RESEARCH ON DIGITAL LIBRARY ACCEPTANCE AND CONTINUED USE: REVIEW OF THEORIES

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Abstract: *The digital library is a new information system/technology that is beginning to be capitalized upon by libraries around the world to enhance information service provisions to their users. Although this information system/technology is still evolving, libraries have been offering this product for their clientele to use for some time. Since it is a new information system/technology with many implications for the organization, in this case specifically the library, the issue of its acceptance is of importance for its future development. This paper reviews some of the literature that is pertinent to research on the digital library acceptance and continued use research including the variable of intention to use of the digital library which also explains its continued use, and the significant variables interplay among these variables. Finally, the paper concludes all of previous studies have been inspired by the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and two adapted UTAUT models, namely Nationality Based Unified Theory of Acceptance and Use of Technology (NUTAUT), and the Service Oriented Unified Theory of Acceptance and Use of Technology (SOUTAUT). TAM and UTAUT are models that are generally used by researchers to measure acceptance and intention to use digital library systems.*

Keywords: Digital library acceptance, information system/technology

INTRODUCTION

The digital library is a new information system/technology that is beginning to be capitalized upon by libraries around the world to enhance information service provisions to their users. Although this information system/technology is still evolving, libraries have been offering this product for their clientele to use for some time. Since it is a new information system/technology with many implications for the organization, in this case specifically the library, the issue of its acceptance is of importance for its future development. This situation has attracted researchers from a variety of backgrounds such as information systems management and library science to study the extent of its acceptance by the library community at large. In this context, an interesting development in digital library research is that, researchers from an information systems background have utilized some of the established information system acceptance models to study the use of digital libraries by their users. Models such as the Technology Acceptance Model (TAM) (Davis, 1989) and the Unified Technology Acceptance and Use of Technology Model (UTAUT) (Venkatesh et al., 2003) have been adopted and adapted by digital library researchers to study the acceptance of digital libraries by their users. Prior to their use in digital library acceptance research, these models have been used quite extensively by information systems researchers to examine the acceptance of various other types of information systems. This part of the paper focuses on the relevant information system acceptance models by describing their development and how they have been adopted and adapted to study digital library acceptance in libraries.

TECHNOLOGY ACCEPTANCE MODEL (TAM)

The Technology Acceptance Model (TAM) developed by Davis (1989) is an information system acceptance model. Theoretically and empirically, information systems researchers have found that although TAM has a very simple structure, it has a greater explanatory power in examining adoption behaviour of information systems than other sophisticated models such as the theory of reasoned action and the theory of planned behaviour (Davis, Bagozzi, & Warshaw, 1989; Mathieson, 1991; Taylor & Todd, 1995). Therefore, TAM is one of the most frequently used theoretical framework in addressing why users accept or reject an information system (Legris, Ingham, & Collerette, 2003). TAM clearly explains that users' intention to use the information system determines the actual usage of the information system. In this context, intention to use the information system is related to users' beliefs about the information system. There are two kinds of users' beliefs; they are perceived usefulness of the information system, and perceived ease of use of the information system. Perceived usefulness of the information system means the extent to which the user believes that his/her job performance will be enhanced as a result of using the information system. Meanwhile perceived ease of use of the information system means the extent to which the user believes that using the information system will be free of effort. TAM also proposes that any effects of external variables on the usage intention of information system are mediated by these perceptions.
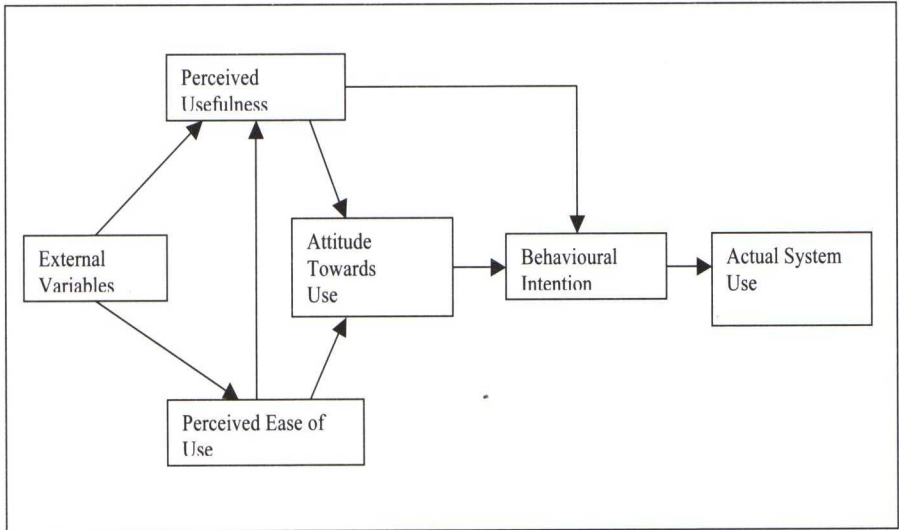
Figure 1: Technology Acceptance Model (TAM)

