IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGY ON BANK PERFORMANCE: A STUDY OF SELECTED COMMERCIAL BANKS IN NIGERIA (2001 – 2011)

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Abstract

This study assessed the Impact of Information and Communication Technology on the Nigerian banking industry using eleven selected Commercial Banks in Nigeria. The study used bank annual data over the period 2001 to 2011. This study applied Fixed and Random Effects Models in its analysis. The results from the Hausman test revealed that Random Effects Model was appropriate. The findings of the study indicated that the use of ICT in the banking industry in Nigeria increases return on equity. It has also been found an inverse relationship between additional sustained investment in ICT and efficiency which the study recommends among other thing shifting more emphasis on policies that will boost efficient/proper utilization of ICT equipment rather than additional investments.

Keywords: Information and Communication Technology (ICT), Banks' Performance, Return on Assets, Return on Equity and Profitability

Background to the study

Researches by Grigorian, *et al*., (2002); Nzotta and Okereke, (2009); Thiel, (2001) has shown that globalization has caused intense competition in the banking industry, worldwide. The world is seen as a global village which turned the markets and economies in like manner. The phenomenon called globalization has significantly intensified competition in three particular aspects in the way competition had evolved giving it a new dimension viz.:

(i) banks faces pressures from a wide and diverse range of competitors; (ii) the regulatory environment has become less protective of the banking sector and (iii) competition has become global in nature (Abdulsalam, 2006).

The universal banking system was introduced in Nigeria in the early 1990s and rest of the world as an offshoot of globalization. Under this new system, banks were no longer specialized in either merchant banking or commercial banking; rather they are allowed to provide banking and other financial services to their customers under the new universal banking license. Banks could therefore provide commercial banking, stock broking, insurance business, asset and trustee management services under the new banking regulation. It also prompted a rapid and significant branch office expansion program with its attendant significant increases in the volume of customers' transactions in banking industry for survival and profitability (Johnson, 2005).

The increased demand for information and communication technology (ICT) in banking sector became imminent and unavoidable in the world at large and Nigeria in particular. Invariably, the future lies in the ICT driven banking systems and services. Banks have embarked on deployment of ICT based banking products and services such as automated teller machine (ATM), internet banking, mobile banking solutions, point of sale terminals, computerized financial accounting and reporting, human resources solution among others (Ovia, 2005).

Linked to this, was the banking license liberalization of the early 1990s in Nigeria. The landmark period witnessed the birth of the new generation banks (i.e. GT Bank, Zenith Bank, etc.) that commenced operations with the state-of-the-art technology, which exposed the sluggishness and inefficiency of the older banks (i.e. the three Giants; First Bank, UBA and Union Bank). Some researches had shown that the then "re-engineering" fever, compelled the old generation banks to change. It was further stated that the trend actually took selected commercial banks some time to follow suit because the issues were much more than designing algorithms and chewing seminal computing papers from first class journals.

Statement of the problem

One of the challenges confronting e-banking in Nigeria could be classified into three classes as human, operational and technical constraints. The human constraints include physical disability, poor sight, illiteracy and ageing. The operational constraints include insecurity of funds transferred, frauds and standardization of channels. The technical constraints are centered on the lack of supporting infrastructures such as erratic electricity

supply, interdependence and lack of encryption on short message system (SMS) messages (Agbada, 2008).

Other identified problems that can have an impact on the banks in the adoption of ICT can be grouped broadly as psychological and behavioral. These include consumer awareness, security, accessibility to computers, reluctance to change, the cost of adoption, and preference for personalized services among others.

Additionally, diffusion of smart card innovation needs high investment for the upgrades of ATMs and EFT/POS terminals to be capable of accepting smart cards and presumably a substantial investment in adding smart card technology for mobile computers and telephony stand to be another challenge. The implementation of smart cards for the whole Europe, according to Visa figures, requires eight billion dollars ($8 billion) investment. Although this is an affordable amount for many of the potential players, most players would only pay the entire amount if it would give them some proprietary or luck in advantage. So far, no player has felt confident enough to take a committed first mover position. This is in developed countries, what more of a developing country like Nigeria (Ovia, 2005).

Coupled with these problems is a situation where a bank issue an individual debit card that is associated with an account with a line of credit and is also an ATM debit card, the individual can perform a number of different types of transactions with the same card. The line of credit could be accessed fraudulently, where the owner has recourse under consumer credit legislation and under regulation if the fraud involves an electronic fund transfer (EFT). When automated teller machine (ATMs) or electronic point of sale (POS) terminals are used, his liability is limited under the EFTA. If, however, the fraudulent use of the card directly debits his bank account in a paper-based transaction, the consumer has no recourse under current legislation. This is an example where the same card represents three different instruments, each of which, in the case of fraud, would require different actions by the consumer (Agbada, 2008).

In order to investigate the impact of ICT on bank performance in addition to problems identified, this study intends to investigate and answer the following question:

To what extent does ICT improve bank performance with reference to the selected commercial banks in Nigeria?

Objectives of the study

The general objective of this study is to analyze the role of ICT in enhancing the performance of banking operations with reference to selected commercial banks in Nigeria.

Specifically this research work is to empirically test whether ICT has improved the performance of selected commercial banks in Nigeria or otherwise.

Hypothesis of the study

This study will make use of the following null hypothesis:

H_0:   There is no significant relationship between the level of ICT and bank performance.

Scope and Limitations of the study

Specifically, the study intends to investigate the use and development of some classes of ICT applications namely: automated teller machine (ATM); local area network (LAN), on-line banking, electronic fund transfer, and data processing (DP) applications among others and their impact on selected commercial banks performance. The study covers the period between 2001 to 2011. The choice of the period is informed by the fact that in the year 2005 Universal Banking was in its fifth year of operation in Nigeria.

