Review on IT adoption: insights from recent technologies

Hemlata Gangwar, Hema Date and A.D. Raoot
Department of Information Technology,
National Institute of Industrial Engineering Mumbai, Mumbai, India

Abstract

Purpose – The purpose of this paper is to review the literature on information technology adoption in organizations to understand the need of integrated models for technology adoption. It further makes an attempt to identify key parameters to integrate technology acceptance model (TAM) and technology-organization-environment (TOE) framework for firm level technology adoption. This integration is intended to improve predictive power of resulting model.

Design/methodology/approach – The research papers are accessed from the popular databases from 2000 to 2012. The selected papers have addressed technology adoption in context of recent technologies such as e-commerce, ERP, RFID, EDI and knowledge management, etc. The paper attempts to review the studies based on TAM model and TOE framework to identify relevant set of variables for the adoption of these technologies in organizations.

Findings – TAM and its extended versions have high capability to explain the technology adoption while the significance of TOE framework is similarly recognized in explaining technology adoption. This review presents a holistic picture of a set of variables which can be used in the adoption of similar technologies in future. Further, the study has advocated the integration of TAM model and TOE framework to improve their explanatory power in technology adoption. The identified set of variables of TAM model and TOE framework can be used to integrate the two. Guidelines for integrating the two are also explained.

Research limitations/implications – This study provides a platform for studying adoption of similar technologies using integration of TAM and TOE.

Practical implications – The researchers and managers can use the set of variables identified for adoption of similar technologies in organizations.

Originality/value – The review presents a set of variables which can be used to study adoption of similar technologies in future.

Keywords Information technology, TOE, Technology adoption, TAM

Paper type Literature review

1. Introduction

In the information system (IS) domain, technology adoption has been one of the extensively researched areas. Studies on technology adoption have aimed to understand, predict and explain variables influencing adoption behavior at individual as well as organizational levels to accept and use technological innovations. These studies have led to development of conceptual models and frameworks to understand the relationship of these variables with the adoption behavior. Hence, this study makes an attempt to review such studies, and acknowledges greater significance of technology acceptance model (TAM) and technology-organization-environment (TOE) framework (compared to other technology adoption models) to explain technology adoption on one side and their limited explanatory power on the other side. Further, it advocates their integration using the set of identified variables so that their explanatory power can be improved to an extent. Hence, the study identifies the set of variables explaining the adoption of recent technologies such as, e-commerce, ERP, RFID, EDI and knowledge management, etc. and proposes the guidelines on how the two models can be integrated for better explanation of technology adoption.
2. Methodology
This paper reviews the studies published from 2000 to 2012; on adoption of recent
technologies such as internet, e-commerce, ERP, RFID, EDI and knowledge management,
etc., at an organizational level. The studies are accessed from the popular databases such
as Emerald, EbscoHost, ScienceDirect and SSRN, etc. using keywords (or, combination
of keywords) such as technology adoption, technology adoption models, TAM, TOE,
information technology (IT), internet, e-commerce, ERP, RFID, EDI and knowledge
management, etc. The studies based on TAM model and TOE framework are included
to identify relevant variables which can be used to study the adoption of similar
technologies in future such as cloud computing and grid technologies, etc. TAM and
TOE are selected due to their preference available in the literature over other
adoption models such as theory of reasoned action (TRA), theory of planned
behavior (TPB), innovation diffusion theory (IDT), etc.

The literature review process is presented diagrammatically as follows:

- Selection of keywords → Searching published articles in the databases → Making
  choice for relevant papers → Identifying IT adoption models at organizational level →
  Selecting TAM model and TOE framework as most accepted models → Developing an
  understanding on needs of integrating models → Developing ways to integrate the
  two (TAM model and TOE framework) → Writing discussion and conclusion.

3. Technology adoption
Khasawneh (2008) defines the technology adoption as “[... the first use or acceptance
of a new technology or new product.” As a voluntary individual behavior (Musawa and
Wahab, 2012), technology adoption is explained by various theories and models such as:

- TAM proposed by Davis (1989);
- IDT proposed by (Rogers, 1995);
- TRA proposed by Fishbein and Ajzen (1975);
- TPB proposed by Ajzen (1991);
- TOE framework proposed by Tornatzky and Fleischer (1990); and
- unified theory of acceptance and use of technology (UTAUT) (which combines
  eight theoretical models including the TAM and TPB) proposed by Venkatesh
  et al. (2003).

