

# A review of the Information System Models for Technology Acceptance

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**Abstract-** The words “acceptance” and “behaviour” have been used interchangeably. The acceptance of any form of technology is determined by the behaviour of the individual towards that technology. Extensive research has been carried out on factors that influence human behaviour. This includes research in mathematics, philosophy, anthropology, information systems theories and many more. In the field of Information Technology and Information systems, there are models that have been developed in an attempt to try and understand technology acceptance. The aim of this paper is to review 6 unique Information Systems models of acceptance (Diffusion of Innovations, Theory of Reasoned Action, Theory of Planned Behaviour, Technology Acceptance Model, Task Technology fit and Unified Theory of Acceptance and use of Technology). The paper defines each of the models, providing past applications and recommending future applications within the context of a university of technology. The aim of this review is to help create awareness among fellow academics about the various acceptance models and their possible usage.

**Keywords-** Diffusion of Innovations, Theory of Reasoned Action, Theory of Planned Behaviour, Technology Acceptance Model, Task Technology Fit, Unified Theory of Acceptance and use of Technology,

## I. INTRODUCTION

The acceptance of a technology, or lack thereof, is determined by an individual’s behaviour or attitude towards the technology [1]. The lack of user acceptance is a barrier to the success of new technology innovations [1]. In a university context, the aim of a technology is to improve performance. When performance is improved, technology adoption is attained. In a pragmatic viewpoint, understanding the factors of IT use ought to guarantee effective deployment of IT resources within an organization [2].

According to Taylor and Todd [2] a diversity of perspectives of theoretical research has provided an improved understanding of the factors that affect technology use. This theoretic research includes intention-based models which use behavioural intention to predict the use of technology.

In this paper, 6 technology acceptance models are reviewed. The paper reports on the Diffusion of Innovations (DIO), Theory of Reasoned Action (TRA), Theory of Planned behaviour (TPB), Technology Acceptance Model (TAM), Task Technology Fit (TTF) and the Unified Theory of Acceptance and Use of Technology (UTAUT). Each of the models is introduced in the form of a brief history, what the model entails, where it has been used and where it can be used in the Central University of Technology (CUT) context. Recommendations as to how these technologies may be used at a university of technology may heighten academic awareness of these technologies. The paper then ends with a conclusion.

## II. DIFFUSION OF INNOVATIONS

The Diffusion of Innovations (DIO) theory was developed in the United States by Everett Rogers, a rural sociologist and professor of communication studies in 1962 [3]. The DIO theory originates from the “German-Australian and the British schools of diffusionism in anthropology”. Members of these schools noted that most variations in society result from the outline of innovations from supplementary societies. French sociologists further suggested incorporating the S-shaped diffusion curve and the role of estimation leaders in the progression of “imitation” [4].

Greenhalgh, et al. [5] define the DIO theory as a theory that seeks to explain how technology spreads through culture. Furthermore, it seeks to explain the rate at which new technology and ideas are adopted [5]. According to Wejnert [6], the DIO theory denotes a range of intellectual ideas and notions, methodological information, and definite practises in a social system. It clarifies where the range indicates movement from a basis to an adopter, usually through communication and impact.

The DIO model is depicted in figure 1. The DIO theory, according to Rogers (1976), is a procedure by which an origination is interconnected. The interconnection is over certain canals during a specific period between the affiliates of the social order system. Through succeeding clusters of consumers accepting the new technology (presented in blue in figure 1), its market share (yellow) will eventually reach the saturation level [4]. Rogers [4] declares that in mathematics terminology, the yellow curve is called the logistic. The curve is divided according to sections of adopters

The DIO was initially used in the adoption of organic agriculture [7]. It was applied in a study that reviewed a large number of studies in organic farming. The study was carried out in several countries over a period of about 20 years.

The DIO was applied in health studies. The study summarised an extensive literature review regarding the spread and sustainability of health service delivery [5]. It was also applied in social networks as a basis for adopter categorisation instead of solely relying on the system-level analysis [8].

