COMPARISON OF EXISTING TECHNOLOGY ACCEPTANCE THEORIES AND MODELS TO SUGGEST A WELL IMPROVED THEORY/MODEL

G D M N Samaradiwakara, MLS, BSc
Faculty of Graduate Studies, University of Colombo, Colombo, Sri Lanka
C G Gunawardena, PhD, MA, BA
Emeritus Professor of Education, Open University of Sri Lanka, Nugegoda, Sri Lanka

Abstract

This paper presents a part of an on-going research study which aims to develop a model on technology acceptance appropriate to the Sri Lankan context. Current paper reviews the theoretical literature to propose an improved theory/model from a comparison of existing technology acceptance theories/models. In this technological era, awareness of technology is important in today's fast changing networked society. Since technology is of little value unless it is used, how people accept and use technology may have salient theoretical and practical implications. Therefore, researchers concurred on the fact that quality elucidations occur because of robust theories/models on technology acceptance. Despite of the negative aspects identified in the theoretical paradigms of these theories/models, one significant paradigm out of fourteen theories/models could be drawn from the conceptual review on theory/model comparison presented here. Among the fourteen theories reviewed, UTAUT seems to be an improved theory that could provide a useful tool to assess the likelihood of success for technology acceptance studies.

Keywords: Technology acceptance, Technology acceptance theories and models, Technology acceptance model comparison

Introduction:

This paper will discuss an improved technology acceptance theory/model which was selected for the main research study. The first part of the paper provides the background information on technology acceptance and the latter parts discuss fourteen technology acceptance theories and

models. Then the paper makes a comparison of technology acceptance theories and models to identify a model which is better explored the technology acceptance behaviour.

Technology:

Technology was defined as the spoken word of manual craft or cunning skill in the ancient time. The earliest use of the word technology in the United States was found in a Harvard University course on the "application of the Sciences to the useful Arts" in 1816. The 1832 Encyclopedia Americana defined technology as principles, processes, and nomenclatures.

The use of wireless electronic communication over 100 years ago was the starting point of the electronic era. The advancements in technology or modern technology have brought many changes to life styles of people. It has pervaded every aspect of human life whether it is health, education, economic, governance, entertainment etc. (Suvarna and Godavari 2012). Thus no matter what the field is, technology must have brought some positive change to work in away to increase productivity. Today, every nation strives to get the latest technology for the benefit of its citizens. Technological progress is vital in the fields of business, education as well as health care. Technology is also seen as an enabler or a vehicle to disseminate knowledge (Oye, Iahad and Ab.Rahim 2012).

Technology acceptance:

According to Louho, Kalliojaand Oittinen (2006), technology acceptance is about how people accept and adopt some technology for use. User acceptance of technology has further been explained as the demonstrable willingness within a user group to employ IT for the tasks it is designed to support (Dillon 2001). Therefore acceptance can be viewed as a function of user involvement in technology use. Acceptance can be further described as the critical factor in determining the success or failure of any technology and acceptance has been conceptualized as an outcome variable in a psychological process that users go through in making decisions about technology (Dillon and Morris 1996).

Technology is of little value, unless it is accepted and used (Oye, Iahad and Ab-Rahim 2012). Therefore the understanding of technology acceptance is vital because the most important benefit associated with access to the new technologies is the increase in the supply of information (Suvama and Godavari 2012). Researchers are interested strictly in identifying why people accept information technology so that superior processes for designing, evaluating, and predicting how users will react to new technology can be improved. Therefore, the researchers have studied a range of issues

related to technology acceptance from individual user characteristics such as cognitive style to internal beliefs and their impact on usage behavior (Dillon 2001). This individual user acceptance of technology for intended purposes have been modeled and predicted using theories. The main objective of many of those studies is to investigate how to promote usage and also explain what hinders acceptance and usage of technologies (Kripanont 2007). Many researchers have proposed theories and models of technology acceptance in order to explain and predict user acceptance with technology in order to account for rapid change in both technologies and their environment (Oye, Iahad and Ab-Rahim 2012). A review of the existing technology acceptance theories/ models is therefore important to suggest an improved model.