Liu et al. (2008) categorized adoption at three levels: individual, group/team and
organization. Studies have argued that TRA, TPB and UTAUT were originally developed
for predicting individual adoption and there are lesser studies in organizational context
(Oliveira and Martins, 2011; Williams et al., 2009; Liu et al., 2008). On the contrary,
TAM and TOE are widely used in studying technology adoption at organizational
level. Most of the studies have found TAM as the valid, robust and most dominant
model to explain the technology adoption at organizational levels (King and He,
2006). Critical reviews of studies on TAM by several researchers have yielded that
TAM and its modified versions have gained substantial theoretical and empirical
support over a period of time; and hence are most widely used by IS researchers over
alternative models (Hong et al., 2006; Amoako-Gyampah and Salam, 2004; Legris
et al., 2003). Carr et al. (2010) state that TAM has several benefits such as it is
straightforward and designed to provide an adequate explanation for and a predication
of diverse users’ acceptance of IT within different organizational contexts; it has
a well-researched and validated inventory of psychometric measurements; and it is a dominant model for investigating user technology acceptance.

On the other hand, TOE framework has emerged as a widespread theoretical perspective on IT adoption and hence, several authors have tested its variables for the adoption of several technologies (Thiesse et al., 2011; Wang et al., 2010; Zhu et al., 2004; Kuan and Chau, 2001). According to Oliveira and Martins (2011), IDT constructs are identical to the technology and organization context of the TOE framework, and TOE framework is found superior to IDT to explain technology adoption as it includes new constructs as well (i.e. environmental). TOE framework is more significant than IDT as per theoretical analysis of Rogers (1983) as well (Zhu et al., 2003). Hence, considering the high significance of TAM model and TOE framework over other theories and models, we have considered the organization-based studies based on TAM and TOE in this paper.

4. TAM
Among the many theoretical models, TAM is widely accepted model for understanding IT adoption and usage processes. It explains much of the variance in users' behavioral intention (BI) related to IT adoption and usage across a wide variety of contexts (Hong et al., 2006). It predicts a user's acceptance of IT and its usage on the job (Au and Zafar, 2008) and explains the determinants of user acceptance of a wide range of end-user computing technologies (Davis, 1986).

4.1 Determinants of TAM model
TAM seeks to explain the relationship between individual's technological acceptance and adoption and subsequently, their BI to use it (Autry et al., 2010). It poises the perceived usefulness (PU) and perceived ease of use (PEOU) as primary determinants of system use (Chen and Tan, 2004; Au and Zafar, 2008). PU is defined as “the prospective user’s subjective probability that using a specific application system will increase his or her job performance within an organizational context,” and PEOU refers to “the degree to which the prospective user expects the target system to be free of effort” (Davis, 1989). The model also suggests that PEOU influences PU, because technologies that are easy to use can be more useful (Schillewaert et al., 2005). This has been proved by repeated testing of TAM which shows that these two variables consistently explain 40 percent of the variance in individuals’ intention to use (acceptance) and subsequent implementation (adoption) of a technology (Autry et al., 2010).

Though TAM was originally developed to predict users’ initial adoption of a new IT, it is expected to explain and predict future user behavior based on simple measures taken “after a very brief interaction with a system” as a prototype or in a pre-adoption trial (Hong et al., 2006) and its meaningfulness in post-adoption studies has been supported empirically as well. Further, TAM is advocated as an intention-based model which stipulates that the intention to adopt a technology is a good predictor of its actual usage (Hong et al., 2006). For a better understanding of the two constructs, effective organizational interventions are designed that might lead to increased user acceptance and use of new IT systems, and thus efforts have been made to extensions to the theory (Amoako-Gyampah and Salam, 2004). Hence, it can be concluded that the TAM model has strong implications on technology adoption from theoretical and conceptual perspectives.

4.2 Extension of TAM
TAM was specifically tailored for modeling user acceptance of IT with the aim of explaining the BI to use the system and hence, has served as a basis for past research in
IT dealing with BIs and usage of IT (Amoako-Gyampah and Salam, 2004). To examine firm-wide acceptance and adoption of IT, the extension of the basic framework (i.e. TAM2 and TAM3) has included broad categories of antecedents to the PU and PEOU.

