Information & Communication Technologies (ICTs) in Higher Education: Factors Influencing Adoption and Diffusion by Students in Kenyan Universities

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Abstract

Recently, universities have been investing heavily on the provision of Information and Communication Technologies (ICTs) such as Internet bandwidth, E-mail, expensive e-learning platforms, administrative intranet, and library information systems, not only for use and access by all university students, but also, to create a competitive advantage. Despite these enormous investments and rapid ICTs deployment rates in universities, only a few studies mainly from the information technology (IT) and information systems (IS) literature have been devoted in uncovering the factors particularly those of the environmental context that influence the adoption and diffusion of new ICTs within an institutions' students. Similarly, empirical studies regarding the predictability of ICTs diffusion in institutions of higher learning are strikingly limited. In an attempt to fill this research void, the present research examines the environmental, technological, organizational and individual factors that affect the adoption and diffusion of ICTs by students in public and private universities in a developing country -Kenya. This paper is part of an ongoing PhD. research, and presents findings on the interaction of the environmental factors with individual student's decision on technology acceptance.

A quantitative approach was used and data for this research was collected by means of a survey conducted in selected sample of public and private higher education institutions in Kenya in 2008. By testing a number of hypotheses using structural equation modelling (SEM), the authors conclude that the environmental context antecedents of ICTs diffusion have a significant and positive influence on ICTs assimilation by students. Among the results for this paper, competitive pressure, Government ICTs support, Industry/Vendor/ISPs ICTs support, and socioeconomic conditions had a positive influence on ICTs adoption and diffusion. This study, therefore has contributed by identifying some important environmental context antecedent factors that enhance ICTs adoption and diffusion and hence corrected the limitations of existing technology acceptance model (TAM).

Keywords: Adoption, Diffusion, ICTs, TAM, Internet, Environmental Variables

1. INTRODUCTION

Information and Communications Technologies (ICTs) consists of hardware, software, networks, and media for collection, storage, processing, transmission, and presentation of information including video, voice, data, text, and images [15]. In today's highly competitive higher education sector the use of information and communication technologies e.g., local area networks (LAN), Wide Area Networks (WAN), Learning Management System (LMS), Intranet, Email, and Library systems by university students, faculty and staff appears to be an imperative for reducing and easing administrative processes, and saving operational costs [41]. Further, ICTs enhance teaching, learning and research [1], and, provide a sustaining competitive advantage [31]. This has lead to a rapid increase of the number of universities deploying ICTs for use and access by all university students. However the problem of technology rejection is common that make such systems often either underutilized or not used at all [7]. Consequently, one of the progressing issues of information systems (IS) research is that of identifying factors that cause people to accept and make use of systems developed and implemented by their institutions [16].

Over the last three decades in the Information Systems field, various theories and models have been developed to address this problem. Although they are popular and useful, a great number of

researchers in IS are still interested in investigating whether these theories/models should be revised, extended or modified to account for rapid change in user behaviour, technologies and their environments [24], [29], [44], [47]. Thus, several shortcomings of existing theories have been highlighted in the literature. One of the main weaknesses identified is that most theories or models have been developed in the U.S. and hence have been questioned whether they can be used in least developed countries. It is also questioned whether there might be other determinants and moderators that play important roles in the specific environment. In addition, researchers have found that studies with a focus on least developed countries (LDCs) are almost non-existent in mainstream information systems research [24]. Consequently, these several problems lead to a knowledge gap and the lack of ICTs diffusion models that take into account contextual and local variables in LDCs, such as access to ICTs, and socioeconomic conditions which are not factors of concern in developed countries. Consequently, university administrators and practitioners would benefit immensely by understanding the factors that influence and accelerate the adoption and diffusion of ICTs by students. Such knowledge will aid the universities to achieve their student learning objectives by deploying interventions that guarantee that students will make full use of deployed ICTs in their studies.

2. LITERATURE REVIEW

2.1 ICTs in Higher Education

According to a number of researchers, ICTs improve teaching, learning, and research, both from the instructivist and constructivist theories of learning [25]. This increasing confidence in the role of information and communication technology in higher education however, assumes the acceptance of technology by various commentators. However, the assumption of technology acceptance as natural phenomena in higher education has been challenged, since many previous studies have posited that technology rejection is common [7]. Although Information Systems projects may fail due to failure to deliver projects on time, within budget and to specification, many systems fail after the development phase because once installed they are rarely deployed [7]. This phenomenon is of particular note for the higher education environment because university students have a high level of autonomy and it is rare that they can be coerced into adopting new learning tools. Previous studies conclude that although there is evidence of commitment to, and investment in ICTs, and more general exploitation of Information and Communication Technology (ICT), under-utilisation is considered to be a problem for almost all higher education institutions [10].