Technology acceptance theories and models:

Theories provide a set of explanatory variables which can be used to predict a particular phenomenon. A model, on the other hand, is defined as a systematic description of a system, a theory or a phenomenon that accounts for its known or inferred properties which may be used for further study of its characteristics. Also a model is any abstract representation of some portion of the real world, constructed for the purpose of understanding, explaining, predicting or controlling a phenomenon being investigated (Burch 2003: 266). A large number of theories/models have been designed to explore the acceptance and use of technologies environment. Therefore such theories/models that provide the basis for technology acceptance can be portrayed as follows:

Cognitive Dissonance Theory (CDT)

Cognitive Dissonance Theory was formulated by Festinger (1957) to explain how discrepancies (dissonance) between one's cognition and reality change the person's subsequent cognition and/or behaviour (Bhattacherjee 2001). This theory depicts a process model of individual behaviour whereby users from an initial pre-usage expectation (belief) about a technology, experience its usage overtime, and then from post-usage perceptions of the technology. The dissonance between users' original expectations and observed performance is captured in the disconfirmation construct (Bhattacherjee 2001).

Innovation Diffusion Theory (IDT)

Innovations Diffusion Theory (Rogers 1995; Rogers and Shoemaker 1971) uses to describe the innovation-decision process. It has gradually evolved until the best well-known innovation-decision process was introduced by Rogers (Rogers 1995; Rogers and Shoemaker 1971). Innovation diffusion theory is perhaps the principal theoretical perspective

on technology acceptance which has been applied at both individual and organizational levels of analysis while its primary intention is to provide an account of the manner in which any technological innovation moves from the stage of invention to widespread use (or not) (Dillon and Morris 1996).

Task Technology Fit Model (TTF)

Task-Technology Fit (Strong, Deshaw and Bandy1973) model holds that IT is more likely to have a positive impact on individual performance and can be used if the capabilities of IT match the tasks that the user must perform (Goodhue and Thompson 1995). TTF consists of eight factors: quality, locatability, authorization, compatibility, ease of use/training, production timeliness, systems reliability, and relationship with users. TTF has been applied in the context of a diverse range of information systems.

Expectation-Disconfirmation Theory (EDT)

Expectation Disconfirmation Theory or Expectation Confirmation Theory (Oliver 1980) which is built upon the basis of Cognitive Dissonance Theory definition and from Marketing has now come to be applied to the adoption of information technology (Bhattacherjee 2001). EDT focuses in particular on how and why user reactions change over time. It consists of four main constructs: expectations, performance, disconfirmation, and satisfaction.

Theory of Reasoned Action (TRA)

The first theoretical perspective to gain widespread acceptance in technology acceptance research is the Theory of Reasoned Action (Fishbein and Ajzen 1975). TRA is a versatile behavioral theory and models the attitude-behavior relationships. This theory maintains that individuals would use computers if they could see that there would be positive benefits (outcomes) associated with using them.

Theory of Planned Behaviour (TPB)

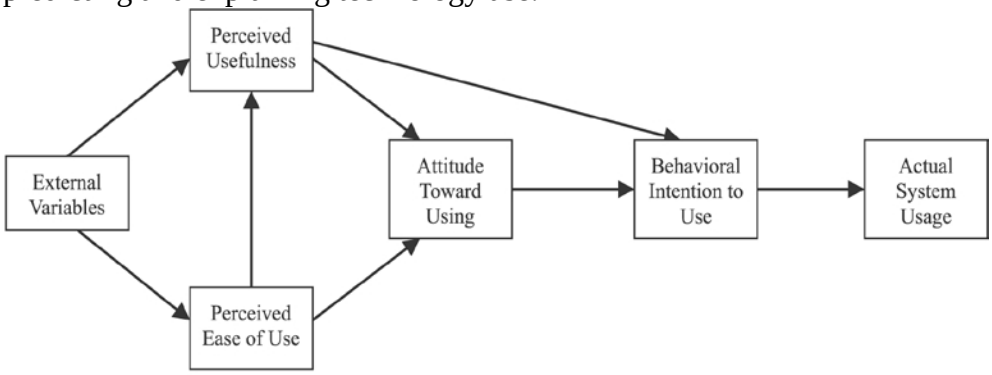
The Theory of Planned Behaviour (Ajzen 1985, 1991) is a successor of TRA and it introduced a third independent determinant of intention, perceived behavior control (PBC). It is determined by the availability of skills, resources, and opportunities, as well as the perceived importance of those skills, resources, and opportunities to achieve outcomes (Kriponant 2007). As Kriponant (2007) emphasised, by changing these three predictors (attitude, subject norm and perceived behavior control), 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.

