Original research paper

EXPLORING ICT ADOPTION FOR IMPROVED EFFICIENCY OF E-LEARNING IN HIGHER INSTITUTIONS OF KOGI STATE

UDC 007:004(669 Kogi); 378(669 Kogi)

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Abstract. *This study aimed at the effect of ICT on the efficiency of e-learning in higher institutions of Kogi State. The study adopted descriptive research design. 226 respondents were surveyed. Reliability results showed the Cronbach alpha of ICT adoption for e-learning ($\alpha = 0.984$) and efficiency of e-learning ($\alpha = 0.755$). Data were gathered and analysed using descriptive, Multiple Regression and Binary Logit Regression. Finding showed that ICT adoption has strong influence on efficiency of e-learning in the higher institutions of Kogi State. The study recommended that policy makers should strategically design a framework that can enhance effective ICT adoption to influence improved efficiency of e-learning in the higher institutions of Kogi State.*

Key words: *Information and Communication Technology, Efficiency of E-learning, ICT Avoidance, Self-efficacy toward ICT, Severity of Malicious IT*

1. INTRODUCTION

ICT is viewed as a technology pipeline for passing and receiving vital information that are useful for operations, administration and knowledge acquisition in the learning communities in Kogi State. It has facilitated the fast and total transparency in higher institutions. It is through the Information and Communication Technology (ICT) that the higher institutions now witness increasing innovations. Before now, activities are popularly carried out using traditional method. Thus the traditional file and cabinet dominated higher institutions administrative service. This made operation flow very slow, and there was almost nothing to write home about concerning productivity, efficiency, effectiveness and transparency. Relative to the e-learning and administration of higher institutions in Kogi State during this COVID19 pandemic, the imperatives of ICT towards distance learning, efficiency and effectiveness cannot be over-emphasized.

With respected to this, the study is narrowed down to the higher institutions in Kogi State. This is because ICT promotes educational quality and increased efficiency. It supports data protection and reduced operation and administrative cost of higher institutions in Kogi State. On the other hand, Lawal-Solarin (2015) opined that high cost is associated with ICT training; thereby making it expensive for university to use ICT in Nigeria. Abbas (2014) advocated the need for training on ICT. Yemi-Peters, Sokari, Olayemi, Abba Haliru, and Gama (2019) recognize the importance of ICTs, and emphasize on the need for training relative to its effective usage/ applications and maintenance. This has the possibility of influencing efficiency in e-learning of higher institutions in Kogi State. The efficiency in e-learning of higher institutions does not really premise on the availability of technologies, but it has its cradle from the adequate knowledge of use and approach. The level of knowledge acquired reflects on the optimal use of new technologies for e-learning. Pavel, Fruth, and Neacsu (2015) added that "ICT and e-leaning can enhance the quality of higher education through innovative methods by increasing the students' motivation, interest and engagement, by facilitating the acquisition of skills and by enhancing teacher training which will eventually improve communication and exchange of information" (p.23).

It is observed that there are some challenges facing the higher institutions in Kogi State with respect to ICT adoption for e-learning during this pandemic. According to FrontEnders (2016), they are related to storing the records, maintaining Information System, maintenance of equipment, learning error and lot more. Adeoye, Adanikin and Adanikin (2020) opined that "the challenges arise as a result of the varying degree of preparedness of the institutions, lack of infrastructures, paucity of funds and policies issues in the Nigeria education sector" (p.28). Some higher institutions in Kogi State have been facing the problem of efficiency, effectiveness and transparency due to these challenges. The fact remains that there is a gap in ICT adoption in the higher institutions of Kogi State.