Referring to Wu (2011) and King and He (2006), four kinds of modifications contributed to the evolution of TAM: altering external antecedents; amending predictive variables; manipulating moderator variables; and varying consequence measures. The built-in core component common to all modifications of TAM consists of three constructs: PU, PEOU and BI (Wu, 2011; King and He, 2006) out of which in the core part, BI is affected by both PU and PEOU, while PU is influenced by PEOU. So, PU and PEOU are two core constructs that shape user attitudes and intentions in adopting a technology system (Wu, 2011; Lee et al., 2010).

For technologies such as, RFID and ERP, there are several variables those determine PU and PEOU such as trust in service provider, partner’s influence, security trust, partner’s influence, training, education, work environment and communication, etc., as mentioned in Tables I and II.

### 4.3 Limitations of TAM

Nevertheless, TAM has been found with certain limitations. Studies on TAM have generated conflicting findings and have led to the confusion over moderating and external variables (Chen and Tan, 2004). Hence, TAM model should be generalized with caution. Further, TAM measures perceived adoption and self-reports on future behavior rather

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Technology</th>
<th>Variable(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoako-Gyampah and Salam (2004)</td>
<td>ERP</td>
<td>Project communication, shared belief, training</td>
</tr>
<tr>
<td>Kerimoglu et al. (2008)</td>
<td>ERP</td>
<td>Capability, flexibility, innovativeness, project management</td>
</tr>
<tr>
<td>Lee et al. (2010)</td>
<td>ERP</td>
<td>Training and education, work environment, communication</td>
</tr>
<tr>
<td>Hwang et al. (2008)</td>
<td>ERP</td>
<td>Perceived strategic value, external pressure/support, organizational readiness</td>
</tr>
<tr>
<td>Lee (2009)</td>
<td>RFID</td>
<td>Security trust, employee knowledge, partner influence, provider trust</td>
</tr>
<tr>
<td>Abbasi et al. (2011)</td>
<td>Internet</td>
<td>Subjective norms, government support, institute support</td>
</tr>
</tbody>
</table>

**Table I.** TAM-based studies

<table>
<thead>
<tr>
<th>Technology</th>
<th>Perceived ease of use (PEOU)</th>
<th>Perceived usefulness (PU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFID (Lee, 2009)</td>
<td>The trust in a service provider</td>
<td>Significant</td>
</tr>
<tr>
<td></td>
<td>The employee’s knowledge</td>
<td>Significant</td>
</tr>
<tr>
<td></td>
<td>The partner’s influence</td>
<td>Insignificant</td>
</tr>
<tr>
<td></td>
<td>The security trust</td>
<td>Significant</td>
</tr>
<tr>
<td>ERP (Lee et al., 2010)</td>
<td>Training and education</td>
<td>Significant</td>
</tr>
<tr>
<td></td>
<td>Work environment</td>
<td>Significant</td>
</tr>
<tr>
<td></td>
<td>Effective communication</td>
<td>Significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table II.** PEOU and PU
than measurement of actual behavior (Wu, 2011; Schillewaert et al., 2005). TAM contains restricted constructs and thus cannot handle the issue of adopting new services or solutions (Wu, 2011). Also, TAM is known for its limited possibility of explanation and prediction, triviality and lack of practical value (Garača, 2011). Hence, there is a scope of investigating role of certain other variables such as technological influences, the role of firm size in the technology make/buy decisions, the innovativeness of the firm, a firm's level of technology readiness, security, trust, marketing effort and also on evaluating the consequences of technology usage on performance such as responsiveness and financial performance (Wu, 2011; Autry et al., 2010; Schillewaert et al., 2005).

Further, TAM is proven to be a parsimonious model and its repeated empirical testing shows that the variables of TAM consistently explain 40 percent of the variance in individuals' intention to use (acceptance) and subsequent implementation (Autry et al., 2010; Hong et al., 2006). Since TAM model has been used by most of the IT adoption studies, Williams et al. (2009) highlighted that IS innovation is gradually moving toward homogeneity, leading to weakening the field and argue to make greater use of theoretical variety for under researched but contemporary issues. Also, Legris et al. (2003) highlighted that TAM-based empirical studies do not produce totally consistent or clear results; hence, significant factors are needed to be identified and included in the models. This clearly indicates the need of integrating TAM model with other IT adoption models and theories.