At the CUT, the DIO can be used to evaluate e-thuto (Blackboard) system. Blackboard is a culture among most universities. The DIO could be used to evaluate the use of blackboard among lectures. The results may explain the rate at which Blackboard is adopted and reveal whether it is used to its full functionality.

## III. THEORY OF REASONED ACTION

The Theory of Reasoned Action (TRA) was proposed by Martin Fishbein and Icek Azjen in 1975. It was a derivative of a previous study that began as an attitude theory [9]. According to Vallerand, et al. [9],

the TRA is a popular model in the domain of social psychology.

The theory proposes that an individual's behavioural intention is subjected to the individual's attitude concerning behaviour and subjective norms [10]. These researchers added that, if an individual anticipates an action, then it is probable that the individual will engage with the action.

The TRA consists of three general constructs: Behavioural intention, Attitude, and Subjective norm. Behavioural intention measures one's relative intention to execute an action or specific behaviour. Attitude entails the beliefs about the shortcomings of executing the behaviour multiplied by one's evaluation of the shortcomings [10]. Subjective norm is the perceived societal pressure cause by one's perception and refers to the social pressure a person feels in carrying out or not carrying out a specific behaviour [10]. The model has its constructs depicted in figure 2. According to figure 2, an individual's behavioural intention is influenced by the individual's attitude and subjective norm. Once behavioural intention exists, then the individual will perform the behaviour.

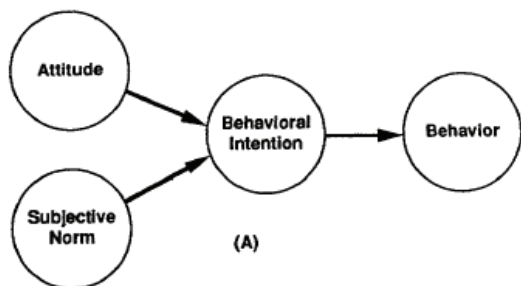


Figure 2: The Path Model for Theory of Reasoned Action [10]

The TRA was applied in commerce to test its ability to predict consumer online grocery buying intention [11]. It was also applied in a study that evaluated the use of coupons by consumers [12].

In the health industry, the TRA was applied as framework for understanding and AIDS related behaviours [13]. In IT, the TRA was applied in a study that investigated the adoption of IT by end-users. The TRA was integrated with the DIO and the model indicated good support that it can be used for understanding the utilisation of IT [14].

At CUT, this model may be applied in investigating the use of the solar panel USB chargers at the Engineering and IT faculty. The TRA can be applied in investigating the behavioural intention of students towards the solar panel USB chargers. Applying the TRA may reveal an individual's attitude concerning behaviour and subjective norms.

#### IV. THEORY OF PLANNED BEHAVIOUR

According to Francis, et al. [15] the theory of planned behaviour (TPB) was developed in 1988 by Icek Azjen to improve the predictive power of the TRA. The TPB connects human principles and behaviour and is devised from the

psychology subsidy; it also lengthens the limiting conditions of wholesome volition stated in the TRA [16].

Madden, et al. [16] proclaimed that the TPB comprises beliefs concerning the proprietorship of mandatory resources and prospects for execution of a given behaviour. The theory states that one's attitude towards behaviour, subjective norm and perceived behavioural control, shape an individual's behavioural intention and behaviours [17].

According to the theory, human behaviour is guided by two types of concerns: behavioural beliefs and normative beliefs [16]. Behavioural beliefs relate to the probable results of the behaviour and the assessment of these results. Normative beliefs concern the normative anticipations of others and the drive to conform to these anticipations. According to Azjen [18], attitude concerning the behaviour, subjective norm, and perceived behavioural control result in the realisation of behavioural intention. In conclusion, given an adequate amount of definite mechanism over the behaviour, individuals are anticipated to perform their intent when the occasion arises. Figure 3 represents the TPB where attitude, subjective norm and perceived behavioural control will predict the intention to perform a behaviour. Intentions are the predecessors of behaviour. The constructs of this model reflect psychological constructs that have a distinctive implication for the theory [9].

