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Technology Acceptance Model in the Domains of LIS and Education: A Review of Selected Literature

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Abstract

The Technology Acceptance Model (TAM) is a theoretical framework that is most extensively utilized in explaining an individual's acceptance of an information technology or an information system. This study reviews numerous literature related to the TAM focusing on TAM applications in the domains of Library and Information Science (LIS) and Education. The different studies in these areas were evaluated to understand the modifications incorporated into this model. The study attempts provide insight on future trends in the technology acceptance model as well to help identify gaps in literature where future research could be conducted.

Keywords: Technology Acceptance Model, Perceived ease of use, Perceived usefulness, Review, Library and Information Science, Education, acceptance, behavioural intention, information system, attitude.

Introduction

Users' technology acceptance has been a long-lasting issue and a significant stream of research for more than two decades (Chutter, 2009). These studies attempt to examine how to promote technology usage among users as well as to identify factors that hinder the usage and intentions to use the technology (Kripanont, 2007). A considerable number of theories and models engaged in explaining users' technology acceptance have been developed by different researchers. These include the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), the Technology Acceptance Model (TAM) (Davis, 1989; Davis, Bagozzi & Warshaw 1989), the Theory of Planned Behaviour (Ajzen, 1991), Social Cognitive Theory (SCT) (Bandura, 1986), the Information System (IS) Success Model (DeLone & McLean, 1992), the Innovation Diffusion Theory (Rogers, 1995), TAM 2 (Venkatesh & Davis, 2000),

Decomposed Theory of Planned Behaviour (DTPB) (Taylor & Todd, 1995b) and Combined TAM and TPB (Augmented TAM) (Taylor & Todd, 1995a) (Li, 2010; Jeong, 2011).

Among those theoretical frameworks, the Technology Acceptance Model (TAM) holds a prominent status in Information Systems (IS) research (Kim, 2006; Han, 2003). The Technology Acceptance Model (TAM) is a well established model and is frequently being tested in IS research (Jeong, 2011; Hindagolla & Takashi, 2014). Also, TAM is regarded to be the most influential model with the power to explain and predict users' technology usage behaviour (Hindagolla & Takashi, 2014). Kim (2006) asserts that, the Technology Acceptance Model has been identified as "the most robust, parsimonious, and influential" model among user acceptance theories (p.1716). TAM is simple as well as easy to employ into different research contexts and this model provides a quick and cost-effective way of obtaining information on a user's perceptions towards a technology (Han, 2003)..

This study comprehensively and critically reviews the literature related to TAM, including TAM replications, validations, extensions and TAM related empirical studies, with the main focus on the contexts of 'Education' and 'Library and Information Science (LIS)'. Also, the study attempts to understand different changes done on the model by various researchers. Reviewing TAM related literature will aid to value the current state of knowledge and to recognize the gaps in literature which could be filled by future studies in this area.

Overview of the Technology Acceptance Model (TAM)

The TAM is a theoretical extension of the Theory of Reasoned Action (TRA) which explains the determinants of behaviours performed with conscious intentions (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). TRA describes one's behaviour via his or her intention to perform it, which is in turn suggested to be shaped by the individual's attitudes and the person's subjective norms with regard to that behaviour (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). In 1986, Fred D. Davis introduced the TAM in his PhD thesis, as an adaptation of TRA (Davis, 1989). The TAM was specifically designed to explain behaviours with regard to computer usage (Davis et al., 1989).

Technology Acceptance Model (TAM) offers a compelling theoretical foundation for explaining a person's motives of utilizing an information technology or system (Kim, 2006). This model suggests that when a person is introduced to a new information system or new technology, his or her decision on using it will be affected by several factors. The TAM

theorizes that two belief variables, Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) are the fundamental determinants of the user's behavioural intention to use a technology (Davis, 1989). Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320), whereas perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). In the study of Davis (1989) the relationships of useful-usage and ease of use-usage were compared and usefulness was revealed to be significantly more strongly associated with usage in comparison to ease of use (Davis, 1989). Also, he concluded that PU was strongly correlated with the users' technology acceptance (Davis, 1989).

It is vital to consider user beliefs in system or technology adoption, due to their effect on the usage behaviour. The significance of PU and PEOU has been extensively analyzed from different theoretical angles such as "expectancy theory, self-efficacy theory, behavioural decision theory, diffusion of innovations, marketing, and human-computer interaction" (Davis, 1989, p.133).