APPLICATION OF TECHNOLOGY ACCEPTANCE MODEL (TAM) IN DIGITAL LIBRARY RESEARCH

The Technology Acceptance Model (TAM) began to be applied in digital library research in 2002 with studies conducted by Hong (2002) and Thong et al. (2002). Since then a number of other studies have been conducted, including   Heinrichs et al. (2007), Masrek et al. (2010), Ramayah (2006a), Ramayah (2006b), Ramayah, Arafi & Ignatius (2004), Ramayah et al. (2004), Kim (2006), and Thong et al. (2004).

 A study was carried out by Thong et al. (2002) at the Open University of Hong Kong to examine not only the effect of perceived usefulness and perceived ease of use on the intention to use the digital library, but also to examine the impact of a set of external variables on the Intention to Use the Digital Library through perceived usefulness and perceived ease of use. The set of external variables were Interface Characteristics, Organizational Context, and Individual Differences. This is graphically shown in Figure 2 below.
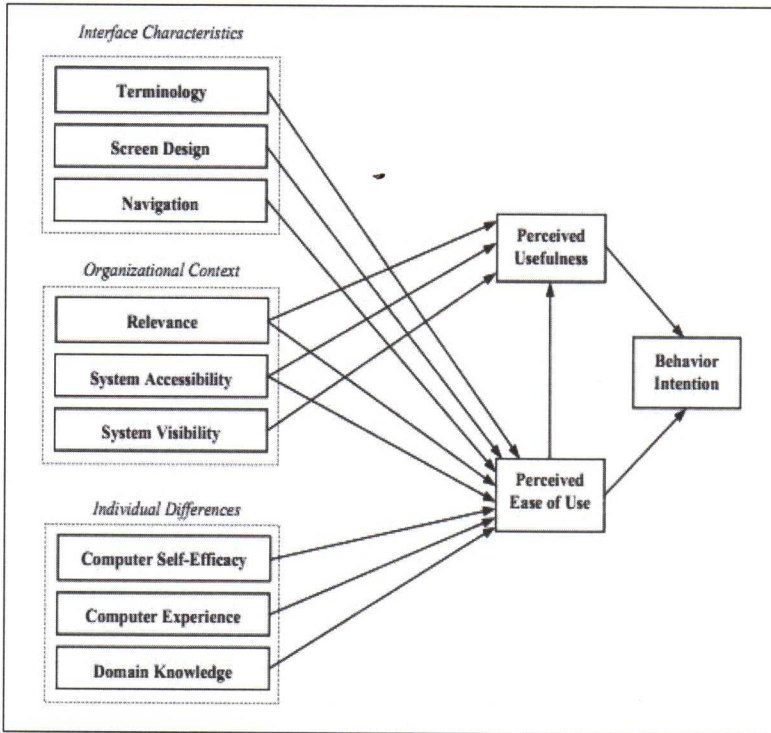
Figure 2: Research Model in Thong et al. (2002)

Intention to Use a Digital Library

Usability in the context of their study means the capability of the digital library to be used by users easily and effectively. The dimensions of usability are the perceived usefulness and the perceived ease of use. Their findings showed that both perceived usefulness and perceived ease of use have a significant impact on intention to use the digital library. Furthermore, perceived ease of use also exerted an indirect effect on Intention to Use the Digital Library via perceived usefulness.

