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A model for adoption of e-learning technologies: The perspective of Ugandan high education institutions (HEI)

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Abstract
This study aimed at coming up with a model of adoption of e-learning technologies in Ugandan High Education Institutions. Although the advent of e-learning technologies presents a cheaper and more cost effective approach to teaching and learning, the success of these innovations primarily depend on their adoption. For a long time, a number of theoretical models suggested by numerous researchers have been advanced to investigate and understand the issues affecting the acceptance or rejection of computer technology. These theoretical models explain adoption factors that will influence the decisions or behaviors of the individuals, organizations and social systems to adopt innovations. In spite of the number of issues of why individuals, organizations and social systems would accept or reject innovations it is unlikely that a single-variable explanation can convince for this conclusion. Due to this notion, this study built on the model developed by Lee *et al*., (2011). Results show that Perceived Usefulness (R^2 = 0.46, P<0.00) significantly influenced adoption of e-learning technologies and four independent variables (CPA, CPL, ADV and PEOU) contribute to this factor. Perceived Ease of Use (R^2 = 0.60, P < 0.01) was found significantly influencing adoption of e-learning technologies with three independent variables (CPA, TRA and ADV) contributing to it. Over all P, CPA, CPL, ADV, PU and PEOU were found significant in influencing Behavior intention (R^2 = 0.56, P < 0.00) to adopt e-learning technologies (R^2 = 0.56). Therefore, the regression analysis results and the expert findings confirm that the e-learning technologies adoption model developed is appropriate for use in Ugandan HEIs.

Keywords: E-learning technologies, Compatibility (CPA), Complexity (CPL), Observability (OB), Relative Advantage (ADV), Patronage (P), Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Trialability (TRA) and Behavioral intention (BI)

1. Introduction
Although the advent of e-learning technologies presents a cheaper and more cost effective approach to teaching and learning, the success of these innovations primarily depend on their adoption. For a long time, a number of theoretical models suggested by numerous researchers have been advanced to investigate and understand the issues affecting the acceptance or rejection of computer technology. These theoretical models explain adoption factors/issues that will influence the decisions or behaviors of the individuals, organizations and social systems to adopt innovations. In spite of the number of issues of why individuals, organizations and social systems would accept or reject innovations it is unlikely that a single-variable explanation can convince for this conclusion. This study built on the model developed by Lee *et al*., (2011) [13]. Lee *et al*., (2011) [13] technology adoption model integrates theoretical framework, which blends TAM and Innovation Diffusion Theory (IDT). The research model posits that five innovation characteristics (compatibility, complexity, relative advantage, ability to try and observe) exert an important effect on adoption of an innovation. Compatibility refers to the degree to which an innovation is regarded as being consistent with the potential end-users' existing values, prior experiences, and needs (Moore and Benbasat, 1991). Innovations with a high compatibility are more readily adopted. If the cost of incompatibility is higher than the relative advantage, most people are unlikely to adopt it Njenga (2011) [16]. Complexity is the end-users' perceived level of difficulty in understanding innovations and their ease of use (Lee *et al*., 2011) [13]. Relative advantage is defined as the degree to which an innovation is considered as being better than the idea it replaced ((Lee *et al*., 2011, Rogers, 2003) [13]. While, Observability refers to the observable benefits or awareness of an innovation. For example if the benefits of using e-learning technologies in Ugandan HEIs are visible to the intended adopters who are the students, ICT support and academic staff, the innovation will be adopted more easily. Scholars urge that if the benefits of innovations are visible, there will be increased the likelihood of adoption of that innovation. However, most technological products have limited Observability (Berkun, 2007).
Lee *et al*., (2011) [13] e-learning technology adoption model does not consider a variable like patronage and it even ignores moderating variables i.e. Experience, Age, Gender, Awareness of e-learning technologies. As a result of the gap in the Lee *et al*., (2011) [13] model. According to research, the degree of support factor (patronage) for technology bears a major influence on the perception of usefulness (Ngai *et al*., 2007) [14] of technology. Patronage in this study was conceptualized in terms of university support, training and technical support. Patronage factor explains the e-learning technologies adoption as elicited from the field based on the Ugandan experience and therefore, was used to extend Lee *et al*., (2011) [13] model.

2. Research methods
To develop a model for adoption of e-learning technologies in

Ugandan HEIs. A regression analysis was performed using the data obtained from the felid survey. Data was collected from 380 participants (students, lecturers and ICT support staff) from four HEIs in Uganda (Kampala International University (KIU), Makerere University (MAK), International health sciences university (IHSU), and Mbarara University of science and technology (MUST)) using a cross-sectional design. A questionnaire was used as a tool of data collection as per research approach. This tool was used because it enabled the researcher to collect a larger amount of data within the shortest time possible and it could also eliminate the bias as the respondents

The developed model was validated using, forty (40) ICT experts in areas of Academic Management System and Learning Management System were asked to respond on the basis of the validation questionnaire. Forty (40) experts were chosen which was in line with Roscoe's 1975 rule that a sample size between 30 and 500 is sufficient (Byomire, 2014) [4].

