INDIANA PUBLICATIONS
PRODUCTIVE AND QUALITY RESEARCH

Review Article

Individual Acceptance of Technology: A Critical Review of Technology Adoption Models and Theories

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Abstract: This paper is based on a critical review of literature on technology adoption models and theories. Literature supports the notion that the success or failure of new technology is based on individual acceptance levels. This paper contributes to the existing literature by critically and comprehensively reviewing the theoretical models most recently used in technology acceptance research in order to understand and predict human behaviour involved in adopting new technology.

Keywords: Technology Acceptance, Technology Adoption, Models and Theories.

INTRODUCTION

Researches in the technology acceptance field have yielded many competing technology adoption models, each with a different set of acceptance variables (Venkatesh *et al.,* 2003). These models and theories help to predict the behavior of an individual whether to accept or reject a new technology. This is supported by (Schaupp *et al.,* 2010) who highlighted that the question of how and why individuals choose to adopt new technologies has forever been the focal point of information systems research. The success or failure of any technology is determined by the acceptance or adoption of that particular technology by the users. Therefore, acceptance theories becomes a critical factor. Technology is of little value, unless it is accepted and used by the intended users (Oye *et al.,* 2014).

LITERATURE REVIEW

Defining Technology Acceptance and Adoption

The process of adoption is defined as the mental process through which an individual passes from first hearing about an innovation to final adoption, and adoption as the decision by an individual to become a regular user of the product or innovation (Kotler & Armstrong, 2004). Technology acceptance is about how people accept and adopt some technology for use (Louho *et al.,* 2006). Dillon & Morris (2001) defined technology acceptance by the user as the demonstrable willingness within a user group to employ information technology for the tasks it is designed to support.

According to (Simon *et al.,* 2001), technology acceptance can be defined as the positive decision to use an innovation.

Kotler & Armstrong (2004) further highlighted that the process of adoption consists of five stages which are; awareness, interest, evaluation, trial and adoption.

### Technology Adoption Models and Theories.

There are many different theories and models of behavior associated with technology adoption and usage that can help understanding and predicting the behaviour of an individual with regards to technology acceptance. These theories help to predict the behavior of an individual whether to accept or reject the adoption of a new technology. The following section provides an overview of these models and theories and provide details for a complete understanding of user adoption of new technologies.

Theory of Reasoned Action (TRA)

The Theory of Reasoned Action (TRA) was originally developed by (Fishbein & Ajzen, 1975). The Theory of Reasoned Action (TRA) is the first theory to gain widespread acceptance in the technology acceptance research field (Olushola & Abiola, 2017).TRA is also one of the most influential and fundamental theories of human behavior and has been used to predict a wide range of behaviors (Venkatesh *et al.,* 2003). This theory maintains that individuals would

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use technology if they could see that there would be positive benefits associated with its use. TRA proposes that beliefs influence attitudes, which in turn lead to intentions and then generate behavior (Olushola & Abiola, 2017). The Theory of Reasoned Action predicts an individual's behaviour by considering the effect of attitude (personal feelings) and subjective norm (perceived social pressure). The person's attitude toward the behavior coupled with the subjective norm concerning the behavior determines the behavioral intention and then finally generate behavior. (Kurland, 1995).
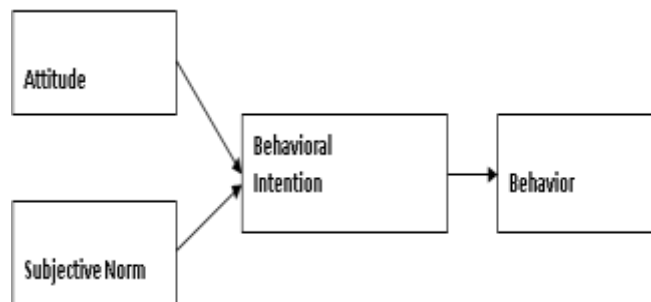
Figure 1: Theory of Reasoned Action (TRA)
Source: Fishbein & Ajzen (1975)

Strengths and Weaknesses of the Theory of Reasoned Action (TRA)

The Theory of Reasoned Action (TRA) is still being applied in various academic disciplines by many researchers today. It is noted that though this theory has got a number of strengths, it has several limitations. In terms of strengths, the theory has proved that it has got a strong predictive power of consumer's behavioral intention after being tested with a wide variety of consumer products and technologies. The theory of Reasoned Action is a well researched theory which has the capability to explain almost any human behavior (Olushola & Abiola, 2017). In terms of its limitations (Kurland, 1995) noted that TRA is deficient in that it assumes that actions are totally under volitional control and this assumption fails to acknowledge that individuals' behavior may be directed for example by systematic constraints. Baraghani (2008) highlighted that Theory of Reasoned Action (TRA) is very general in that it does not specify the beliefs that are operative for a particular behavior and this means that researchers using TRA must first identify beliefs that are salient for subjects regarding the behavior under investigation.

Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) was developed by (Ajzen, 1985). It extended the Theory of Reasoned Action (TRA) by incorporating an additional factor namely perceived behavioral control (PBC) (Olushola & Abiola, 2017). This extension was necessitated by the Theory of Reasoned Action's limitation in dealing with behaviors over which people have incomplete volitional control (Ajzen, 1991). The perceived behavioral control construct which was added to TRA is defined as the perceived ease of use or difficulty with which the person will be able to carry out the behavior (Morris *et al.,* 2012). The argument behind perceived behavioral control as an additional factor in TPB is that, in addition to attitudes toward use, subjective norms and perceived behavior control such as resources, opportunities and skills needed to use the system also influence behaviour. In other words, perceived behavioral control is an estimate of the skills needed for expressing the behaviour and the possibility to overcome barriers (Al-Mamary *et al.,* 2016). Morris *et al.* (2012) argued that an individual's behavior can be explained by behavioral intention which is jointly influenced by subjective norms, attitude and perceived behavioral control. Egmond & Bruel (2007) highlighted that in the Theory of Planned Behaviour (TPB), attitudes, subjective norms and perceived behavioral control predict the intention which in turn predicts the behavior. Kripanont (2007) noted that by changing perceived behaviour control, subjective norm and attitude, the chance that the person will intend to do a desired action can be increased and thus increases the chance of the person actually doing it.

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**Figure 2**: Theory of Planned Behavior (TPB)
Source: Ajzen (1985,1991)
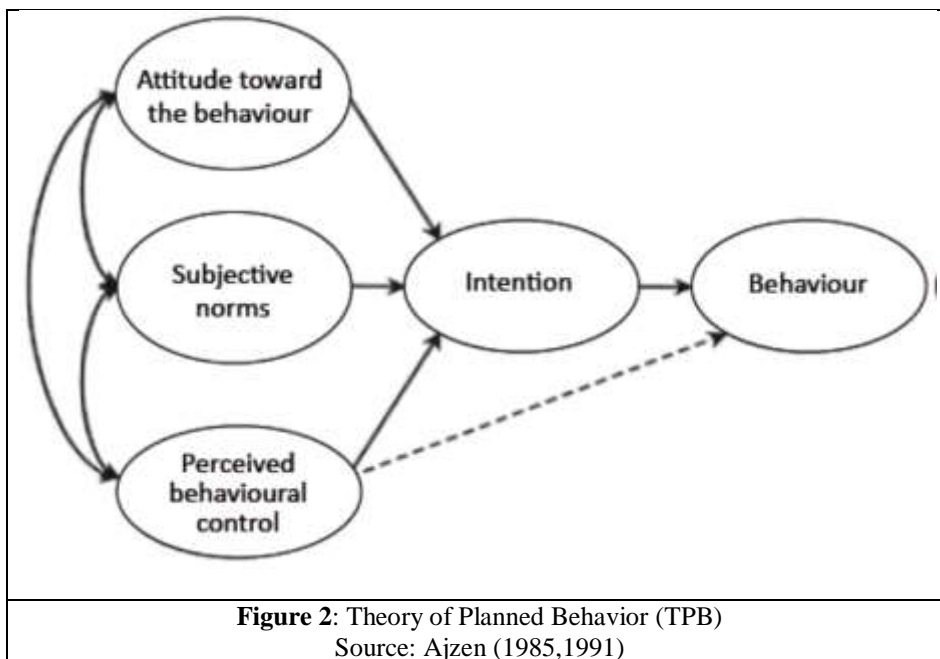
Ajzen (1991), further highlighted that perceived behavioral control relates to the extent to which the individual believes that he has control over personal or external factors that facilitate or constrain the behavioral performance. As with any other theory, the Theory of Planned Behavior (TPB) has got its own strengths and weaknesses as well. The strengths of the TPB are that; Theory of Planned Behavior is a broader model as compared to the Theory of Reasoned Action (TRA) mainly because of the perceived behavioral control as an additional construct. The Theory of Planned Behavior has received substantial empirical support for accurately predicting behavior in information systems and many other domains (Olushola & Abiola, 2017). However, the Theory of Planned Behaviour (TPB) is limited because its constructs are sometimes difficult to define and measure when carrying out research. The theory also suffers from multicollinearity among the independent variables (Olushola & Abiola, 2017).