The study of this nature is normally faced with lack of accessibility to data because most of the data are classified and considered to be confidential in nature. However this limitation was overcome by relying on officials in the bank that were capable of furnishing the required information by virtue of their ranks and files. The data obtained is expected to serve the purpose of the analysis. Secondly, lack of cooperation from the bank management and staff on issues relating to ICT investment and other ICT related issues. Often, banks are reluctant to divulge data bothering on these issues for competitive reasons. Data obtained from published reports and banks' officials are expected to serve as the basis for this analysis.

Empirical Literature
Information and Communication Technology (ICT) and Bank Performance

Information Technology (IT) is the automation of processes, controls, and information production using computers, telecommunications, software and ancillary equipment such as automated teller machine and debit cards (Johnson 2005). Irechukwu (2000) lists some banking services that have been revolutionized through the use of ICT as including account opening, customer account mandate, and transaction processing and recording. Communication technology deals with the physical devices and software that link various computer hardware components and transfer data from one physical location to another (Laudon and Laudon; 2001). ICT products in use in the banking industry include automated teller machine, smart cards, telephone banking, MICR, electronic funds transfer, electronic data interchange, electronic home and office banking (Akpan, 2008 and Johnson, 2005).

Agboola (2001) studied the impact of computer automation on the banking services in Lagos and discovered that electronic banking has tremendously improved the services of some banks to their customers in Lagos. The study was however restricted to the commercial

nerve center of Nigeria and concentrated on only six banks. He made a comparative analysis between the old and new generation banks and discovered variation in the rate of adoption of the automated devices.

Aragba-Akpore (1998) investigated on the application of information technology in Nigerian banks and pointed out that IT is becoming the backbone of banks' services regeneration in Nigeria. He cited the Diamond Integrated Banking Services (DIBS) of the Diamond Bank Limited and electronic smart card accounts (ESCA) of All States Bank Limited as efforts geared towards creating sophistication in the banking sector. Ovia (2000) discovered that banking in Nigeria has increasingly depended on the deployment of information technology and that the IT budget for banking is by far larger than that of any other industry in Nigeria. He contended that the on-line system has facilitated internet banking in Nigeria as evidenced in some of them launching websites. He found also that banks now offer customers the flexibility of operating an account in any branch irrespective of which branch the account is domiciled.

Woherem (1997) discovered that since 1980s Nigerian banks have performed better in their investment profile and use of ICT systems, then the rest of the industrial sector of the economy. An analysis of the study carried out by African Development Consulting Group Ltd. (ADCG) on IT diffusion in Nigeria shows that banks have invested more on IT, have more IT personnel, more installed base for PCs, LANs, and WANs and have a better linkage to the internet than other sectors of the Nigerian economy. The study, however pointed out that whilst most of the banks in the west and other parts of the world have at least one PC per staff, Nigerian banks are lagging seriously behind, with only a PC per capita 0.18 (Woherem, 1997).

Gwashi and Alkali (1996) observe that ICT covers all forms of computer and communications equipment and software used to create, store, transmit, interpret, and manipulate information in its various formats e.g., business data, voice conversations, still images, motion pictures and multimedia presentations. It also refers to the electronic devices used to collect, process, store and disseminate information. Similarly, the deployment of ICT is skyrocketing with many organizations using it in office automation, i.e. word processing, electronic mail, telecommunicating and teleconferencing. Other areas of ICT application are as follows:

In business management, computerized database management system (DBMS) and management information system (MIS) are now making commerce and Industry pleasurable and ensuring decision making.

Acharya, *et al*., (2008) examined the impact of web design features of a community bank's performance using a sample of 55 community banks with online services in the five midwestern states of the USA. The author utilized both primary and secondary data by applying multiple regression models. The results show that banks with higher usability of ICT perform significantly better than those with low ICT usability.

Berger, *et al*., (2003) examined technological progress and its effects in the banking industry using data collected from the banking industry in the United States over the period 1967 to 2001. The author employed multiple regression model, and the findings revealed that improvements in costs of lending capacity due to improvements in "back – office" technologies, as well as consumer benefits from improved "front office" technologies suggests significant overall productivity increases in terms of improved quality and variety of banking services.

Malhotra and Singh (2009) examined the implications of internet banking on the Indian banking industry using information drawn from a survey of 85 scheduled commercial banks' websites, during the period June 2007, by applying multiple linear regression model. Results revealed however, that profitability in the banking industry while offering internet banking does not have any significant association with their overall performance.

Opera, *et al*., (2010) investigated the impact of technology on relationship marketing orientation (RMO) and business performance (BP) of the Nigerian banks using quantitative and qualitative data generated from 123 different bank branches in Port Harcourt, with 565 targeted respondents. The authors employed multiple regression model to analyze the data, and the findings revealed that the technology exists as a moderating variable in the RMO – BP relationships of the Nigerian banks. The study also recommended that banks should be technologically compliant in order to have high performance and lasting customer relationship. England, *et al*., examined the number of US banks offering internet banking and analysed the structure and performance characteristics of these banks. They however, found no evidence of major differences in the performance of the group of bank offering internet banking activities compared to those that do not offer such services in terms of profitability, efficiency or credit quality.

Dos Santos and Peffers (1993) empirically studied the effects of early adoption of Automated Teller Machine (ATM) technology by banks on employee efficiency using a sample of 3,838 banks covering the period 1970 to 1979 by applying multiple regression models. The finding revealed that the introduction of ATM technology improves the bank's performance. Akram and Hamdan (2010) examined the effects of information and

communication technology (ICT) on Jordanian banking industry for the period of 2003 – 2007. The authors used a sample of 15 banks to analyze the data obtained by applying multiple regression model and diagnostics test to check the normality and multicollinearity problems. The results of the study indicated that there is a significant impact on the use of ICT in Jordanian banks on the market value added (MVA) earning per share (EPS), Return on Assets (ROA) and Net Profit Margin (NPM).