2.2 Innovation Diffusion

Ryan and Gross (1943) cited in [45] were among the earliest researchers to discuss the diffusion of technology innovation. Since then, this has been a fascinating research topic and is still one of the hot issues for many researchers in several fields [45]. Rogers [35] raised this issue in the management information systems (MIS) field, and many researchers have proposed several theories, models, frameworks, and research methods. The focus of contemporary ICT adoption and diffusion research appears to be centred on understanding the dynamics of adoption and diffusion at four specific levels:- National, industry, organization or individual [4]. In this paper national and industry factors are termed as environmental factors. These are variables that are beyond the control of both the student (individual) and the organization, yet may influence the adoption and diffusion behaviours of the individual student. This is illustrated in Figure 1.

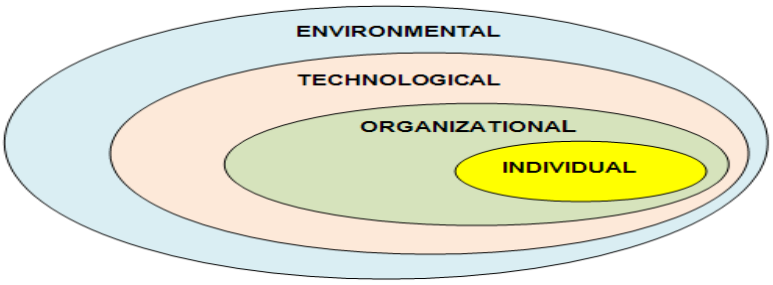

Figure 1: Factors that influence Individual ICTs Adoption and Diffusion

The existing literature identified a host of popular theories that have been advanced in the literature for the adoption and diffusion of innovations such as ICTs. Eight of these theories shave been discussed in [44].This study has adopted the technology acceptance model (TAM) model that was proposed by [7], [8] to investigate the influence of environmental factors on the individual as opposed to the organization, which has been the view of previous studies. External environmental variables investigated in previous studies include competitive pressure, government ICTs Support, business partner power, and Vendor ICTs support [34], [5]. All of these variables have been shown to predict intention to adopt EDI [14]. While existing research have studied the interaction of these variables with the organization, studies investigation in the interaction of these factors with the individual adoption of ICTs are nonexistent. It is therefore prudent that this paper has devoted to investigate the environmental factors of competition pressure, government ICTs support, Industry/Vendors ICTs support, and socioeconomic variables.

2.3 TAM model

TAM attempts to explain the potential of ICTs user's behaviour behavioural intention to use a technological innovation [7], [8]. TAM is based on the theory of reasoned action (TRA) [2] a psychological theory that seeks to explain behaviour. TAM used two primary predictors- perceived usefulness (PU) and perceived ease of use (PEOU) and the dependent variable behavioural intention (BI), which TRA assumed to be closely linked to actual behaviour on ICTs usage. Among the main reasons why TAM is one of the most extensively used models in IS, is its understand ability and straightforwardness [42]. However, it has been criticized over various weaknesses. Among these include: all TAM relationships are not borne out in all studies; there is a wide difference in the number, type, and context of variables in various studies, there is wide variation in the predicted effects in various studies with different types of users and systems [20], [16]. However [16] compiled the 88 TAM empirical studies that they considered to be the relevant set that showed that the number of research rose considerably, from a publication rate of 4 per year in 1998-2001 to a rate of 10 per year in 2002-2003, and this rate has been increasing rapidly [16]. This confirms that although research on TAM has been plentiful, it is not adequate [42], [46], [44], [12], [40], [23], [37], [7]. This inadequacy of TAM research provides this paper with a motivation to extend it by including environmental variables that have not been adequately addressed by previous studies.

3. RESEARCH FRAMEWORK AND HYPOTHESIS

A theoretical framework is defined as a collection of theories and models from the literature which underpins a positivistic research study [13]. Figure 2 is the research model adopted for this study. In the model, the TAM part is indicated with a dashed box, while the arrows in the figure indicate the directions of the key hypotheses (H1 – H8b) described in the section below. First, the research model proposes that four environmental variables namely: *competition pressure, government ICTs support, Industry/Vendors ICTs support, and socioeconomic factors* will influence perceived usefulness and perceived ease of use. Second, in the TAM the relationships between the constructs of perceived usefulness, perceived ease of use and behavioural intention are indicated. The setting of the research is in an emerging economy in Sub-Saharan Africa - Kenya. It has a population of 38 million inhabitants [6]. Despite its large population, Kenya leads other East African countries in terms of the ICT Opportunity Index [17].