It is seen that students and some lecturers rather avoid ICT than adopting it for lecture delivery. Such avoidance may be subject to some peculiar factors by the students and lecturers. Technology Threat Avoidance Theory (TTAT) outlined that risk tolerance, social influence, perceived susceptibility, severity of malicious IT, costs, and self-efficacy toward ICT are factors that lead to the avoidance of ICT adoption (Xue, Liang, Mbarika et al., 2015). There are other factors that can influence the adoption or avoidance of ICT for learning purpose. Cost (Seyal & Rahim, 2006), knowledge, external pressure and government support (Alam & Noor, 2009) prevent the adoption and implementation of ICT. Technological Frames of Reference Theory posited that 'technical strategy, motivation for adoption and nature of technology' have more explanatory power over adoption and implementation of ICT. Technology Acceptance Model (TAM) suggested that perceived usefulness and perceived ease of use can influence the adoption of ICT (Gefen & Larsen, 2017). In a study conducted by Eteng and Ntui (2009), it was revealed that lecturers and students are literate in the use of most aspects of Information and Communication Technology; most e-learning facilities are available and functional but inadequate in Universities. Thus, inadequate e-learning facilities influence the avoidance of ICT in higher institutions of Kogi State. The specific objectives were to:

1. Investigate the extent at which ICT adoption can influence efficiency of e-learning in the higher institutions of Kogi State.
2. Examine the extent at which factors influence the avoidance of ICT in the higher institutions of Kogi State.

2. LITERATURE REVIEW

The E-learning in some higher institutions may be a mirage due to lack of proper planning, development, implementation, utilization, exploitation, management, control and maintenance of previously acquired information systems. Figure 1 shows that the problem of Bandwidth (the maximum rate of data transfer across a given path), perceived ease of use, nature of the technology, readiness to accept change, inadequate facilities and so on have plague the adoption of full ICT in the higher institutions of Kogi State. Murgor (2015) added that "high cost of bandwidth, inadequate and unreliable telecommunication services and applications still remains a major challenge, and there is also the problem of insincerity on the part of service provider" (p.64). The e-learning Africa report (2012) highlights some of the most significant constraining factor as being limited bandwidth (17%), followed by the lack of financial resources, inadequate human resource capacity and limited electricity, all with 11% (Kasse & Balunywa, 2013).

On the part of learners, students face over-deduction of data which may arise from the insincerity of service providers. Learners also face the high cost of subscription which often prone them into sustaining traditional learning pattern. Murgor (2015) noted that stress or anxiety felt by a student faced with the necessity of using computer in a learning or performance context may affect the adoption of ICT. The institutional management instability is another challenge facing the adoption of ICT. A rector or provost or vice chancellor who does not have ICT knowledge is likely to decline effort that may be put forward to influence ICT adoption. Ejiaku (2014) expressed that "ineffective government policies, poor infrastructure and inadequate training and qualification are contributory factors in creating challenges in ICT adoption" (p.65).

There is also possibility that ICT adoption can influence efficiency in the higher institutions of Kogi State (see figure 1). Carter and Belanger (2003) posited that the use of ICT can improve efficiency. The study of Gupta, Dasgupta, and Gupta (2008) found that ICT adoption has influence on efficiency in organizations. Finally, Liang and Xue (2009) also posited that risk tolerance, social influence, severity of malicious IT, costs, and self-efficacy toward ICT can influence the avoidance of ICT adoption in the higher institutions of Kogi State.
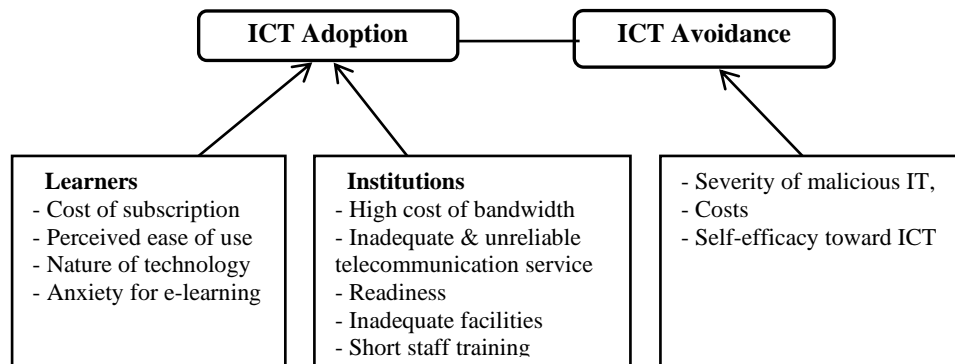
Fig 1 Conceptual Framework
Source: Adapted from Carter and Belanger (2003), Gupta, Dasgupta, & Gupta (2008), Liang and Xue (2009), Murgor (2015)