Social Cognitive Theory (SCT)

Social Cognitive Theory (Bandura 1986) is based on the basis that environmental influences such as social pressures or unique situational characteristics, cognitive and other personal factors including personality as well as demographic characteristics are equally significant in determining behaviour. Further, more variables: gender, age, and experience, from SCT were researched as to whether they play an important role in the explanation of technology acceptance (Losh 2004; Colley and Comber 2003; Venkatesh and Davis 2000).

Technology Acceptance Model (TAM)

Technology Acceptance Model (Davis 1989) was the first model to mention psychological factors affecting technology acceptance and it was developed from Theory of Reasoned Action (TRA) by Davis (Davis 1989). Davis (1989) developed and validated better measures through TAM for predicting and explaining technology use.



Source: Davis *et al.* (1989, p. 985)

Figure 1: TAM (Davis *et al.* 1989: 985)

As shown in Figure 1, TAM posits that perceived usefulness and perceived ease of use determine an individual's intention to use a system with the intention to use serving as a mediator of actual system use. Perceived usefulness is also seen as being directly impacted by perceived ease of use. The underlying links between two key constructs and users' attitudes, intentions and actual technology usage behaviour, were specified using the theoretical underpinning of the TRA. Attitude and perceived usefulness jointly determine the behavioural intention and attitude is determined by perceived usefulness and perceived ease of use.

Model of PC Utilization (MPCU)

Model of PC Utilization (Thompson *et al.* 1991) presents a competing perspective to the theories TRA and TPB and the underpinning conceptual

paradigm is theory of human behaviour of Triandis (1977). This model predicts the PC utilization behaviour. However, the nature of the model makes it particularly suited to predict individual acceptance and use of a range of information technologies (Venkatesh *et al.* 2003). Thompson *et al.* (1991) used this to predict usage behaviour rather than intention to use.

Motivational Model (MM)

Motivation theory (Davis, Bagozzi and Warshaw 1992) in psychology is the keystone concept behind this model. Several studies have examined motivational theory and adapted it for specific contexts and also applied it to understand new technology adaption and use (Venkatesh and Speier 1999). The core constructs of the theory are extrinsic motivation and intrinsic motivation.

Decomposed Theory of Planned Behaviour (DTPB)

The Decomposed TPB (DTPB) introduced by Taylor and Todd (1995) explores the dimensions of attitude belief, subjective norm (social influence) and perceived behavioral control by decomposing them into specific belief dimensions (Taylor and Todd 1995b). Taylor and Todd (1995b) suggest decomposing attitudinal belief into three factors: perceived usefulness (PU), perceived ease of use (PEOU), and compatibility. These three factors have been found to be consistently related specifically to IT usage (Kriponant 2007).

Combined TAM and TPB (C-TAM-TPB)

The key determinants of TPB, influence of social and control factors which are not used to measure the behaviour in TAM have been joined together to form the C-TAM-TPB. Taylor and Todd in 1995 added two factors: subjective norm and perceived behavioral control to TAM to provide a more complete test of the important determinants of IT usage, because of their predictive utility in IT usage research and their wide use in social psychology (Taylor and Todd 1995a). This is an adequate model of IT usage for users who are both experienced and inexperienced with a technology system.

Technology Acceptance Model (TAM2)

The goal of TAM2 (Venkatesh and Davis 2000) is a theoretical extension of the TAM to (1) include additional key determinants of TAM that explains perceived usefulness and usage intentions in terms of social influence and cognitive instrumental processes and (2) to understand how the effects of these determinants change with increasing user experience over time with the target technological system (Kriponanat 2007).

According to the study of Venkatesh and Davis (2000) both social influence processes (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and perceived ease of use) significantly influence user acceptance.

The Unified Theory of Acceptance and Use of Technology (UTAUT)

Another important theoretical model was proposed as the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Davis and Davis 2003) with four core determinants of intention and usage, and up to four moderators of key relationships. Four constructs, 1) performance expectancy 2) effort expectancy3) social influence and4) facilitating conditions, have been theorized in formulating UTAUT with the aim of determining user acceptance and usage behavior on technology as depicted in Figure 2.

Attitude toward using technology, self-efficacy, and anxiety are theorized not to be direct determinants of intention (Kriponant 2007). The key moderators in the model are gender, age, voluntariness, and experience. From a theoretical perspective, UTAUT (Venkatesh *et al.* 2003) provides a refined view of how the determinants of intention and behavior evolve over time, and it is important to emphasize that most of the key relationships in the model are moderated (Kriponant 2007).