Kagan, *et al*. (2005) examined the impact of online banking applications on community bank performance in the United States using data collected from 1183 banks operating in Iowa, Minnesota, Montana, North Dakota, and South Dakota. The authors employed an econometric model (Structural Equation Model) for the data analysis. The findings of the study revealed that online banking helps community banks improve their earning ability.

Studies on the effects of ATMs on profitability provide evidence of cost savings and better services for customers. Survey of banks conducted by Abdullah (1985) in Malaysia, Katagiri (1989) in Japan and Shawkey (1995) in the USA, revealed that investing in ATMs reduces banking transaction costs, the number of staff and the number of branches. Therefore, investing in ATMs increases the value of deposit accounts, which are cheaper in terms of costs of funds than other sources, such as borrowing money from other institutions, hence reducing the overall cost of funds. This suggests that there is a role for IT investment in the explanation of bank profitability.

Kozak (2005) analyzing the values of return on asset (ROA) and over the period of 1992 - 2003 found out that the value of the return on assets for the U.S, the banking sector has increased by 51 percent. This result suggests that IT improvements, associated with extensive office networks and range of offered services have helped to generate additional revenues for banks. For the same period much smaller reduction of the non-interest costs has been achieved. It means the value of cost efficiency fell by 13 percent. This means that a huge number of diverse operations require higher IT investments and additional non-interest charges. In order to assess relationships between the degree of the IT progress, and the profitability (ROA) and cost efficiency, the regression analysis was used to achieve more precise statistical results, based on quarterly values obtained from the FDIC.

Return on Asset (ROA) and Return on Equity (ROE) as indices for Bank Performance Indicators

Measuring bank performance is complicated, but one of the most reliable yardsticks is an institution's return on assets, or ROA and ROE have been widely used as measures of

banks' performance. Banking sector in Saudi Arabia has been examined by Ahmed and Khababa (1999). They used three measures of profitability as dependent variables; ROE, ROA and percentage change in earnings per share. On the other hand, they used four independent variables. These were: business risk measured by dividing the total loans of the bank by its total deposits, market concentration, the market size measured by dividing the deposits of the bank by the total deposits of the commercial banks under study and the size of the bank. The results of their findings indicated that the business risk and the bank size were the major determinants of the banks' performance.

In another study Abdulsalam and Abdullahi (2008) indicated that the competitive banking environment in Nigeria between 1999 and 2004 was very intense. The average profit elasticity (PE) for all the sampled banks put together is 184.1% implying that for the period under study, a bank in the industry can only increase profit if it can increase operating expenses by 184.1%. This percentage shows a fierce competition in the industry. As such, some banks operated inefficiently because they had to increase their operating expenses in order to cope with the fierce competition. The average ROA for all sampled banks put together was 2.50%, implying that only a fraction of banks' management could use their assets efficiently to generate income. This supports the claim of the competition-inefficiency hypothesis that an increase in competition could cause a decline in bank efficiency (Weill, 2003; and Boot and Schmeits, 2005).

Return on assets (ROA) is a comprehensive measure of overall bank performance from an accounting perspective (Sinkey, Jr., 1992). It is a primary indicator of managerial efficiency. It indicates how capable the management of the bank has been converting the bank's assets into net earnings. ROE measures accounting profitability from the shareholder's perspective. It approximates the net benefit that the stockholders have received from investing their capital (Rose and Hudgins, 2006).

Theoretical Framework

Some analysis applied modified forms of Solow's (1957) neoclassical growth model (e.g., Jorgenson and Stiroh 2000; Oliner and Sichel 2000). Essentially, they employed aggregate output (Y) modeled as a simple function of IT capital services (KIT), other capital services (KOTH), include labor (L), and a multifactor productivity term (MFP). Technological change is embodied in the MFP variable. A number of neoclassical assumptions are imposed, including perfect competition, constant returns to scale, no adjustment costs, equal returns to all types of capital, Hicks-neutral technological change, etc. The growth in labor productivity is given by:

$$\Delta(Y/L) = \alpha_1 \, \Delta(K_{IT}/L) + \alpha_2 \, \Delta(K_{OTH}/L) + \Delta MFP$$

Where Δ denotes a growth rate, and the α are income shares. Technological progress is measured by the Solow residual or ΔMFP.

These studies generally found that IT contributed significantly to the recent upswing in aggregate productivity in two ways. First, the very large investments in IT equipment over time resulted in "capital deepening" or increases in $\Delta(K_{IT}/L)$, growth in IT capital per unit of labor. Second, IT contributed to ΔMFP primarily as a result of productivity gains in the production of this equipment.

Porter (1985) explains that competitive advantage grows fundamentally out of the value a firm is able to create for its buyers that exceeds the firm's cost of creating it. In this sense, value is what buyers are willing to pay, and superior value stems from offering lower prices than competitive price for equivalent benefits or providing unique benefits that more than offset a higher price. To achieve sustainable profit, therefore, a firm needs sustainable advantage, in either cost or differentiation (Porter, 1980, 1985). Thus, there are two basic types of competitive advantage: cost leadership and differentiation. These two basic types of source of competitive advantage combined with the scope of the firm's activity lead to three known generic strategies – cost leadership, differentiation strategy and focus strategy – for achieving above – average performance in an industry.

This research work adopted Porter (1985) "competitive advantage grows" as it is more significant in developing countries. It is the theory among all other competing theories that regards competition as an "engine of growth", as it can be seen that most of the developing economies are adopting export promotion policies by boosting their economies through competition. Most of the empirical studies reviewed in this research work that use data from developing countries adopt a competitive theory, and most of them confirm the positive and significant influence of competition, with very few that confirms negative influence.