3. METHODOLOGY

This study encompassed both the processes and the procedural framework used to acquire the data and information necessary to structure and solve the research issue. The study adopted descriptive research design. The total population of the academic staff of the selected Higher Institutions in Kogi State was 1,388 (Directorate of Academic Planning and Academic Officer, 2019; education.gov.ng). For this study, given the population of 1,388 academic staff of the selected Higher Institutions in Kogi State, the research adopted Sallant and Dillman's (1997) method. The formula is stated below:

$$N_S = \frac{N_p(p)(1-p)}{(N_p-1)\left(\dfrac{B}{C}\right)^2 + (p)(1-p)}$$

where,

N_s = completed sample size required

N_p = sample population

p = proportion expected to answer in a certain way (50% or 0.5 is most conservative)

B = acceptable level of sampling error ($0.05 = \pm 5\%$; $0.03 = \pm 3\%$)

C = Z statistic associated with the confidence interval ($1.645 = 90\%$ confidence level; $1.960 = 95\%$ confidence level; $2.576 = 99\%$ confidence level)

$$\frac{1388(0.5)(1-0.5)}{(1388-1)\left(\dfrac{0.05}{1.645}\right)^2 + (0.5)(1-0.5)} = 226 approx.$$

The sample size of the study was 226. For this study, multistage random sampling technique was adopted. In this study, multistage sampling consider with simple random without replacement sampling at the first stage, and with an arbitrary sampling design for further stages. The Cronbach Coefficient alpha (α) was used to determine the instrument's consistency. The Cronbach Coefficient alpha was; ICT adoption for e-learning (α = 0.984) and efficiency of e-learning (α = 0.755). Data were gathered and analysed. Both descriptive and inferential analytical techniques were used for this purpose. The analytical techniques that were employed are basically three: Multiple Regression, Principal Component Analysis and Binary Logit Regression.

EOE = Dependent variable (efficiency of e-learning);

f = a function to be specified

X = a vector of explanatory variables that pertain to ICT adoption for e-learning

In specific form, equation (5) translates into equation 6 thus:

$$EOE = a + \beta_1 COS + \beta_2 PEU_2 + \beta_3 NOT_3 + \beta_4 AFE_4 + e$$

where,

a = Constant

COS = Cost Of Subscription

PEU = Perceived Ease of Use

NOT = Nature of Technology

AFE = Anxiety for E-Learning

e = residual or stochastic term

$\beta_1, \beta_2, \beta_3, \beta_4$ are regression coefficients which determine the contribution of the independent variables

4. DATA ANALYSIS AND RESULTS

Table 1 shows the gender of respondents. It is observed that 123 respondents (54.4%) were male; and 103 respondents (45.6%) were female. The table depicts that majority of the respondents in the study area were male.

Table 1 shows the age bracket of respondents. It is observed that 49 respondents (21.7%) were below 20 years; 98 respondents (43.4%) were within the age bracket of 21-25 years; 63 respondents (27.9%) were within the age bracket of 26-30 years; and 16 respondents (7.1%) were within the age bracket of 31-35 years. This result shows that majority of respondents in the study area were within the age bracket of 21-25 years.

Table 1 Demographic Characteristics of Respondents

Responses	Frequency	Percent (%)
Gender		
Male	123	54.4
Female	103	45.6
Total	226	100.0
Age bracket		
< 20 Years	49	21.7
21-25 Years	98	43.4
26- 30 Years	63	27.9
31-35 Years	16	7.1
Total	226	100.0
Years of Experience		
Below 1 Year	17	7.5
1-5 Years	64	28.3
6-10 Years	50	22.1
11-15 Years	41	18.1
16-20 Years	40	17.7
21-25 Years	10	4.4
Above 25 Years	4	1.8
Total	226	100.0

Source: Field Survey (2021)

The table 1 shows the years of experience of respondents. It is observed that 17 respondents (7.5%) have below 1 year of experience; 64 respondents (28.3%) have 1-5 years of experience; 50 respondents (22.1%) have 6-10 years of experience; 41 respondents (18.1%) have 11-15 years of experience; 40 respondents (17.7%) have 16-20 years of experience; 10 respondents (4.4%) have 21-55 years of experience; and 4 respondents (1.8%) were above 25 years of experience. The result depicts that majority of respondents in the study area have 1-5 years of experience.