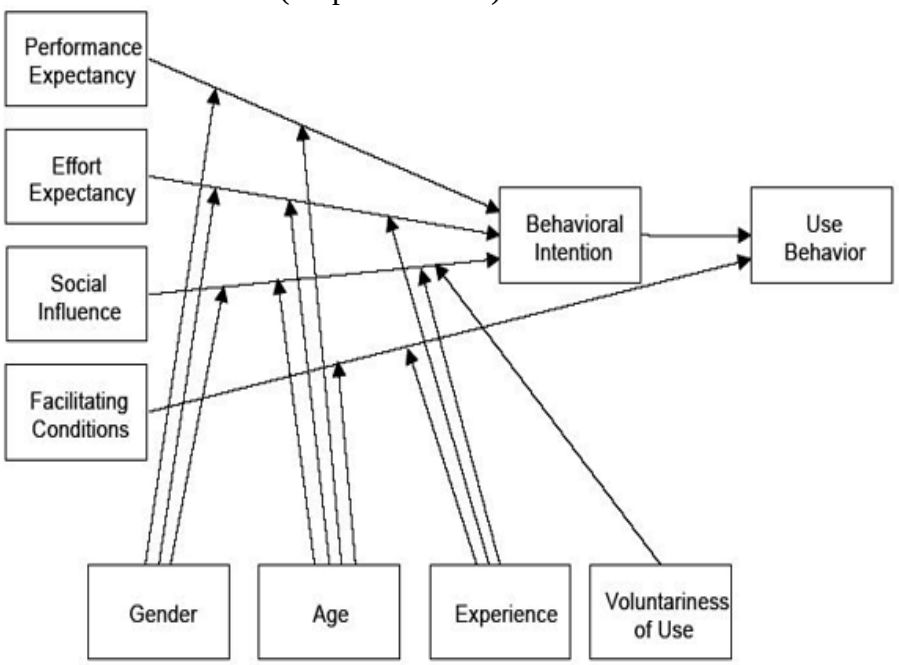


Figure 2: UTAUT model (Venkatesh *et al.* 2003)

Comparison of technology acceptance theories/models:

Comparison of technology acceptance theories/models in general is vital to position a well improved theoretical paradigm which provides an overall picture of underpinning concepts of theories/models which have been used on the technology acceptance environment.

The underpinning paradigms of CDT and EDT theories have been proved as more relevant to form technology acceptance through a few studies in the literature (Bhattacherjee and Premkumar 2004; Bhattacherjee 2001). However, those aspects do not appear to direct most of the technology acceptance studies sufficiently and they have not received the same level of attention in the available literature as the other theories/models in technology acceptance. CDT and EDT have not been researched in various contexts in technology acceptance.

TRA, TPB, TAM, TAM2 and UTAUT are more popular technology acceptance theories/ models that are being used worldwide in different settings more especially in IS literature.TRA has been adapted for use in many fields and is widely used in academia and business today (Magee 2002) and has demonstrated validity in the Information Systems literature (Han 2003). TRA model though has some limitations including a significant risk of confounding between attitudes and norms since attitudes can often be reframed as norms and vice versa. The second limitation is the assumption that when someone forms an intention to act, they will be free to act without limitation. In practice, constraints such as limited ability, time, environmental or organisational limits, and unconscious habits will limit the freedom to act. However, there is also a growing recognition that additional explanatory variables are needed for TRA (Thompson *et al.* 1991; Webster and Martocchio 1992).

The Theory of Planned Behaviour (TPB) attempts to resolve the limitations of TRA. TPB and has been the explicit theoretical basis for many studies over various contextual settings. Therefore, DTPB should provide a more complete understanding of technology usage (Taylor and Todd 1995b). But, Davis, Bagozzi and Warshaw (1989) explained that social norm scales have a very poor psychometric standpoint, and may not exert any influence on BI, especially when IS applications are fairly personal and individual usage is voluntary.