Methodology
Data and Sources

In this study, secondary data in the form of panels have been used. The data have been collected from the banks' annual financial reports and Factbooks covering the period 2001 – 2011. The data comprises of net profits, total assets, total equity, ATM machines and e-banking services of the selected commercial banks.

Sample size and sampling techniques

According to Asika (2006), it is practically impossible to take a complete and comprehensive study of the entire population because of the nature and pattern of distribution

or dispersion of the elements of the population. For the purpose of this research work, the sample used comprises 11 selected commercial banks out of a total population of 21 commercial banks in Nigeria. Thus, compared to the population, the sample is a bit above fifty percent which makes it adequate for the purpose of drawing inferences with respect to the entire population of the 21 mega banks in the country.

A non-probability sampling method was applied in some circumstances where it was not feasible or practical to conduct random sampling. In the course of this research study, a non-probability sampling method in the form of availability/purposive sampling techniques have been used. The use of purposive/availability sampling techniques was relied upon in order to solicit information that was available on our variables of interest in this study which were purposefully designed in our model. The nature of some of the variables we are looking for such as net profit, ICT, total asset, return on equity may not be comprehensively provided by all the banks. Consequently we relied on where we could source our target data.

Variables and Measurements

The variables captured in the model specified in this study were measured as follows;

Dependent variable

Bank Performance – this variable has often been measured using return on asset (ROA) and return on equity (ROE). Return on asset is defined as net income after tax divided by total assets. This ratio is an indicator of managerial efficiency; it indicates how capable the management of the banks has been converting the bank's assets into net earnings, while return on equity is measured as net income after tax divided by total equity capital. It measures the rate of return to the shareholder (Adegbaju and Olokoyo, 2008; Ahmad and Khababa, 1999; and Kim and Kim, 1997). But in this study we have used return on equity as a proxy on bank performance.

Independent variables

The explanatory variables in the model are also measured as follows:

i.   Net profit. This was measured as profits realized by the bank after tax following the works of Adegbaju and Olokoyo, 2008; Ahmad and Khababa (1999) and Kim and Kim (1997).

ii.   ATM's this variable was measured by the number of ATM used by each bank (Agbada, 2008). Other control variable are:

iii.   E-banking services in order to show the level of e-banking application by each bank of the selected banks.

Method of Data Analysis

A panel-data set was analyzed using the STATA econometric software version 9. In order to avoid any form of model misspecification adequate panel approaches have been followed in analyzing the data set. According to Yaffee (2005) the Ordinary Least Squares (OLS), constant coefficients, fixed effects and random effects models are among the commonly used models in analyzing panel data. Examples of these models are thus stated. According to Bruderl (2005) the OLS model (pooled-OLS) for panel data can be estimated as:

$$Y_{iT} = \beta_o + \beta_1 X_{it} + U_{it} _____ (1)$$

This estimate may have some elements of unobserved heterogeneity where the error term and an independent variable are correlated. To this end, there may be the need to exploit other models (Bruderl, 2005). As for the fixed-effects (error-components) model it is specified as:

$$Y_{iT} = \beta_1 X_{it} + V_{it} + E_{it} _____ (2)$$

In doing away with the problem of unobserved heterogeneity, the model conducts a form of within transformation which could be done by averaging equation 2 over time for each *i,* this is specified as:

$$\overline{y}_i = \beta_1 \overline{X}_i + V_i + \overline{E}_{it} _____ (3)$$

Then equation 4 was obtained by subtracting equation (3) from equation (2) as follows:

$$y_{it} - y_i = \beta_1 (\overline{X}_{it} - \overline{X}_i) + E_{it} + \overline{E}_{it} _____ (4)$$

According to Bruderl (2005) this kind of model allows for time-constant heterogeneity to be solved. However, Yaffee (2005) is of the view that the random effects model may be the most appropriate in running a panel data regression. The random effects model assumes the intercept is a random outcome variable, therefore the following specification was used to circumvent likely problems in the dataset:

$$Y_{it} = \beta_o + \beta_1 X_{it} + \beta_2 X_{2it} + e_{it} _____ (5)$$

$$\beta_o = \beta_1 + V_{it} _____ (6)$$

Therefore, the following equation was arrived at by having a model that has an intercept, that is a random effect. This is specified as:

$$y_{it} = \beta_o + \beta_1 X_{it} + \beta_2 X_{2it} + e_{it} + v_i _____ (7)$$

In this case, the fixed effects model has the distinct advantage of allowing for time-invariant variables to be used as independent variables (Yaffee, 2005). In trying to adopt the most suitable for all models for the panel data, the Hausman specification test was used to

determine the use of any of these models. In essence, the STATA econometric package version 11 was used to run such test.

Model Specification

In trying to assess the impact of ICT on commercial bank's performance in Nigeria, the following model has been used:

$$BP = \beta_0 + \beta_1 Profit + \beta_2 ATM + \beta_3 ebserv + \mu _____ (8)$$

Where

BP   =   Bank performance

β_0 =   Constant parameter

Profit =   Profit after tax

ATM   =   ATM usability

ebserv =   e-banking services

μ =   Error term

Hausman Specification Test for Best Model Selection

In a bid to select the use of the best model for the regression analysis series of tests were carried out. According to Yaffee (2005) either of the fixed-effects or random-effects estimators would be the best linear unbiased estimator (BLUE). To achieve this, the Hausman specification test was used. At the end of the test the random effects estimator was selected as the most appropriate of the two.

Data Presentation and Analysis

In this section, both descriptive and inferential analysis of the data is dealt with.

Table 4.1 presents a summary of the descriptive statistics for the five variables used in this study. The data were extracted from eleven Nigerian Commercial Banks over the period 2001 to 2011. The summary is presented in the form of mean, standard deviation, minimum and maximum.