The sets of external variables investigated were the interface characteristics, organizational context, and individual differences. This means that, students tend to be more willing to use a digital library if they perceive it is useful to their studies and also when they realise that digital library is easy to use. If they found that the digital library is difficult to use, then they tend to perceive that it is not useful to them.

Interface Characteristic

A good interface design will help users to use the system. The dimensions for interface characteristics are terminology, screen design, and navigation.
Terminology means the words, sentences, and abbreviations used by the system. Accurate terminology could assist the users in using the digital library.

Screen design relates to the way information is presented and arranged on the screen of the digital library. A good screen design could assist the users in identifying relevant information on the screen.

Navigation refers to the ease of moving around the digital library system by users when using it. Providing good navigation aids would help the users to use the digital library easily.

In relation to the interface characteristics, the findings of Thong *et al.* (2002) showed that all the three variables were significant determinants of perceived ease of use, with navigation found to be relatively less significant. This means that clear and consistent terminology is important to users of digital libraries. Similarly a good screen design is crucial with proper and logical arrangement of information on the screen. As for the navigation aspect, proper cues like navigation aids can prevent users becoming disoriented and lost while manoeuvring within the digital library.

Organizational Context
Organizational context relates to the influence of the system's organization on the digital library's success. Relevance, systems accessibility, and system visibility are the dimensions of organizational context.

Relevance refers to how the digital library system fits into the work practices of the users. Users would also perceive digital library system to be easy to use if it is relevant, in that the information needed can be found and acquired in a short time. Systems accessibility refers to the ease of locating and accessing the digital library system by users. The users would be more likely to find the digital library useful if they can locate and access it easily. Furthermore, if digital library system is easy to use with the availability of software or computers, then users would perceive it to be easy to use.

System visibility refers to the exposure of the digital library system to users so that users are aware that the system is available. This would influence the usefulness of the system to the users. As such, the researchers Thong *et al.*, (2002) concluded that in relation to organizational context, their findings showed that organizational context variables had a significant effect on the intention to use digital libraries through both perceived usefulness and perceived ease of use. Among the three variables, relevance was found to have the strongest effect on perceived usefulness, and was greater than the effect of perceived ease of use. This means that establishing a fit between digital library content and users' information requirements is crucial. Accessibility can be achieved by installing more computers with Internet connection and proper software for the purpose of gaining access to the digital library. Visibility can be improved by conveying the benefits of digital library to users and also advertising its availability to the users.

Individual Differences

According to the researchers three factors related to individual users may influence their acceptance of digital libraries; namely, computer self-efficacy, computer experience, and domain knowledge.

Computer self-efficacy refers to an individual's judgment of his or her capability to use a computer; hence this would affect behaviour intention through perceived ease of use.

Computer experience relates to the users' familiarity with computerized systems and hence could influence their propensity to learn how to use a digital library.

Domain knowledge refers to users' knowledge in the subject domain. This can affect users' performance in using the digital library because of their familiarity with technical terminology in searching and also confidence in making judgments.

In their findings, all the three variables pertaining to individual differences were found to be significant to enhancing users' confidence in using the digital library. Computer self-efficacy was a stronger indicator of perceived ease of use compared to computer experience. Courses on using computers to equip students with computer literacy could help students gain more confidence in using a new information system such as a digital library. As for domain knowledge, when users had more knowledge of a specific subject domain while searching the digital library, they could manipulate their searching more easily, thereby facilitating their use of the digital library.

THE UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY (UTAUT)

One of the main concerns in researching information system acceptance is to utilize a model or a framework that can correctly and strongly predict the acceptance of the information system. This has resulted in as many as eight models or frameworks developed by information systems researchers. To date, among them are:

a. Technology Acceptance Model
b. Theory of Planned Behaviour
c. Combined Technology Acceptance and Theory of Planned Behaviour Model
d. Motivational Model
e. PC Utilization Model
f. Innovation Diffusion Theory
g. Social Cognitive Theory
h. Theory of Reasoned Action