Generally, Technology Acceptance Model (TAM) specifies general determinants of individual technology acceptance and therefore can be and has been applied to explain or predict individual behaviours across a broad range of end user computing technologies and user groups (Davis, Bagozzi and Warshaw 1989). Simultaneously TAM compared favorably with TRA and TPB in parsimonious capability (Han 2003). However, TAM is easier to use than TPB, and provides a quick and inexpensive way of gathering

general information about an individual's perception of a technology. According to the critical review and meta-analysis of TAM Legris *et al.* (2003), claimed the TAM to be a useful model. However many researchers have attempted to expand TAM which has only created confusion (Baenbasat and Barki 2007). Therefore the comparisons confirm that TAM is parsimonious and easy to apply across different research settings; nevertheless, it has to pay the trade-off of losing information richness derived from the studies (Kriponant 2007).

In a meta-analysis study on TAM with 88 published studies, King and He (2006) concluded that the TAM is a valid and robust model. For the past two decades, substantial empirical evidence has supported TAM. Perceived usefulness, perceived ease of use, social influence, facilitating conditions, attitude, self-efficacy and anxiety together with UTAUT would thus be the basis of the explanation of the usage of new technology (van Raaij and Schepers 2008; Wills, El-Gayar and Bennett 2008; Wu, Tao and Yang 2007). Venkatesh *et al.* (2003) have also added situational variables, gender, age, experience and voluntariness of use to the UTAUT model even though core constructs play a very important role in the explanation of the acceptance and use of technology (De Wit, Heerwegh, and Verhoeven 2011; Verhoeven, Heerwegh and De Wit 2011; Verhoeven, Heerwegh and De Wit 2010). Therefore, the UTAUT has been playing a key role in technology acceptance research and provides a solid base to explain why users accept or reject technology in a specific perspective.

It is clear that these theories/models have been expansively applied in a vast array of research studies in technology contexts and other various areas of academic interest and they have further proven their enhanced applicability in modelling technology acceptance in different contextual settings. The reviewed literature on technology acceptance theories/models confirmed that they have different premises and benefits.

According to Singleton, Straits and Straits (1993), Taylor and Tod (1995) and Kriponant (2007), despite the specific advantages of each theory, the capability of a theory/model in predicting and explaining behavior is measured by the extent to which the predictors in the theory could account for a reasonable proportion of the variance in behavioral intention and usage behavior. Considerably better variances explain a broader range of phenomena. Therefore, it is necessary to compare them in order to identify the most appropriate ones in respect of their ability to predict and explain individual behavior towards acceptance and usage of technology. Literature reports superior comparisons of technology acceptance models by Venkatesh *et al.* (2003) and Kriponant (2007). Venkatesh *et al.* (2003) have compared eight models based on empirical data. Kriponant (2007) has also compared nine models based on literature. Therefore the model comparison of

Venkatesh *et al.* (2003) can be concluded as a more pragmatic approach and they have determined individual models' ability to explain behavioral intention (the explained variance R^2). Table 1 presents a summary of technology acceptance theories/models comparisons in terms of their key constructs, moderators and the explained variance.

Table 1: Technology acceptance theories/models comparison

Theory/Model	Constructs (Independent variables)	Moderators	Explained variance (R2)
1.Theory of Reasoned Action (TRA)	1. Attitude toward behavior 2. Subjective norm	1.Experience 2. Voluntariness	0.36
2.Technology Acceptance Model - a (TAM2)	1. Perceived usefulness 2. Perceived ease of use 3. Subjective norm	1.Experience 2. Voluntariness	0.53
- b (TAM- including gender)	1. Perceived usefulness 2. Perceived ease of use 3. Subjective norm	1. Gender 2. Experience	0.52
3.Motivation Model (MM)	1. Extrinsic motivation 2. Intrinsic motivation	None	0.38
4.Decomposed Theory of Planned Behavior (DTPB) - a TPB (including voluntariness)	1. Attitude toward behavior 2. Subjective norm 3. Perceived behavioral control	1.Experience 2. Voluntariness	0.36
- b TPB (including gender)	1. Attitude toward behavior 2. Subjective norm 3. Perceived behavioral control	1. Gender 2. Experience	0.46
- c TPB (including age)	1.Attitude toward behavior 2. Subjective norm 3. Perceived behavioral control	1. Age 2. Experience	0.47
5.Combined Technology Acceptance Model and Theory of Planned Behavior (C-TAM-TPB)	1. Attitude toward behavior 2. Subjective norm 3. Perceived behavioral control 4. perceived usefulness	1. Experience	0.39
6.Model of PC Utilization (MPCU)	1. Job fit 2. Complexity 3. Long term consequences 4. Affect towards use 5. Social factors 6. facilitating conditions	1. Experience	0.47
7.Innovation Diffusion Theory (IDT)	1. Relative advantage 2. Ease of use 3.Result demonstrability 4.Triability 5. Visibility 6. Image 7. Compatibility 8. Voluntariness of use	1. Experience	0.40
8.Social Cognitive Theory (SCT)	1.Outcome expectation 2. Self-efficacy 3. Affect 4. Anxiety	None	0.36
9.Unified Theory of Acceptance and Use of Technology (UTAUT)	1.Performance expectancy 2. Effort expectancy 3. Social influence 4.Facilitating conditions	1. Gender 2. Age 3. Experience 4.Voluntariness	**0.69**

