

Individual and Organizational Acceptance of Technology Theories and Models: Conceptual Gap and Possible Solutions

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ABSTRACT

This paper provides a critical analysis of technology acceptance literature. The significance of the study lies in the fact that it analyzed models that have been developed regarding technology acceptance at the individual and organizational levels. Based on the different models, the study aims to identify important factors of technology acceptance at both the individual and organizational level and consequently make obvious their strengths and conceptual gaps so as to assist researchers make appropriate choices during technology acceptance. The study also proffers possible options for further studies.

(Keywords: acceptance, gap, individual, model, organizational, technology)

INTRODUCTION

Acceptance and use of technology is a topic that has received the attention of researchers and experts in various fields in recent times. Technology acceptance has been described as the approval, favorable reception and ongoing use of newly introduced devices and systems (Chen and Chan, 2011). Both practitioners and researchers have a strong interest in understanding why people accept information technology so that better methods for designing, evaluating, and predicting how users will respond to new technology can be developed (Dillon and Morris, 1996).

Within this broad area of inquiry, there have been several streams of research. One stream of research focuses on individual acceptance of technology by using intention or usage as a dependent variable. Other streams have focused

on implementation success at the organizational level (Venkatesh et al., 2003).

It is commonly accepted today that Information Technology (IT) has significant effects on the productivity of firms. These effects will only be fully realized if, and when, IT is widely spread and used. It is crucial, therefore, to understand the determinants of IT adoption and the theoretical models that have arisen addressing IT adoption (Oliveira and Martins, 2011). At the individual level of acceptance, lack of user acceptance is a significant impediment to the success of new information systems. In fact, users are often unwilling to use information systems which, if used, would result in impressive performance gains. Therefore, user acceptance has been viewed as the pivotal factor in determining the success or failure of any information system project (Dillon and Morris, 1996).

Also, research to increase the understanding of customer acceptance of new products and technologies is widespread and scattered. Researchers from psychology, sociology, information technology, organizational behavior, economics, and marketing have examined the determinants of new product and technology acceptance with mixed success (Ittersum, 2006). There are not many reviews of literature about the comparison of IT adoption models at the individual level, and there are even a smaller number at the firm level (Oliveira and Martins, 2011).

Furthermore, studies and research about technology acceptance, by individuals and organizations have been written in the recent years under a variety of approaches, presenting a strong growth on these initiatives from the middle of the 1990 decade. These studies are

made with the intention to search constant enhances, and identify intrinsic and extrinsic factors involved in the decisions, intentions and individual's satisfaction, about the acceptance and the use of information technology, through many tests and evaluation methods (Venkatesh et al., 2003; Silva and Dias, 2007). Therefore, to better predict technology usage behavior, it is important to understand the factors that influence acceptance and usage of technology (Chen and Chan, 2011).

This study thus examines technology acceptance behaviors at both the individual and organizational levels showcasing their strengths and conceptual gaps in order to appropriately enable researchers and practitioners choose relevant factors and adapt or develop adequate models during technology acceptance.

LITERATURE REVIEW

Acceptance Models

The study examined technology acceptance models at the individual and organizational levels. At the individual (or consumer) level the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) models were analyzed while the Technology Organizational and Environment (TOE) and the Diffusion of Innovation (DOI) models were examined at the organizational level.

Individual Acceptance of Technology Models

The Technology Acceptance Model (TAM): TAM was initially developed by Davis in 1989 to provide an explanation of the determinants of computer acceptance. In general, it is capable of explaining user behavior across a broad range of end-user computing technologies and user populations theoretically justified (Davis, 1989; Rigopoulos and Askounis, 2007; Chiemeke and Ewwiekpaefe, 2011). Moreover, TAM has been extensively incorporated as a methodology to measure attitude towards technology adoption from users in multiple domains, as well as within financial domain. TAM variations have also been proposed and applied for measuring users' attitude towards adoption of several IT based services (Rigopoulos and Askounis, 2007). TAM, shown in Figure 1, is based on the following principal concepts:

Perceived Usefulness: Perceived usefulness is defined as “the degree to which a person believes that using a particular system would enhance his or her job performance. A system high in perceived usefulness, in turn, is one for which a user believes in the existence of a positive use-performance relationship (Davis, 1989).