3.1 TAM Constructs

The TAM asserts that Behaviour Intention is a proper proxy to examine and predict a user's behaviour toward a particular technology or system. But it is important to note that BI is more predictive of usage behaviour when individuals have had prior experience with the technology (Taylor and Todd 1995b). Accordingly, the following hypothesis is introduced: ***H_1:*** *There is a positive influence of Behavioural intention to adopt ICTs to ICTs Usage.* Premkumar (2003) cited in [33] argues that there are very few researches that have investigated the influence of technological factors in the context of small business. Consequently, there are even few studies in higher education. Nonetheless, technology adoption and diffusion research [35], [23], [18] have found that perceived usefulness (relative advantage factor) influences ICTs adoption and usage significantly and positively [42], [30, [27, [28],

Accordingly, the following hypothesis is introduced: ***H_2:*** *There is a positive influence of perceived usefulness on the intention to adopt ICTs.* There are many researchers [26], [3] who have studied the relationship between perceived ease of use and perceived usefulness, nonetheless, the relationship remains contradictory. For instance, [9] discovered that the relationship was not significant in predicting e-mail acceptance as a technology, while others like [26] proved otherwise. Therefore, we hypothesize : ***H_3:*** *There is a positive influence of perceived ease of use on the intention to adopt ICTs. and* ***H_4:*** *There is a positive influence of perceived ease of use on perceived usefulness.*

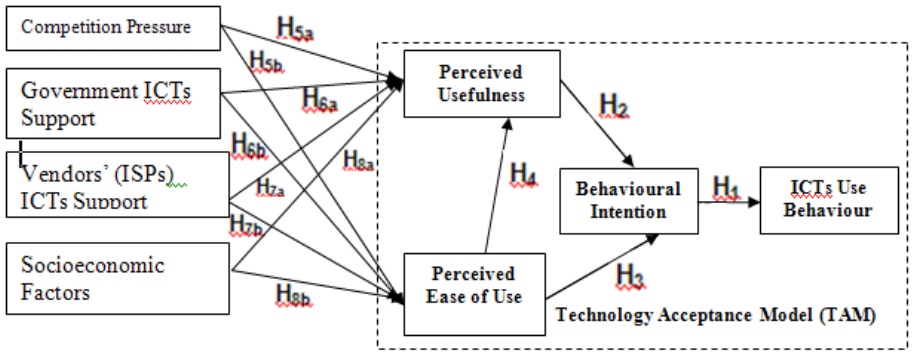

Figure 2: The Research Model

3.2 Environmental Factors Hypothesis

Competitive pressure, government ICTs support, vendor/ISPs ICTs support and socio-economic factors are among the major environmental variables commonly mentioned in the literature that influence ICTs adoption and diffusion. The competitive pressure in the educational sector and external ICTs support are considered to be factors that influence an institutional s' willingness to adopt ICTs [33]. Ramdani and Kawalek in [33] have argued that the industry in which the organization operates influences the adoption and diffusion of IS innovations. Therefore this study has included the variable in the model and hypothesized: ***H_{5a}.*** *Competitive pressure positively influences the perceived usefulness. And* ***H_{5b}.*** *Competitive pressure positively influences the perceived ease of use.* Previous researchers have studied the influence of government support in the decision of ICTs adoption and [36]. In the category of environmental factors studied by Seyal et al., government support was found significant in determining the adoption of EDI among SMEs. Similarly, the study by [21] indicated many adopters would consider implementing more e-commerce if more government support was available. We therefore hypothesis: ***H_{6a}.*** *Government ICTs support positively influences the perceived usefulness and* ***H_{6b}.*** *Government ICTs support positively influences the perceived ease of use.*

Vendor support "is the degree to which the vendor of an innovation gives support during the decision phase and during the implementation Process" [11]. Wood and Nosek (1994) cited in [21] found that vendor support factor is positively associated with SMEs success with ICTs which suggests that support from ICT vendors and Internet Service Providers (ISPs) have a likelihood of positive influence on ICTs adoption and diffusion by individuals as well as institutions. However, [11] used vendor support as an innovation characteristic, by arguing that degree of vendor support can vary from supplier to supplier. However in this study we use it as an environmental indicator since the level of vendor support including their completion is determined by other factors beyond the potential adopter, organization or the technology itself. Consequently we hypothesis: ***H_{7a}.*** *Vendor ICTs support positively influences the perceived usefulness. And* ***H_{7b}.*** *Vendor ICTs support positively influences the perceived ease of use.* According to Mbarika, Musa, Byrd, and McMullen, (2002) cited in [28] posits that the masses of Sub-Saharan Africa (SSA) lag behind the rest of the world in basic socioeconomic factors such as income, education, health, productivity, and so on, all of which are pertinent to the day-to-day use of modern ICTs. However research in the influence of socioeconomic factors in SSA has been very rare [24]. Consequently this study found it pertinent to investigate this variable and hypothesised: ***H_{8a}.*** *Socioeconomic factors negatively influence the perceived usefulness. and* ***H_{8b}.*** *Socioeconomic factors positively influence the perceived ease of use.*