Source: (Venkatesh*et al.* 2003; Kripanont 2007, Dulle, Minishi-Majanja and Coloete2010).

Following facts can be drawn from the model comparison in Table 1 by examining the constructs, moderators and the explanatory ability.

- Core constructs of the theories/models vary between 2 (TRA and MM) and 8 (IDT). Most of them consist of 3-4 constructs.
- Moderators show a discrepancy from 0-4. MM and SCT have no moderators and the highest number of moderators is included in the UTAUT. Most common moderator used in these theories/models is the 'experience'.
- The explanatory power of technology usage intention in terms of variance has ranged from 0.36 (TRA, SCT) lowest to 0.69 (UTAUT) highest.

It is evident that moderators can play a significant role on the explanatory ability of the theories/models even under situations of similar constructs. Explanatory power of the TAM2 and TPB varies with different moderator changes and same constructs from 0.52 to 0.53 and 0.36-0.47 respectively.

According to Taylor and Todd (1995b) models should be evaluated in terms of both parsimony (few predictors) and their contribution to understanding. This means that a model with a good explanatory power and a lesser number of variables is well suited. But the researchers have argued that parsimony is not desirable by itself but is desirable only to the extent that it facilitates understanding (Venkatesh *et al.* 2003). For predictive, practical applications of the model, parsimony may be more heavily weighted; on the other hand, if trying to obtain a complete understanding of a phenomenon, a degree of parsimony may be sacrificed (Kriponant 2007). As shown in the Table 5.1 the UTAUT is rich in the explanatory ability in explaining behavioral intention and usage of technology. Therefore, the theory in question contributes to a better understanding about the drivers of behavior of acceptance and the use of new technologies than other similar theories and models (Venkatesh *et al.* 2003; Kripanont 2007; Wu, Tao and Yang 2007; Dulle 2010).

Rationalization for a well improved theory/model:

This section will further provide a justification the suggestion of the UTAUT model as well improved theory/model for technology acceptance. This critique is principally based upon existing criticisms made by Information Science theorists, and the researcher's own arguments to provide a synthesis of various viewpoints on technology acceptance with logical reasoning. This is not a trial to find conformity with the opinions and arguments already made, but to make known the potential issues faced in formulating a rational conceptual basis for the selection of UTAUT as a better model to explore the technology acceptance behaviours.

According to the reviewed literature, Venkatesh *et al.* (2003) and Bagozzi (2007), the following important features could be drawn in flavor of UTAUT as a well improved model to explain the technology acceptance behavior.

- The explanatory power of the UTAUT is higher;
- Eight specific models (Theory of Reason Action, Theory of Planned Behavior, Technology Acceptance Model, Motivational Model, Combine Theory of Planned Behavior and Technology Acceptance Model, Model of PC Utilization, Innovation Diffusion Theory and Social Cognitive Theory) have been identified and discussed to form the determinants of behavioral intention and usage behavior of technology in constructing the UTAUT;
- Comparison of selected models was done using longitudinal data from four organizations (Entertainment, Telecom Services, Banking, and Public Administration) in constructing UTAUT;
- Use of conceptual and empirical similarities and disparities across eight models to formulate the conceptual framework of the UTAUT model;
- Empirically testing the conceptualized UTAUT model using the original data from the above four organizations and then cross-validated it using new data from additional two organizations (Financial services and Retail electronics);
- Growing number of empirical evidences in last 5-6 years in favor of UTAUT.

Considering above facts it is clear that UTAUT will provide a solid base to explain why users accept or reject a technology in a specific perspective and it has much potential in enhancing our understanding of technology acceptance.