Table 2 shows that it is expensive for institutions to use ICT for e-learning ($\dot{x}$ =1.5531; α = 0.71760). The mean value is weak (considering the mean values of other variables), and the standard deviation shows lesser divergence. This may mean that not all higher institutions can afford to adopt ICT in Kogi State. ICT seems to be very complex for some users ($\dot{x}$ = 2.0575; α = 1.21884). From the result, the mean score seems to be adequate enough to describe the complexity. The mean score may be considered to state that its complexity for users is on the minimal. The standard deviation is a bit higher; indicating

more divergence from the mean. This is also an indication that the assertion that "ICT is complex for users" is not strong.

Table 2 Descriptive statistics of ICT usage

	N	Min.	Max.	Mean	Std. Deviation
High cost attached ICT usage for e-learning	226	1.00	3.00	1.5531	.71760
ICT complexity	226	1.00	5.00	2.0575	1.21884
Anxiety relative to ICT usage	226	1.00	5.00	2.0487	1.21922
Convenience	226	1.00	5.00	2.3407	1.35444

Source: Field Survey (2021)

There is fear for the use of ICT for e-learning in higher institutions in Kogi State ($\dot{x} = 2.0487$; $\alpha = 1.21922$). The mean score of the statement is on the average. This implies that some users nurture fear for ICT in e-learning while others seem to be confident regarding its usage. The standard deviation supports the position of this study due to the divergence of the data from the mean.

There is convenience in the share of assignments, lecture notes and study material through ICT ($\dot{x} = 2.3407$; $\alpha = 1.35444$). This is a confirmation of the benefits of ICT for e-learning in higher institutions in Kogi State. The result (having the strongest mean score) shows that the benefits of ICT for e-learning are obvious to all individuals in the higher institutions of Kogi State. The standard deviation (having higher divergence) describes that some users are not comfortable with the benefits. This may be due to the factors best known to them.

Table 3 shows that learning objectives ($\dot{x} = 3.1991$; $\alpha = 1.50855$), educationally purposeful activities ($\dot{x} = 3.1283$; $\alpha = 1.46860$), and students' self-reliance and skills ($\dot{x} = 3.6947$; $\alpha = 1.42038$) translates into the efficiency of e-learning in higher institutions of Kogi State. All the variables appear to have strong mean scores. The standard deviation shows more divergence of data from the mean. However, students' self-reliance and skills appear to have the strongest with the efficiency of e-learning in higher institutions of Kogi State.

Table 3 Descriptive statistics of efficiency of e-learning

	N	Mean	Std. Deviation
Learning objectives	226	3.1991	1.50855
Educationally purposeful activities	226	3.1283	1.46860
Students' self-reliance and skills	226	3.6947	1.42038

Source: Field Survey (2021)

Table 4 indicates that severity of malicious IT ($\dot{x} = 1.4425$; $\alpha = 0.49778$), costs ($\dot{x} = 1.6504$; $\alpha = 0.47789$), and self-efficacy toward ICT ($\dot{x} = 1.5000$; $\alpha = 0.50111$) are attributed to the avoidance of ICT in the higher institutions of Kogi State. Costs appear to be the strongest factors influence the avoidance of ICT in the higher institutions of Kogi State.