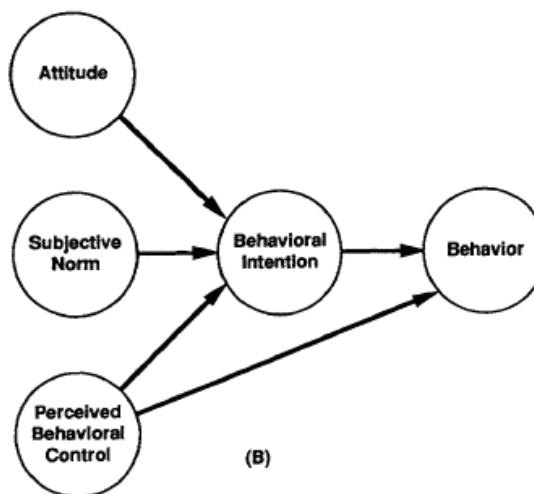


Figure 3: The Path Model for Planned Behaviour [10]

The TPB was applied in the Psychology field in a study that examined the role of self-identity and social identity constructs on intention behaviour. The study was concerned with the prediction of intention to engage in household recycling and reported cycling behaviour [19].

The TRA was applied in the Entrepreneurial field [20]. The study investigated the behavioural intention of entrepreneurs towards entrepreneurship. In Sports Management, the TRA was applied in studies that determined the behaviour and role of sports exercises and better understanding the consumers' intention in attending a sports event [21-23].

At the CUT, the TPB can be applied to first year computer literacy students. It can also be used to evaluate the behaviour of lectures towards the use of Clickers technology

in their classes. Applying the TRA in this context may reveal the lecture's normative beliefs. It may also give insight to the normative beliefs of lectures.

## V. TECHNOLOGY ACCEPTANCE MODEL

The Technology Acceptance Model (TAM) is the most prominent extensions of Ajzen and Fishbein's TRA which was developed by Fred Davis in 1986. Surendran [24] ascertains that the TAM is one of the theories that has been based on TRA and has been used to explain an individuals' acceptance behaviour. Teo [25] argues that it is one of the utmost prominent additions of Ajzen and Fishbein's TRA. According to Kashi and Zheng [26], the TAM has substituted several of TRA's attitude measures with the two technology acceptance measures (ease of use, and usefulness). It suggests that apparent usefulness and apparent comfort of use include a person's intention to make use of a system with "intention to use" serving as an intermediary of real system use [27]. The TAM incorporates two fundamental constructs, namely PEOU and PU [28]. Park [28] declares that the core apparatuses essential to PEOU are design and features of a technology while the main understanding of PU is exertion-decreasing. According to Al-Adwan, et al. [29], the TAM is acknowledged as one of the well-known models related to technology acceptance and use. It has presented great potential in unfolding and predicting the actions of users of a technology [29]

According to Gómez, et al. [30], the TAM is a model that simulates how users come to adopt and use a technology. The TAM is further designed for demonstrating user approval of information systems [31]. Wu and Ke [32] declare that the TAM is a model that can efficiently describe user behaviours relative to new technologies. Wu and Ke [32] also suggested that the TAM is an adoption theory, meaning it emphasises that when an individual decides to perform an action, then they will do it without hesitation.

Davis [33] states that performance achievements are often disillusioned by user's reluctance to acceptance and use of an existing system. According to Davis [33], people have a habit of using or not using a technology to the magnitude they trust it will be of assistance to them in better performing their tasks. This variable is referred to as PU. Even if prospective users have faith that a given technology is worthwhile, they may possibly also trust that the technology is too difficult to use. Performance reimbursement usages are thereby determined by the exertion of using a technology [33]. Furthermore PU is hypothesised to be subjective to PEOU and is linked to the other four constructs of the TAM.