Perceived Ease of Use: Perceived ease of use refers to “the degree to which a person believes that using a particular system would be free of efforts”. All else being equal an application perceived to be easier to use than another is more likely to be accepted by users (Davis, 1989).

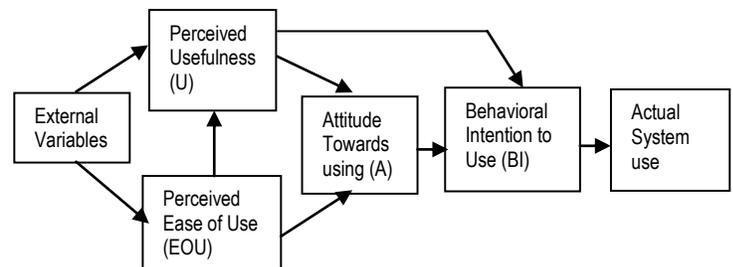


Figure 1: Technology Acceptance Model (TAM)
Sources: Davis (1989)

Unified Theory of Acceptance and Use of Technology (UTAUT) Model: Venkatesh et al. (2003) developed the Unified Theory of Acceptance and Use of Technology (UTAUT) model to consolidate previous TAM related studies. UTAUT explained user intentions to use an Information System (IS) and subsequent usage behavior. The theory holds that four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) are direct determinants of usage intention and behavior (Venkatesh et al., 2003).

Gender, age, experience, and voluntariness of use are posited to mediate the impact of the four key constructs on usage intention and behavior. The theory was developed through a review and consolidation of the constructs of eight models that earlier research had employed to explain IS usage behavior (Venkatesh et al., 2003; Chiemeke et al., 2014). The model is shown in Figure 2.

The eight models are Technology Acceptance Model (TAM) (Davis 1989); Innovation Diffusion Theory (IDT) (Rogers 1995); the Theory of Reasoned Action (TRA) (Fishbein and Ajzen 1975); the Motivation Model (MM) (Davis et al. 1992); the Theory of Planned Behavior (TPB) (Ajzen 1991, Taylor and Todd 1995b); the Combined TAM and TPB (Taylor and Todd 1995a); the Model of PC Utilization (MPCU) (Thompson et al., 1991); and Social Cognitive Theory (Bandura 1986).

UTAUT was able to account for 70 percent of the variance (adjusted R^2) in usage intention—a substantial improvement over any of the original eight models and their extensions. Further, UTAUT was successful in integrating key elements from among the initial set of 32 main effects and four moderators as determinants of intention and behavior collectively posited by eight alternate models into a model that incorporated four main effects and four moderators (Venkatesh et al., 2003).

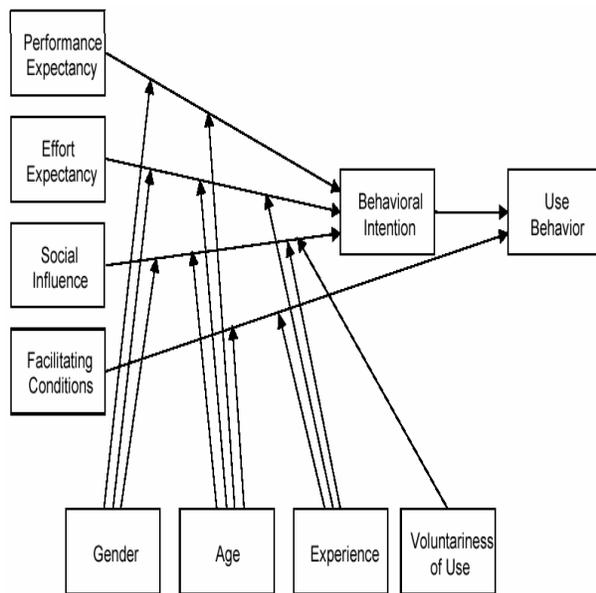


Figure 2: Unified Theory of Acceptance and Use of Technology (UTAUT) Model
Source: Venkatesh et al. (2003)

Factors of UTAUT: The factors of the UTAUT model are described in detail in Table 1.