4. RESEARCH METHOD

4.1 Sampling

The survey was conducted on students in a selected sample of public and private universities in Kenya to evaluate the application of TAM to the adoption and diffusion of ICTs. Some universities had started implementing the use of ICTs such as e-learning since 2005 to compliment traditional classroom teaching. The subjects were drawn from among degree students. A total of 250 questionnaires were delivered to the students at various universities (N=250) who were using the ICTs in their courses. Each participant was asked to fill out the questionnaire indicating his or her agreement or disagreement with each statement on a 7-point Likert-type scale starting with 1 "Very Strongly Disagree" and ending with 7 "Very Strongly Agree". Scale items appearing on the survey were adapted from scales measuring variables in Davis et al. (1989) and other sources in the literature. Sample demographic information with respect to age, gender, year of study, and experience in ICTs was also taken for potential control purposes in data analysis. Responses were received from 160 subjects, giving a response rate of around 64% (n=160). Descriptive statistics collected from the survey showed that 93% of the subjects had average or more ICTs experience, and 74% spent over 1 hour per day on ICTs. Slightly over half of the respondents (69%) were male, and 87% of the respondents' age varied from 18 to 25 years reflecting the population from which the sample was drawn.

4.2 Measurement

Operationalisation of the constructs proceeded by identifying already existing measures, and then modifying them, as necessary, to suit the context of ICTs. For purposes of this study, a 7-point Likert Scale was used where (1) very strongly disagree, (2) strongly agree (3) agree (4) neutral (5) agree, (6) strongly agree, and (7) very strongly agree. Measurement validity in terms of reliability and construct validity was evaluated. The reliability analysis was conducted in order to ensure the internal validity and consistency of the items used for each variable. Hair et al. (1998) cited in [22] recommended that Cronbach alpha values from 0.6 to 0.7 were deemed the lower limit of acceptability.

We examined the reliability and construct validity of our abbreviated ICTs measures. Table 1 last column displays the composite reliabilities of Behavioural Intention, Perceived Usefulness, Perceived Ease of Use, Competition Pressure, Government ICTs Support, Vendors ICTs Support and Socioeconomic Variable were 0.951, 0.960, 0.945, 0.670, 0.452, 0.233, and 0.326 respectively, all exceeding the 0.6 threshold recommended by Bagozzi and Yi (1988) cited in [19], except the last three. To measure convergent validity, we examined the significance and magnitude of factor loadings shown in Table 1. All standardized loadings are significant at the 0.001 confidence level and only one of the items in Table 1 have loadings below the 0.5 criterion recommended by Bagozzi and Yi (1988) cited in [19], thus providing evidence of convergent validity. We decided to retain the one item because it reflects the core meaning of the factor concerned, thereby enhancing the content validity of the factor's operational measure.

Table 1. Rotated Component Matrix(a)

	Component								Cronbach
	1	2	3	4	5	6	7	8	Alpha
BIU01	.873	.157	.162	-.001	.031	.003	.087	-.109	
BIU02	.876	.156	.211	-.006	.002	-.048	.035	-.059	
BIU03	.867	.160	.124	.004	.084	-.063	-.072	.148	0.951
BIU04	.869	.186	.167	.012	.040	-.070	.011	.143	
BIU05	.868	.091	.022	.125	.034	.118	.085	.040	
BIU06	.870	.065	.057	.123	.019	.034	.026	.038	
PUWWW01	.166	.863	.189	.189	.012	.025	.071	.012	
PUWWW02	.224	.870	.105	.116	.031	-.037	.052	.012	
PUWWW03	.160	.862	.188	.046	.091	.072	.045	.012	0.960
PUWWW04	.189	.877	.215	.072	.082	.104	.051	-.090	
PEOUWWW01	.214	.212	.800	.147	.231	.128	.017	-.089	
PEOUWWW02	.140	.168	.863	.117	.035	.061	-.035	-.036	
PEOUWWW03	.187	.262	.828	.064	.073	.132	-.002	.015	0.945
PEOUWWW04	.155	.171	.689	-.061	.127	.013	.085	.341	
ECCP01	-.047	.219	-.171	.561	-.103	.372	.132	.150	
ECCP02	-.023	.113	-.176	.545	.177	-.173	.222	.443	
ECCP03	.104	.068	.288	.757	-.024	.107	.094	-.013	0.670
ECCP04	.105	.132	.098	.745	.018	-.104	-.063	.011	
ECCP05	.123	.033	.075	.418	.480	.229	-.177	.052	
ECGS06	-.024	.025	.174	-.003	.671	.031	.115	.224	
ECGS07	.071	.114	.079	-.046	.811	-.027	.146	.009	0.452
ECGS08	.023	-.019	-.037	.281	.167	.200	.679	.081	
ECVS09	-.223	.205	.075	.116	-.051	.585	.212	.038	
ECVS10	.063	-.038	.081	.111	.215	.114	-.126	.731	0.233
ECVS11	.090	.032	.080	.278	.384	.519	.000	-.366	
ECSE12	.179	-.093	.131	.088	-.005	.109	.506	.577	
ECSE13	.090	.248	.060	-.155	.071	-.024	.688	-.079	
ECSE14	.155	.051	.090	-.235	.345	.530	-.336	.186	0.326
ECSE15	.069	-.123	.402	-.045	-.004	.566	.118	.131	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 9 iterations.