According to the TAM, the actual technology usage is determined by the behavioural intention which is in turn influenced by PEOU and PU (Davis et al., 1989) (Figure 1) Also, perceived usefulness directly influences the behavioural intention while perceived ease of use exerts either a direct influence or an indirect influence via PU on the behavioural intention (Davis et al., 1989). Perceived usefulness is also influenced by perceived ease of use because, "other things being equal, the easier the system is to use the more useful it can be" (Venkatesh & Davis, 2000, p.187). Further, the TAM posits that the impact of external factors on the behavioural intention for technology use will be mediated by PEOU and PU (Venkatesh & Davis, 2000). According to Davis et al. (1989), "external variables provide the bridge between the internal beliefs, attitudes and intentions represented in TAM and the various individual differences, situational constraints and managerially controllable interventions impinging on behavior" (p. 988). In processes of implementation, practitioners could exert an effect on user perceptions towards a system and ultimately their behavioural intentions and system usage via the manipulation of these external factors (Hong, Thong, Wong, & Tam, 2002).

The Technology Acceptance Model enumerates the general factors determining user acceptance of technology and hence this model has the power for explaining and predicting

“user behaviour across a broad range of end-user computing technologies and user populations” while simultaneously being “both parsimonious and theoretically justified” (Davis et al., 1989, p.985).

The ‘attitude’ construct was included in the initial TAM version but it was removed from the final model (Figure 1) after Davis and his associates discovered that the impact of the two belief variables, PEOU and PU, on intention was not fully mediated by attitude (Venkatesh, 2000). Attitude is “an individual’s positive or negative feelings (evaluative affect) about performing the target behaviour” (Fishbein & Ajzen, 1975, p.216). It was suggested by Davis et al. (1989) that, there may be instances when a person was presented with a system perceived to be useful, he or she may straightaway develop a sound behavioural intention to use that system without generating any attitudes towards the system. The omission of the ‘attitude’ component improves the understanding of the impact of perceived ease of use and perceived usefulness on the model’s key dependent variable of intention (Venkatesh, 2000). A number of studies in the information systems research domain have demonstrated that the TAM retained its robustness even while excluding the attitude construct, because a user’s behavioural intention is largely explained by the belief variables, perceived ease of use and perceived usefulness (Park et al., 2009; Jeong, 2011; Kim, 2006; Yi, Jackson, Park, & Probst, 2006; Williams, Slade, & Dwivedi, 2014). However, some researchers (Chau & Hu, 2002; Jackson, Chow, & Leitch, 1997) have provided empirical evidence to confirm that attitude exerted a significant effect on a user’s behavioural intention and that it was a critical construct in the TAM.

One assumption of the Technology Acceptance Model is that the use of a certain technology or information system is voluntary (Davis, 1989). Also, the TAM assumes that, provided adequate knowledge as well as time on a certain behavioural activity, a user’s behavioural intention will bear a close resemblance to his or her way of that behaviour (Kripanont, 2007). This assumption applies only to cases where the behaviour is under “volitional control” of the person (Ajzen & Fishbein, 1980). In addition, Technology Acceptance Model has sound “behavioural elements” and “it assumes that when someone forms an intention to act, they will be free to act without any limitations” (Kripanont, 2007, p. 55). Yet, in the real world people may face many hindrances including lack of abilities, limited time, environmental constraints and unconscious behaviours that will restrict their freedom to act (Bagozzi, Davis & Warshaw, 1992).

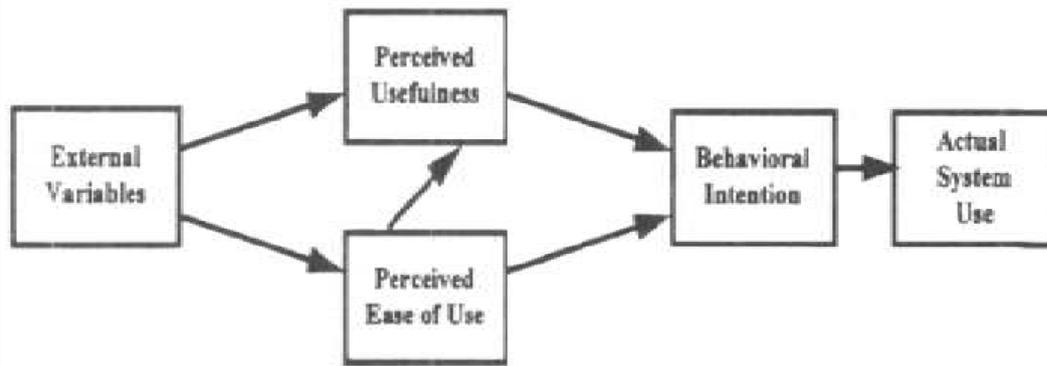


Figure 1: Final Model of the TAM (Venkatesh & Davis, 1996, p. 453)

TAM Related Empirical Studies in Information Systems (IS) Research

TAM Replication and Validation Studies

There are many TAM applications across various contexts in information systems research. Several researchers have performed replications of the original TAM study to check the validity and reliability of the TAM. For instance, Adams, Nelson and Todd (1992) replicated and extended the prior work of Davis (1989). They tested the TAM variables across a variety of technology applications, namely word processors, graphics, spreadsheets, e-mail and voice mail. The findings exhibited reliability and validity of the scales for measurement of perceived ease of use and perceived usefulness (Adams et al., 1992). Also, the results indicated that the TAM generally retained its validity and consistency when explaining user technology acceptance behaviour across different settings and information systems. In a similar effort, Davis (1993) performed a replication of his prior work (Davis et al., 1989) employing e-mail and a text editor. He conducted a field study among 112 professional and managerial employees. The findings showed that TAM could successfully explain the user adoption of both technologies considered in the study. Subramanian (1994) also replicated the original TAM study, employing two diverse communication technologies (voice mail and customer dial-up system). He performed a field study of 179 knowledge workers and obtained evidence in support of the results reported in prior TAM studies.