Taking into consideration all the eight models above, Venkatesh et al. (2003) conducted a systematic analysis and comparison of them from which they developed a new model known as the Unified Theory of Acceptance and Use of Technology (UTAUT) model. After being utilized and tested in many studies of acceptance of information systems the UTAUT model has been found to provide twice the prediction capacity of information system acceptance (70%

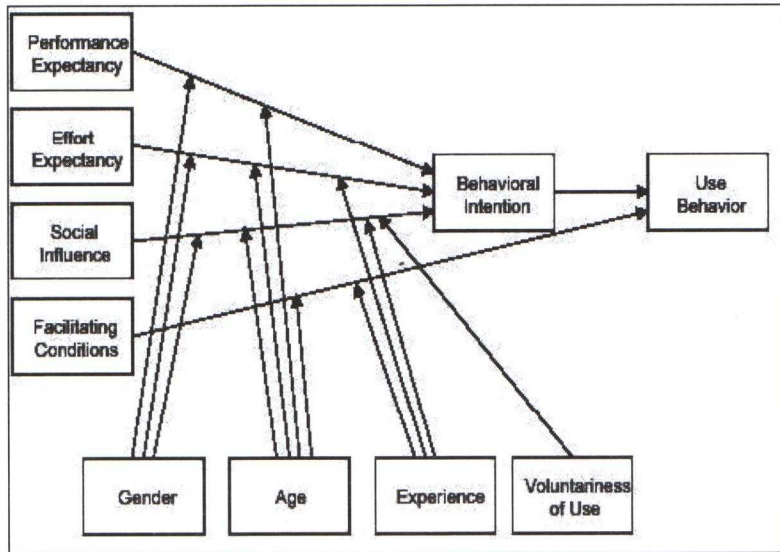prediction capacity) than TAM (35% prediction capacity). The original UTAUT model is shown in Figure 3 below.

Figure 3: UTAUT Model (Venkatesh et al., 2003)

Basically, the UTAUT model consists of four (4) independent variables: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions; four (4) moderating variables: Gender, Age, Experience, and Voluntariness of Use; one (1) mediating variable: Behavioural Intention; and one (1) dependent variable: Use Behaviour.

a. Performance Expectancy means the degree to which a user believes that using the information system would improve his/her job performance;

b. Effort Expectancy (EE) means the degree of ease in using the information system

c. Social Influence means the degree to which an individual perceives that it is important that others believe that they should use the information system

d. Facilitating Conditions means the degree to which an individual believes that organizational and technical support exist to assist him/her in using the information system

e. Gender is either male or female

f. Age is the age of the user

g. Experience refers to how long the user has used the information system

h. Voluntariness of use refers to the use of the information system that is either mandatory or voluntary

i. Behavioural Intention refers to the likelihood that the users would use the information system

j. Use Behaviour refers to the acceptance of the information system by the user
    Owing to the fact that the UTAUT model has high level of prediction capacity, it has been adopted and adapted by several researchers to investigate various types of information systems, such as acceptance of computers in Bentley College (Garfield, 2005) ; acceptance of a web log system (Pu & Kishore, 2006); use of hybrid media applications (Louho, Kallioja, & Oittinen, 2006); adoption of wireless mobile communication in Europe (Carlsson, Carlsson, Hyvönen, Puhakainen, & Walden, 2006); use of wireless LAN technology in smaller enterprises in the USA (Anderson & Schwager, 2006); use of course management software (Marchewka, Liu, & Kostiwa, 2007); acceptance of EpiHandy (Engebretsen, 2005); acceptance of Tablet Personal Computers (Moran, 2006) ; E-Business Quality Model (Allen & Kishore, 2006); human-robot user studies in institutions for the elderly (Heerink, Krose, Wielinga, & Evers, 2006).

    With its high capacity for predicting the acceptance of an information system by users, the UTAUT model has also been utilized and in given circumstances adapted for research on digital libraries. The following discussion   focus on the utilization of UTAUT model in several digital library research studies.