5. DATA ANALYSIS AND RESULTS

The research model shown in Figure 1 was tested using Statistical Package for Social Sciences (SPSS) version 15.0 software. Separate linear regression analyses were conducted based on 160 completed questionnaires collected from the study. The researcher set the hypothesis testing the correlation of the core TAM constructs namely: between the Behavioural intention and ICTs usage (Hours per day of Internet/www use), Perceived usefulness, Perceived ease of use and Behavioural intention, and Perceived ease of use and perceived usefulness of ICTs using the Pearson Product Moment Correlation; (ρ) . The result shown in Table 2 shows that:

H_1: Behavioural intention correlated to Actual ICTs Usage
H_2: Perceived usefulness correlated to Behavioural intention
H_3: Perceived ease of use correlated to Behavioural intention
H_4: Perceived ease of use correlated to Perceived usefulness

Consequently, these findings provides the justification to accept the hypothesis H_1, H_2, H_3, and H_4. Further, these results confirm the validly of TAM constructs.

Table 2: Pearson Correlations

	1	2	3	4	5	6	7	8
1. Usage (Hrs/Day Internet)	1							
2. Behavioural Intention	.170(*)	1						
	.040							
3. PU_IWWW	.148	.429(**)	1					
	.071	.000						
4. PE_IWWW	.233(**)	.408(**)	.452(**)	1				
	.004	.000	.000					
5. Competition	.041	.149	.261(**)	.174(*)	1			
	.635	.081	.002	.041				
6. Government ICTs Support	.171(*)	.100	.159	.205(*)	.287(**)	1		
	.035	.223	.050	.011	.001			
7. Vendors ICTs Support	.070	.009	.135	.195(*)	.354(**)	.326(**)	1	
	.394	.911	.096	.016	.000	.000		
8. Socioeconomic Variable	.236(**)	.215(**)	.153	.378(**)	.180(*)	.334(**)	.265(**)	1
	.004	.010	.060	.000	.035	.000	.001	

From the result of hypothesis testing the correlation between the perception of environmental factors and the perception ICTs usefulness as well as perceived ease of use showed that every environmental factor correlation with PEOU has the p-value less than the significant threshold level, 0.05. So, there is the reason to accept the hypothesis H_{5b}, H_{6b}, H_{7b}, and H_{8b}, It implied that each of these factors that correlate with PEOU, does influence behavioural intention to use ICTs. On the contrary, the environmental factors of Government ICTs support, Industry/Vendor/ISPs ICTs support, and socioeconomic conditions correlation with PEOU has the p-value less more than the significant level, 0.05. For this reason, we reject the hypothesis H_{6a}, H_{7a}, and H_{8a}, and accept H_{5a} whose p-value is less than the 0.05 level. Table 3 summarises the results of this study, while Figure 3 displays the revised ICTs adoption and diffusion model following the finding of this research.