In order to produce further evidence to support the TAM scales, Hendrickson, Massey and Cronan (1993) assessed the “test-retest reliability” of the scales used for perceived usefulness and perceived ease of use, utilizing two software packages: a spreadsheet package and database management package. They conducted a field study of 123 undergraduate students and found that the TAM instrument showed significant test-retest reliability (Hendrickson et

al., 1993). In another study, Szajna (1994) examined the “predictive validity” of the measurement of Technology acceptance Model. The author derived reasonably good predictive validity for both perceived usefulness and perceived ease of use by performing a discriminant analysis of behaviours in selecting database management systems (DBMSs) by 47 students following MBA.

However, Segars and Grover (1993) obtained results contradictory to the prior studies in their re-examination of Adams et al. (1992)’s replication study of Davis (1989)’s work. The authors found via confirmatory factor analysis that, rather than the model constituting the two factors of perceived usefulness and perceived ease of use, a measurement model involving three factors, namely usefulness, effectiveness, and ease-of-use was more critical. Also, the three factor model was found to exhibit strong psychometric properties (Segars & Grover, 1993). But these findings were disproved by Chin and Todd (1995). They performed an analysis using structural equation modeling (SEM), and concluded that there was “no substantive rationale to separate PU into two dimensions as PU and effectiveness”, because a “single factor PU measure demonstrated reasonable psychometric properties” (Lee et al., 2003; p.756).

In another study, Davis and Venkatesh (1996) confirmed the reliability as well as the validity of the TAM variables (PEOU and PU), and recommended that researchers who use TAM scales should persist in using initial TAM measurement scales. Three experiments, using a total of 708 subjects and two systems, were carried out to examine the influence of grouping vs. inter mixing of items, on psychometric properties of the TAM measurement scales. The participants were exposed to different permutations and combinations of the two scales, with statements for both PU and PEOU mixed together. Findings indicated that “item grouping vs. item intermixing had no significant impact on the high levels of reliability and validity of the TAM scales”, as well as on the “path coefficients” that connected those (Davis & Venkatesh, 1996, p.19).

TAM Extension Studies

Researchers have taken substantial efforts to proliferate the expansion of the TAM by introducing new variables to postulate various links between constructs (Lee et al., 2003). In attempting to determine boundary conditions researchers have investigated external variables influencing the major TAM constructs of perceived usefulness and perceived ease of use. Insight on the antecedents of perceived usefulness and perceived ease of use would aid

practitioners to detect the reasons for users' technology resistance as well as to pursue effective measures to enhance technology acceptance of users. (Han, 2003)

Agarwal and Prasad (1999) provided an extension for the TAM by integrating five types of variables relating to individual differences, as the antecedents of PU and PEOU. These individual difference variables were: role with regard to technology, tenure in workforce, level of education, prior similar experiences and participation in training (Agarwal & Prasad, 1999). The empirical testing of the proposed research model was done using survey data gathered from 230 users of a graphical user interface (GUI). The findings revealed PEOU was significantly affected by three individual difference variables, namely, role with regard to technology, prior similar experiences and level of education, whereas PU was significantly affected by participation in training and PEOU (Agarwal & Prasad, 1999). Yet, tenure in workforce was found to exert no impact on either of the belief variables, PU and PEOU (Agarwal and Prasad, 1999). In another attempt to extend the TAM, Igbaria, Guimaraes, and Davis (1995) investigated the influence of individual (user training, user computing experience), organizational (end-user computing support, management support) and system characteristics (quality) on the user acceptance of micro computer technology. Survey data gathered from 214 MBA students who were engaged in full-time work were used to test the conceptual model. Individual, organizational, and system characteristics were found to have significant associations with both PU and PEOU (Igbaria et al., 1995). Further, the results verified several previously proposed notions such as the impact of PEOU on usefulness, and the impact of PU on the usage (Igbaria et al., 1995).