3. Findings

Table 1: A Summary of the relationships between the variables in the proposed model

Relationship/ hypotheses	Independent Variables	Dependent Variables
H1-1: Patronage has a positive effect on behavioral intention to the e-learning technologies adoption.	Patronage	Perceived Usefulness, Perceived Ease of use, behavioral intention
H1-2: Patronage has a positive effect on PU of the e-learning technologies adoption.		
H1-3: Patronage has a positive effect on PEOU of e-learning technologies adoption.		
H2-1: Compatibility has a positive effect on PU of the e-learning technologies adoption.	Compatibility	Perceived Usefulness, Perceived Ease of use, behavioral intention
H2-2: Compatibility has a positive effect on PEOU of the e-learning technologies adoption		
H2-3: Compatibility has a positive effect on behavioral intention e-learning technologies adoption.		
H3-1: Observability has a positive effect on PU of the e-learning technologies adoption.	Observability	Perceived Usefulness, Perceived Ease of use, behavioral intention
H3-2: Observability has a positive effect on behavioral intention e- learning technologies adoption		
H3-3: Observability has a positive effect on PEOU of the e-learning technologies adoption.		
H4-1: Trialability has a positive effect on PU of the e-learning technologies adoption	Trialability	Perceived Usefulness, Perceived Ease of use, behavioral intention
H4-2: Trialability has a positive effect on behavioral intention e-learning technologies adoption		
H4-3: Trialability has a positive effect on PEOU of the e-learning technologies adoption.		
H5-1: Complexity has a negative effect on PU of the e-learning technologies adoption	Complexity	Perceived Usefulness, Perceived Ease of use, behavioral intention
H5-2: Complexity has a negative effect on behavioral intention of the e-learning technologies adoption.		
H5-3: Complexity has a negative effect on PEOU of the e-learning technologies adoption.		
H6-1: Relative Advantage has a positive effect on PU of the e-learning technologies adoption	Relative Advantage	Perceived Usefulness, Perceived Ease of use, behavioral intention
H6-2: Relative Advantage has a positive effect on behavioral intention e-learning technologies adoption		
H6-3: Relative Advantage has a positive effect on PEOU of the e-learning technologies adoption		
H7-1: Perceived Ease of use has a positive effect on PU of the e-learning technologies adoption.	Perceived Ease of use	Perceived Usefulness
H8-1: Perceived Usefulness has a positive effect on behavioral intention of the e-learning technologies adoption.	Perceived Usefulness	behavioral intention

3.1 The Model Regression Results

Overall, 11 hypotheses were supported by the data. Significance was measured at $P < 0.05$. Results revealed that Behavioral intention was significantly influenced by six out of seven exogenous variables: P ($\beta = 0.14$, $P = 0.01$), CPA ($\beta = 0.09$, TRA ($\beta = 0.06$, $P = 0.00$), CPL ($\beta = -0.25$, $P = 0.00$), ADV ($\beta = 0.30$, $P = 0.00$), PU ($\beta = 0.12$, $P = 0.04$). Therefore, hypotheses H1-1, H2-2, H4-2, H5-2, H6-2, and H8-1 were supported. OB ($\beta = 0.000$, $P = 0.99$) didn't have any significant influence on BI and H3-2 hypothesis was not supported. PU was found to be significantly influenced by PEOU ($\beta = 0.37$, $P = 0.00$), CPA ($\beta = 0.27$, $P = 0.00$), CPL ($\beta = 0.06$, $P = 0.00$), ADV ($\beta = .136$, $P = 0.00$), supporting hypotheses H7-1, H2-1, H5-1 and H6-1. Furthermore, P ($\beta = 0.14$, $P = 0.20$), OB ($\beta = 0.05$, $P = 0.22$) and TRA ($\beta = 0.08$, $P = 0.14$) didn't significantly influence PU which didn't support hypotheses H1-2, H3-1 and H4-1. PEOU was found to be significantly influenced by three exogenous factors: CPA ($\beta = 0.15$, $P = 0.00$), TRA ($\beta = 0.09$, $P = 0.01$) and ADV ($\beta = 0.16$, $P = 0.00$), supporting hypothesis H2-3, H4-3 and H5-3. P ($\beta = -0.021$, $P = 0.72$), OB ($\beta = 0.07$, $P = 0.29$), and CPL ($\beta = -0.02$, $P = 0.42$) did not significantly influence PEOU, therefore, not supporting hypotheses H1-3, H3-3, H4-3 and H5-3 respectively. PU was found to be significantly influenced by four variables (CPA, CPL, ADV and PEOU), resulting in R^2 of 0.46. This meant that the above variables accounted for 46% of variance in PU. Likewise, PEOU was found to be significantly influenced by three exogenous variables (CPA, TRA and ADV resulting in R^2 of 0.60. This meant that the above exogenous variables explained 60% of variance in PEOU. BI was significantly determined by P, CPA, CPL, ADV, PU and PEOU, resulting in $R^2 = 0.56$. In other words, the variables described above explained 56% of the variance of BI. Therefore, the regression model was significant as shown by the ability of constructs to predict up to 56.0 % of user's intention to adopt e-learning technologies in Ugandan HEIs. The extended model can therefore be reliably used.

