

Adekunle Oluwole Binuyo (South Africa), Tersia Brevis-Landsberg (South Africa)

Does information and communication technologies contribute to organization performance? Evidence from Nigerian universities

Abstract

This study assessed the relationship between ICT investments in relation to organizational performance with specific focus on knowledge-imbibed organizations – universities. The study focusses on drawing possible relationships between ICT investment and ICT cost efficiency and, various indicators of organization performance such as return on capital employed, net profit margin and return on assets. The study uses data generated from the annual report of 37 universities in South West Nigeria over the period between 2001 and 2010 in dynamic panel environment. Controlling for structural differences and time-varying dynamics among these universities, the analyses show varying effects of ICT investment on performance. The findings indicate that ICT investment and ICT cost efficiency have positive and significant relationship with performance indicators. The study recommends that ICT investment should be guided in order to stimulate organizational performance.

Keywords: ICT investment, ICT cost efficiency, firm performance, resource-based theory, university business unit, South West Nigeria.

JEL Classification: M10, L25.

Introduction

Previous studies suggest that Information and Communication Technology (ICT) and e-business applications provide many benefits across a wide range of intra- and inter-firm business processes and transactions (Papp, 2001; Phojola, 2001; Brynjolfsson, 2002; van Ark, 2002; Varian et al., 2002; Koellinger, 2005; Pilat, 2005).

The Organization for Economic Co-operation and Development (OECD) (2004) observes that ICT applications are capable of improving information and knowledge management of a firm and, thereby reduce transaction costs while it increases the speed and reliability of transactions for both business-to-business and business-to-consumer transactions in tandem. In addition, the same source suggests that ICT systems are effective tools for improving external communications and quality of services for established and new customers.

For firms to adopt e-business and e-commerce strategies and tools, benefits derivable from the system must outweigh investment and maintenance costs. In other words, commercial considerations and potential returns are observed to drive ICT investment. The possible increase in ICT investment is premised on its expediency, which ranges from operational efficiency through to competitive advantages. In specific terms, investment in ICT systems leads to improved information and knowledge management within the firm, which culminates in efficient business processes and better firm performance.

Further, communication via e-mail and the Intranet can help to improve external communication, in either

business to customer or business-to-business contexts, and may reduce transaction costs, increase transaction speed and reliability, and extract maximum value from each transaction in the value chain. Increasingly, sophisticated ICT applications such as Knowledge Management System (KMS) and Enterprise Resource Planning (ERP) allow firms to store, share and use their acquired knowledge and know-how in a more effective and efficient way. For example, customer databases with a history of client-specific correspondence help managers and employees to respond more effectively to customers' enquiries and to better manage customer profile for optimal organizational performance.

In recent years, numerous scholars have analyzed the relationship between ICT investment and firm's performance covering several developed and developing countries. However, the results from these studies have remained inconclusive. While some of these studies such as Brynjolfsson and Hitt (1995), Diverty and Sabourin (1995), Lichtenberg (1995) Brynjolfsson and Hitt (1996), Baldwin and Sabourin (2002; 2003) suggest that the effect of ICT investment on performance is positive, some argued that it is negligible (Ordanini and Rubera, 2010) and yet some other studies maintained that the effect is negative (Loveman, 1994; and Barua, Kriebel & Mukhopadhyay (1995). Besides, most of these studies such as Devaraj and Kohli (2000), Brynjolfsson and Kahin (2002), Sabourin and Smith (2003), Baldwin, Li-Hua and Khalil (2006), Bayo-Moriones & Lera-Lopez (2007), Badescu & Garcés-Ayerbe (2009), mainly focused on large firms with very few directed at small firms. None of those studies investigated the contribution of ICT investment to the performance of business units of universities, which is the major contribution of this study.