Table 4 Descriptive statistics on avoidance of ICT in the higher institutions

	N	Mean	Std. Deviation
Severity of malicious IT	226	1.4425	.49778
Costs	226	1.6504	.47789
Self-efficacy toward ICT	226	1.5000	.50111

Source: Field Survey (2021)

Table 5a shows that ICT adoption influences efficiency of e-learning in the higher institutions of Kogi State (given the R^2 = 0.728). This implies that ICT adoption explains the variations in efficiency of e-learning in the higher institutions of Kogi State by 72.8%. There are other variables that can explain the remaining 27.2% variations in efficiency of e-learning in the higher institutions of Kogi State. The R-square value shows that the influence of ICT adoption on efficiency of e-learning in the higher institutions of Kogi State is a strong one. This is because the R-square value is above average (50%).

Table 5a Model Summary on ICT adoption's influence on efficiency of e-learning

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.853[a]	.728	.727	.30226

a. Predictors: (Constant), ICT for e-learning

Table 5b indicates that the regression model is adequately predicted by the dependent variable. The *F*-statistic (599.358) reflects a significant variance in the efficiency of e-learning in the higher institutions of Kogi State (given that the sig < 0.05). This provides a very strong evidence of the need to reject the null hypotheses. The ANOVA table (having reported a significant *F*-statistic) also states that using the model is better off than guessing the mean. Thus, it shows a good fit for the data. The mean square residual value (0.091) is small. This shows less deviation between the observed and fitted value. The coefficient of determination (in table 5a) for ICT adoption (R^2 = 0.728) proves a very strong and significant influence on the efficiency of e-learning in the higher institutions of Kogi State.

Table 5b ANOVA on ICT adoption's influence on efficiency of e-learning

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	54.757	1	54.757	599.358	.000[b]
	Residual	20.464	224	.091		
	Total	75.221	225			

a. Dependent Variable: Efficiency of E-learning
b. Predictors: (Constant), ICT for e-learning

Table 5c shows that there is a positive linear relationship between ICT adoption and efficiency of e-learning in the higher institutions of Kogi State (given the β = 0.848; Sig-value= 0.01). This implies that 84.8% change in ICT adoption will lead to corresponding change in efficiency of e-learning in the higher institutions of Kogi State. The result proves that ICT adoption has significant positive linear relationship with efficiency of e-learning in the higher institutions of Kogi State.

Table 5c Coefficients on ICT adoption's influence on efficiency of e-learning

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.334	.055		6.120	.000
	ICT for e-learning	.848	.035	.853	24.482	.000

a. Dependent Variable: Efficiency of E-learning

From the result of the Logit Regression on table 6, the coefficient of determination (LR) of 218.950 and adjusted (Pr) 0.000 which implies that 100% of the changes observed in the avoidance of ICT in the higher institutions of Kogi State were explained by the variables in the model. The table 6 shows the Logit Regression coefficient of factors (self-efficacy toward ICT, costs and severity of malicious IT) influencing the avoidance of ICT in the higher institutions of Kogi State. The result in the table shows that only self-efficacy toward ICT (β = -1.812; p = 0.01) has negative relationship with the avoidance of ICT in the higher institutions of Kogi State. The strength of the relationship is above 100%; indicating highly interesting and strong negative relationship between self-efficacy toward ICT and the avoidance of ICT in the higher institutions of Kogi State. The simple implication of this is that 181% change in self-efficacy toward ICT will bring about proportional decrease in the avoidance of ICT in the higher institutions of Kogi State. Thus, perceived self-efficacy toward ICT is discovered to be having significant negative influence on the avoidance of ICT in the higher institutions of Kogi State. The table shows that costs has insignificant positive linear relationship with the avoidance of ICT in the higher institutions of Kogi State (β = 0.434; p = 0.127).

Table 6 Logit Regression result on factors influencing the avoidance of ICT in the higher institutions of Kogi State

Variables	Coefficients	Standard Error	P > |z|
Self-efficacy toward ICT	-1.812	.290	.000
Costs	.434	.284	.127
Severity of malicious IT	.126	.266	.035

Legend: Number of Obs = 226; LR chi^2 = 218.950; Prob > chi^2 = 0.000; Pseudo R^2 = 0.192

Source: Field Survey (2021)

The table also shows that severity of malicious IT has significant positive linear relationship with the avoidance of ICT in the higher institutions of Kogi State (β = 0.126; p = 0.035). This implies that 12.6% increase in severity of malicious IT will lead to proportional increase in the avoidance of ICT in the higher institutions of Kogi State. That is, the avoidance rate will increase given increase in the severity of malicious IT. However, the linear relationship is observed weak. On the general note, the Pseudo R^2 (0.192) shows that factors weakly influence the avoidance of ICT in the higher institutions of Kogi State.