3.2 Model validation

Regression analysis findings and the expert opinion comparisons

Results indicated that Patronage factor had the highest beta value of ($\beta = 0.14$) with 60% agreement from expert opinion in influencing Perceived Usefulness with ($\beta = 0.04$, and $\beta = -0.02$) as the lowest in influencing PEOU and BI. Compatibility had ($\beta = 0.27$ and $\beta = 0.15$) with expert agreement at 50% in influencing Perceived Usefulness and Perceived Ease of Use

and (β = 0.09) as the lowest in influencing Behavior intention. Complexity had (β = 0.25) as the highest with expert opinion at 70% in influencing Behavior intention and (β = 0.06, β = -0.020) as the lowest in influencing Perceived Usefulness and Perceived Ease of Use. Relative Advantage had (β = 0.14, β = 0.16 and β = 0.30) the highest with expert agreement at 80.4% in influencing Perceived Usefulness, Perceived Ease of Use and Behavior intention. Perceived Usefulness had (β = 0.12) with 90% agreement expert opinion in influencing Behavior intention and Perceived Ease of Use had (β = 0.37) in influencing Perceived usefulness with 60.2% agreement of expert opinion, Trialability all its beta values were very small (β = 0.07, β = 0.09 and β = 0.06) with 65.2% agreement of the expert opinion in influencing PU, PEOU and BI to adopt e-learning technologies in Ugandan HEIs. This was followed by Observability which also had very small beta values of (β = 0.05, and β = 0.07) with expert opinion of 45%. Nevertheless almost all the independent variables positively influenced the dependent variables to adopt e-learning technologies in Ugandan HEIs. Positive influence implies that an increase in any of the independent variable will lead to an increase in the dependent variable in the similar direction.

4. Discussion of results

4.1 Patronage

Results showed that there was a positive relationship between patronage, perceived usefulness and behavioral intention except Perceived Ease of Use had negative relationship with patronage (-0.02) to adopt e-learning technologies. This means that an increase in patronage will result into adoption of e-learning technologies. These results concur with Ngai *et al.* (2007) [14] findings that the degree of support given to users in adoption of an innovation bears a major influence on the perception of usefulness of that innovation. Njenga, (2011) [16] & Ssemaluulu, (2012) [20] assert that if innovations are to be adopted by intended users, top management needs to appropriate the necessary resources, and create a policy or a vision for support and use of such innovations, and at the same time drive the policy to realize the vision perceived lack of managerial support is likely to significantly hinder the users perceiving e-learning technologies as useful and resulting into not adopting them.

4.2 Compatibility

Compatibility was found significantly influencing behavioral intention to adopt e-learning technologies in Ugandan HEIs. There was a positive relationship between compatibility, perceived usefulness, perceived ease of use and behavioral intention. As compatibility increases, adoption of e-learning technologies in Ugandan HEIs would also increase. Hence, hypotheses were supported which stated that compatibility has a positive effect on perceived usefulness, perceived ease of use and behavioral intention of e-learning technologies adoption. These findings concur with Njenga (2011) [16] that innovations with a high compatibility are more readily adopted. If the cost of incompatibility is higher than the relative advantage, most people are unlikely to adopt a given innovation.

4.3 Observability

Regression results showed that there was positive relationship between observability variable and perceived usefulness, and perceived ease of use. However, Observability didn't have any significant influence on behavioral intention to adopt e-learning technologies in Ugandan HEIs and its hypothesis was not supported. These findings are similar to that of Ng, (2012) [15] that observability had no significant influence on adoption of e-learning at Universiti Sains Malaysia. This implies that if students, lectures and ICT support staff do not see the benefits that can be perceived from e-learning technologies or the ease with which e-learning technologies can be observed or visible in Ugandan HEIs, they will not accept and adopt them (Ng, 2012; Abukhzam & Lee, 2010) [15, 2].