5. TOE framework
TOE framework was developed by Tornatzky and Fleischer (1990) to examine firm-level adoption of various IS/IT products and services. It has emerged as a widespread theoretical perspective on IT adoption (Zhu et al., 2004). Inclusion of technological, organizational and environmental variables has made TOE advantageous over other adoption models in studying technology adoption, technology use and value creation from technology innovation (Hossain and Quaddus, 2011; Oliveira and Martins, 2010; Ramdani et al., 2009; Zhu and Kraemer, 2005). Also, it is free from industry and firm-size restrictions (Wen and Chen, 2010). Hence, it provides a holistic picture for user adoption of technology, its implementation, foreseeing challenges, its impact on value chain activities, the post-adoption diffusion among firms, factors influencing business innovation-adoption decisions and to develop better organizational capabilities using the technology (Wang et al., 2010; Salwani et al., 2009; Lin and Lin, 2008; Zhu et al., 2004).

5.1 Elements of TOE framework
According to Tornatzky and Fleischer (1990), there are three types of contexts that may influence technological innovation adoption and implementation process. Some of the major studies on TOE are highlighted in Table III. These three contexts of TOE framework are explained as follows.

(i) Technological context. Technological context is comprised of the variables that influence an individual, an organization, and an industry's adoption of innovations (Huang et al., 2008; Claycomb et al., 2005). It includes five innovation attributes (from IDT) that influence the likelihood of adoption (Dedrick and West, 2003; Rogers, 1983). Apart from innovation attributes, researchers have included several other variables as well. The studies found that system assimilation, trailability, complexity, perceived direct benefits, perceived indirect benefits and standardization are significant variables while observability is found insignificant (Musawa and Wahab, 2012; Hossain and Quaddus, 2011; Thiesse et al., 2011; Jang, 2010; Wang et al., 2010; Ramdani et al., 2009;
<table>
<thead>
<tr>
<th>Author</th>
<th>Context</th>
<th>Significance</th>
<th>Technology</th>
<th>Organization</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huang <em>et al.</em></td>
<td>EDI</td>
<td>Significant</td>
<td>Relative advantage, complexity, strategic use of communication technology, trust in technology</td>
<td>Top management support, organizational slack</td>
<td>Potential power, trust in partner, competitive pressure, relationship commitment</td>
</tr>
<tr>
<td>(2008)</td>
<td></td>
<td>Insignificant</td>
<td>Compatibility, network externality</td>
<td></td>
<td>Dependency on partner, exercised power</td>
</tr>
<tr>
<td>Kuan and Chau</td>
<td>EDI</td>
<td>Significant</td>
<td>Perceived direct benefits, perceived financial costs</td>
<td>–</td>
<td>Pressure from the government</td>
</tr>
<tr>
<td>(2001)</td>
<td></td>
<td>Insignificant</td>
<td>Perceived indirect benefits</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Ramdani <em>et al.</em></td>
<td>ERP</td>
<td>Significant</td>
<td>Relative advantage, trailability</td>
<td>Top management support, organizational readiness, size</td>
<td>–</td>
</tr>
<tr>
<td>(2009)</td>
<td></td>
<td>Insignificant</td>
<td>Compatibility, complexity, observability</td>
<td>–</td>
<td>Industry sector, market scope, external IS support, competitive pressure</td>
</tr>
<tr>
<td>Kouki <em>et al.</em></td>
<td>ERP</td>
<td>Significant</td>
<td>–</td>
<td>Top management support, organizational culture, skilled and competent staff, training</td>
<td>Vendor support</td>
</tr>
<tr>
<td>(2009)</td>
<td></td>
<td>Insignificant</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Lin and Lin</td>
<td>e-business</td>
<td>Significant</td>
<td>Expected benefits</td>
<td>IS expertise and infrastructure</td>
<td>Trading partner pressure, competitive pressure</td>
</tr>
<tr>
<td>(2008)</td>
<td></td>
<td>Insignificant</td>
<td>–</td>
<td>Organizational compatibility</td>
<td>–</td>
</tr>
<tr>
<td>Salwani <em>et al.</em></td>
<td>e-commerce</td>
<td>Significant</td>
<td>–</td>
<td>Technology competence</td>
<td>Pressure intensity</td>
</tr>
<tr>
<td>(2009)</td>
<td></td>
<td>Insignificant</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Carnaghan and Klassen (2007)</td>
<td>e-business</td>
<td>Significant</td>
<td>Efficiency benefits, new market benefits</td>
<td>Firm size</td>
<td>Regulatory support</td>
</tr>
<tr>
<td>Zhu <em>et al.</em></td>
<td>e-business</td>
<td>Insignificant</td>
<td>–</td>
<td>Management support</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insignificant</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Author</td>
<td>Context</td>
<td>Significance</td>
<td>Technology</td>
<td>Organization</td>
<td>Environment</td>
</tr>
<tr>
<td>------------------------</td>
<td>---------</td>
<td>--------------</td>
<td>------------</td>
<td>--------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Hossain and Quaddus (2011)</td>
<td>RFID</td>
<td>Significant</td>
<td>–</td>
<td>–</td>
<td>External pressure, external support, perceived competitive advantage</td>
</tr>
<tr>
<td>Wang et al. (2010)</td>
<td>RFID</td>
<td>Insignificant</td>
<td>–</td>
<td>Complexity, compatibility</td>
<td>Infrastructure, Market pressure, Competitive pressure, trading partner pressure, information intensity</td>
</tr>
<tr>
<td>Ramdani et al. (2009)</td>
<td>KM</td>
<td>Insignificant</td>
<td>Relative advantage</td>
<td>Top management support, technology competence</td>
<td>–</td>
</tr>
<tr>
<td>Scupola (2009)</td>
<td>e-commerce</td>
<td>Significant</td>
<td>Relative advantage, barriers and benefits</td>
<td>Top management, knowledge and attitude, resource constraints</td>
<td>Industry sector, market scope, competitive pressure, external IS support, Pressure from competitors, customer pressure, access and quality of consulting, Role of government</td>
</tr>
</tbody>
</table>
The variable “Compatibility” is found significant in RFID and knowledge management adoption while insignificant in EDI and ERP adoption; because these technologies are internet-based and internet is so omnipotent that compatibility is not considered as a concerned element for technology adoption (Hossain and Quaddus, 2011; Wang et al., 2010; Ramdani et al., 2009; Huang et al., 2008). Similarly, the significance of “Relative advantage” and “Perceived cost” are also found to be varying with the context. Thus, it presents a holistic picture of variables having impact on recent technologies.