Technology Acceptance Model (TAM)
The Technology Acceptance Model (TAM) was developed by (Davis *et al.,* 1989) and it was adapted from the Theory of Reasoned Action (TRA) by (Ajzen & Fishbein, 1980) and Theory of Planned Behavior (TPB) by Ajzen (1985). Surendran (2012) highlighted that Technology Acceptance Model (TAM) is one of the most influential and popular models used to predict the use and acceptance of information systems and technology by users. In other words TAM is specifically tailored for modeling user acceptance of information systems as it is used to determine the level of technology adoption at the individual level. TAM has two constructs, which are perceived usefulness (PU) and perceived ease of use (PEOU) and these are the constructs that determine a user's attitude towards use of that particular technology, which in turn, influences the behavioral intention to use technology. 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 (Davis *et al.,* 1989). Davis *et al.* (1989) defined perceived ease of use as the user's perception of the amount of effort required to utilize the system or the extent to which a user believes that using a particular system will be effortless.
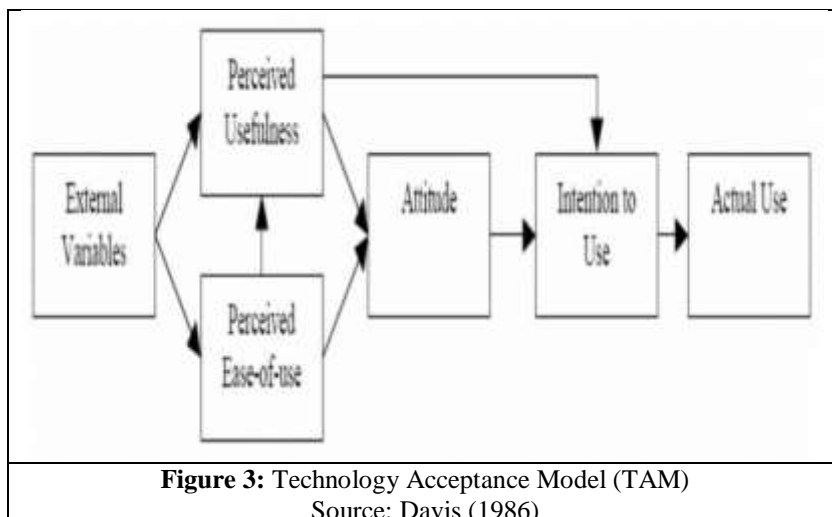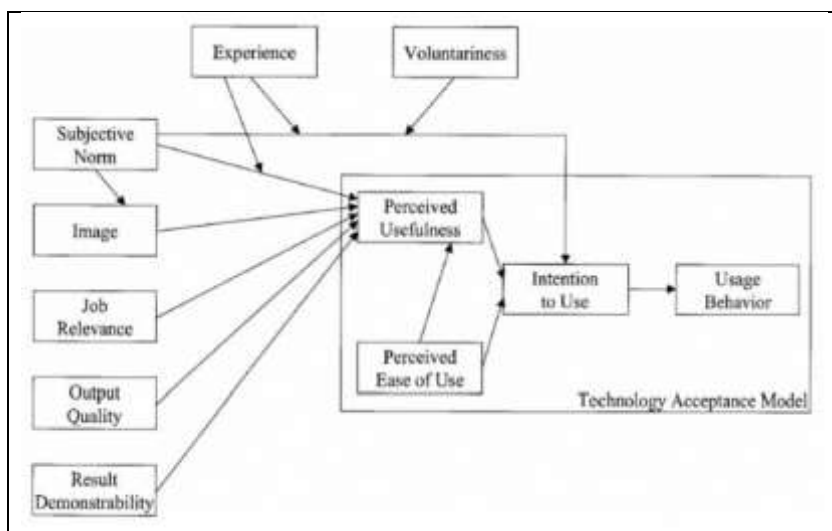
Figure 3: Technology Acceptance Model (TAM)
Source: Davis (1986)

The Technology Acceptance Model (TAM) has got a number of strengths; firstly, TAM is a powerful and robust model for predicting user acceptance of systems. This is supported by numerous empirical studies which have been conducted and proved that TAM consistently explains a substantial proportion of the variance in usage intentions and behaviors with a variety of information systems Olushola & Abiola (2017). Secondly, TAM used perceived usefulness and perceived ease of use to replace subjective norm in Theory of Planned Behavior. The limitation of TAM is that it assumes usage is volitional that is, there are no barriers that would prevent a person from using a system if he or she chose to do so but however there are so many barriers preventing a person from using a system such as perceived behavior control and perceived user resources (Mathieson *et al.,* 2001).

Technology Acceptance Model 2 (TAM 2)

In 2000, (Venkatesh, & Davis, 2000) proposed the Technology Acceptance Model 2 (TAM2)

on the basis of Technology Acceptance Model (TAM). TAM2 theorizes that, what acts as a basis for forming perceptions regarding the usefulness of the system is the user's mental assessment of the match between important goals at work and the consequences of performing job tasks (Venkatesh & Davis, 2000). TAM2 extended the original TAM to explain perceived usefulness and usage intentions in terms of cognitive instrumental processes and social influence. TAM2 was tested using longitudinal data collected regarding four different systems at four organizations, two involving voluntary usage and two involving mandatory usage and the results indicated that TAM2 performed well in both voluntary and mandatory environment Lai (2017). Wu & Wang (2003) highlighted that in TAM2, perceived usefulness, perceived ease of use and subjective norm all indirectly influence actual system use through behavioral intention. In other words, in TAM2, perceived usefulness perceived ease of use and subjective norm jointly determine behavioral intention.