4.4 Trialability

Results showed that there was a positive relationship between trialability perceived usefulness, perceived ease of use and behavioral intention. Trialability was found significantly influencing perceived ease of use and behavioral intention to e-learning technologies in Ugandan HEIs though it didn't significantly influence perceived usefulness. The positive relationship meant that an increase in trialability would lead to an increase in perceived usefulness, perceived ease of use and behavioral intention to adopt e-learning technologies in Ugandan HEIs. These results are consistent with other studies (lee, 2007; Ng, 2012; Njeng, 2011) [12, 15-16] that trialability as influencing factor and found that trialability was a significant variable for technology adoption. Other related studies Karahanna *et al*., (1999) [10] assert that the ability to try out a technology is only salient for end users before they adopt because the experimentation helps them overcome uncertainties and makes the change process less demanding.

4.5 Complexity

Results showed that complexity impinges on adoption of e-learning technologies in Ugandan HEIs. The relationship between complexity, perceived ease of use and behavioral intention is negative. Complexity was found significantly influencing perceived usefulness and behavioral intention to adopt e-learning technologies in Ugandan but it didn't significantly influence perceived ease of use. There was a positive relationship between complexity and perceived usefulness. These findings are consistent with other similar studies that complexity had a direct and a significant effect on perceived usefulness and perceive ease of use of an e-learning systems (Njeng, 2011; Teo, 2003) [16, 21].

4.6 Relative Advantage

There was a strong relationship between relative advantage, perceived usefulness, perceived ease of use and behavioral intention. Relative advantage was found significantly influencing perceived usefulness, perceived ease of use and behavioral intention to adopt e-learning technologies in Ugandan HEIs. This also meant that an increase in relative advantage would lead to an increase to adopt e-learning technologies in Ugandan HEIs. Similar results from (Shih, 2007; lee, 2007; Abbad *et al*., 2009; Zvanut *et al*., 2011; Ng, 2012) [7, 12, 24, 15] found that perceived relative advantage positively affected intentions of users to adopt e-learning technologies.

4.7 Perceived Usefulness

Results indicated that perceived usefulness had a strong positive relationship with behavioral intention to adopt e-

learning technologies in Ugandan HEIs. This means that an increase in perceived usefulness would lead to an increase in behavioral intention to adopt e-learning technologies in Ugandan HEIs. Therefore, the hypothesis that perceived usefulness has a positive effect on behavioral intention to adopt e-learning technologies was supported. Davis *et al*., (1989) [5] concur with these findings that perceived usefulness is a direct determinant of users' intentions to adopt technology.

4.8 Perceived Ease of Use

Results indicated that perceived ease of use had a strong positive and significant influence on perceived usefulness to adopt e-learning technologies in Ugandan HEIs. This also meant that an increase in perceived ease of use would lead to an increase in perceived usefulness to adopt e-learning technologies in Ugandan HEIs. Therefore, the hypothesis that perceived ease of use has a positive effect on perceived usefulness to adopt e-learning technologies was supported. This concurs with Davis *et al*., (1989) [5] that an application which is perceived to be easier to use than another is more likely to be accepted or adopted by users. An innovation is perceived as being consistent with existing values, past experience (norms), habits, values and lifestyle and perceived needs of adopters (Njenga, 2011) [16].

4.9 Behavioral intention

It was shown that six factors (Perceived Ease of Use, Perceived Usefulness, Compatibility, Trialability, Complexity and Relative Advantage) significantly influenced behavioral intention of the adoption of e-learning technologies in Ugandan HEIs. This also meant that an increase in any of the six factors would lead to an increase in behavioral intention to adopt e-learning technologies in Ugandan HEIs. Therefore, the hypotheses that perceived ease of use, perceived usefulness, compatibility, trialability, complexity and relative advantage have a positive effect on behavioral intention to adopt e-learning technologies were supported, These results affirm that if users of innovations like e-learning technologies are given support this will result into their intention to adopt it,

5. Conclusions

This study proposed an extension to the lee *et al*., (2011) [13] model by examining the patronage factor in addition to the other variables; Compatibility, Observability, Trialability, Complexity, Relative Advantage, Perceived Usefulness, Perceived Ease of Use, and Behavioral Intention. This study provided a new model for Ugandan HEIs to study students, lecturers, and ICT support staff in the adoption of e-learning technologies. This model is therefore capable of helping the Ugandan HEIs and other organizations deter from dissipating financial resources on e-learning technologies projects that may eventually not bring benefits but enable them to successfully implement and ensure adoption of e-learning technologies projects in Ugandan HEIs.

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