(ii) Organizational context. It refers to descriptive measures related to organizations such as firm scope, firm size and managerial beliefs, etc. (Salwani et al., 2009). Adoption propensity is influenced by formal and informal intra-organizational mechanisms for communication and control; along with resources and innovativeness of the organization (Dedrick and West, 2003). The significant variables in organizational context include financial resources, firm structure, organizational slack, innovation capacity, knowledge capability, operational capability, strategic use of technology, trust, technological resources, top management support, support for innovation, quality of human capital, organizational knowledge accumulation, expertise and infrastructure and organizational readiness while financial capacity and technology competence are identified as insignificant (Musawa and Wahab, 2012; Hossain and Quaddus, 2011; Jang, 2010; Lee et al., 2010; Wang et al., 2010; Lin, 2009; Ramdani et al., 2009; Huang et al., 2008; Lin and Lin, 2008; Carnaghan and Klassen, 2007; Raymond and Uwizeyemungu, 2007). Firm size was identified as significant in RFID, e-commerce and ERP adoption while insignificant in EDI adoption (Hossain and Quaddus, 2011; Li et al., 2010; Wang et al., 2010; Lin, 2009; Ramdani et al., 2009; Salwani et al., 2009; Huang et al., 2008). The reason explained by the authors is, organizations of all sizes have realized the strategic importance of technology for the success of their businesses, thus are willing to invest heavily on technologies to improve their competitive advantages. Similarly, role of top management commitment varies from context to context (Thiesse et al., 2011; Jang, 2010; Li et al., 2010; Wang et al., 2010; Ramdani et al., 2009). Some inter-organizational variables are also studied in context on EDI by Huang et al. (2008) who identified potential power of the partner, trust in the partner and relationship commitment with a partner as significant variables while exercised power of the partner and dependency on the partner as insignificant variables. Thus, it presents a holistic picture of variables having impact on recent technologies.