APPLICATION OF THE UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY (UTAUT) IN DIGITAL LIBRAY ACCEPTANCE RESEARCH

Tibenderana *et al.* (2010) adapted the UTAUT model and developed SOUTAUT (Service Oriented Unified Theory of Acceptance and Use of Technology) to measure levels of end-users' acceptance and use of hybrid library services in eight Ugandan universities which had implemented ICT library services. SOUTAUT was developed by replacing some of the constructs in UTAUT with other constructs that were deemed more appropriate for the environment of the study. In this context, the constructs of "effort expectancy" and "voluntariness" in UTAUT were replaced respectively by "relevance" and "awareness" constructs for the SOUTAUT model. This was to enable the study to determine differences among library end users' acceptance and use of e-library services, and therefore the researchers regarded the constructs of "relevance" and "awareness" as more appropriate to the service of the digital library. The SOUTAUT model is shown in Figure 2.4 below.
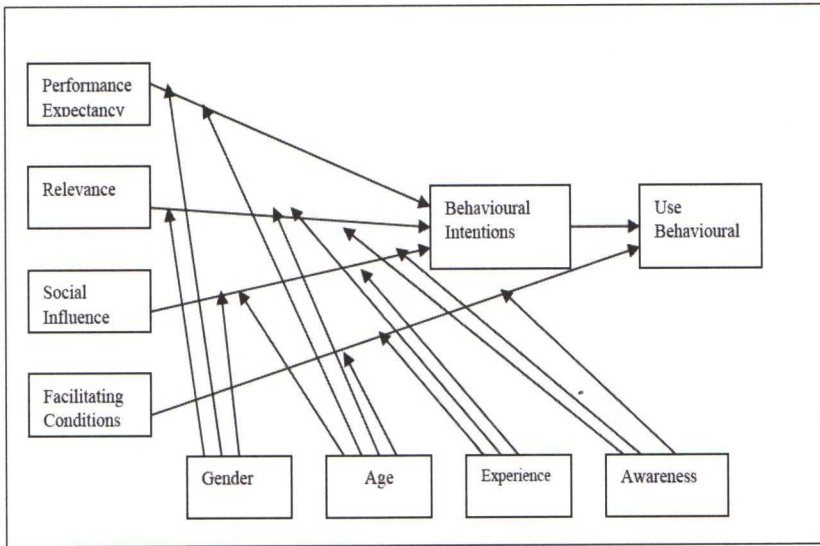
Figure 4: SOUTAUT Model (Tibenderana et al., 2010)

Specifically, the study intended to determine the level of acceptance and use of electronic library services by end user communities in universities, the efficiency of technology adoption in university libraries as determined by the UTAUT model, and the impact of various UTAUT variables and other variables not included in UTAUT model on end-users' acceptance of electronic library services. Findings of the study reveal the following:

For the universities studied, end users expressed a relatively high inclination (30 per cent) towards behavioural intention to accept and use electronic library services, a relatively low level (9 per cent) of usage behaviour of the electronic library services, and a moderate expectation of the benefits from the services (18 percent variance). Performance Expectancy did not have an effect on the behavioural intentions to accept and use electronic library services. As for relevance (a construct added by the researchers in the study), it was shown that e-library services were relevant in the students' day-to-day academic pursuits. The study also revealed that one of the driving forces of behavioural intention to use electronic library services was the Social Influence construct. This means that university library end-users in Uganda were influenced by their social groupings. In relation to the construct of expected benefits, the study revealed that end-users gained what they expected when using electronic services. The study also found that the most prominent factor contributing to non-acceptance and use of e-library services was lack of awareness amongst end-users about the facilities associated with the services. The relevance construct was more salient for experienced individuals. Relevance construct was a strong determinant of individual's intention to use e-library services, and for older and experienced male workers.