According to Nath, et al. [34], the TAM recognises PU and PEOU as influential in Attitude towards and the Intention to Use a technology. It regards them as the most important determinants of Actual Use (Davis et al., 1989. Figure 4 presents the original TAM, where external variables do influence PU and PEOU [35]. Colletette, et al. [35] defines the external variables as the system's characteristics. PU and PEOU determine the individual's attitude towards use and in turn influence intention to use.

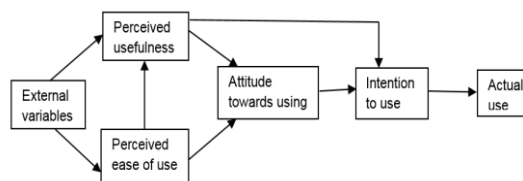


Figure 4: Technology Acceptance Model [33]

In education, especially for electronic learning (e-learning) and mobile learning (m-learning), the TAM has been vastly applied [30, 36-38]. It was applied in study that evaluated the acceptance of e-learning systems by students.

The TAM has been evaluated in corporate companies [26, 34, 38]. The TAM was applied in a study that examined the attitudes of employees and their acceptance of e-learning systems in their organisations.

In the field of management studies, the TAM has been widely used [39-41]. The TAM was applied in a study that investigated PU and usage intention in terms of influence [41]. This was for the purpose of evaluating four longitudinal studies in management.

The IT department at the CUT has introduced the use of Barcoded scanners for student attendance in the Digital Literacy classes. These Barcode scanners are only limited to the Digital Literacy classes. The TAM can be applied in evaluating the acceptance and adoption of these devices.

## VI. TASK TECHNOLOGY FIT

The Task Technology Fit (TTF) theory was developed by Goodhue and Thompson in 1995 [42]. This theory is a linkage of models from two complementary streams of research (user attitudes as predictors of utilisation and task-technology fit as a predictor of performance). Goodhue and Thompson [43] established this theory to examine the link concerning IT plus individual performance. Goodhue and Thompson [43] wanted to confirm the idea that combining usage and task-technology fit can better clarify the performance of IT.

Sarker and Valacich [44] proclaim that the TTF theory argues that individuals form an opinion on the appropriateness of technology built on perceptions of how the technology supports their requirements. The TTF theory can be defined as the extent to which the capabilities of the technology counterpart the task's demand [43, 45]. Goodhue and Thompson [43] ascertain that a technology will be used when it conforms to, or fits the task of the user. According to Waite, et al. [46], the TTF is a theory that ascertains that a technology must be used to the best of its functionality and the technology must be a good fit with the task that it supports. According to Goodhue and Thompson [43], the TTF theory ascertains that for a technology to have an encouraging influence on performance, it is necessary for the technology to be used. It should be a 'good fit' with the tasks it supports. Figure 5 presents the TTF theory, where task characteristics and technology characteristics all combine to lead to the fit of a technology to a task. When this fit is achieved, it then leads to performance impact and utilisation.



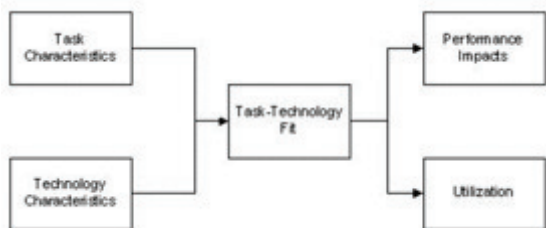


Figure 5: Task Technology Fit Model [43]

The TTF theory has been used in many studies of education [17, 44, 47, 48]. It was used in China where the basic characteristics and tasks of the 21<sup>st</sup> century education were evaluated. The researcher denoted that the 21<sup>st</sup> century is the age of knowledge-based and the central of task education in the age of knowledge-based economy is education for quality [48].

The TTF theory has been used in corporate companies [45, 49, 50]. It was used in a study that investigated the acceptance of Knowledge Management Systems (KMS). The aim of the study was to explore the effects of empowering leadership, task-technology fit and compatibility of the KMS. According to Kuo and Lee [45], empowering leadership, TTF are significant predictors of perceived ease of use.