Table 1: Summary of UTAUT components

Factor	Description
<i>Performance expectancy</i> (PE)	Degree to which an individual believes that using the system will help attain gains in job performance.
<i>Effort expectancy</i> (EE)	The degree of ease associated with the use of the system.
<i>Social influence</i> (SI)	The degree to which an individual perceives that important others believe he or she should use the new system.
<i>Facilitating conditions</i> (FC)	The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.
<i>Behavioral Intention</i> (BI)	The measure of the likelihood of an individual to employ the application.
<i>Use Behavior</i> (UB)	This measures the acceptance of the technology.

Organizational Acceptance of Technology Models

Technology-Organization-Environment (TOE) Model: The TOE model is an integrative schema incorporating characteristics of the technology, contingent organizational factors, and elements from the macro-environment (Tornatzky and Fleischer, 1990; Li, 2010). Tornatzky and Fleischer (1990) developed the technology-organization- environment framework, which identified three aspects of a firm’s context that influence the process by which it adopts and implements technological innovation: organizational context, technological context, and environmental context.

Organizational context is typically defined in terms of several descriptive measures: firm size; the centralization, formalization, and complexity of its managerial structure; the quality of its human resource; and the amount of slack resources available internally. Technological context describes both the internal and external technologies relevant to the firm. This includes existing technologies inside the firm, as well as the pool of available technologies in the market.

Environment context is the arena in which a firm conducts its business, its industry, competitors, access to resources supplied by others, and dealings with government (Tornatzky and Fleischer 1990) as shown in Figure 3. This framework has been examined by a number of studies on various IS domains (Zhu et al, 2003).

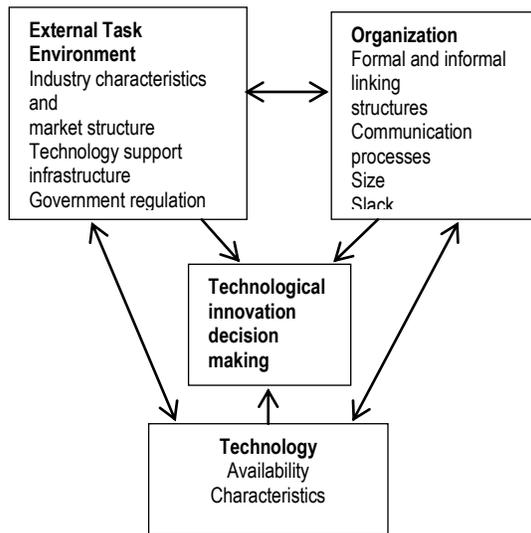


Figure 3: Technology Organizational Environment Model. Source: Tornatzky and Fleischer (1990)

Diffusion of Innovation Theory (DOI) Theory:

Rogers (1995) defines the diffusion of innovations as the process by which an innovation is communicated through certain channels over time among the members of a social system. Rogers' definition contains four elements that are present in the diffusion of innovation process. The elements are:

- Innovation – is an idea, practice or object that is perceived as new by an individual or other unit of adoption.
- Communication channels - the means by which messages get from one individual to another.
- Time - the three time factors are: innovation-decision process, Relative time with which an innovation is adopted by an individual or group and Innovation's rate of adoption.
- Social system - a set of interrelated units that are engaged in joint problem solving to

accomplish a common goal as shown in Figure 4.

Also, there are five different attributes of innovations as being important for rapid diffusion (Rogers, 1995). Each is somehow interrelated with the other four, but they are conceptually different. They are:

- Relative advantage is the degree to which an innovation is perceived as being better than the idea it supersedes.
- Compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters.
- Complexity is the degree to which an innovation is perceived as difficult to understand and use.
- Trialability is the degree to which an innovation may be experimented with on a limited basis.
- Observability is the degree to which the results of an innovation are visible to others (Figure 4).

Also, according to the DOI theory at organizational level (Rogers 1995), innovativeness is related to three independent variables as individual (leader) characteristics, internal organizational structural characteristics, and external characteristics of the organization (Figure 5).

(a) Individual characteristics describe the leader attitude toward change.

(b) Internal characteristics of organizational structure includes the following attributes according to Rogers (1995) where: "centralization is the degree to which power and control in a system are concentrated in the hands of a relatively few individuals"; "complexity is the degree to which an organization's members possess a relatively high level of knowledge and expertise"; "formalization is the degree to which an organization emphasizes its members' following rules and procedures"; "interconnectedness is the degree to which the units in a social system are linked by interpersonal networks"; "organizational slack is the degree to which uncommitted resources are

available to an organization”; “size is the number of employees of the organization”.