Gefen and Straub (1997) also sought to extend the TAM by incorporating the influence of gender difference on IS acceptance into the model. A cross-sectional survey was performed among a sample of 392 male and female knowledge workers to gather data for the empirical validation of the proposed model. The results demonstrated that gender strongly moderated the influences of PU, PEOU and social presence (Gefen & Straub, 1997). Also, it was revealed that men were more influenced by perceived usefulness, whereas women were more influenced by perceived ease of use and subjective norm (Gefen & Staub, 1997). In an attempt to extend the TAM for the context of World Wide Web (WWW), Moon and Kim (2001) introduced playfulness as an "intrinsic motivation factor" influencing the user acceptance of the WWW. A questionnaire was used to gather data from 152 management graduate students who had prior experience in using the WWW. The findings of the study indicated that a person's attitude towards using WWW was significantly affected by PEOU,

PU and perceived playfulness of the WWW. Also, it was found that the users' behavioural intention was highly associated with attitude, perceived playfulness, as well as PU. The results implied that the user acceptance of the WWW was significantly influenced by both intrinsic and extrinsic motivation factors while intrinsic motivation factors were more powerful than extrinsic factors in forming positive user attitudes (Moon & Kim, 2001).

In their study focused on understanding the determinants of the construct PEOU, Venkatesh and Davis (1996) observed that a person's self-efficacy had an influence on his or her perceptions towards the PEOU of a certain system, before as well as after the user had hands-on experience with the system. In addition, objective usability was revealed to exert an effect on PEOU only after the user had direct usage experience (Venkatesh & Davis, 1996). Venkatesh (2000) further improved this study by identifying how perceptions towards ease of use of new information systems may form and change over time. He proposed a model including, "control (internal control of computer self-efficacy and external control of facilitating conditions), intrinsic motivation (conceptualized as computer playfulness), and emotion (conceptualized as computer anxiety)" (Venkatesh, 2000, p.346) as anchors influencing a person's early beliefs towards the ease of use regarding a new system. It was assumed that with increasing experience, a person's "system-specific PEOU" will still be "anchored to the general beliefs on computers and computer use", but will be adjusted with regard to "objective usability, perceptions of external control specific to the new system environment, and system-specific perceived enjoyment" (Venkatesh, 2000, p.343). The empirical testing of the proposed model was carried out in three different organizations, using 246 employees. Measurements were taken at three points in time (after initial training, after 1-month of training and after 3-months of training), over a period of three months (Venkatesh, 2000). The authors found strong support for the conceptualized model, and this model was capable of explaining about 60% of the variance in system-specific perceived ease of use (Venkatesh, 2000).

A further extension of the original TAM into TAM 2 was proposed by Venkatesh and Davis (2000) by incorporating significant variables that spanned "social influence (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, and result demonstrability)" (Venkatesh & Davis, 2000, p.187) to better explain PU and usage intentions. To empirically test the new conceptual framework the researchers performed four longitudinal field studies among 156 knowledge workers, from four organizations that used four different systems. Two of these systems were for mandatory use

while the other two systems were for voluntary use. The constructs of the model were measured at each organization using three points of measurements (“pre-implementation, one month post-implementation, and three months post-implementation”) (Venkatesh & Davis, 2000, p.186). TAM2 was found to perform well in voluntary as well as mandatory settings. Yet, the construct subjective norm was found to have no influence in voluntary contexts, but it exerted a significant effect on usage intentions in mandatory contexts (Venkatesh & Davis, 2000). This extended version of TAM (TAM2) explained 40%-60% of variance in PU and 34%-52% of variance in the intention to use (Venkatesh & Davis, 2000).

Venkatesh and Bala (2008) further updated the Technology Acceptance Model (TAM) from version two to version 3 by elaborating the number of factors influencing PEOU and PU of an innovation, which will consequently affect the behavioural intention and ultimately the usage behaviour. According to the TAM 3, the factors influencing PEOU were anchor factors of “computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness’ and adjustment factors of “perceived enjoyment and objective usability” (Venkatesh & Bala, 2008, p. 277-278). Also, the TAM3 postulated that PU was influenced by “subjective norm, image, job relevance, output quality, and result demonstrability” (Venkatesh & Bala, 2008, p.277-278). Further, experience and voluntariness acted as moderators of the behavioural intention. In order to test the TAM3, longitudinal field studies were performed at four organizations that implemented new technology applications. Data were gathered across a five-month period with measurements taken at four points in time. Overall, the “TAM 3 explained between 40% and 53% variance in behavioural intention across different time periods and models” (Venkatesh & Bala, 2008, p.290-291).

The following researchers have integrated existing theories and models into the TAM in order to develop a stronger model with more explanatory power than the standalone TAM.

Chau (1996) formulated a model by integrating the Technology Acceptance Model and the Personal Computer Utilization Model to study the factors influencing the CASE (Computer-aided software engineering) acceptance by system developers. The integrated model composed of five factors: “ease of use, near term usefulness, long term consequences, transitional support and implementation gap” (Chau, 1996, p.272). According to the results, ease of use was the strongest predictor of CASE acceptance, and long term consequence was the second-strongest predictor. Even though both transitional support and near-term usefulness were found to exert no direct influence on the acceptance, those variables

indirectly influenced the acceptance via ease of use and long term consequences (Chau, 1996). In addition, implementation gap had a significant negative effect on the CASE acceptance via ease of use and near term usefulness (Chau, 1996).