(iii) Environmental context. It focusses on areas in which a firm conducts its business operations, with the priority given to external factors influencing the industry such as government incentives and regulations (Salwani et al., 2009). It includes variables related to industry characteristics such as rivalry, relations with buyers and suppliers, as well as the stages of the industry life cycle (DePietro et al., 1990, pp. 169-171). Significant variables in environmental context include customer mandate, competitive pressure, external pressure, internal pressure, trading partner pressure, vendor support, commercial dependence, environmental uncertainty, information intensity and network intensity while government regulation is not identified as significant variable (Musawa and Wahab, 2012; Hossain and Quaddus, 2011; Thiesse et al., 2011; Jang, 2010; Li et al., 2010; Wang et al., 2010; Salwani et al., 2009; Huang et al., 2008; Lin and Lin, 2008; Raymond and Uwizeyemungu, 2007; Zhu et al., 2004). Thus, it presents a holistic picture of variables having impact on recent technologies.
5.2 Limitations of TOE framework

Studies based on TOE framework have several limitations too. According to Dedrick and West (2003), TOE framework is just a taxonomy for categorizing variables and it does not represent an integrated conceptual framework or a well developed theory, hence, there is a requirement of a more robust framework to study organizational adoption. Low et al. (2011) also highlighted that TOE framework has no major constructs in the model and the variables in each context. TOE framework is limited in its explanatory power of technology adoption as well as it can be seen in case of EDI adoption where around half of the percentages of EDI adoption variance remain unexplained (Musawa and Wahab, 2012). Also, Wang et al. (2010) mentioned that TOE framework has unclear major constructs and the variables of TOE framework may vary with the context. Hence, some other variables should be included to enrich TOE framework such as sociological variables, cognitive variables, technology readiness (e.g. knowledge management capabilities), ability to leverage IT investment through different channels (e.g. organizational learning), professionals’ experience and skills, managerial capabilities of change management, security concerns, government promotion and factors salient to the country context such as government policy/regulation, technology infrastructure and culture (Hossain and Quaddus, 2011; Wen and Chen, 2010; Jang, 2010; Oliveira and Martins, 2010; Wang et al., 2010; Teo et al., 2009; Zhu et al., 2004).

6. Discussion

The review clearly highlights that though TAM model and TOE framework are found significant in understanding and explaining technology adoption, their individual predictive power is limited. The two constructs of TAM (PU and PEOU) explain about 40 percent of the system’s use (Legris et al., 2003) and the external variables in the extended models of TAM are not clearly defined yet. These external variables are more dependent on the context and vary from one study to another. Therefore, TAM is known as partial model of technology adoption (Riyadh et al., 2009). Hence, Legris et al. (2003) pointed out that TAM has to be integrated with other innovation adoption models which include variables “related to human and social change processes, and to the adoption of the innovation model.” On the other hand, TOE framework has unclear major constructs (Wang et al., 2010) and is too generic (Riyadh et al., 2009). So, TOE framework is needed to be strengthened by integrating it with the models having clear constructs. Still, a wide range of empirical and conceptual studies have justified the significant, dominant and relevant role of TAM model and TOE framework in explaining technology adoption. Therefore, researchers in the IS domain have suggested to integrate TAM model and TOE framework so that some of their limitations can be overcome.

When TAM is integrated with other IT theories that incorporate decision makers’ social and idiosyncratic characteristics, forms a richer theoretical framework to guide the understanding, explanation and prediction of adoption and use behavior of IT in an organized system (Zhao et al., 2010; Awa et al., 2010). To cater to this, TOE framework sounds a suitable alternative. TOE framework and TAM model can be blended together very well because of complementarity of their constructs to each other and thus, it captures the impact of internal factors, external factors as well as the role of institutions to overcome some of the limitations of TAM and TOE framework (Zhao et al., 2010; Lee et al., 2010; Riyadh et al., 2009). This integrated model advocated being meaningful in explaining technology adoption in developing countries as well (Riyadh et al., 2009).
Some of the authors have proposed integration of TAM with other technology adoption theories. For example, Parker and Castleman (2009) proposed integration of TAM with IDT and provided preliminary ideas to develop the framework but this integration is specific to small firms and e-commerce. The objective of this paper is to offer ideas for developing a framework that can cater to similar information technologies and is applicable to all sizes of the firm. On the other side, this study has found that relevant variables of IDT are already a part of TOE framework.