The TTF has been used in the field of commerce [51, 52]. A study which combined the TTF and TAM to evaluate consumer e-commerce as a technology adoption process was conducted. According [52], TTF is a valuable addition to TAM.

The CUT provides free Wi-Fi. The TTF can be applied in evaluating the use of the free Wi-Fi by students. The TTF would evaluate the technology used for accessing the Wi-Fi. The results may indicate the link between the technology used for accessing the Wi-Fi and the performance of students.

## VII. UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY

The Unified Theory of Acceptance and Use of Technology (UTAUT) was developed by Venkatesh, Morris, Davis and David [53]. This theory is a more current model, which is a combination of eight present models of technology acceptance with the TAM [54]. Venkatesh, et al. [53] integrated these models to promote a unified view of user acceptance and to identify the most significant influences. Oshlyansky, et al. [54] proclaimed that the UTAUT model incorporates elements from the TRA, Motivational Model, the TPB, a combined TAM and TPB model, Model of PC Utilization, the DIO and Social Cognition Theory.

Each of these models covers a user's intention to use a technology or the actual use of a technology as the dependent variable. The variance in user intentions is explained between 17% and 53% [55]. By integrating the conceptual and empirical similarities of these eight models, the UTAUT model explains up to 70% of the variance in intention to use a technology [55]. According to Vanneste, et al. [55] the UTAUT model explains up to 50% of the variance in technology use. The UTAUT model constructs are performance expectancy, effort expectancy, social inference, facilitating conditions, use behaviour, gender, age, experience and voluntariness of use (see Figure 6).

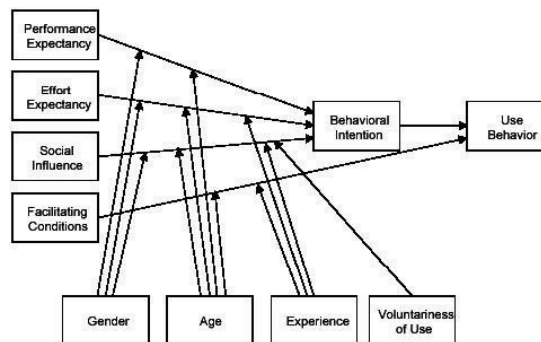


Figure 6: Unified Theory of Acceptance and Use of Technology [56]

In industrial Engineering, the UTAUT was applied in a study that evaluated the use of mobile 3G communication users. The study was useful in providing tactics and strategies for computer orientated 3G services to existing and potential customers [57].

The UTAUT was applied in E-Government systems. It was applied in a study to investigate the effects of web quality on adoption of E-Government services [58]. The UTAUT was also applied in Human Computer Behaviour. The study investigated the uptake of technology innovations in online family disputes resolution services [59].

At the CUT, the UTAUT can be used in evaluating the use of SAM from Cengage and Cisco Net Academy. These are both online learning systems used at the university and may well be under-used. The UTAUT can be applied to evaluate the acceptance of these online learning systems and to evaluate the student's behaviour towards them.

## VIII. CONCLUSION

The aim of this paper was to review 6 unique Information Systems models of acceptance (Diffusion of Innovations, Theory of Reasoned Action, Theory of Planned Behaviour, Technology Acceptance Model, Task Technology fit and Unified Theory of Acceptance and use of Technology).

These models can be applied in the in following ways:

- How technology can spread through culture.
- To measures one's relative intention to execute an action or specific behaviour.
- Studying the beliefs of individuals concerning the proprietorship of mandatory resources and prospects for execution of a given behaviour.
- How users come to adopt and use a technology.
- Examine the link concerning IT and individual performance.
- Evaluating a user's intention to use a technology or the actual use of a technology as the dependent variable.

The limitation of this paper is that the recommendations have only been made for the CUT. The CUT may apply these models in evaluating some of the technologies used. Indeed, technology acceptance is influenced by an individual's behaviour.

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