Table 4.1: Summary of Descriptive Statistics

Variables	Observation	Mean	Std. Dev.	Min.	Max.
Shareholders Fund	121	1.61	2.71	-2.81	1.18
Net Profit	121	1.33	2.65	-2.81	9.62
ATM	121	129.27	196.6782	0	1090
E-banking	121	7.25	4.6193	3	23
Return on Equity	121	28.12	85.78	-41.11	525.67

Source: Author's Computation using STATA Version 9.1

The results in Table 4.1 show that, for the period 2001 to 2011, the average value of total equity of the eleven selected commercial banks stood at 1.61, while minimum stood at -2.81 and the maximum 1.18.

The mean value of the net profit for the selected banks was 1.33, while -2.81 was the minimum and 9.62 was the maximum. The average value of return on equity was 28.12, while -41.11 was the minimum and 525.67 was the maximum. The average use of ATM machines stood at 129 machines per annum, while 0 was the minimum and maximum stood at 1,090 machines. The average use of various e-banking services stood at 7.25, while 3 was the minimum and 23 was the maximum.

Table 4.2 shows the results obtained from the regression analysis.

Table 4.2: Regression Results

Dependent Variable: Return on Equity		
Independent Variables	Fixed Effects	Random Effects
Net profit	2.17	2.19
	(0.000)	(0.000)
ATM	0.017	-0.025
	(0.731)	(0.485)
E-banking services	-4.648	0.631
	(0.227)	(0748)
R^2	0.51	0.50
F	0.000	0.000
Std Error	24.29	16.24

Source: Author's Computation using STATA Version 9.1
Note: Figures in parentheses are t-values

Fixed effects model shows that, the two tail P-values test the hypothesis that each coefficient is different from 0. The null hypothesis is rejected at the 5 % level of significance showing that one of the independent variables (net profit) has a significant positive influence on return on equity which is used as a proxy for bank performance. The fixed effects model shows that the variable net profit has a positive coefficient (2.17) and statistically significant at the 1 % level. This finding indicates that an increase in bank's profits leads to increase in bank performance. This is obvious because an increase in profit can give room for re-investment thus leading to procurement of more assets. The coefficient (0.0171) for ATM's usability shows a positive influence on the bank's performance but it is not statistically significant. This finding indicates that the use of ATM's does not influence commercial bank's performance in Nigeria. The coefficient (-4.648) related to various internet banking services provided by a commercial bank is negative and not statistically significant. The finding indicates that an increase in investments in those banking services does not significantly influence bank performance. One possible explanation for this is that e-banking gadgets are capital intensive projects which consume huge amount of capital.

Table 4.2 also presents the random effects regression. The coefficient (2.19) for net profit shows a positive influence on the bank's performance, and it is statistically significant at the 1 % level. This finding indicates that an increase in bank profitability leads to increase

in bank performance. The coefficient (-0.025) for ATM's usability shows a negative influence on the bank's performance but it is not statistically significant. The coefficient related to e-banking services (0.631) shows a positive influence on bank performance but it is not statistically significant. This indicates the e-banking services do not influence bank performance. The R^2 value from Fixed Effects model shows 51 % variation of the bank's performance. The F statistics value in both models shows that all the models are adequate at 1 % level of significance.

To decide between fixed and random effects we ran a Hausman test where the null hypothesis states that the preferred model is random against the alternative which says the preferred model is fixed. The results show that the random effects model is appropriate for the p-value 0.2591 is not significant.

Discussion of Findings

The main objective of this study is to examine the impact of information and communication technology (ICT) on the efficiency of selected commercial banks in Nigeria. In order to do that some important variables such as Net profit, ATM usability and e-banking services were regressed on return on equity.

The results from both fixed and random effects models show that the use of ICT in the banking industry does not improve performance of the selected banks. This finding is in line with the findings of Lin (2007), and Acharya et al., (2008). Even though, the use of ICT does not improve return on assets, nonetheless, the findings may be useful for assessing the effects of ICT investments on bank's productivity. Presumably, if ICT investment increases bank profitability, the banks that invest the most in ICT is expected to have superior efficiency at any point in time.

In order to select between the two models since both shows similar results, Hausman specification test has been conducted. The findings from Hausman Specification Test reveal that random effects model is the most appropriate in this study.

Summary of Findings

The objective of this study is to identify whether information and communication technology (ICT) improves performance of commercial banks in Nigeria using a sample of eleven (11) commercial banks. Previous findings indicate that the use of ICT improves bank's performance, but does not specify the actual performance measure, i.e. return on assets or return on equity that the best measure efficiency of the bank's with the adoption of ICT. In order to contribute to this debate this study uses both fixed effects (FE) and random effects (RE) Models.

The data used in this study were sampled from various bank annual financial reports and Factbooks. The Hausman specification test was used to decide between fixed effects or random effects to be adopted for this study. The results of the test indicated that the random effects model is appropriate for this study. The findings are summarized as follows:

a.   Investment in information and communication technology (ICT) does not improve performance in the Nigerian Commercial Banks.

b.   An increase in bank's profitability enhances commercial bank's performance in Nigeria.

c.   The coefficient related to e-banking services (0.631) shows a positive influence on bank performance but it is not statistically significant.

Conclusions

On the basis of the findings of this study, the following conclusions are drawn: investment in ICT does not improve commercial bank's performance in Nigeria. This confirms the reality that most of the Nigeria's commercial banks are in financial distress since consolidation. In addition, profits serve as driving factor for commercial bank's performance in Nigeria, however, best measures of performance are return on equity and return on assets.