Figure 4: Technology Acceptance Model2 (TAM2)
Source: Venkatesh & Davis (2000)

One of the strengths of TAM2 is that it encompasses both social influence processes and cognitive instrumental processes; this provides a detailed account of the key forces underlying judgments of perceived usefulness. Alsharif, (2013), indicated that TAM2 proves that subjective norm exerts a significant direct effect on usage intentions over and above perceived usefulness and perceived ease of use for mandatory systems but not voluntary systems.

Technology Acceptance Model 3 (TAM3)

Venkatesh (2000) combined TAM2 by (Speier & Venkatesh, 1999) and the model of the determinants of perceived ease of use (Speier & Venkatesh, 1999) and developed an intergrated model of technology acceptance known as TAM3 shown in Figure 5. Technology Acceptance Model 3 (TAM3) posits three relationships that were not empirically tested in Speier & Venkatesh (1999) and Venkatesh & Davis (2000).

Venkatesh (2000) suggest that experience will moderate perceived ease of use to perceived usefulness, computer anxiety to perceived ease of use and perceived ease of use to behavioral intention. TAM3 is based on a theoretical framework consisting of four major categories of constructs from all previous TAM researches that is individual differences, system characteristics, social influence and facilitating conditions. Each of the four categories: individual differences (Computer Self Efficacy, Computer Anxiety, Computer Playfulness); system characteristics (Job Relevance, Output Quality, Result Demonstrability, Perceived Enjoyment, Objective Usability); social influence (Subjective Norm, Image); and facilitating conditions (Perception of External Control) are made up of their own variables based on the two main determinants of PU and PEOU (Howard *et al.,* 2010).

Figure 5: Technology Acceptance Model3 (TAM3)
Source: Venkatesh & Bala (2008)2000)
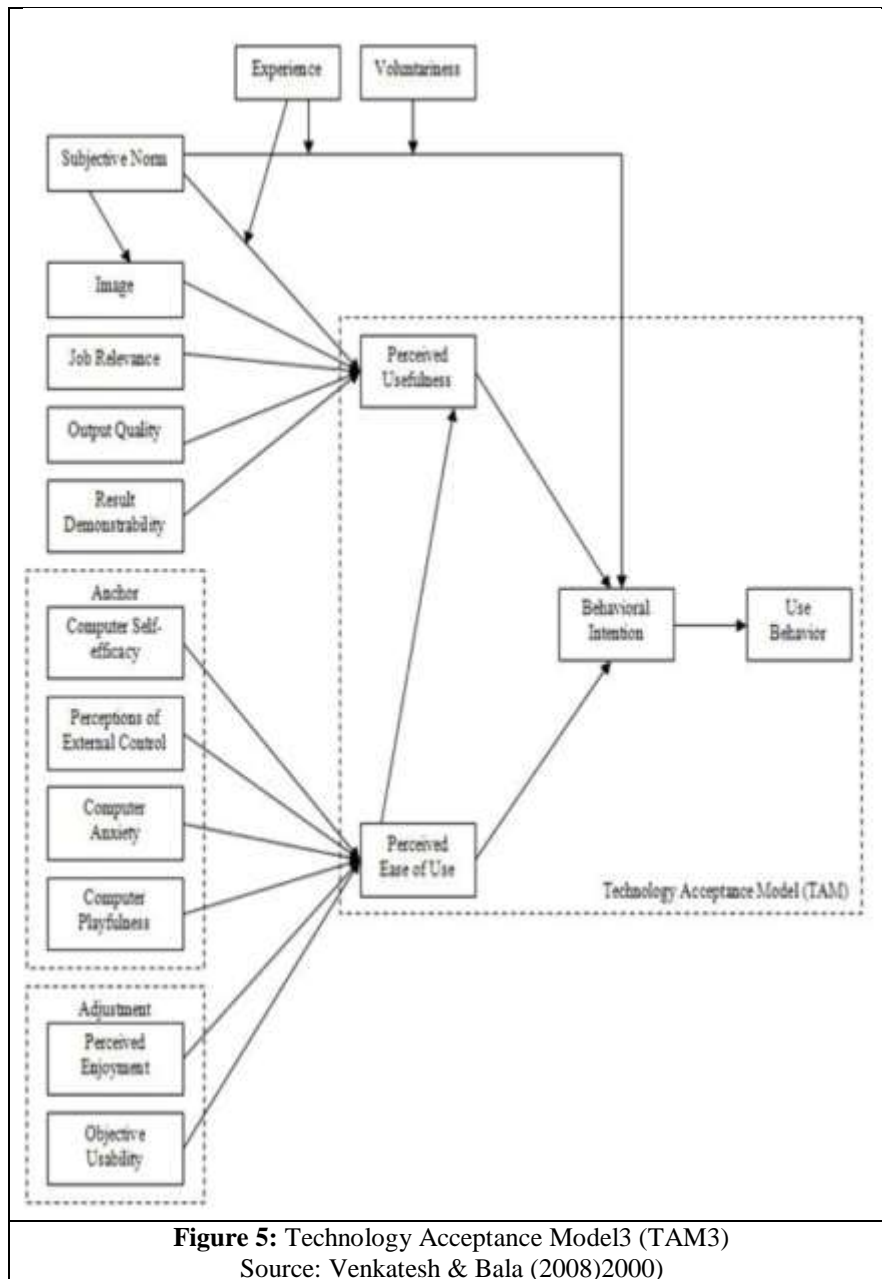
Combined TAM-TPB (C-TAM-TPB)