(c) External characteristics of organizational refer to system openness. As shown in Figure 5.

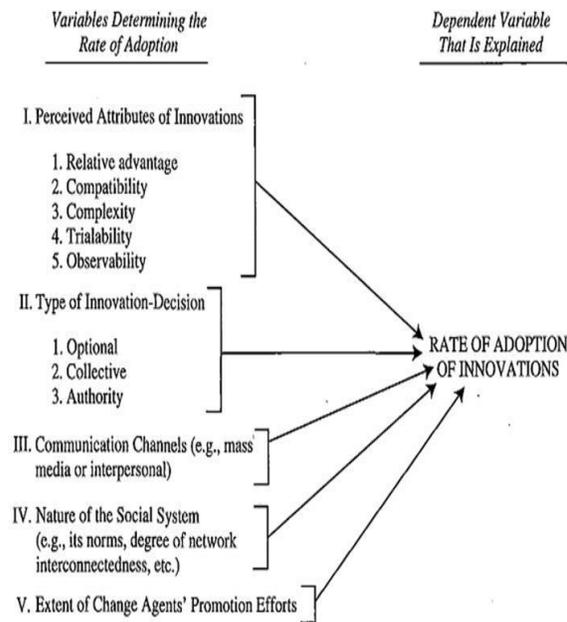


Figure 4: Variables Determining the Rate of Diffusion of Innovation. Source: Rogers (1995).

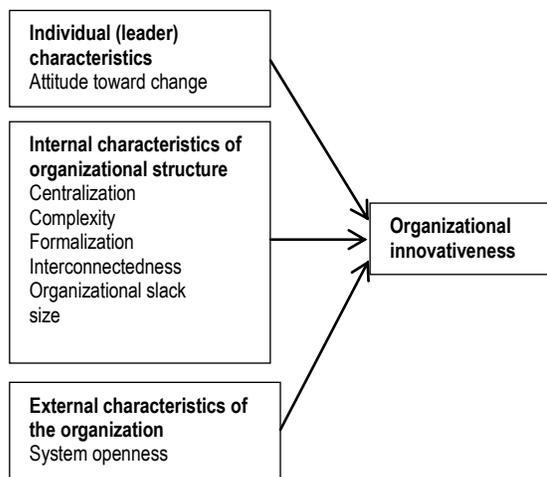


Figure 5: Independent Variables Related to Organizational Innovativeness. Source: Rogers (1995).

DISCUSSION

Strength and Conceptual Gap of TAM

TAM has been stated to be a more parsimonious model and more for various research settings and user populations. However, it has been criticized for neglecting the social aspects of the IT acceptance process (Raitoharju, 2007). One of the biggest advantages of TAM is its generalizability across a wide variety of technologies. TAM has been applied in simple standalone software adoption settings (e.g., a word processing), in collaboration tool studies (e.g email system), but also at complex and multilayered working environments (Venkatesh, 2006; Lahtinen, 2012). Nevertheless, TAM has been criticized for not explaining how the external factors outside of the organization affect the adoption process (Lahtinen, 2012).

Strength and Conceptual Gap of the UTAUT Model

UTAUT model posits that adoption intention has significant positive influence on technological usage in every research settings (Venkatesh et al. 2003). In other words, UTAUT is inherently a general adoption theory which is not context-dependent (Lahtinen, 2012). UTAUT model though a very robust model does not handle specific domains hence the model is constantly being modified or extended. A model focused on a specific class of technology will be more explanatory compared to a general model that attempts to address many classes of technologies (Table 2). Such a focused model will also provide designers and managers with levers to augment adoption and use (Brown, et al., 2010). Further, the original UTAUT model focused on the mandatory use of technologies in a work environment (Lahtinen, 2012). This sometimes makes it difficult using it in voluntary situations. Also, UTAUT did not include the process that technology progresses through to be adopted (Kiwanuka, 2015)

Strength and Conceptual Gap of the TOE Model

TOE is widely used in the field of organizational technology adoption research (Lahtinen, 2012). The process by which an organization adopts and implements technological innovations is influenced by the technological context, the

organizational context, and the environmental context. These three elements present “both constraints and opportunities for technological innovation” (Tornatzky and Fleisher 1990). Therefore this makes the TOE model regulated to firm or macro organizational setting, thereby limiting it from individual or consumer adoption context which is the custom of most IS studies. However, TOE does not intend to offer a fixed model, including specific factors that may affect the adoption processes; it is actually a taxonomy for categorizing factors in their relevant context (Ven and Verelst, 2011). Again, TOE framework did not discuss specifically the characteristic or features of technology as compared to Diffusion of Innovation Theory by Rogers (1995) (Table 2).