Furthermore, the methodology applied in this study has never been used before in any documented study in this research area. In specific, most of the previous studies employ primary data for their investigation whereas this study made use of time series data over a period of ten years in a panel environment. Moreover, there is no documented study that has investigated the relationship between ICT cost efficiency and organization performance. This is also an innovative contribution to the body of existing knowledge. To achieve these objectives, the study examined the relationship between ICT investment, ICT cost efficiency and performance of business units of universities in South West Nigeria.

1. Theoretical background

Despite the potential benefits of ICT, there is the debate about whether and how such an investment improves firm performance. The use of and investment in ICT requires complementary investments in skills, organization and innovation investment. These changes in organization architecture are not without attendant risks and costs as well as benefits in the long run.

While many studies provide evidence of the positive effects of ICT investment on firm performance, others have shown no relationship between computer use and firm performance (OECD, 2004). Penetration level of ICT however varies with the characteristics of respective organizations. The lowest penetration is found among the small sized organizations (those having 10-49 employees) while medium penetration rates is common to medium sized organizations (those having 50-249 employees) and the highest penetration rates is found among the large sized firms (those having more than 250 employees) (Mehrtens et al., 2001).

SMEs generally lack the human technological resources needed for ICT because they focus on day-to-day operations and lack the knowledge of the benefits of new technologies to run their organizations. Even when they are aware of the potential benefits of adopting e-commerce, they require know-how or qualified personnel to implement the feat. The firms that adopt Internet and e-commerce are likely to have within the firm workers that have a reasonable amount of knowledge of the specific technology and/or technology in general. A study of small ICT companies with 3-80 employees suggests that the Internet was adopted by firms with personnel who understand the technology and not necessarily ICT professionals (Mehrtens et al., 2001).

ICT is considered as a key enabler for globalization, given that it facilitates world-wide flows of

information, capital, ideas, people and products which are contingents on improving not only the quality of life across but at a much cheaper rate as well. Globalization in the words of Aregbeshola and Palmer (2007) have transformed into an ideology owing to the magnitude of its effects, coupled with its diverse use and understanding and the various attention garnered by its advocates and adversaries courtesy of ICT.

In developed countries, ICTs are generally believed to have dramatic influence on corporate performance and are conceptualized to continually determine the competitive nature of virtually all businesses. Furthermore, Bamidele (2006) argue that ICT deployment and utilization increases the efficiency and performance of firms. Conversely, in the context of developing countries, Sanusi (2003) maintained that advances in ICTs were pivotal to the social and economic transformations that are capable of engendering better organizational performance.

Some researchers have tried to combine the previous definition by considering ICT as a group of elements (hardware, software, and people) that should be working together in the process to present the benefits to the organization in the form of information, product or services and so on (Li-Hua & Khalil, 2006).

According to these authors, ICT includes all the technology that facilitates the processing, transfer and exchange of information and communication services. It is considered as a subject of expertise that links information technology (computers and applications) and telecommunication networks (Intranet and Internet), that lets people and computers interrelate irrespective of physical location. Marchand et al. (2004) suggested four dimensions of ICT applications in operational, business process, management, and innovation supports.

However, ICT can impact a company on three different levels: individualistic or user level, organizational level and external or environmental level. In addition, technological and economical contexts are of great importance in facilitating organizational decision regarding ICT investment and how to use it. Therefore, influencing factors for ICT investment examined across a range of contexts suggested by the literature can be organized within five contexts: technological, organizational, environmental, individualistic, and economic context.

Evidence shows that effective and efficient use of ICT is a key factor differentiating successful firms from their less successful counterparts. This study focusses on the performance effect of ICT, an issue that has generated much debate over the last decade.

Several theories have been used in previous studies such as the process-oriented view that examines the effects of IT on intermediate business process. Most of the similar studies in the past which include those of Bharadwaj (2000), Ordanini & Rubera (2010), Lee, Koo & Nam (2010), Fahy & Hooley (2011), Rashidirad, Syed & Soltani (2012) were anchored on the resource-based view.