Taylor & Todd (1995) proposed de-composing the elements of Theory of Planned Behavior (TPB) into detailed constituents. Once the theory of Planned Behavior has been broken out into these constituencies, it elaborates the TPB through the inclusion of elements from the Diffusions of Innovation (DOI) perspective. The key determinants of TPB, influence of social and control factors which are not used to measure the behavior in TAM have been joined together to form the C-TAM-TPB (Samaradiwakara & Gunawardena ,2014). In other words (Taylor & Todd, 1995) added two more constructs: subjective norm and perceived behavioral control to TAM to provide a more complete test of the important determinants of system acceptance and usage, because of their predictive utility in IT usage research and their wide use in social psychology. In this model, behavior is influenced by behavioral intention, which in turn is influenced by attitude, subjective norm, perceived behavioral control and perceived usefulness. Taylor & Todd (1995) also suggest that user experience would moderate the relationships among the elements appearing in combined TAM-TPB model. The Combined TAM-TPB model is demonstrated below in Figure 6.

Figure 6: Combined TAM-TPB
Source: Taylor & Todd (1995)
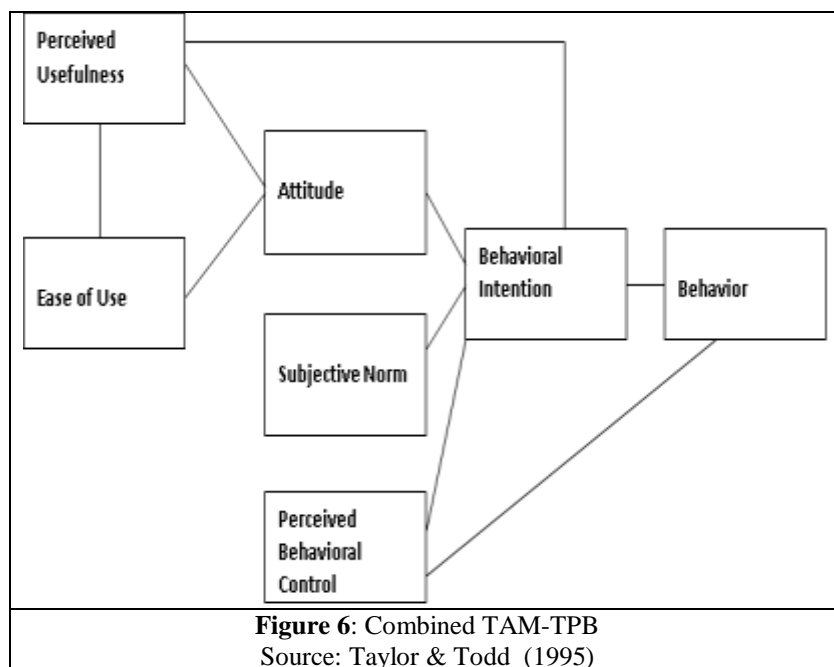
Motivational Model (MM)

The motivational theory in the field of psychology by (Davis *et al.*, 1992) is the keystone concept behind the Motivational Model (MM). Wu and Wang (2003) highlighted that several studies have examined the motivational theory and adapted it for specific contexts and also applied it to understand new technology adaption and use. The general motivational theory has become popular because of its ability to explain behavior as supported by a significant body of research in psychology. In the information systems domain, the applied motivational theory is used to study and understand new technology adoption and use (Davis *et al.*, 1992). The core constructs of the model are extrinsic motivation and intrinsic motivation. Davis *et al.* (1992) defined extrinsic motivation 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, promotions or pay. 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 (Venkatesh *et al.*, 2003).

Model of Personnel Computer Utilization (MPCU)

The Model of PC Utilization (MPCU) according to (Venkatesh *et al.*, 2003) is derived from (Triandis, 1977) theory of human behavior. Thompson *et al.* (1991) adapted and refined the theory of human behavior by (Triandis, 1977) and they came up with their own model to predict PC Utilization. The model of PC Utilization presents a competing perspective to the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB). Venkatesh *et al.* (2003) highlighted that the nature of MPCU makes it particularly suited to predict individual acceptance and use of a range of information technologies.

Diffusion of Innovation Theory (DOI)

Diffusion of Innovation (DOI) theory describes the adoption or non-adoption of new technology in a systematic way. It is a theory that seeks to explain how, why and at what rate is technology spread through cultures. Rogers (1995) defined diffusion as the process in which an innovation or technology is communicated through certain channels over time among users of a social system. He also defines adoption process as the mental process through which an individual passes from first hearing about an innovation to final adoption. Dillon & Morris, (2001) argues that the Diffusion of Innovation theory offers a principal theoretical perspective on technology acceptance both at individual and organizational level of analysis by providing an account of the manner in which any technological innovation moves from the stage of invention to widespread use or not.