Recommendations

On the basis of the finding of this study, the following recommendations are offered:

i.   Since the findings of this study indicate that investment in ICT does not enhance Nigerian commercial banks performance, banks should give emphasis on efficient utilization of the ICT equipment such as credit and electronic cards to pay at retail outlets, points of sales (POS), phone banking, electronic payment debit, cash withdrawal machines that becomes Automated Teller Machines (ATM), home banking, internet banking, mobile banking, personal digital assistant banking rather than purchase of new ones; and

ii.   For banks to actually reap the benefit of ICT more campaigns and orientation of clients need to be pursued to create awareness for them to patronize the facilities. Acceptance of these facilities will consolidate the gains from investing in them.

iii.   Unlike the usual assumption that profitability is the measure for performance, firms should now go for either ROA or ROE because they are the best measures of performance.

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APPENDICES

```
    ___  ____  ____  ____  ____ tm
   /__    /   ____/   /   ____/
  ___/   /   /___/   /   /___/    9.1    Copyright 1984-2005
    Statistics/Data Analysis             StataCorp
                                         4905 Lakeway Drive
                                         College Station, Texas 77845 USA
                                         800-STATA-PC
  http://www.stata.com
                                         979-696-4600        stata@stata.com
                                         979-696-4601 (fax)


  40-student Stata for Windows (network) perpetual license:
        Serial number:  1990515882
          Licensed to:  SED Facoltà di Economia
                        Università Tor Vergata


  Notes:
  1.  (/m# option or -set memory-) 1.00 MB allocated to data

  . edit
  (8 vars, 121 obs pasted into editor)

  . run "C:\DOCUME~1\user2\LOCALS~1\Temp\STD09000000.tmp"

  . browse

  . log using "C:\Documents and Settings\user2\My Documents\Stata
  9.1\aaaaaa.smcl"
  ----------------------------------------------------------------
  log:  C:\Documents and Settings\user2\My Documents\Stata
  9.1\aaaaaa.smcl
    log type:  smcl
   opened on:  23 Nov 2012, 11:01:57

  . summarize shfund netprof atm ebserv roe

  Variable |   Obs     Mean     Std. Dev.   Min        Max
  -------------+-------------------------------------------------
      shfund |  121   1.61e+08   2.71e+08  -2.81e+08   1.18e+09
```

231

```
       netprof | 121    1.33e+08    2.65e+08  -2.81e+08    9.62e+08
           atm | 121    129.2727    196.6782         0        1090
        ebserv | 121    7.247934    4.619309         3          23
           roe | 121    28.12483    85.75849  -41.11396    525.6674


xtset id year
        panel variable:  id (strongly balanced)
         time variable:  year, 2001 to 2011
                 delta:  1 unit


.

. xtreg roe pat atm ebserv, re

Random-effects GLS regression    Number of obs      =       121
Group variable: id               Number of groups   =        11

R-sq:  within  = 0.4974          Obs per group: min =        11
       between = 0.5257                          avg =      11.0
       overall = 0.5025                          max =        11

Random effects u_i ~ Gaussian     Wald chi2(3)     =    115.66
corr(u_i, X)       = 0 (assumed)  Prob > chi2      =    0.0000

------------------------------------------------------------------------------
--
       roe |    Coef.   Std. Err.      z    P>|z|    [95% Conf.
Interval]
------------+-----------------------------------------------------------------
--
       pat |   2.19e-07   2.18e-08   10.02   0.000    1.76e-07    2.61e-
07
       atm |  -.0254275   .0363892   -0.70   0.485    -.0967491
.0458941
    ebserv |   .6310353   1.967128    0.32   0.748    -3.224464
4.486535
     _cons |   5.255632   16.23958    0.32   0.746    -26.57337
37.08463
------------+-----------------------------------------------------------------
--
   sigma_u |  25.263062
   sigma_e |  58.096311
       rho |   .1590227   (fraction of variance due to u_i)
------------------------------------------------------------------------------
--

. xtreg roe pat atm ebserv, fe

Fixed-effects (within) regression  Number of obs     =       121
Group variable: id                 Number of groups  =        11
R-sq:  within  = 0.5063            Obs per group: min =        11
       between = 0.2006                           avg =      11.0
       overall = 0.4169                           max =        11
                                   F(4,106)         =     27.18
corr(u_i, Xb) = -0.2713            Prob > F         =    0.0000

------------------------------------------------------------------------------
--
```

```
        roe |      Coef.   Std. Err.        t     P>|t|      [95% Conf.
Interval]
------------+-----------------------------------------------------------
--
        pat |   2.17e-07   2.27e-08      9.57    0.000     1.72e-07    2.62e-
07
        atm |   .0171377   .0497691      0.34    0.731    -.0815343
.1158098
     ebserv |  -4.648265   3.822842     -1.22    0.227    -12.22742
2.930893
      _cons |    36.7172   24.28612      1.51    0.134    -11.43238
84.86679
------------+-----------------------------------------------------------
--
    sigma_u |  39.236211
    sigma_e |  58.096311
        rho |  .31324236   (fraction of variance due to u_i)
----------------------------------------------------------------
F test that all u_i=0:   F(10, 106) = 2.31   Prob > F = 0.0168

. estimates store fixed

. xtreg roe pat atm eserv, re
variable eserv not found
r(111);

 . xtreg roe pat atm ebserv, re

Random-effects GLS regression        Number of obs      =         121
Group variable: id                   Number of groups   =          11

R-sq:  within = 0.4974               Obs per group: min =          11
       between = 0.5257                             avg =        11.0
       overall = 0.5025                             max =          11

Random effects u_i ~ Gaussian        Wald chi2(3)       =      115.66
corr(u_i, X)       = 0 (assumed)     Prob > chi2        =      0.0000

------------------------------------------------------------------------
--
        roe |      Coef.   Std. Err.        z     P>|z|      [95% Conf.
Interval]
------------+-----------------------------------------------------------
--
        pat |   2.19e-07   2.18e-08     10.02    0.000     1.76e-07    2.61e-
07
        atm |  -.0254275   .0363892     -0.70    0.485    -.0967491
.0458941
     ebserv |   .6310353   1.967128      0.32    0.748    -3.224464
4.486535
      _cons |   5.255632   16.23958      0.32    0.746    -26.57337
37.08463
------------+-----------------------------------------------------------
--
    sigma_u |  25.263062
    sigma_e |  58.096311
        rho |   .1590227   (fraction of variance due to u_i)
------------------------------------------------------------------------
--
```

```
. estimates store random

. hausman fixed, sigmamore
```