Conclusion:

Many researchers in the IS field are interested in examining the role of human trust in technology acceptance. Trust in technology is an ever more imperative concept as anew mode of technologies is appearing and may become more complex and harder for some and not for others. Such substantial differences between groups in how they perceive items on technology acceptance may have salient theoretical and practical implications for usage predictions. In the course of conceptual improvement and empirical findings of past studies, most researchers have concurred on the fact that quality elucidations emerge through robust theories/models. Despite of the negative aspects identified in the theoretical paradigms of these theories/models, one significant paradigm out of the fourteen theories/models could be drawn from this conceptual review. This

recognized dominant theoretical perception, as UTAUT which could be duly used for modelling technology acceptance behaviour.

References:

Ajzen, I. (1985). From intentions to actions: a theory of planned behaviour. *Action Control: From Cognition to Behaviour*, pp. 11-39. Available at:http://search.epnet.com/login.aspx?direct=true&db=aph&authdb=epref&an=ACFCB.AJZEN.SPRINGER.AIHE.AA [Accessed on17 December 2010]

Ajzen, I. (1991).The Theory of Planned Behaviour.*OrganisationalBehaviour and Human Decision Processes*, 50(2), pp. 179-211.

Baenbasat, I. and Barki,H. (2007). Quo Vadis, TAM. *Journal of the AIS*, 8, pp.211-218.

Bagozzi, R. P. (2007). The legacy of the technology acceptance model and a proposal for a paradigm shift.*Jounal of the Association for Information Systems*, 8(4), pp. 244-254

Bandura, A. (1986).Social foundations of thought and action, Prentice Hall, Englewood Cliffs, NJ.

Bhattacherjee, A. (2001). Understanding information systems continuance: an Expectation-Confirmation model. *MIS Quarterly*, 25(3), pp.351-370.

Bhattacherjee, Anol and Prekumar, G. (2004). Understanding changes in belief and attitude towards Information technology usage: a theoretical model and longitudinal test (FN1). *MIS Quarterly*, 28(2), pp. 229-254.

Burch, T. K. (2003). Demography in a new key: a theory of population theory. *Demographic research*, 9(11): pp. 263-284.

Colley, A. and Comber, C. (2003). Age and gender differences in computer use and attitudes among secondary school students: what has changed? *Educational Research*, 45(2), pp.155 -165.

Davis, F. D. (1989).Perceived usefulness, perceived ease of use, and user acceptance of information technology.*MIS Quarterly*, 13, pp. 319–340.

Davis, F. D., Bagozzi, R. P. and Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 35(8), pp. 982-1003.

Davis, F. D., Bagozzi, R. P. and Warshaw, P. R. (1992).Extrinsic and intrinsic motivation to use computers in the workplace.*Journal of Applied Social Psychology*, 22(14), pp.1111-1132.

De Wit, Kert, Heerwegh, Dirk andVerhoeven, Jef C. (2011). Changes in the basic ICT skills of freshmen between 2005 and 2009: who's catching up and who's still behind?.*Education & Information Technologies*, DOI 10.1007/s10639-011-9154-z.

Dillon, A.And Morris, C. (2001).User Acceptance of Information Technology. In W. Karwowski (ed). *Encyclopedia of Human Factors and Ergonomics*. London: Taylor and Francis.

Dulle, F. W. (2008). Open access publishing: the emerging opportunity for wider dissemination of scholarly output. A paper presented at PANTIL Annual Research Workshop, 06-09 October, 2008, Dodoma, Tanzania.

Dulle, F. W., Minishi-Majanja, M. K. and Cloete, L. M. (2010).Factors influencing the adoption of open access scholarly communication in Tanzanian public universities. World Library and Information Congress: 76th IFLA General Conference and Assembly 10-15 August 2010, Gothenburg, Sweden.

Festinger, L. A. (1957).Theory of cognitive dissonance.Row and Peterson, Evanston, IL.

Fishbein, M. and Ajzen, I. (1975).Belief, attitude, intention and behaviour: an introduction to theory and research, Addison-Wesley, Reading, MA.

Goodhue, Dale L. and Thompon, Ronald L. (1995).Task-technology fit and individual performance.*MIS Quarterly*,19(2), pp. 213-236.

King, William R. and He, Jun. (2006).A meta-analysis of the technology acceptance model.*Information & Management*, 43, pp. 740-755.