The resource-based view of the firm posits that firms compete on the basis of “unique” corporate resources that are considered to be valuable, rare, difficult to either imitate or substituted by other resources. The theory stemmed from the area of strategic management research and has widely attracts attention as a suitable tool to examine the value delivered by IT resources (Melville, 2004; Wade & Holland, 2004).

The resource-based theory rationalizes firm’s superior performance to organizational resources and capabilities. This paper highlights the importance of ICT investment (ICTINV) and ICT cost efficiency (ICTCE) as pivotal determinants of organizational capability and examines the relationship between ICTCE, ICTINV, and performance of business units of universities in South West Nigeria.

The resource-based view of the firm links the performance of organizations to resources and skills that are firm-specific, rare, and difficult to imitate or substitute (Barney, 1991). The value chain analysis corroborates the resource-based theory in this study. The value chain analysis rationalizes competitive advantage of a firm on the basis of the customers’ perceived value of their product which may be greatly enhanced by the application of information and communication technology to enhance both the primary and support activities of an organization. Porter (1985) describes the value chain as the internal processes or activities a company perform “to design, produce, market, deliver and support its product.” He further states that “a firm’s value chain and the way it performs individual activities are a reflection of its history, its strategy, its approach to implementing its strategy, and the underlying economics of the activities themselves.” This is in view of the fact that processes lend themselves to such measures as cost, time, output, quality, and customer satisfaction.

The several benefits of ICT notwithstanding, the technology – ICT is not without its associated challenges. According to Barba-Sanchez, Martinez-Ruiz and Jimenez-Zarco (2007) challenges associated with the adoption of ICT include: acquisition cost, and high maintenance cost. Challenges identified by other studies are: scarce technological skill for effective implementation, availability and cost of appropriate

interoperable small-firm systems, network infrastructure, and ICT related support services like power supply (Roberts, 2000; Prasad et al., 2001; and Leenders and Wierenga, 2002). Arguably, the challenges as identified is expected to affect different firms differently depending on the circumstances surrounding each firm in terms of whether it is within a developed or developing economy, owner characteristics, etc.

2. ICT investment

The relationship between ICT investment and performance has been investigated by many researchers. There seems to be no consensus on the nature of the relationship. While some argue that there is a positive relationship between ICT investment and performance (Indjikian and Siegel (2005), van Ark and Piatcovski (2004) studied ICT investment patterns and their impact on economic performance using two sets of countries considered to be at different levels of economic development as reference points (the old and the new Europe respectively). They concluded that there is a trend toward convergence in investment in ICT capital which was also found to be an important source of productivity growth in both types of countries. Furthermore, Frankema and Duteweerd (2004) observed that countries that are largely driven by technology grow more than those countries that are not so much driven by technology. McKinsey (2004) however argue that a higher productivity in the USA is attributable to a more favorable regulatory environment, stronger competition, and superior corporate organization that define its operating system rather than ICT investment. Evidence from more recent studies suggest a positive relationship between ICT investment and firm performance (Becchetti, Bedoya & Paganetto, 2003; Hernando and Nunez, 2004; Bayo-Moriones and Lera-Lopez, 2007; Badescu and Garces-Ayerbe, 2009).

Thus we hypothesize that:

H01: There is a positive significant relationship between ICT investment and performance of business units of universities in South West Nigeria.

3. ICT cost efficiency (ICTCE)

This is a very important ratio in this study because the study is to determine the role and effectiveness of the utilization of ICT on the performance of the business units of universities in South West Nigeria. Cost efficiency in the spirit of strategic cost management is concerned with strategies aimed at obtaining maximum possible revenue with minimum possible inputs (Fethi & Pasiouras, 2010; Casu & Giradone, 2004; 2006). Furthermore, Casu (2004)

and Tanna (2009) posited that efficiency can be measured in terms of observable increase in efficiency owing to technical progress is a function of technological change.