Note: the rank of the differenced variance matrix (2) does not equal the number of coefficients being tested (3); be sure this is what you expect, or there may be problems computing the test. Examine the output of your estimators for anything unexpected and possibly consider scaling your variables so that the coefficients are on a similar scale.

```
                ---- Coefficients ----
    |   (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
    | fixed        random        Difference        S.E.
-------------+----------------------------------------------------
pat  |2.17e-07      2.19e-07      -1.95e-09      5.73e-09
atm  |.0171377     -.0254275       .0425652       .0336754
ebserv|-4.648265    .6310353      -5.2793        3.260967
----------------------------------------------------------------
          b = consistent under Ho and Ha; obtained from xtreg
          B = inconsistent under Ha, efficient under Ho; obtained from
xtreg

    Test:  Ho:  difference in coefficients not systematic

              chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                     =          2.70
            Prob>chi2 =         0.2591
```

LIST OF SELECTED COMMERCIAL BANKS

BANK	B_ID	Year	SF	PAT	ATM	ebserv	ROE
ACCESS	1	2001	919493000.00	77743000.00	0.00	5.00	0.08455
ACCESS	1	2002	1343704.00	-55245000.00	0	5	-41.114
ACCESS	1	2003	2365356.00	556573000.00	0	5	235.302
ACCESS	1	2004	2702830.00	637473000.00	0	5	235.8539
ACCESS	1	2005	14071324.00	501515000.00	0	6	35.64092
ACCESS	1	2006	28893886.00	737149000.00	34	6	25.51228
ACCESS	1	2007	28384891.00	6083439.00	71	6	0.21432
ACCESS	1	2008	171860665.00	16056464.00	95	7	0.093427
ACCESS	1	2009	185188124.00	20814216.00	154	7	0.112395
ACCESS	1	2010	175370457.00	11068121.00	190	7	0.063113
ACCESS	1	2011	197042209.00	16708255.00	305	9	0.084795
DIAMOND	2	2001	47372580.00	1689618.00	25	4	0.035667
DIAMOND	2	2002	53003546.00	1478175.00	28	4	0.027888
DIAMOND	2	2003	115263000.00	65776000.00	35	4	0.57066
DIAMOND	2	2004	883414000.00	903411000.00	41	4	1.022636
DIAMOND	2	2005	2510279.00	2509810.00	50	4	0.999813
DIAMOND	2	2006	222833154.00	3977059.00	150	4	0.017848
DIAMOND	2	2007	320419399.00	7086770.00	164	4	0.022117
DIAMOND	2	2008	625669618.00	12821074.00	165	4	0.020492
DIAMOND	2	2009	650757117.00	-8174413.00	180	4	-0.01256
DIAMOND	2	2010	6522455.00	548402560.00	180	4	84.07916
DIAMOND	2	2011	-22187848.00	722965977.00	180	4	-32.5839
ECO	3	2001	2522540.00	716071000.00	0	4	283.869
ECO	3	2002	2945733.00	553725000.00	0	4	187.9753
ECO	3	2003	3518887.00	816815000.00	0	4	232.1231
ECO	3	2004	4413327.00	854439000.00	0	4	193.6043
ECO	3	2005	25762863.00	1368174.00	0	4	0.053106
ECO	3	2006	132091706.00	3558591.00	52	4	0.02694
ECO	3	2007	311395894.00	7449777.00	104	4	0.023924
ECO	3	2008	432466245.00	2130461.00	163	4	0.004926
ECO	3	2009	355662000.00	-4588000.00	185	4	-0.0129

BANK	B_ID	Year					
			SF	PAT	ATM	ebserv	ROE
ECO	3	2010	206817600.00	21091040.00	191	4	0.101979
ECO	3	2011	233493760.00	33094400.00	191	4	0.141736
FIDELITY	4	2001	1300533.00	400661000.00	0	8	308.0745
FIDELITY	4	2002	1915211.00	539242000.00	0	10	281.5575
FIDELITY	4	2003	2515423.00	856885000.00	0	10	340.6524
FIDELITY	4	2004	3519624.00	913604000.00	0	10	259.5743
FIDELITY	4	2005	9776922.00	1305854.00	0	10	0.133565
FIDELITY	4	2006	25664717.00	3218617.00	32	10	0.12541
FIDELITY	4	2007	30101287.00	4714283.00	56	12	0.156614
FIDELITY	4	2008	136371740.00	13356301.00	89	14	0.09794
FIDELITY	4	2009	435666000.00	1557000.00	112	15	0.003574
FIDELITY	4	2010	154371740.00	14256301.00	134	18	0.09235
FIDELITY	4	2011	165371740.00	15356421.00	168	18	0.09286
FIRST	5	2001	18170000.00	5066000.00	50	5	0.278811
FIRST	5	2002	19406000.00	4776000.00	65	5	0.246109
FIRST	5	2003	27006000.00	11010000.00	73	6	0.407687
FIRST	5	2004	41605000.00	11483000.00	104	8	0.276
FIRST	5	2005	48726000.00	13234000.00	280	10	0.2716
FIRST	5	2006	64277000.00	17383000.00	650	10	0.270439
FIRST	5	2007	83627000.00	20636000.00	729	10	0.246762
FIRST	5	2008	351854000.00	36679000.00	818	10	0.104245
FIRST	5	2009	337405000.00	12569000.00	904	10	0.037252
FIRST	5	2010	32123000.00	1962444.00	1090	16	0.061092
FIRST	5	2011	47462000.00	2463543.00	1090	16	0.051906
GTBANK	6	2001	4026177.00	1503694.00	15	13	0.373479
GTBANK	6	2002	8016492.00	2187059.00	23	13	0.27282
GTBANK	6	2003	9638925.00	3144182.00	26	15	0.326196
GTBANK	6	2004	11754406.00	4125832.00	35	15	0.351003
GTBANK	6	2005	33643184.00	5433748.00	60	17	0.161511
GTBANK	6	2006	40549833.00	8590265.00	160	18	0.211845
GTBANK	6	2007	47324118.00	13193759.00	170	18	0.278796
GTBANK	6	2008	160008886.00	21169477.00	185	20	0.132302