5. DISCUSSION OF FINDINGS

Finding shows that ICT adoption has strong influence on efficiency of e-learning in the higher institutions of Kogi State. This aligns with the finding of Gupta et al. (2008)

that ICT adoption has influence on efficiency in organizations. The result of the study shows that ICT adoption has significant influence on the efficiency of e-learning in the higher institutions of Kogi State. This also agrees with the finding of Nwachukwu and Pepple (2015) that ICT improves efficiency.

Finding revealed that self-efficacy toward ICT has negative relationship with the avoidance of ICT in the higher institutions of Kogi State. The implication of this is that increased self-efficacy toward ICT will reduce the level of avoidance of ICT in the higher institutions of Kogi State. The finding of this study confirms the assumption of Technology Threat Avoidance Theory (TTAT) self-efficacy toward ICT leads to the avoidance of ICT adoption (Xue et al., 2015). This finding also aligns with the assertion of Liang and Xue (2009) that self-efficacy toward ICT can influence the avoidance of ICT adoption. Severity of malicious IT was found to be significantly influencing avoidance of ICT in the higher institutions of Kogi State positively. Fenner Jr. (2017) noted that perceived malicious technology makes users to put up avoidance behaviors. This finding also confirms the position of TTAT that severity of malicious IT culminates into avoidance of ICT adoption. It was found that cost has no significant influence on the avoidance of ICT in the higher institutions of Kogi State.

6. Conclusions and Recommendations

ICT adoption was seen to have strongly influenced the efficiency of e-learning in the higher institutions of Kogi State. The avoidance of ICT in higher institutions may be tied to some factors. The study focused on self-efficacy toward ICT, cost and severity of malicious IT. This study established that self-efficacy toward ICT has inverse link with the avoidance of ICT in the higher institutions of Kogi State; while severity of malicious IT directly influence avoidance of ICT in the higher institutions of Kogi State. The study recommended that:

1. Policy makers should strategically design a framework that can enhance effective ICT adoption to influence improved efficiency of e-learning in the higher institutions of Kogi State.
2. The high institution should induce self-efficacy of users toward ICT and reduce the tendency of severity of malicious IT. These will discourage avoidance of ICT in the higher institutions of Kogi State.

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ISTRAŽIVANJE USVAJANJA IKT-A U CILJU POBOLJŠANJA EFIKASNOSTI E-UČENJA U VISOKOM OBRAZOVANJU U DRŽAVI KOGI

Ova studija imala je za cilj ispitivanje uticaja IKT-a na efikasnost učenja u visokom obrazovanju u državi Kogi, u Nigeriji. Korišćene su deskriptivne metode istraživanja. Rezultati pouzdanosti pokazali su da je Kronbah alfa α = 0.984, kada je u pitanju usvajanje IKT-a za e-učenje, i α = 0.755, u slučaju efikasnosti e-učenja. Podaci su prikupljeni i analizirani korišćenjem deskriptivne, Multiple Regresije i Binarne Logit Regresije. Dobijeni rezultati pokazali su da usvajanje IKT-a za e-učenje ima visok nivo uticaja na efikasnost e-učenja u visokom obrazovanju u državi Kogi. Preporuka je da kreatori obrazovnih politika treba da osmisle strateški okvir koji će omogućiti unapređivanje efektivnosti u usvajanju IKT-a, koji bi uticao na poboljšanje efikasnosti e-učenja u visokoobrazovnim institucijama u državi Kogi.

Ključne reči: *Informacione i komunikacione tehnologije, efikasnost e-učenja, izbegavanje IKT-a, samoefikasnost kroz IKT, jačina zlonamernog IT-a*