Table 3: Summary of Results

H	Hypothesis Status in TAM	Pearson Correlation Results	Hypothesis/Supported/Not supported	Reason for acceptance/Rejection
H_1	Existing	r = 0.170, p=0.040, one tailed	Supported	p<0.05
H_2	Existing	r = 0.429, p=0.000, two tailed	Supported	p<=0.000
H_3	Existing	r = 0.452, p=0.000, two tailed	Supported	p<=0.000
H_4	Existing	r = 0.408, p=0.000, two tailed	Supported	p<=0.000
H_{5a}	New	r = 0.261, p=0.002, two tailed	Supported	p<=0.05
H_{5b}	New	r = 0.174, p=0.041, one tailed	Supported	p<0.05
H_{6a}	New	r = 0.159, p=0.050	Not Supported	p>=0.05
H_{6b}	New	r = 0.205, p=0.011, one tailed	Supported	p<0.05
H_{7a}	New	r = 0.135, p=0.096	Not Supported	p>=0.05
H_{7b}	New	r = 0.195, p=0.016, one tailed	Supported	p<0.05
H_{8a}	New	r = 0.153, p=0.060	Not Supported	p>0.05
H_{8b}	New	r= 0.378, p=0.000, two tailed	Supported	p <=0.000

Since some hypothesis was not supported, we revised the model for predicting ICTs adoption and diffusion as shown in Figure 3.

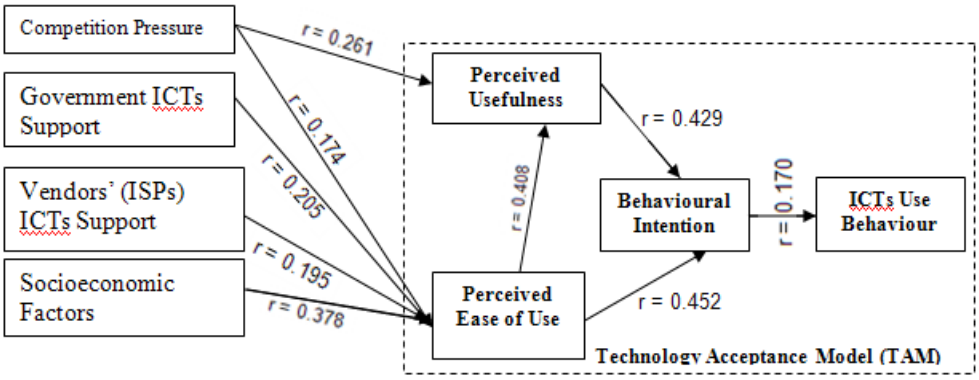

Figure 3: Revised Research Framework

6. DISCUSSION AND CONCLUSION

Environmental characteristics were analyzed in order to extract such factors that have an impact on the diffusion of ICTs in higher education students. The results agree with previous studies that competitive pressure is an important environmental characteristics [32] It influences both PU and PEOU with confidence level of 0.002 and 0.041 respectively. Consequently Hypothesis H5a and H5b are supported. Thus, institutions administrators need to note that the students are alert of ICTs implementations in other competing institutions. And this in turn influences their decision and behaviour towards ICTs. A competitive environment will result in more successful ICTs implementation, which administrators will take advantage. Although, competition is an unfortunate fact of life, as is having a limited scope to control the competitive environment. It is strongly emphasized that universities need to pay closer attention to competitors ICTs advancement [38]. The findings of this research agree with previous studies that conclude that competitive pressures and conformance to established practices have an impact on technology adoption [39]. Likewise, Hypothesis 6b, 7b, and 8b are supported, while Hypothesis 6a, 7a, and 8a are not supported.

7. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

From the results of the structural model, it appeared that *competition pressure, government ICTs support, Industry/Vendors ICTs support, and socioeconomic factors* are significantly related to ICTs adoption. For the construct *competition pressure,* this is probably due to the fact that competition increases investments in ICTs by the institutions to gain competitive advantage. This intern leads to improved access and availability of ICTs to students, and hence affecting the rate of adoption. However, competitive pressure was initially operationalized into one dimension. Future research could examine the complete dimensions to clarify the influence of this variable on ICTs adoption. The development of measurement for environmental factors that influence individual decision to adopt ICTs need to be advanced. Further, the study adopted the Internet as the ICT artifact for consideration. Further research is required to study other ICTs artifacts.

References

[1] Achacoso, M. (2003). *Evaluating Technology and Instruction:Literature Review and Recommendations.* The University of Texas.Retrieved from,http://scholar.google.com/scholar?q=Evaluating+Technology+and+Instruction:Literature+Review+and+Recommendations&hl=en&um=1&ie=UTF-8&oi=scholart.

[2] Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour.* Prentice Hall. Retrieved from January 20, 2008, http://search.epnet.com/login.aspx?direct=true&db=aph&authdb=epref&an=UAPSB.AJZEN.PRENTICEHALL.AIHJ .