Strength and Conceptual Gap of the DOI Theory

Similarly to the TAM origin models, DOI and TOE are general adoption models which have been utilized in countless environments and research settings (Lahtinen, 2012). It is argued that the theory does not provide evidence on how attitude

evolves into acceptance and rejection decisions and how innovation characteristics fit into this process (Chen et al. 2002; Karahanna et al. 1999) (Table 2).

Possible Solutions

According to Venkatesh et al., 2003, researchers are confronted with a choice among a multitude of models and find that they must “pick and choose” constructs across the models, or choose a “favored model” and largely ignore the contributions from alternative models. Looking critically at Table 2, it is obvious that all existing IS models and theories are general technology acceptance theories and models. This supports the arguments of Kiwanuka (2015) that currently, there exists no universally accepted theory to explain information technology and information systems adoption. The situation the paper believes leaves researchers in a “state of methodological vacuum and theoretical confusion” and making scholars develop their own theories or extend the existing ones to cater for their research problems.

Table 2: Summary of Conceptual Gap of Some IS Models

S/N	RESEARCH MODEL	STRENGTH	CONCEPTUAL GAP	SUPPORTING LITERATURES
1	Technology Acceptance Model (TAM)	i. General technology acceptance theory. ii. Can be applied to a wide variety of technologies.	i. Neglects the social aspects of the IT acceptance process ii. Does not explain how external factors outside of the organization affect the acceptance process	Davis et al., 1989; Kiwanuka, 2015; Lahtinen, 2012
2	Unified Theory of Acceptance and Use of Technology Model (UTAUT)	i. General technology acceptance theory ii. very robust model iii. An integrated model	i. Does not handle specific domains ii. Lack effective use in a voluntary setting iii. Lack effective use in an organizational (firm or macro) setting iv. UTAUT did not include the process that technology progresses through to be adopted.	Lahtinen, 2012; Venkatesh et al., 2003; Kiwanuka, 2015.
3	Technology Organization Environment (TOE) Model	i. General technology acceptance theory ii. Good technology, environmental and organizational support iii. Supports elements from the macro-environment, ie, strong at the organizational or firm's context	i. Lack Organization support at micro level firm level ii. Constructs are difficult to define and measure especially at the technology aspect. iii. ignore individual support of IS acceptance	Lahtinen, 2012; Tornatzky and Fleisher, 1990; Zhu et al., 2003.
4	Diffusion of Innovation Theory (DOI)	i. General technology acceptance theory	i. Lack effective organization support at the micro firm level ii. Does not include some important construct like the environmental and attitude construct	Lahtinen, 2012; Kiwanuka, 2015.

Therefore, based on the above and on the various models analyzed from both the individual and organizational levels the study conceptually proposes the following:

- That studies utilizing the TAM should include social influence to better predict technology acceptance.
- UTAUT should be combined with other theories or model to reflect the specifics of the research domain during IT acceptance and in line with Kiwanuka (2015) technology adoption processes should be included in UTAUT to better predict technology acceptance.
- For the TOE model, constructs of the model at the technology aspect should be well defined in order to achieve adequate technology acceptance.
- For the DOI theory, the theory should include some important construct like the Environment and Attitude constructs in order to achieve acceptable technology acceptance.
- In all, the study recommends a combination of more than one theoretical model in order to achieve a better understanding of the IT acceptance since most IS model are general technology acceptance theories.

CONCLUSION

With the advancement and growth of new technologies there have been a number of researches addressing consumer and organizational acceptance of these technologies. How fast these technologies are accepted depends on a number of factors as well as an understanding of the appropriate model to adapt or develop. This paper therefore sheds light on technology acceptance models at both the individual and organizational level highlighting their gaps and strengths. This will aid researchers and practitioners in choosing appropriate models or model combination for technology acceptance.

The study further recommends that for more adequate new technology acceptance it is imperative to combine more than one theoretical model to achieve a better understanding of the IT acceptance.

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