Venkatesh, Morris, Davis and Davis (2003) synthesized eight user acceptance and motivation models in order to develop a unified model called the Unified Theory of Acceptance and Use of Technology (UTAUT). The eight models employed by the researchers were, “the Theory of Reasoned Action, the Technology Acceptance Model, the Motivational Model, the Theory of Planned Behaviour, a model combining the TAM and the Theory of Planned Behaviour, the Model of PC Utilization, Innovation Diffusion Theory, and Social Cognitive Theory” (Venkatesh et al., 2003, p.425). The authors found that all eight models could explain about 17% -53% of the variance in the behavioural intention to use an information technology. On the other hand, the unified model was more powerful and it surpassed the eight individual models by explaining 70% of the variance in intention to use (Venkatesh et al., 2003). The UTAUT suggested that the core constructs of “performance expectancy, effort expectancy, social influence, and facilitating conditions”, were “direct determinants” of technology acceptance and use (Venkatesh et al., 2003, p.447). In addition, age, gender, experience and voluntariness acted as key moderators in this model (Venkatesh et al., 2003).

In another study, Lee (2010) combined the Expectation–Confirmation Model, Technology Acceptance Model, Theory of Planned Behaviour, and the Flow Theory to develop a theoretical framework that was capable in explaining and predicting users’ continuance intentions towards e-learning. The empirical validation of the proposed model was carried out by employing a sample of 363 students who used of a web-based learning system. The findings indicated that satisfaction exerted the largest influence on the continuance intention of users. The factors of perceived usefulness, attitude, concentration and perceived behaviour control were also revealed to be significant but weaker determinants of the continuance intention (Lee, 2010).

TAM Applications in the Field of Education

The TAM has been widely applied in the field of education and particularly in e-learning, the new paradigm of education which is created via the advancing ICT access (Liu, Liao, & Pratt, 2009; Sánchez & Hueros, 2010; Del Barrio-García, Arquero, & Romero-Frías, 2015; Adetimirin, 2015; Alharbi & Drew, 2014; Tarhini, Hassouna, Abbasi & Orozco, 2015).

Liu, Liao, and Pratt (2009) developed an integrated model to study the effects of media richness and flow on the user acceptance of streaming media for e-learning. Three theoretical frameworks, namely the TAM, Flow Theory and the Media Richness Theory provided the foundation for this integrated model. A field experiment was performed to empirically validate the proposed model. The subjects of the study were 102 MIS major students at a Taiwan university who were registered in an IS course and they were allowed to use one of the three different combinations of text, streamed audio and streamed video (Liu et al., 2009). PEOU was revealed to be a determinant of perceived usefulness while both PU and the user attitude were found to be determinants of the usage intention. Presentation types with more rich media showed positive correlations with high concentration levels but demonstrated mixed results in correlations with PU (Liu, Liao, & Pratt, 2009). In a related study, Adetimirin (2015) employed the TAM3 as the underlying theory to examine LIS post graduate students' acceptance of online discussion forum (ODF) technology for learning. A survey was performed among 121 LIS post graduate students at a Nigerian university to collect data for the empirical validation of the proposed research model. It was revealed that "computer self-efficacy, perceptions of external control, computer anxiety and computer playfulness" significantly influenced the students' usage of ODF for their learning" (Adetimirin, 2015, p.265). The author suggested that it was important to encourage postgraduate students to use ODF for learning (Adetimirin, 2015).

In a study conducted in Lebanon, Tarhini et al. (2015) applied the TAM to create a scale to examine the antecedents of the usage of web feeds. The authors attempted to study students' beliefs with regard to accepting and adopting RSS (Really Simple Syndication) feeds. The proposed scale was reassessed by four experts in the stream of technology adoption, and was tested among 235 students using the survey strategy. The results revealed that PEOU was not a significant determinant of both PU and attitude. The overall model exhibited an acceptable fit while accounting for 38% of variance of the behavioural intention, which was a low value in comparison to the original TAM (Tarhini et al., 2015). The researchers suggested that certain facets of the proposed model may have poor criterion validity in the Lebanese settings and they highlighted the need of extending the model by incorporating moderators and predictors that spanned subjective norms and cultural values of users (Tarhini et al., 2015).