How efficient the application of ICT solution has been a function of ICT cost to total earnings. This ratio helps to determine to what level or proportion ICT application has enhanced the earnings of the business units of the universities in South West Nigeria. It is a measure of cost effectiveness of ICT application by a firm. From literature and a-priori expectation, ICT cost efficiency is expected to associate positively with performance. The positive relationship of ICTCE is however subject to the threshold level of ICT investment beyond which further investments in ICT will become cost ineffective, hence, we can therefore formulate the following hypothesis:

H02: There is a positive significant relationship between ICT cost efficiency and performance of business units of universities in South West Nigeria.

4. Methodology

Secondary data was generated from the annual reports of the universities covered in this study. The population of the study covers the business units of all the thirty seven universities that are located in the South West Nigeria geographical zone. These universities are chosen because we can easily generate requisite data. Further, these universities are accredited by the Nigerian Universities Commission as at the time of carrying out the study (2013). These comprise of seven federal, ten state and twenty private Universities located within that geographical zone.

The data was generated for the period between 2001 and 2010. The dataset was generated for the respective business units of each of the universities covered in the study. In addition, the dataset was generated for variables of interest to proxy the dependent and independent variables. Performance indicators of interest (dependent variables) distilled from the secondary data are as follows: Net Profit Margin (*NPMARG*), Return on Capital Employed (*ROCE*), and Return on Assets (*ROA*). These variables have been used in previous study as proxies for organizational performance (Akintoye, 2004). The dataset for the independent variables, which include the measures investment in ICT are: ICT investment

(*ICTINV*) and ICT cost efficiency (*ICTCE*). These variables were in nominal format and they had to be converted into ratios to suit the objectives of this study. These financial ratios are calculated as stated below:

$$\text{Net Profit Margin} = \frac{\text{Net Profit} * 100}{\text{Gross Earnings}}, \quad (1)$$

$$\text{Return on Capital Employed} = \frac{\text{Gross Earnings}}{\text{Capital Employed}}, \quad (2)$$

$$\text{Return on Asset} = \frac{\text{Gross Earnings}}{\text{Total Asset}}, \quad (3)$$

$$\text{ICT Cost Efficiency} = \frac{\text{Gross Earnings}}{\text{ICT Investment}}. \quad (4)$$

This information was computed from the available annual reports and accounts of the universities covered by the study. It must be pointed out that the dataset contained some missing units. To eliminate the missing units, especially in the dependent variables, five-year moving average backward was adopted. We are cautious to adopt the same process for all the dataset in order to maintain some originality of data distribution. The dataset was used in dynamic panel analyses. The number of instruments used in the analyses was restricted to one in order to cater for endogeneity. In the analyses, the Sargan test of overidentifying suggests that none of the instruments used in the estimation poses endogeneity problem and the incidence of autocorrelation was amply accommodated through the insignificance of the Sargan statistics in the series.

Further pre-estimation diagnostics include the use of stepwise regression to test the contribution of each variable to the joint explanatory power of the model (not presented). The result of the stepwise regression suggests that Gross Earnings (*GEARNINGS*), Capital Employed (*CE*), and Net Profit (*NTPROFIT*) reduce the explanatory power of the regression and they were thus eliminated from the final estimations.

5. Data analyses

The estimation began with descriptive statistics. This was done to establish that the dataset was normally distributed. In statistical analysis, dataset must pass the tests of normal distribution else the basic assumptions of Ordinary Least Squares (OLS) regression would be violated. The result of the descriptive statistics is presented in Table 1.

Table 1. Descriptive statistic

	<i>ICTINV</i>	<i>NPMARG</i>	<i>NTPROFIT</i>	<i>ROA</i>	<i>ROCE</i>	<i>ICTCE</i>	<i>GEARNINGS</i>	<i>CE</i>
Mean	18489.50	138.8192	51622.30	0.284478	0.698222	2.12938	32551.97	799822.1
Median	14784.00	87.45765	15466.50	0.282027	0.747995	1.48352	16725.50	19555.50
Maximum	56982.00	3950.484	1374018.	1.294114	2.782164	11.7879	259515.0	13783781