Kripanont, N. (2007). Using technology acceptance model of Internet usage by academics within Thai Business Schools. PhD thesis submitted to the Victoria University. Available at: http://wallaby.vu.edu.au/adt-VVUT/public/adt-VVUT20070911.152902/index.html[Accessed on 6 January 2012].

Legris, P., Ingham, J. and Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model.*Information & Management*, 40, pp.191–204.

Losh, S.C. (2004). Gender, educational and occupational digital gaps: 1983-2002. *Social Science Computer Review*, 22(2), pp.152-166.

Louho, R., Kallioja, M. and Oittinen, P. (2006).Factors affecting the use of Hybrid media applications.*Graphic arts in Finland*, 35 (3), pp. 11-21.

Magee, A. (2002).Attitude-behaviour relationship. Available at: http://www.ciadvertising.org/SA/fall_02/adv382j/mageeac/theory.htm[Accessed on 10 April 2011].

Oliver, R. L. (1980). A cognitive model for the antecedents and consequences of satisfaction.*Journal of Marketing Research*, 17, pp. 460-469.

Oye, N. D., Iahad, N.A. and Ab.Rahim, N. (2012).The history of UTAUT model and its impact on ICT acceptance and usage by academicians.*Educational Information Technology*, DOI 10.1007/s10639-012-9189-9.

Rogers, E. M. and Shoemaker, F. F. (1971).Communication of Innovations: a cross-culture approach.2nd edn, Free Press, New York.

Rogers, E.M. (1995).Diffusion of Innovations, 4th edn, The Free Press, New York, NY.

Singleton, R. A., Straits, B. C. and Straits, M. M. (1993).Approaches to social research.2nd edition. New York: Oxford University Press.
Strong, D. M., Dishaw, M. T., Bandy, D. B. (2006). Extending Task Technology Fit with Computer Self-Efficacy. In: *ACM SIGMIS Database*, 37(2-3), pp. 96 – 107.
Suvarna, J. S. and Godavari, Jang (2012).Higher education through ICT in rural areas.*Golden Research Thoughts*, 1(X), pp.1-4.
Taylor, S. and Todd, P. (1995a).Assessing it usage: the role of prior experience.*MIS*
Quarterly, 19(4), pp. 561-70.
Taylor, S. and Todd, P. A. (1995b). Understanding information technology usage: A test of competing models. *Information Systems Research*, 6, pp. 144–176.
Thompson, R. L., Higgins, C. A. and Howell, J. M. (1991). Personal computing: toward a conceptual model of utilization. *MIS Quarterly*, 15(1), pp. 125-143.
Triandis, H. C. (1977). Interpersonal Behavior.Brooke/Cole, Monterey, CA.
vanRaaij, Erik M. and Schepers, Jeroen J. L. (2008). The acceptance and use of a virtual learning environment in China.*Computers & Education*, 50, pp.838–852
Venkatesh, V. and Davis, F. D. (2000). A theoretical extension of technology acceptance model: Four longitudinal field studies. *Management Science*, 46, pp.186–204.
Venkatesh, V., Morris, M. G., Davis, G. B. and Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27, pp.425–478.
Venkatesh, V. *and Speier*, C. (1999). The hidden minefields in the adoption of sales force. *Organizational Behavior and Human Decision Processes*, 79, pp. 1-28.
Verhoeven, Jef C., Heerwegh, Dirk and De Wit, Kurt. (2010). Information and Communication Technologies in the life of university freshmen: an analysis of change. *Computers & Education*, 55, pp.53-66.
Verhoeven, Jef C., Heerwegh, Dirk and De Wit, Kurt. (2011).First year university students' self-perception of ICT skills: Do learning styles matter?.*Education & Information Technologies*, DOI 10.1007/s10639-010-9149-1
Webster, J. and Martocchio, J. J. (1992). Microcomputer playfulness: development of a measure with workplace implications. *MIS Quarterly*, 16(2), pp. 201-226.
Wills, Matthew J., El-Gayar, Omar F. and Bennett, Dorine. (2008). Examining healthcare professionals' acceptance of electronic medical records using UTAUT. *Issues in Information Systems*, IX(2), pp.396- 401.

Wu, Y., Tao, Y. and Yang, P. (2007).Using UTAUT to explore the behaviour of 3G mobile communication users.Available at: http://tao.nuk.edu.tw/papers/IEEM2007.pdf [Accessed on 8 January 2011]