Along similar lines with the above studies, Sánchez and Hueros (2010) and Del Barrio-García, Arquero, and Romero-Frías (2015) conducted their studies in the context of Spain, using university students as research subjects. Sánchez and Hueros (2010) explored the

motivational factors influencing students' acceptance of the web-based learning platform, Moodle. They extended the TAM by incorporating technical support as an extrinsic factor and perceived self-efficacy as an intrinsic factor, assuming that these variables can influence the acceptance of Moodle. In order to collect data, a survey was performed among 226 students who were enrolled in business and teaching courses at a Spanish university. The results demonstrated that technical support had a direct influence on both PEOU and PU. Further, Moodle usage was found to be directly affected by PEOU and attitude (Sánchez & Hueros, 2010). Del Barrio-García, et al. (2015) also extended the TAM into open digital environments where the general usage of web 2.0 tools was established. They studied the determinants, specifically the "e-learning satisfaction and students' perceptions", that affected students' intention to use a Personal Learning Environment 2.0 (PLE 2.0) approach (Del Barrio-García, et al., 2015, p.129-131)). In addition, the role played by the Need for Cognition (NFC) as a moderator was also examined. An online questionnaire was employed to gather data from a sample of 203 students who were registered in an international accounting course at a Spanish university. Findings indicated that the proposed model had "adequate predictive power to understand the future intention of use of a PLE based on Web 2.0 tools" (Del Barrio-García et al., 2015, p. 137). Also, the results supported the moderating role of students' NFC, with regard to the influence of intrinsic human factors in the PLE 2.0 acceptance (Del Barrio-García et al., 2015).

In a recent study Chang, Hajiyer and Su (2017) investigated the factors influencing the behavioral intention of university students to use e-learning for educational purposes in the context of Azerbaijan. In this study the extended TAM proposed by Abdullah and Ward (2016) was empirically validated using data collected from a convenient sample of 714 undergraduate and master students and data analysis was done applying Structural Equation Modeling (SEM). It was found that subjective norm, experience and enjoyment were significant positive factors affecting students' PU of e-learning. Yet, computer anxiety was found to exert a negative influence on PU and hence this study was the first to detect such a significant negative association in the setting of students' e-learning (Chang et al., 2017). Further, PEOU was found to be influenced by experience, enjoyment and self-efficacy. Also, subjective norm had a significant positive effect on the behavioural intention, while technological innovation was an important moderator of the causal links between subjective norm and PU as well as PU and the behavioural intention (Chang et al., 2017). A similar study was performed by Hussein (2017) in the Malaysian context, where the researcher

attempted to gain insight on the student's attitude towards using e-learning system from the TAM perspectives. A questionnaire-based survey strategy was employed to gather data from 151 students who were selected using random sampling method. The results demonstrated that attitude was a significant determinant of the student's intention towards using e-Learning and it was expected this study would aid in enhancing and upgrading e-learning system to satisfy students' needs (Hussein, 2017).

On the other hand, the study of Alharbi and Drew (2014) focused on the perspectives of academics towards the use of Learning Management Systems (LMS), rather than using students as research subjects. The authors modified the TAM in their attempt to predict academics' behavioural intention of LMS usage in Saudi Arabian public universities. The proposed model included the major TAM constructs (PEOU, PU and attitude towards use) and external variables of "lack of LMS availability, LMS usage experience and job relevance" (Alharbi & Drew, 2014, p.146-147). The results obtained in the study were consistent with the original TAM findings while the overall research model suggested that all variables under concern exerted an indirect or direct influence on the behavioural intention towards using an LMS (Alharbi & Drew, 2014). Further, the study rendered evidence in support of the successful applicability of TAM into the Saudi Arabian higher education context (Alharbi & Drew, 2014).

TAM Applications in the LIS Field

Many researchers have conducted TAM-based studies in the realm of electronic libraries (e.g. Hong, Thong, Wong, & Tam, 2002; Kim, 2006; Thong, Hong, & Tam, 2002; Park et al., 2009; Goh & Liew, 2009; Jeong, 2011; Ayele & Sreenivasaro, 2013; Tella, 2013; Vaidyanathan, Sabbaghi, & Bargellini, 2005; Ramayah & Aafaqi, 2004). Several external variables have been identified by employing the TAM as an effective theoretical basis to study the e-library systems acceptance of users (Park et al., 2009).

Jeong (2011) examined the behaviours of using and accepting an e-library system by Korean elementary students. A paper and pencil survey was employed to gather data from a sample of 395 students who used an e-library system called booktobi. The Technology Acceptance model and the Flow Theory provided the theoretical basis for this study. It was found that both the belief variables of perceived usefulness and perceived ease of use were strong predictors of the users' behavioural intention, while the system characteristics were significant determinants of PU and PEOU (Jeong, 2011). Also, the external variables of

“individual differences, interface characteristics and system characteristics” were expected to exert a significant impact on the behavioural intention, while PU and PEOU were expected to mediate these effects (Jeong, 2011, p. 57). A similar study was conducted by Tella (2013) in the Nigerian context. He explored the user acceptance of e-library from the perspective of the TAM. Data were gathered from 1,500 undergraduates of University of Ilorin, Nigeria, using a self-designed questionnaire. Findings demonstrated that all eight factors incorporated into the research model, namely “ease of use, perceived usefulness, actual use, satisfaction, relevance, awareness, computer/internet self-efficacy, and social influence” were significant determinants of the e-library acceptance and that all these factors together predicted the user acceptance of e-library (Tella, 2013, p. 42). The author recommended university e-library users improve their “computer and internet self efficacy” (Tella, 2013, p.43) which will help to enhance the e-library usage of the students, and he further stated that the university can contribute to this by coordinating training sessions for the students (Tella, 2013).