Table 1 (cont.). Descriptive statistic

	<i>ICTINV</i>	<i>NPMARG</i>	<i>NTPROFIT</i>	<i>ROA</i>	<i>ROCE</i>	<i>ICTCE</i>	<i>GEARNINGS</i>	<i>CE</i>
Minimum	2013.000	7.904360	3561.000	0.002852	0.009954	0.29062	4689.000	6517.000
Std. dev.	12689.37	291.8201	154539.4	0.287692	0.413699	2.02966	38528.35	2318479.
Skewness	0.724975	9.455242	5.764280	1.646262	1.399824	1.92438	2.860395	3.129435
Kurtosis	2.406976	115.3945	38.35141	6.076306	8.858716	6.94965	13.26836	12.29088
Jarque-Bera	26.58532	140726.4	14978.49	219.9640	456.7614	329.472	1496.805	1359.517
Probability	0.000002	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	4807270.	36092.99	13421797	73.96427	181.5377	553.640	8463512.	2.08E+08
Sum sq. dev.	4.17E+10	22056168	6.19E+12	21.43653	44.32713	1066.95	3.84E+11	1.39E+15
Observations	260	260	260	260	260	260	260	260

The descriptive statistics (Table 1) clearly indicates that all the variables are well distributed. Although, the Jarque-Bera statistics exhibit some abnormally high values in some instances, but the variables still pass the normal distribution tests based on their statistically significant *p*-values. The high values exhibited by Jarque-Bera, the high Skewness and Kurtosis statistics all point to possibility of skewed distribution. However, evidence (Baltagi, 2010; Keller, 2012) suggest that these statistics are largely unstable in small sample sizes (as in this case). To that extent, the null hypothesis of normal

distribution can therefore not be rejected in this case. After conducting the descriptive statistics, we conducted correlation statistical analysis. This analysis is meant to uncover if there is any deterministic relationship among the variables under consideration. Further, this analysis helps to investigate possible autocorrelation among the variables used in the estimation. Conventionally, high correlation statistics between two variables would signal the possibility of autocorrelation in the series. The result of the correlation statistics is presented in Table 2.

Table 2. Correlation statistic

	<i>ICTINV</i>	<i>NPMARG</i>	<i>NTPROFIT</i>	<i>ROA</i>	<i>ROCE</i>	<i>ICTCE</i>	<i>GEARNINGS</i>	<i>CE</i>
<i>ICTINV</i>	1.000000	0.324958	0.414641	0.187455	-0.372199	-0.26579	0.501433	0.510293
<i>NPMARG</i>	0.324958	1.000000	0.879211	-0.208238	-0.156170	-0.10240	0.057445	0.662434
<i>NTPROFIT</i>	0.414641	0.879211	1.000000	-0.187994	-0.278512	0.00329	0.258227	0.704312
<i>ROA</i>	0.187455	-0.208238	-0.187994	1.000000	-0.030000	-0.07150	0.381419	-0.306880
<i>ROCE</i>	-0.372199	-0.156170	-0.278512	-0.030000	1.000000	-0.11019	-0.412231	-0.530455
<i>ICTCE</i>	-0.265796	-0.102408	0.003293	-0.071509	-0.110192	1.000000	0.475416	-0.061606
<i>GEARNINGS</i>	0.501433	0.057445	0.258227	0.381419	-0.412231	0.47541	1.000000	0.258520
<i>CE</i>	0.510293	0.662434	0.704312	-0.306880	-0.530455	-0.06160	0.258520	1.000000

According to Table 2, there is very little evidence to suggest autocorrelation between ICT investment and the independent variables, especially given that the highest level of relationship is shown between ICT investment and gross earnings and capital employed. If these variables are used in the estimation, diagnostic approaches will be employed to control for autocorrelation. It must be pointed out that, one of the dependent variables (*ROCE*) exhibits inverse relationships with two independent variables (*ICTINV* and *ICTCE*). In addition, the statistics contained in Table 2 suggest that there is good relationship (correlation) between the dependent variables (*ROCE*, *ROA* and *NPMARG*) and the two independent variables (*ICTINV* & *ICTCE*), with *ICTINV* and *NPMARG* having the highest positive correlation out of the variables used in the estimation.