In DOI, diffusion occurs progressively among users when information and opinions about a new technology are shared among potential users through available communication channels and in this way users acquire a personal knowledge about the new technology Al-Mamary *et al.* (2016); Rogers (1995) came up with a five staged process of innovation adoption, which are knowledge, persuasion, decision (to adopt or to reject new technology), implementation and confirmation. Knowledge occurs when an individual is exposed to an innovation's existence and gains an understanding of how it functions. Persuasion occurs when an individual forms a favorable or unfavorable attitude towards the innovation. Decision takes place when an individual or user engages in activities that lead to a choice in accepting or rejecting the innovation. Implementation occurs when the user puts the innovation into use and then finally comes confirmation, which takes place

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when an individual seeks reinforcement of an innovation-decision already made, but they may reverse this previous decision if exposed to conflicting messages about the innovation (Alsharif , 2013).

In terms of strengths, DOI is a powerful theory in predicting the behavior of individuals at the firm level and is very relevant when studying higher education and educational environments (Oliveira & Martins, 2011). However DOI has limitations in that firstly it does not offer adequate constructs to deal with collective adoption behaviors and it focus solely on an innovation and ignore other factors that determine how the innovation is adopted and again the theory fails to predict the behavior of individuals.

Social Cognitive Theory (SCT)

This is a theory that was developed by (Bandura, 1986; Azmi & Kamarulzaman 2010). The Social Cognitive Theory (SCT) defines human behavior as a triadic and reciprocal interaction of personal factors, behavior and the environment. The SCT posits that an individual's behavior is uniquely determined by personal factors, behavior and environment (Al-Mamary *et al.,* 2016). In other words, Social Cognitive Theory (SCT) is based on the notion that environmental influences such social pressure, situational characteristics, cognitive and demographic characteristics significantly determine behavior. 'Environment' here refers to the social and physical environments that can affect a person's behavior.

Family members, friends and colleagues constitute the social environment and the physical environments include elements such as size of a room, the ambient temperature and the availability of certain foods. Bandura (1986); Azmi & Kamarulzaman (2010) argues that the environment or the situation provides the framework for understanding behavior. They further highlighted that the situation is a person's perception of the place, time, physical features or the cognitive or mental representations of the environment that may affect a person's behavior.

Glanz *et al.* (2002) indicated that the three factors, environment, people and behavior are constantly influencing each other, thus behavior is not simply the result of the environment and the person, just as the environment is not simply the result of the person and behavior. Venkatesh *et al.* (2003), highlighted that the Social Cognitive Theory (SCT) is one of the most powerful theories of human behavior and it applies to a wide spectrum of areas of study for example human functioning as career choice, organizational behavior, physical and mental health. The Social Cognitive Theory (SCT) provides ground breaking concepts of self-efficacy, experience, training and social influence and it has also been used to study behavior in the classroom as well (Abbasi, 2011). Though the theory is very powerful, its limitation is that it cannot be generalized easily and it is very difficult to apply. In addition, the Social Cognitive Theory (SCT) is more related to education and motivation.

Figure 7: Social Cognitive Theory (SCT).
Source: Wood & Bandura (1989)
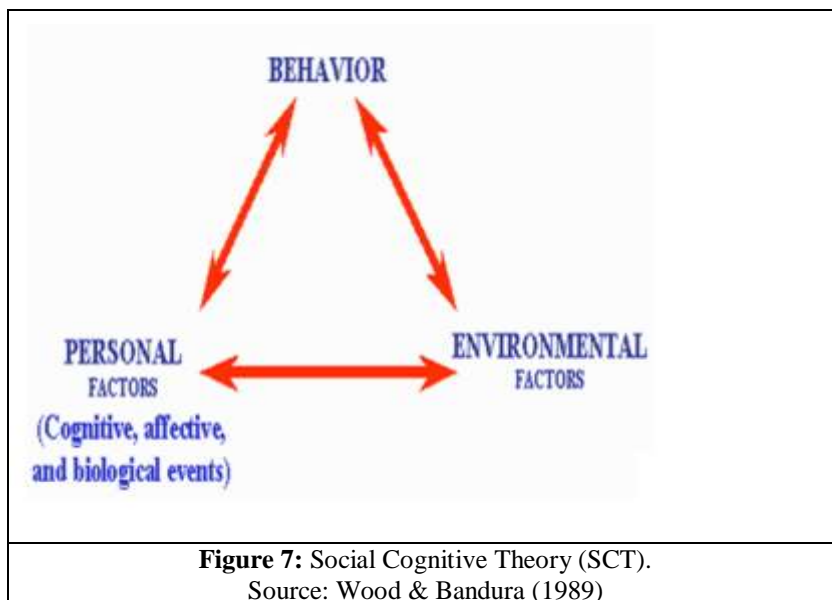
Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh *et al.* (2003), developed the Unified Theory of Acceptance and Use of Technology (UTAUT). The UTAUT model integrated the elements of eight prominent theories and models that have been used to explain technology acceptance behavior. These included the Theory of Reasoned Action (TRA),

Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Planned Behavior (TPB), combined TAM-TPB, Model of Personnel Computer Utilization (MPCU), Innovation Diffusion Theory (IDT) and Social Cognitive Theory (SCT). Venkatesh *et al.* (2003) adopted the unified view because he argued that Information System researchers have a choice of models and thus tend to ignore some models while

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favoring others and in doing so, they create a need for a synthesis in order to reach a unified view of users' technology acceptance.

