et al. (2017) agreed with Morosan and DeFranco(2016). They applied UTAUT2 targeting Jordanian bank customers who used Mobile banking services. After analysing the data that collected from 334 distributed questionnaires, they reported that the behavioural intention construct was affected significantly and positively by performance expectancy, effort expectancy, hedonic motivation, price value and trust.

Compared to previous technology acceptance models, Venkatesh et al. (2012) considered UTAUT2 as the most powerful model to explain behavioural intention. Empirically it scored the highest variance rate in behavioural intention (74%), which has never been accomplished by other models. On the other hand, there are some concerns about the generalisability of UTAUT2, as their study was conducted in Hong Kong, which has a high rate of mobile penetration and usage. It is therefore not comparable with this study as it is conducting in Jordan, which has a lower rate of mobile usage and penetration. Moreover, UTAUT2's sample was skewed, which is another concern about its generalisability, as the mean age of their study sample was 31; maybe it is inapplicable to older ages (Venkatesh et al., 2012).

UTAUT2 targeted mobile internet uses in general; they focused on both utilitarian (e.g. Business uses) and hedonic (e.g. mobile games apps) mobile uses. Nevertheless, this study focuses only and mainly on the utilitarian use of the mobile, in terms of performing banking services. Despite the high results of UTAUT2 regarding its ability to predict users' behavioural intention and actual behaviour to adopt technology, it does not match the objectives of this study, as the added three factors (habit, hedonic motivation and price value) are not within the scope of this study. Furthermore, the habit construct will not be useful to consider in this study. Jordan is a developing country, therefore mobile banking service can be considered in their early stages, and the adoption of such technology is still low (Al-Rfou, 2013).

Regarding the hedonic motivation construct, as mentioned before this study focuses mainly on mobile banking apps, which are clear example of the utilitarian use of the mobile device and therefore apart from the hedonic context. The construct of Price value is not considered in this study as the mobile banking apps are free to download from banks’ website or mobile stores, and the use of such apps does not require any prepaid subscription with the banking services suppliers. However, UTAUT2 is an extension of UTAUT, and it is a good example of how UTAUT could be applied within customers’ context (Venkatesh et al., 2012), which coincides with the main aim of this study that targets Jordanian bank customers.

Finally, this section has provided an overview of the most common technology acceptance models and their common constructs, as summarized below in table 1. Moreover, this section has explained the development and evolution of every model, noted some models’ extensions and modifications, and reported some empirical results from previous studies that applied and adopted such models.

**Table 1: The common constructs among technology acceptance models**

<b>Technology acceptance model</b>	<b>Common constructs affecting behaviour (Intention and actual behaviour)</b>
<b>TRA</b>	Attitude / subjective norms / perceptions
<b>TPB</b>	Attitude / subjective norms / perceived behavioural control
<b>DTPB</b>	Relative advantage / complexity / compatibility / normative influence / efficacy / facilitating conditions / Attitude / subjective norms / perceived behavioural control
<b>TAM</b>	Perceived usefulness / perceived ease of use / attitude
<b>DOI</b>	Innovation features / innovators characteristics
<b>SCT</b>	Personal factors / environmental influences
<b>MPCU</b>	Affect / individual beliefs / social factors / habit / facilitating conditions / complexity/ long-term consequences
<b>MM</b>	Intrinsic motivation / perceived benefits / external pressure
<b>UTAUT</b>	Performance expectancy / effort expectancy / social influence / facilitating conditions
<b>UTAUT2</b>	Performance expectancy / effort expectancy / social influence / facilitating conditions / habit / hedonic motivation / price value

### Methodology

A review of relevant literature is an essential trait of any study. The effective review creates a solid foundation for advancing knowledge; it facilitates theory development, closes areas where overabundance of research exists, and uncovers areas where research is needed (Chiou, 2010). To identify scientific publications that aim to investigate the technology acceptance models, a literature review that synthesizes published work was conducted. This concept-centric review made a broad search for the relevant publications on the topic rather than limiting the search to specific years or specific journals and/or conferences (Chiou, 2010). The review follows trends, and thus, particular research approaches might have been more common during certain periods.

For the purposes of the review, the literature search was undertaken in a 3-month period. The following international online bibliographic databases were consulted:

- ISI Web of Knowledge
- EBSCO Host (consisting of Academic Search Complete and PsycINFO)
- ACM

- ERIC
- ISI Web of Science
- Science Direct
- Google Scholar

The search text used was (“Technology Acceptance Models” OR “Technology Acceptance”). Searches were limited to publications written in English and published in journals and conference proceedings, from 1976 onwards.

### Conclusion

This paper reviewed the related literature of main models and theories that used in previous studies to study the adoption of innovations in different areas such as online banking, mobile banking, E-learning and E-health care systems. Despite of the increasing development of technology and its incorporation into users’ privacy and professional life, a decision regarding to adopt or reject it remains an open question. Thus, a well thought-of amount of research work dealing with the technology acceptance models was conducted among various disciplines.

The paper identified the main theories and models that employed to investigate and study the adoption of innovations such as TRA, TPB, TAM, UTAUT. Also, presented insights about the applicability and the limitations and criticisms about the most dominant theories and models in the field of technology acceptance.

Moreover, this study summarised the main factors that influence the adoption of innovations and mapped such factors with previous factors that derived from, which clarifies the origin of such factors and highlights the power of each factor in influencing the adoption of innovations and provided experimental results from previous studies in this regard,

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