[3] Aladwani, A. M. (2003). Key Internet characteristics and e-commerce issues in Arab countries. *Information Technology & People , 16* (1), 9-20.
[4] Binney, D. (2007). The Extended Knowledge Management Adoption Model. *11th Pacific-Asia Conference on Information Systems* (págs. 100-106). AIS Electronic Library (AISeL).
[5] Chau, P., & Hu, P. (2001). Information technology acceptance by individual professionals: A model comparison approach. *Decision Sciences , 32* (4), 699-719.
[6] CIA World Factbook . (2008).
[7] Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly , 13* (3), 318-339.
[8] Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science , 35*, 982-1003.
[9] Gefen, D., & Straub, D. W. (1997). Gender Differences in the Perception and Use of E-Mail: An Extension to the Technology Acceptance Model. *MIS Quarterly , 21* (4), 389-400.
[10] Gilbert, J., & Kelly, R. (2005). Frontiers and frontlines: metaphors describing lecturers' attitudes to ICT adoption. *Educational Technology & Society , 8* (3), 110-121.
[11] Hezewijk, A. v., Assen, M. v., & Velde, S. v. (2003). *The impact of innovation and organizational factors on APS adoption: Evidence from the Dutch discrete parts industry.* Rotterdam, The Netherlands: Erasmus Research Institute of Management (ERIM).
[12] Hu, P., Chau, P., Sheng, O., & Tarn, K. (1999). Examining the technology acceptance model using physician acceptance of telemedicine technology. *Journal of Management Information Systems , 16* (2), 91-112.
[13] Hussey, J., & Hussey, R. (1997). *Business research: a practical guide for undergraduate and postgraduate students.* Basingstoke, Hampshire: Macmillan Press LTD.Retrieved from,http://scholar.google.com/scholar?q=Business+research:+a+practical+guide+for+undergraduate+and+postgraduate+students&hl=en&um=1&ie=UTF-8&oi=scholart.
[14] Iacovou, C. L., Benbasat, I., & Dexter, A. S. (1995). Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology. *MIS Quarterly , 19* (4), 465-485.
[15] James, T., Miller, J., & Sibthorpe, G. (2002). ICT Diffusion and ICT Applications in Usage Sectors. *Journal of the Association for Information Systems , 2* (6), 105-127.
[16] King, W. R., & He, J. (2006). A meta analysis of the technology acceptance model. *Information and management , 43*, 740-755.
[17] Konde, V. (2007). What type of national ICT policies maximize ICT benefits? *ATDF Journal Volume , 4* (1), 3748.
[18] Kwon, T., & Zmud, R. (1987). *Unifying the Fragmented Models of Information SystemsImplementation, in Critical Issues in Information Systems Research.* (e. R. Hirshheim, Ed.) NY: John Wiley & Sons,.
[19] Lam, S. Y., Chiang, J., & Parasuraman, A. (2008). The Effects Of The Dimensions Of Technology Readiness On Technology Acceptance: An Empirical Analysis. *Journal of Interactive Marketing , 22* (4), 19-39.
[20] Legris, P. I. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information and Management , 40*, 191-204.
[21] Looi, H.-C. (2004). A Model of Factors Influencing Electronic Commerce Adoption among Small and Medium Enterprises in Brunei Darussalam. *International Journal of Information Technology , 10* (1), 73-87.
[22] Masrom, M. (2007). Technology Acceptance Model and E-learning. *12th International Conference on Education,* (págs. 1-10). Darussalam: Sultan Hassanal Bolkiah Institute of Education Universiti Brunei,21-24 May 2007.
[23] Mathieson, K. (1991). Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior. *Information Systems Research , 2* (3), 173-191.
[24] Mbarika, V. W., Okoli, C., Byrd, T. A., & Datta, P. (2005). The Neglected Continent of IS Research: A Research Agenda for Sub-Saharan Africa. *Journal of the Association for Information Systems , 6* (5), 130-170.
[25] Mlitwa, N. (2004). *Global Perspectives on Higher Education and the Role of ICT.* Cape Town: University of the Western Cape. Retreived from http://eprints.rclis.org/archive/00004668/01/Global_Perspective_on_Higher_Education_and_the_Role_of_ICT%E2%80%A6.pdf.
[26] Moon, J., & Kim, Y. (2001). Extending the TAM for a World-Wide-Web context. *Information & Management , 38* (4), 217-230.
[27] Morris, M., & Venkatesh, V. (2000). Age differences in technology adoption decisions: implications for a changing work force. *Personnel Psychology. Retrieved November 18, 2007 form*

<http://search.epnet.com/login.aspx?direct=true&db=aph&authdb=epref&an=PP.EC.CGE.MORRIS.ADTADI> , 53 (2), 375-403.

[28] Musa, P. F. (2006). Making a Case for Modifying the Technology Acceptance Model to Account for Limited Accessibility in Developing Countries. *Information Technology for Development , 12* (3), 213-224.