The inverse relationship between *ROCE* and *ICTINV*, as well as the negative relationship exhibited between all the dependent variables and *ICTCE* suggests that *ICT* cost efficiency may not necessarily enhance

organizational performance. In specific terms, continued expenditure on *ICT* wares may not necessarily be cost expedient. This asseveration raises the question of threshold analysis in the quantum of *ICT* investment (which is beyond the scope of this study).

6. Regression results

The panel generalized method of moments (dynamic panel approach) was used in the estimation, to regress each of the response variables (*ROCE*, *ROA* and *NPMARG*) in turns on *ICT* cost efficiency (*ICTCE*) and *ICT* investment (*ICTINV*). It must be pointed out that each of the dependent variables was entered into the regression differently. To uncover the requisite effects dummy in the estimation, the Hausman regression was conducted, which pointed to the statistical significance of both period and cross-sectional effects. In essence, we introduced both dummies to control for period and structural disturbances in the estimation. Further, the 2SLS

instrument weighting matrix was used for robustness check, coupled with two stage least squares (2SLS)

regression analyses. The results obtained are as shown in the table below.

Table 3. Dynamic panel regression analysis

	1	2	3	4	5
<i>ROCE</i>	-3.23E-06 (3.25E-06)	-0.70369 (0.013251)***	0.802253	5.36E-24	260
<i>ROA</i>	3.33E-06 (8.24E-07)***	0.019738 (0.003360)***	0.973706	3.46E-24	260
<i>NPMARG</i>	0.007324 (0.006244)	-15.60961 (15.54973)	0.306188	3.73E-26	260

Note: Robust standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

From Table 3, column 1 = *ICTINV*, 2 = *ICTCE*, 3 = Adj R^2 , 4 = Probability *J*-statistics, 5 = Number of observations. The interpretation of the Table begins with the test of goodness of fit. According to that table, the three indicators of the goodness of fit (the adjusted *R*-squared, the probability *J*-statistics, and the *p*-value of the regression) all allude to the goodness of fit of the model. More specifically, the *p*-value for the three estimated models are statistically significant at 99% confidence levels. In addition, the probability *J*-statistics are statistically insignificant, buttressing the statistical stability of the Sargan test of overidentification and the adjusted *R*-squared all indicate high explanatory powers.

Looking at each of the variables, it is observable that the effect of ICT investment and ICT cost efficiency is significant on return on asset (*ROA*). This is considering that the *p*-value = 0.0001 (for *ICTINV*) and 0.0000 (for *ICTCE*). The figure obtained for return on capital employed (*ROCE*) also showed a significance of the effect of *ICTCE* on *ROCE* considering the *p*-value = 0.000 (for *ICTCE*) but not significance for *ICTINV* whose *p*-value = 0.3215. The implication of this result is that investment in ICT that is not corroborated with appropriate training and other human capital development activities to enhance optimal utilization of the technology will not yield desired result for an organization. Thus organization should put in place appropriate policies that will ensure optimal utilization of acquired technologies.

Table 4. Cointegration regression

	1	2	3	4	5
<i>ROCE</i>	-0.073385 (0.017753)***	2.45E-07 (3.18E-06)	0.841363	1.434979	232
<i>ROA</i>	0.024622 (0.004589)***	5.68E-06 (8.23E-07)***	0.971292	1.495814	232
<i>NPMARG</i>	36.64994 (121.8283)	0.007324 (0.006244)	0.331493	1.188328	232

Note: robust standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

From Table 4, column 1 = *ICTINV*, 2 = *ICTCE*, 3 = Adj R^2 , 4 = Durbin-Watson statistics, 5 = Number of observations. The interpretation of the table begins with the test of goodness of fit. The three indicators of goodness of fit (the Adjusted R^2 , Probability *J*-statistics, and the *p*-value of the regression) all allude to the goodness of fit of the models. More specifically, the *p*-value for two of the three estimated models are statistically significant at confidence level 99% while it is statistically insignificant for the third (*NPMARG*). In addition, the Durbin-Watson statistics suggest stability of the two models which involves *ROCE* and *ROA* buttressing the statistical stability of the Sargan test of overidentification. The adjusted R^2 for the two indicate high explanatory powers.