Hence, to further take up the integration of the two models (TAM and TOE), there is a further concern over the issues related to the variables of TAM model and TOE framework. There are different external variables of TAM model in different studies while the variables of TOE framework are not widely accepted and vary from one study to the other. So, it has been found that the variables for TAM and TOE and their significance vary in each context. Thus, there is a lack of common set of variables which can be generalized to explain technology adoption and is applicable to any context and technology. Hence, this review presents a set of variables for both, TAM model and TOE framework which can be used for developing integrated model of the two. Contrary to the findings of Jeyaraj et al. (2006), we propose to consider using all set of variables (significant as well as insignificant) while developing an integrated model of TAM model and TOE framework. The argument is, since the significance of variables varies with the context such as technology, country of study, and size of companies (turnover, number of employees, etc.), it is advisable that no variable should be discarded just because it has consistently found insignificant in a set of studies and/or contexts. The variables identified in the paper can serve as guidelines for integrating the models to study technology adoption of various information technologies and to increase their predictive powers. The two models can be integrated in several ways. For example, TOE framework can serve as external variables of TAM model. Also, TAM and TOE can be treated as two independent models determining adoption of information technologies. Such integrated models can serve as foundation for future studies those can overcome shortcomings of existing models and to improve their strength. For integrated models, a lot of experiments are required to be taken up in the future so that a standard integrated model can be developed and widely accepted in IT adoption literature.

This proposed integrated model has practical significance too. The set of identified variables in the study help organizations in analyzing their suitability while moving to recent technologies such as cloud computing, ERP, and green IT, etc. They also help in identifying concerned areas and risks associated so that organizations can take effective course of actions in the concerned areas.

7. Conclusion

Thus, the paper justifies the argument that integrating different models, each making up another, has emerged as a new trend in IS-related research and has proved useful while considering the limitations of various innovation adoption theories and models (Hongjun and Xu, 2010).

The review also concludes that the idea of integrated model of TAM and TOE is advocated over the current innovation theories and models which are less significant in explaining the technology adoption for recent technologies such as ERP, EDI and RFID, etc. at organizational level. The set of variables presented in this paper facilitates the development of integrated model and develops the ground to study the pre-adoption, adoption and post-adoption of the upcoming technologies such as cloud computing,
SaaS, green IT and green computing, etc. in the IT adoption literature. This also tends to increase the predictive power of the models.

The paper has certain limitations too. It has covered the adoption of recent technologies only and it has not considered the individual level adoption of the technology. This review paper does not overrule the acceptance of other adoption models, but it looks into the literature to develop adoption model for study similar information technologies as mentioned earlier. Nevertheless, the review has been able to identify the variables for individual models and thus, presenting a platform for future research for increasing role of integrated model in the IS domain.

References


Liu, Z., Min, Q. and Ji, S. (2008), “A comprehensive review of research in IT adoption”, *Wireless Communications, Networking and Mobile Computing, WiCOM ’08, 4th International Conference, School of Management, Dalian University of Technology, Dalian, October 12-14*, pp. 1-5.


Further reading


About the authors

Hemlata Gangwar is a Research Scholar in the National Institute of Industrial Engineering, Mumbai. She has worked with the National Highway Authority of India as Database Administration for two
years. She has done Masters in Computer Applications. Hemlata Gangwar is the corresponding author and can be contacted at: gangwarhemlata@gmail.com

Hema Date is an Associate Professor in the National Institute of Industrial Engineering, Mumbai. She has 17 years of academic experience. She is a Fellow from the National Institute of Industrial Engineering, Mumbai.

A.D. Raoot is a Professor in the National Institute of Industrial Engineering, Mumbai. He has 40 years of professional experience. He is a Fellow from the National Institute of Industrial Engineering, Mumbai.