The Unified Theory of Acceptance and Use of Technology (UTAUT) contain four core constructs or determinants of intention and usage and these include performance expectancy, effort expectancy, social influence and facilitating conditions (Venkatesh *et al.,*

2003). The key relationships in the UTAUT model are moderated by the variables of gender, age, experience and voluntariness of use. In UTAUT, performance expectancy, effort expectancy and social influence are theorized to influence behavioral intention to use a system, while behavioral intention and facilitating conditions determine technology use Venkatesh & Bala (2008).

Figure 8: The Unified Theory of Acceptance and Use of Technology (UTAUT).
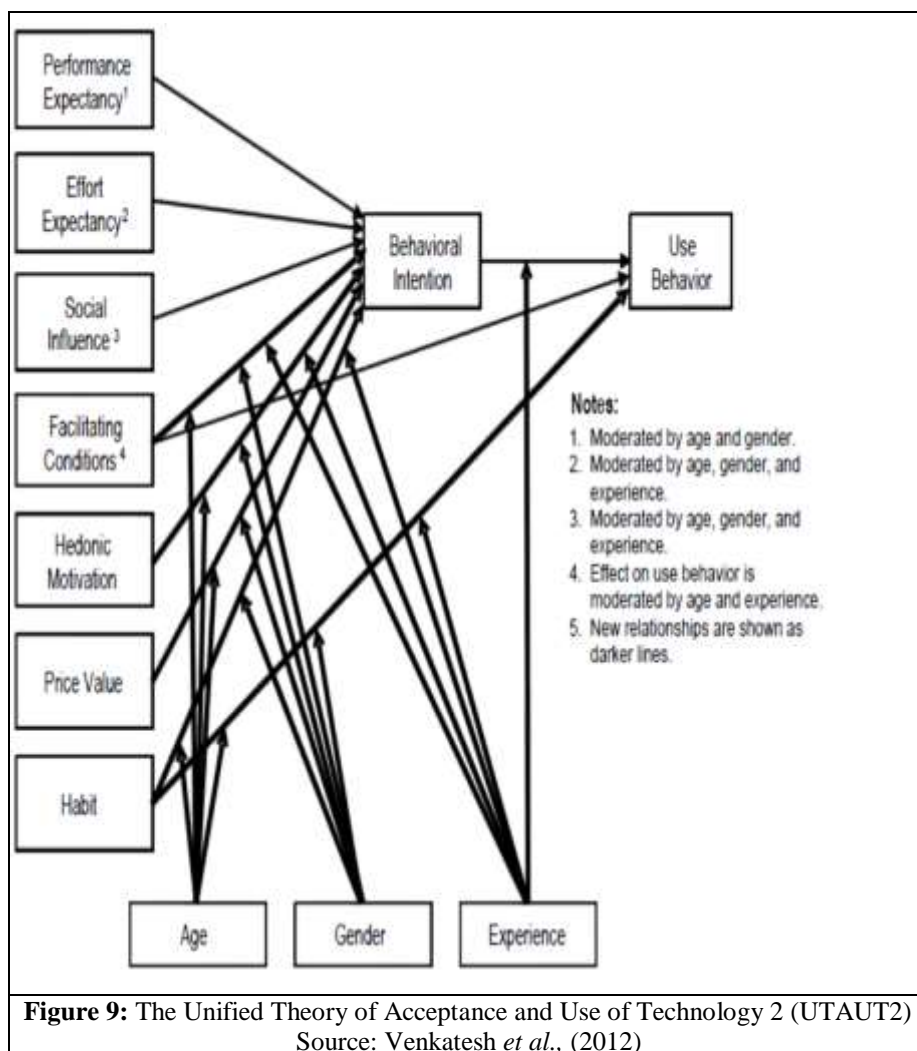Source: Venkatesh *et al.* (2003).
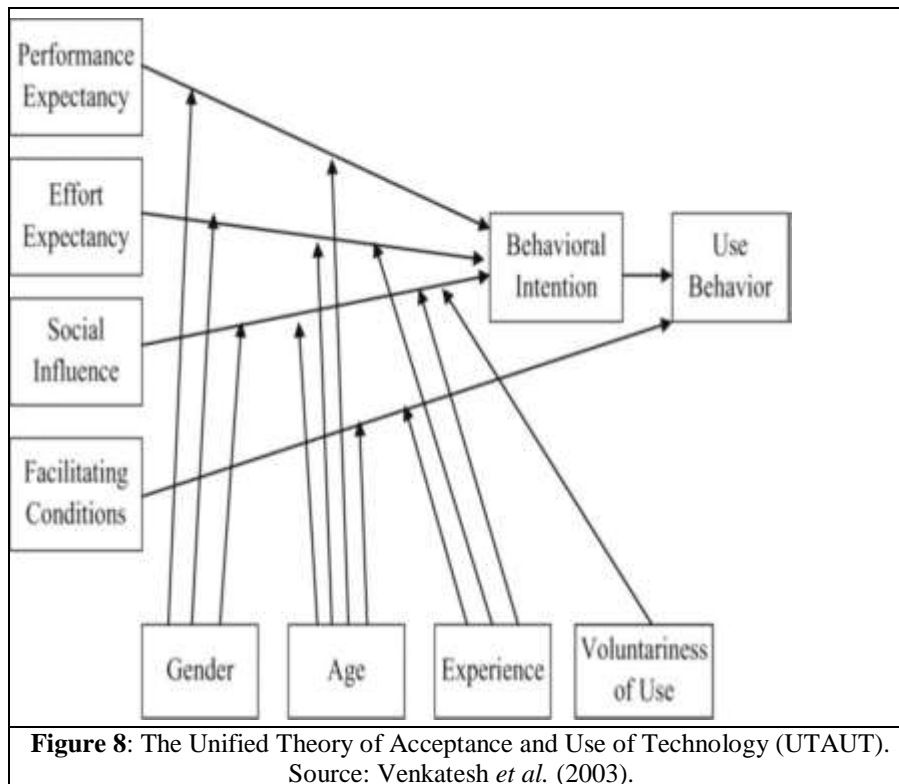
The strength of UTAUT is that it is predictive and is more integrative, it explains up to 70% of the variance in usage intention, which is a considerable improvement over any of the original eight models but however its limitation is that it is weak in its explanatory ability (Olushola & Abiola, 2017). Brown *et al.* (2010) further highlighted that the UTAUT model is considered to be a reflection of an individual's internal schema of beliefs, where the external part is being ignored.