BANK	B_ID	Year	SF	PAT	ATM	ebserv	ROE
GTBANK	6	2009	1065504345.00	23687567.00	200	21	0.022231
GTBANK	6	2010	1125505445.00	27685776.00	215	23	0.024599
GTBANK	6	2011	1175503454.00	32685776.00	218	23	0.027806
STERLING	7	2001	531563000.00	370038000.00	0	4	0.696132
STERLING	7	2002	664454000.00	39810000.00	0	4	0.059914
STERLING	7	2003	831688000.00	178923000.00	0	4	0.215132
STERLING	7	2004	1243294.00	1545077.00	0	4	1.242729
STERLING	7	2005	2966726.00	-4820558.00	0	4	-1.62487
STERLING	7	2006	26319328.00	961645000.00	45	4	36.5376
STERLING	7	2007	26800395.00	620658000.00	50	6	23.15854
STERLING	7	2008	6523153.00	236502923.00	55	6	36.25592
STERLING	7	2009	-6660406.00	205640827.00	60	6	-30.8751
STERLING	7	2010	4178493.00	259579523.00	68	6	62.12276
STERLING	7	2011	6686473.00	504427737.00	68	6	75.44003
UNION	8	2001	13786000.00	5035000.00	0	4	0.365226
UNION	8	2002	30302000.00	4726000.00	0	4	0.155963
UNION	8	2003	32730000.00	6600000.00	0	4	0.20165
UNION	8	2004	39732000.00	8341000.00	0	4	0.209932
UNION	8	2005	43215000.00	9783000.00	0	7	0.22638
UNION	8	2006	100500000.00	10802000.00	35	7	0.107483
UNION	8	2007	102706000.00	13329000.00	56	7	0.129778
UNION	8	2008	25739000.00	26855000.00	83	7	1.043358
UNION	8	2009	-281173000.00	-281373000.00	190	7	1.000711
UNION	8	2010	-135894000.00	118016000.00	198	7	-0.86844
UNION	8	2011	301173000.00	301173000.00	204	7	1
UBA	9	2001	9067000.00	1269000.00	15	3	0.139958
UBA	9	2002	10627000.00	1566000.00	23	3	0.14736
UBA	9	2003	14901000.00	3280000.00	32	3	0.220119
UBA	9	2004	19533000.00	4525000.00	32	3	0.231659
UBA	9	2005	19443000.00	4921000.00	42	4	0.253099
UBA	9	2006	48535000.00	11550000.00	83	4	0.237973
UBA	9	2007	167719000.00	21441000.00	112	4	0.127839

BANK	B_ID	Year	SF	PAT	ATM	ebserv	ROE
UBA	9	2008	1673333.00	40825000.00	142	4	24.39742
UBA	9	2009	1548281.00	2375000.00	182	4	1.533959
UBA	9	2010	2167000.00	1432632.00	253	4	0.661113
UBA	9	2011	-16385000.00	1655465.00	340	4	-0.10104
WEMA	10	2001	619554000.00	675015000.00	0	4	1.089518
WEMA	10	2002	1481667.00	778864000.00	0	4	525.6674
WEMA	10	2003	1477775.00	1527311.00	0	4	1.033521
WEMA	10	2004	967148000.00	1555460.00	0	4	0.001608
WEMA	10	2005	844285000.00	4451625.00	0	6	0.005273
WEMA	10	2006	20540001.00	-6601961.00	120	6	-0.32142
WEMA	10	2007	25182705.00	2554098.00	150	6	0.101423
WEMA	10	2008	128906575.00	-57738739.00	150	6	-0.44791
WEMA	10	2009	142785723.00	-2094692.00	160	6	-0.01467
WEMA	10	2010	203144627.00	16238533.00	168	6	0.079936
WEMA	10	2011	210144627.00	16538533.00	168	6	0.078701
ZENITH	11	2001	2418243.00	1026658.00	25	5	0.424547
ZENITH	11	2002	3504013.00	1026658.00	32	5	0.292995
ZENITH	11	2003	4424186.00	1548555.00	53	5	0.35002
ZENITH	11	2004	5190768.00	1548555.00	67	5	0.298329
ZENITH	11	2005	42100031.00	7143266.00	84	5	0.169674
ZENITH	11	2006	100642511.00	11619227.00	102	7	0.11545
ZENITH	11	2007	114586090.00	18779804.00	123	7	0.163893
ZENITH	11	2008	344348245.00	51992239.00	245	7	0.150987
ZENITH	11	2009	335570000.00	20603000.00	267	7	0.061397
ZENITH	11	2010	350414000.00	33335000.00	303	7	0.09513
ZENITH	11	2011	360868000.00	37414000.00	373	7	0.103678