In another study of digital library use that adapted the UTAUT model, Orji (2010) developed a Nationality Based UTAUT known as NUTAUT. Apart from the variables that have already been mentioned, the NUTAUT model incorporates an additional variable known as "Nationality" into

the model. This was included by the researcher in order to account for the Nationality aspect of the students in the study, with the assumption that the UTAUT independent variables would impact on the acceptance and usage of digital library differently when moderated by gender and nationality simultaneously. The NUTAUT model is shown in Figure 5 below.
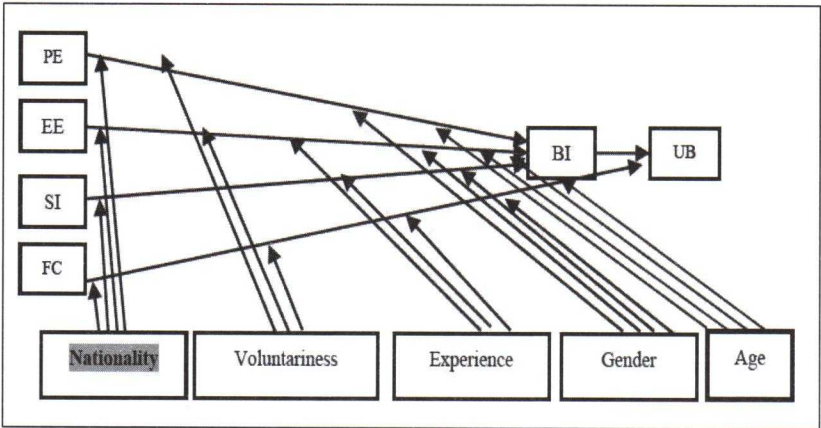

Figure 5: NUTAUT Model (Orji, 2010)

With a total of 116 student participants, the findings from this study revealed that gender and nationality moderate the effect exerted on behaviour intention by social influence. The importance of the social influence was more pronounced for males and females in the international category. There was also a significant difference in the effect exerted on behaviour intention by Performance Expectancy between the international and national groups. Therefore, Performance Expectancy was an important factor for males regardless of their nationality, while effort expectancy determined acceptance for females more than performance expectancy, regardless of nationality. More importantly, this result reveals that perceived Performance Expectancy of a system does vary based on gender. Gender and Nationality will moderate the effect exerted on behaviour intention by effort expectancy such that the influence will be more pronounced for males and females of the national category than for their international counterparts. This study also confirmed that the NUTAUT model is a robust model in predicting acceptance by both male and female students.

CONCLUSION

Thus far, the discussion has centred on all the variables found in the research that are related to the acceptance of the digital library and intention to use it. All of these studies have been inspired by the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and two adapted UTAUT models, namely Nationality Based Unified Theory of Acceptance and Use of Technology (NUTAUT), and the Service Oriented Unified Theory of Acceptance and Use of Technology (SOUTAUT). As indicated earlier, TAM and UTAUT are models that are generally used by researchers to measure acceptance and intention to use digital library systems.

REFERENCES

Allen, E. C. & Kishore, R. (2006). An extension of UTAUT Model with E-Quality,Trust and satisfaction constructs. *SIGMIS-CPR'06.*

Anderson, J. E., & Schwager, P. H. (2006). The tablet PC: applying the UTAUT Model. Paper presented at *the American Conference on Information Systems*, Acapulco, Mexico.

Carlsson, C., Carlsson, J., Hyvönen, K., Puhakainen, J., & Walden, P. (2006). Adoption of mobile devices/services - searching for answers with the UTAUT. *Proceedings of the 39th Hawaii International Conference on System Science*: 1-10.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13* (3): 319-339 .

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

Engebretsen, T. (2005). Acceptance of information technology by health research projects in low-income countries: Intention to use and acceptance of using epihandy (IUAUE). *Master's Thesis. University of Bergen, Norway.*

Garfield, M. J. (2005). Acceptance of ubiquitous computing. *Information Systems Management, 22* (4): 24-31.

Heinrichs, J. H., Lim, K. S., Lim, J. S., & Spangenberg, M. A. (2007). Determining factors of academic library web site usage. *Journal of the American Society for Information Science and Technology, 58* (14): 2325-2334.

Heerink, M., Krose, B., Wielinga, B., & Evers, V. (2006). Human-robot user studies In eldercare: lessons learned. *Institute for Information Engineering, University of Amsterdam, Oudweg, The Netherlands*, Retrieved on 28 Sept. 2006, from *http://www.digital-life.org/jos/index.php?option=com.*

Hong, W. Y. T. (2002). Determinants of user acceptance of digital libraries: An empirical examination of individual differences and systems characteristics. *Journal of Management Information Systems, 18* (3): 94-124.