Unified Theory of Acceptance and Use of Technology2 (UTAUT2)

Venkatesh & Bala (2008) introduced UTAUT2 which was an extension of UTAUT. The objective of developing UTAUT2 was to pay particular attention to the consumer use context and move away from employee use context in UTAUT.UTAUT was originally developed to explain employee technology acceptance and use in organizational settings, but in 2012 it was extended to UTAUT2 which is in the context of consumer technologies or individual

acceptance. Therefore, UTAUT was extended to UTAUT 2 to suit consumer context. Three more constructs were added to the theory which are: hedonic motivation (HM), price value (PV), and habit (HT), these key three constructs explain the consumer's behavior in the use of technology. Individual differences namely: name, age, gender and experience are hypothesized to moderate the effects of these constructs on behavioral intention and technology use. UTAUT2 kept the constructs and definitions of performance expectancy, effort expectancy, social influence and facilitating conditions suggested by UTAUT, adapting them to a consumer use context. In the UTAUT2, Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Hedonic Motivation (HM), Price Value (PV), Habit (HT) and Facilitating Conditions (FC) affect the behavioral intention to use a technology, while the behavioral intention to use a technology determines the use behavior, which is the individual's actual usage of technology.

Figure 9: The Unified Theory of Acceptance and Use of Technology 2 (UTAUT2)
Source: Venkatesh *et al.,* (2012)

UTAUT2 is a validated model and again because of the additional extensions of Price Value, Hedonic Motivation and Habit, this model further increased the predictive ability to explain consumer behavioral intention to use a technology as compared to UTAUT (Venkatesh & Bala, 2008). UTAUT2 consist of most of the external factors that affect directly the behavioral intention to use a technology compared to previous models and this has increased its ability to explain the behavioral intention to use technology.

CONCLUSION

This paper reviewed literature of technology acceptance at the individual level. Twelve models in the field of individual acceptance of technology were critically reviewed. These models and theories are: Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Technology Acceptance Model (TAM), Technology Acceptance Model 2 (TAM2), Technology Acceptance Model 3 (TAM3), Combined TAM-TPB (C-TAM-TPB), Motivational Model (MM), Model of Personnel Computer Utilization (MPCU), Diffusion of Innovation Theory (DOI), Social Cognitive Theory (SCT), Unified Theory of Acceptance and Use

of Technology (UTAUT) and Unified Theory of Acceptance and Use of Technology 2 (UTAUT2). The researcher however recommends the use of UTAUT2 model because it is a comprehensive model with a number of factors that affect the acceptance of any technology. The study will help technology startup companies to predict the behavior of individuals on whether they will accept or reject the adoption of a new technology. Furthermore, the study is useful as it unpacks the strengths and weaknesses in each model which informs future researchers to adopt suitable models for testing in different environment and settings.

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