In another study, Vaidyanathan et al. (2005) also highlighted the significance of relevance and awareness in their attempt to explore user acceptance of digital libraries based on TAM. In this study, five “individual and system components (search function, terminology, design and display, relevance, and reliability” (Vaidyanathan et al., 2005, p.280) were used to examine the digital library acceptance among individual users. Findings showed that antecedents like “search function, screen design, navigation and system reliability”, had significant effects on PEOU and PU, which in turn were significantly related to the user acceptance (Vaidyanathan et al., 2005, p.279). The study provided empirical evidence in support of the established TAM relations since the TAM beliefs of perceived usefulness and perceived ease of use were proved to be strong predictors of the individual acceptance.

Yosoff, Muhammad, Zahari, Pasah, and Robert (2009) also applied TAM to investigate the e-library use by students at a public university in Malaysia. 201 students were surveyed using a questionnaire for data collection and this data were analyzed using linear regression. “Individual differences (computer self efficacy and knowledge of search domain)” were found to have significant positive relationships with PEOU (Yosoff et al., 2009, p.79). Also, the findings indicated that perceived ease of use significantly affected PU, but it had no significant impact on the actual use of the system (Yosoff et al., 2009). On the other hand, PU was found to be a strong determinant of the actual e-library usage (Yosoff et al., 2009). These findings were consistent with previous TAM based studies performed by Hong et al. (2002) and Thong et al. (2002), who also obtained positive relationships between individual

differences and PEOU. In these studies, Hong Kong university students were used as the research subjects and to gather data, the subjects were surveyed via the telephone interview method. Hong et al. (2002) observed that individual differences (computer self-efficacy and knowledge of search domain) were important factors influencing PEOU. System characteristics also played a crucial role in the model, because the results showed that, PEOU and PU were significantly affected by relevance, while PEOU was significantly affected by terminology and screen design (Hong et al., 2002). The results of Thong et al. (2002)'s study indicated that individual differences and interface characteristics were correlated with PEOU, whereas organizational context was correlated with both PEOU and PU of digital libraries (Thong et al., 2002). Furthermore, the findings verified that both PU and PEOU were predictors of the user acceptance of digital libraries.

Ramayah and Aafaqi (2004) were interested in examining the effect of self efficacy on the use of e-library by students of four faculties at a public university in Malaysia. A field study was performed to gather data from 704 subjects. The findings demonstrated that self efficacy exerted a significant direct influence on both the belief variables, PU and PEOU. Also self-efficacy, perceived ease of use and perceived usefulness were revealed to be important determinants of the e-library usage. Furthermore, the findings suggested that, self-efficacy was fully mediated by PEOU and that PEOU was fully mediated by PU, when predicting the e-library use (Ramayah & Aafaqi, 2004). Different results were obtained by Goh and Liew (2009) in their investigation of users' acceptance of a Short Message Service (SMS)-based library catalogue system, and the impact of self efficacy on users' cognitive beliefs and intention to use the system. Data were gathered using a survey which was performed among a sample of 103 students who had experience in using the online public access catalogue (OPAC) of the university library. Self efficacy was revealed to have a positive impact on perceived ease of use, and a negative impact on PU. Further, the results showed that self efficacy did not directly affect the behaviour intention of using the SMS-based library catalogue system (Goh & Liew, 2009).

Park et al. (2009) carried out a research to recognize the factors determining the users' adoption and usage of a digital library system named TEEAL (The Essential Electronic Agricultural Library-TEEAL) and to test whether TAM could be applied into the settings of developing countries. A path analysis of survey data collected from 16 organizations in Africa, Asia and Central America and Latin America, demonstrated that PEOU was a direct predictor of PU. But, PEOU was found to exert only an indirect influence on the behavioural

intention. Further investigations were conducted to identify the similarities and disparities in major determinants behind the acceptance of digital library across countries and continents (Park et al., 2009). This study suggested that “both the key variables and external variables that have been found to affect the users’ behavioural intention to use should be considered as important factors in the process of designing, implementing and operating digital library systems” (Park et al., 2009, p.206). In the same way, Hindagolla and Takashi (2014) applied the TAM to examine the determinants of the Electronic Information Resources (EIR) usage acceptance of Sri Lankan undergraduates majoring in social sciences. A survey was performed among a purposive sample of 119 final year social science undergraduates to collect data. Perceived usefulness was identified as the strongest predictor of the behavioural intention. In addition, social influence and facilitating conditions were revealed to be significant factors influencing the behavioural intention via PEOU and PU (Hindagolla & Takashi, 2014). This study suggested that both major TAM constructs of PEOU and PU, as well as external factors which were found to influence the behavioural intention should be considered as crucial factors in processes of EIR implementation and promotion for social science undergraduates (Hindagolla & Takashi, 2014).