Looking at each of the variables, it is observable that the effect of ICT investment and ICT cost efficiency is significant on Return on Asset (*ROA*). This is considering that the *p*-value = 0.0001 (for *ICTINV*) and 0.0000 (for *ICTCE*). The figure obtained for return on capital employed (*ROCE*) also showed a significance of the effect of *ICTCE* on *ROCE* considering the *p*-value = 0.000 (for *ICTCE*) but not significance for *ICTINV* whose *p*-value = 0.3215. The implication of this result is that investment in ICT that is not corroborated with appropriate training and other human capital development activities to enhance optimal utilization of the technology will not yield desired result for an organization. Thus organization should put in place appropriate policies that will ensure optimal utilization of acquired technologies.

Discussion and conclusion

In this article, we have analyzed the relationship between *ICTINV*, *ICTCE* and performance of the business units of universities in South West Nigeria. The results of the analyses are as contained in Tables 1-4. We developed two hypotheses that have been empirically tested with data from the 37 universities in the South West geo-political zone of Nigeria. The results allowed for the following conclusions to be reached.

Firstly, the results revealed that Return on Capital Employed (*ROCE*) and Return on Asset (*ROA*) show significant relationship with the explanatory variables (ICT investment – *ICTINV* and ICT cost efficiency – *ICTCE*) compared to net profit margin (*NPMARG*).

Secondly, the result showed that the contribution of *ICTCE* to performance is much higher than that of *ICTINV*.

This result suggest that it is not just enough to acquire ICT equipment but that it is more important to seek to achieve cost efficiency in the deployment of ICT facility to enhance performance of an organization. This can be achieved by implementing a program of periodical training for workers whose responsibilities largely depend on use of the ICT equipment. Moreover, the human resources department may emphasize the need for new recruits to possess relevant skills for handling ICT equipment as a prerequisite to being offered employment in certain sections of the organization.

The hypotheses that was advanced in support of a positive relationship between ICT investment and performance was confirmed judging from the dynamic panel regression analysis results for the Return on Asset with 97% explanatory power and

also a very high level of significance. This result is consistent with the findings of Becchetti, Bedoya & Paganetto (2003), Hernando & Nunez (2004), Bayo-Moriones & Lera-Lopez (2007), and Garces-Ayerbe (2009) which posited that a positive relationship exists between ICT investment and firm performance.

ICT investment have capacity to positively impact the performance of firms in various ways which include cost reduction (Phojola, 2001), innovation enhancement (Koellinger, 2005), productivity (van Ark, 2002; Pilat, 2005), competitive advantage (Papp, 2001). Several other empirical studies (although from slightly different perspective as most were based on primary data) also support the argument that ICT investment is positively related to performance (Harris and Katz, 1991; Weill, 1992; van Ark 2002; Devaraj and Kohli, 2003, OECD, 2004; Koellinger, 2005; Pilat, 2005). This is in consonance with a priori expectation. Consequently, we do not reject either of the two hypotheses

This investigation by provides empirical evidence to increase our knowledge of the relationship between ICT investment (*ICTINV*), ICT cost efficiency (*ICTCE*), and performance of business units of universities in South West Nigeria. The conclusion obtained from the results show that ICT investment and ICT cost efficiency have a significant relationship with performance of business units of universities in South West Nigeria. It is however worthy of note from the results that the influence of ICT cost efficiency on firm performance is higher than that of ICT investment. By implication, these results emphasize the need for policy makers to put in place measures that ensures optimal utilization of ICT resources to enhance optimality of organization performance.

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