[29] Nanayakkara, C. (2005). A Model of User Acceptance of Learning Management Systems: a study within tertiary Institutions in New Zealand. *The International Journal of Learning , 13* (12), 223-232.

[30] Ndubisi, N. O. (2007). EVALUATING THE DIRECT AND INDIRECT IMPACT OF TRAITS AND PERCEPTIONS ON TECHNOLOGY ADOPTION BY WOMEN ENTREPRENEURS IN MALAYSIA. *Academy of Entrepreneurship Journal , 13* (2), 1-20.

[31] Papastathopoulou, P., Avlonitis, G. J., & Panagopoulos, N. G. (2007). Intraorganizational information and communication technology diffusion: Implications for industrial sellers and buyers. *Industrial Marketing Management , 36* (3), 322-336.

[32] Patrick, S., Frédéric, T., & Elgar, F. (2007). *Adoption and Diffusion of RFID Technology in the Automotive Industry.* Recuperado el 24 de November de 2008, de www.sigadit.org/edigit07papers/SchmitteDIGIT.pdf

[33] Ramdani, B., & Kawalek, P. (2008). *PREDICTING SMES WILLINGNESS TO ADOPT ERP, CRM, SCM & E-PROCUREMENT SYSTEMS.* University of Manchester, Manchester.

[34] Robey, D., Im, G., & Wareham, J. D. (2008). Theoretical Foundations of Empirical Research on Interorganizational Systems: Assessing Past Contributions and Guiding Future Directions. *Journal of the Association for Information Systems , 9* (9), 497-518.

[35] Rogers, E. M. (1995). *Diffusion of Innovations (4th ed.).* New York: The Free Press.Retrived Aprill 20, 2008 from,http://www.google.com/products?hl=en&q=Diffusion+of+Innovations+(4th+ed.)&um=1&ie=UTF-8&sa=X&oi=product_result_group&resnum=1&ct=title.

[36] Seyal, A. H., Rahman, M. N., Yussof, H. A., & Mohammad, H. A. (2005). A QUANTITATIVE ANALYSIS OF FACTORS CONTRIBUTING ELECTRONIC DATA INTERCHANGE ADOPTION AMONG BRUNEIAN SMES: A PILOT STUDY. *The Second International Conference on Innovations in Information Technology (IIT'05)* (págs. 1-10). Brunei Darussalam: chool of Business Management and Information Technology, Department of Computing & Information Systems, Institute of Technology Brunei, Brunei Darussalam.

[37] Straub, D., Limayem, M., & Karahanna, E. E. (1995). Measuring System Usage: Implications for IS Theory Testing. *Management Science , 41* (8), 1328-1342.

[38] Teng, L., Laroche, M., & Zhu, H. (2007). The effects of multiple-ads and multiple-brands on consumer attitude and purchase behavior. *Journal of Consumer Marketing , 24* (1), 27–35.

[39] Teo, H., Wei, K., & Benbasat, I. (2003). Predicting Intention to Adopt InterOrganizational Linkages An Institutional Perspective. *MIS Quarterly , 27* (1), 19-49.

[40] University of Notre Dame Australia. (2003). *Policy: Email and Internet Usage.* Notre Dame Australia, Retrived July 20, from http://www.nd.edu.au/downloads/current-students/email_internet_usage.pdf .

[41] Uys, P. M., Nleya, P., & Molelu, G. (2004). Technological Innovation and Management Strategies for Higher Education in Africa: Harmonizing Reality and Idealism. *Technological Innovation in African Higher Education , 41* (1), 68-80.

[42] Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Sciences , 39* (2), 273-315.

[43] Venkatesh, V., Morris, M., & Davis, F. (2000). *Technology Acceptance Model 3 (TAM3).* Retrieved August 29, 2008 from http://www.vvenkatesh.com/IT/organizations/Theoretical_Models.asp.

[44] Venkatesh, V., Morris, M., Davis, G., & Davis, F. (2003). User Acceptance of Information Technology: Toward A Unified View. *MIS Quarterly , 27* (3), 425-78.

[45] Yang, K. H., Lee, S. M., & Lee, S. G. (2007). Adoption of information and communication technology Systems. *Industrial Management & Data , 107* (9), 1257-1275.

[46] Yun, G. P., & Murad, M. W. (2006). Factors Influencing Psychology and Skills of the Secondary School Teachers' E-Learning Readiness: A Case Study in Malacca, Malaysia. *Current Developments in Technology-Assisted Education , 7* (4), 2135-2140.

[47] Zhang, P., Li, N., & Sun, H. (2006). Affective Quality and Cognitive Absorption: Extending Technology Acceptance Research. *Proceedings of the 39th Hawaii International Conference on System Sciences* (págs. 1-10). Syracuse University.