In another study, Tri-Agif, Noorhidawati and Siti Hajar (2014) explored the factors affecting higher education students’ intention to continue using e-books, by applying TAM and the Expectancy Disconfirmation Theory as theoretical frameworks. Data were collected from a random sample of 509 subjects through a survey hosted in the Google drive. It was revealed that the determinants of continuance intention to use e-books were influenced by satisfaction, while satisfaction was largely influenced by PEOU and confirmation (Tri-Agif et al., 2014). In addition, it was found that internet self efficacy had a strong influence on satisfaction via PEOU, whereas perceived quality had an influence on satisfaction via confirmation. The authors suggested that the findings of the study could support libraries in selecting and assessing features of e-books prior to the subscription process (Tri-Agif et al., 2014). In a related study, Yoon (2016) explored the factors affecting users to accept mobile library applications in academic libraries. The conceptual model formulated using TAM was empirically tested using survey data collected from 273 undergraduate students. Findings strongly supported the capability of TAM in explaining user acceptance of mobile library applications within the academic library context. It was revealed that PU, interactivity and ease of use significantly influenced the users’ attitude and intention to use mobile library

applications (Yoon, 2016). Also, user satisfaction was the strongest predictor of the usage intention (Yoon, 2016).

In another study, Kim (2006) attempted to study the determinants of web based subscription database usage by university students. He developed an integrated TAM with the external factors of “subjective norm, job relevance, output quality, result demonstrability, user training, accessibility and terminology clarity” (Kim, 2006, p.1717-1720). The author carried out a “cross-sectional field study” by means of a “web-survey” to collect data from 121 undergraduates who had experience in using web-based subscription databases (Kim, 2006, p.1720). Findings indicated that terminology clarity and accessibility were good predictors of PEOU towards the databases, while user training did not have any influence on both belief variables of PEOU and PU (Kim, 2006). The findings also implied that even though subjective norm did not have a direct influence on the intended use it may positively affect user perceptions towards the usefulness of the databases (Kim, 2006).

It can be observed that many TAM related studies performed in the LIS context had their focus on understanding information technology or system acceptance from the library user perspective, whereas less concern had been shown towards exploring the acceptance of new technologies from the library professionals’ perspective. Rabina and Walczyk (2007) also argued that, in most user-centered LIS research the focus had been on the library patron. They further stated that “unfortunately, librarians have not been actively acknowledged as users, and therefore research that focuses on librarians as adopters of ICTs is scarce” (Rabina &Walczyk, 2007, introduction section, para 3). However, some studies examined library professionals’ acceptance and adoption of new technologies (Sheikhshoaei & Oloumi, 2011; Spacey, Goulding, & Murray, 2004a; Spacey, Goulding, & Murray, 2004b; Rabina & Walczyk, 2007).

Sheikhshoaei and Oloumi (2011) employed the TAM to investigate the determinants of IT acceptance by engineering faculty librarians of public universities in Tehran. The survey strategy was used for the collection of data from a study population of 160 librarians. It was revealed that all the TAM variables considered as independent in the study, (that is, PU, PEOU, attitude to use and intention to use) were correlated with the dependent variable of IT use. But, the overall research model gained a R^2 value of 0.033 implying that TAM did not perform well in explaining the IT acceptance by the group of Iranian engineering faculty librarians (Sheikhshoaei & Oloumi, 2011). In a related study, Spacey, Goulding and Murray

(2004a) examined the characteristics of public library staff which influenced their attitudes towards the internet. The authors employed a mixed method combining an amended version of TAM in a questionnaire based survey with interviews and focus groups. This research method differed from majority of prior TAM related research where only surveys had been used. The researchers explored the impact of factors including “gender, age, organizational variables, computer skills, information and communication technology (ICT) experience and subjective norms” (Spacey et al., 2004a, p.270). The findings revealed that the ‘present position of staff’ and ‘type of the position’ were factors influencing PU of the internet, whereas the age and place of work were factors influencing PEOU beliefs of the internet (Spacey et al., 2004a). The results confirmed that users who possess higher computer skills utilized the internet more often than those with poor computer skills (Spacey et al., 2004a). In another similar study, Spacey et al. (2004b) found that attitudes of public library staff towards using internet were strongly associated with usefulness, usage intention and actual usage. The results suggested that even though a minority of staff had negative attitudes towards the internet, in general the staff possessed positive attitudes in their assessments of the internet (Spacey et al., 2004b).

Conclusion

This chapter presented a comprehensive review on the TAM and TAM related prior research in the domains of LIS and Education. This literature review demonstrates that TAM is a robust model which has many successful applications in the prediction of user acceptance and adoption of various technologies across diverse research contexts. This literature review will help to establish a sound basis to formulate a research models with the capability of explaining user technology acceptance for future studies in the areas of LIS and Education.

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