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management , 40* (3), 191.

Masrek, M. N., Jamaludin, A., & Mukhtar, S. A. (2010). Evaluating academic library portal effectiveness-A Malaysian case study. *Library Review, 59* (3), 198-212.

Ramayah, T. (2006a). Doing e-research with e-library: Determinants of perceived ease of use of e-library. *International Journal of Technology, Knowledge and Society, 1* (4): 71-82.

Ramayah, T. (2006b). Interface characteristics, perceived ease of use and intention to use an online library in Malaysia. *Information Development, 22* (2): 123-133.

Ramayah, T., Aarafi, B., & Ignatius, J. (2004). Role of self-efficacy in e-library usage among students of a public university in Malaysia. *Malaysian Journal of Library & Information Science, 9* (1): 39-57.

Thong, J., Hong, W., & Tam, K. Y. (2004). What leads to user acceptance of digital libraries? *Communications of ACM, 47* (11): 79-83.

Kim, J.-A. (2006). Towards an understanding of web-based subscription database acceptance. *Journal of the American Society for Information Science and Technology, 57* (13): 1715-1728.

Louho, R., Kallioja, M., & Oittinen, P. (2006). Factors affecting the use of hybrid media applications. *Graphic Arts in Finland, 3*: 11-21.

Marchewka, J. T., Liu, C., & Kostiwa, K. (2007). An application of the UTAUT model for understanding student perceptions using course management software. *Communications of the IIMA, 7* (2): 93-104.

Moran, J. M. (2006*). College student's acceptance of tablet PCs and application of the Unified Theory of Acceptance Technology (UTAUT) Model.* Unpublished Ph. D. Thesis. Papella University.

Mathieson, K. (1991). Predicting user intentions: Comparing Technology Acceptance Model with the Theory of Plannned Behaviour. *Information Systems Research, 2* (3): 173-191.

Mohd.Yusoff, Y., Muhammad, Z., Mohd Zahari, M. S., Syaifuddin Pasah, E., & Robert, E. (2009). Individual differences, perceived ease of use, and perceived usefulness in the e-library usage. *Computer and Information Science, 2* (1): 76-83.

Orji, R. O. (2010). Impact of gender and nationality on acceptance of a digital library: An empirical validation of nationality based UTAUT using SEM. *Journal of Emerging Trends in Computing and Information Sciences , 1* (2): 68-79.

Pu, J. P., & Kishore, R.,. (2006). How Robust is the UTAUT instrument? A Multigroup Invariance Analysis in the Context of Acceptance and Use of Online Community Weblog Systems. *SIGMIS-CPR '06* .

Taylor, S. and Todd, P. (1995). The role of prior experience. *MIS Quarterly, 19* (4): 561-570.

Tibendarana, P. K., & Ogao, P. J. (2008a). Information communication technologies acceptance and use among universities in Uganda: A model for hybrid library services end-users. *International Journal of Computing and ICT Research, 1* (1): 60-75**.**

Tibenderana, P. K., & Ogao, P. J. (2008b). Acceptance and use of electronic library services in ugandan universities. *Proceedings of the 8th ACM/IEEE-CS joint conference on Digital libraries.* New York, NY, USA: ACM.

Tibenderana, P., Ogao, P., Ikoja-Odongo, J., & Wokadala, J. (2010). Measuring levels of end-users' acceptance and use of hybrid library services. *International Journal of Education and Development using Information and Communication Technology*, 6 (2): 33-54.

Thong, J. Y., Hong, W., & Tam, K.Y. (2002). Understanding user acceptance of digital libraries: what are the roles of interface characteristics, organizational context, and individual differences? *International Journal of Human-Computer Studies*, 57: 215-242.

Udo, G. J., Bagchi, K. K., & Kirs, P. J. (2010). An assessment of customers' e-service quality perception, satisfaction and intention. *International Journal of Information Management,* 30 (6): 481-492.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27 (3): 425-478.

Venkatesh, V., Thong, J., Xu, X., (2012). Consumer acceptance and use of information technology: Extending the Unified Theory of Acceptance and Use of Technology. *MIS Quarterly*, 36 (1): 157-178.