Impact of Investment in Information Technology on Financial Performance of Nigerian Banks: Is There a Productivity Paradox?

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Abstract

This research investigates the impact of investment in Information Technology (IT) on the financial performance of banks in Nigeria. The study covers post-Banking (2006-2010) consolidation period of 5 years. The population of the study comprises of all the 24 banks, and a random sampling of 10 banks was made. The study employs secondary data generated from annual reports and accounts of the banks, records maintained by the Nigerian Stock Exchange (NSE) and Central Bank of Nigeria (CBN) reports. The

data obtained were analyzed using the panel data regression model where investment in IT (hardware, software and Automated Teller Machine [ATM]), total earnings (TR) and total cost (TC) of the 10 sampled banks were used as the independent variables while financial performance is the dependent variable, proxied by return on assets (ROA), return on equity (ROE), net profit margin (NPM) and earnings per share (EPS). Four hypotheses were developed and tested in line with the proxies to the dependent variables. The result from the panel regression revealed that there is a significant relationship between the independent variables and the dependent variables, but the t-test revealed that the impact of IT investment on the financial performance of Nigeria banks is significant for ROA, ROE and EPS at 5% significance level but not significant for NPM at 5% and 10% significance level. The effect of TR is positive and that of TC is negative on all the four financial performance measures, but the effect of IT investment on all the four financial performance variables is negative, which is not an expected sign. This means that an increase on IT spending leads to a decrease in the financial performance of Nigerian banks, that is to say heavy IT investment does not increase banks profitability, hence there is existence of IT productivity paradox in the Nigeria banking industry.

Keywords: **Investment, Information Technology, Financial Performance, Nigerian Banks, Productivity**

INTRODUCTION

The debate on relationship between IT spending and banks performance in Nigeria showed little or no knowledge that exists which defines clearly the relationship between IT expenditures and financial performance. However a handful of studies (Council of economic advisors, 2001; Mckinsey global institute, 2001) on the performance of IT in US banking show weak or non-existent links between IT spending and productivity (specifically post-1995). This confirms the persistence of productivity paradox in US banking industry, which refers to the absence of a positive impact of IT investment on productivity (as originally identified by Solow, 1987). Surprisingly, some studies (Griliches, 1997, Oliner and Sichel, 1994, and Jorgenson and Stiroh, 1995) support the thought of Solow (1987) in concluding that Information Technology may essentially affect negatively banks efficiency and may reduce productivity. This paradox noted by Solow (1987) was that "you can see the computer age everywhere these days, but in the productivity statistics".

Since 1970s to the time Solow was claiming that there was a huge deceleration in growth, technologies were becoming ubiquitous directly or indirectly invading nearly all sectors of the economy. In Nigeria, information technology (IT) has revolutionized banking, transforming the once quiet industry into a vibrant enterprise (Adeosun, Adeosun, and Adetunde, 2009; Oghenerukeybe, 2009). The transformation implies that the Nigerian banking industry, which is dominated by commercial banks, has continued to invest heavily in IT products and services such as hardware, software,

telecommunication, training, consulting, and outsourcing. Commercial banks' investment in IT accounts for about 70% of the industry's total investment cost and 46% of the total organizational IT spending in Nigeria (Central Bank of Nigeria, 2009).

Information technology acquisition and deployment is capital-intensive and requires deliberate commitment for success. Agboola and Salawu (2008) and Andoh-Baidoo and Osatuyi (2009) captures this commitment by noting that some banks have built private very small aperture terminal (VSAT) satellite systems to overcome the challenges posed by the lack of communication infrastructure in Nigeria. Ayankotun (2008) reported that Nigerian commercial banks spend $114 million, annually, on information technology. In 2009, the 24 commercial banks in the country spent more than $107 million US dollars on IT and related services (Ekata, 2011).

Shu and Strassmanm (2005) conducted a survey on 12 banks in the US spanning the period 1989-1997. They noticed that even though Information Technology has been one of the most essential dynamic factors relating all efforts, it cannot improve banks' earnings. However, conversely, there are many studies approving the positive impacts of Information Technology expenses on business value. Kozak (2005) investigates the influence of the evolution in Information Technology on the profit and cost effectiveness of the banking zone during the period of 1992-2003. The study indicates optimistic relationship among the executed Information Technology. Hit and Brynjolfosson (1996) documents the positive impact of IT on output and consumer surplus. They did not find a significant positive correlation between IT spending and financial/operating performance. Similarly, Barua, Kriebel Mukhopadhyay (1995) found that IT investment affects intermediate measures (such as inventory turnover) but found no evidence on the benefits extended to firm performance as measure by return on assets (ROA). As regard to banks, Markus and Soh (1993) found that not all banks achieve clear financial benefits from IT spending: small banks did not show a significant association between IT spending and profitability; while large banks had negative returns from their contemporaneous IT spending.

The surprise confirmation of the productivity paradox in US banking system provides the major motivation for this study which set out to investigate the impact of investment spending on IT on the financial performance of banks in Nigeria. Literature searches yield no much evidence of research about the relationship between IT spending and financial performance of banks in Nigeria. This is due in part to the difficulties of modeling successfully the peculiar nature of bank's production processes- mainly in terms of the identification of variables that accurately represents the activities of the industry and also in part to the lack of good quality data on banks IT spending. Though research studies abound for organizations abroad, Ogunsola (2005) observes that a wide gap in IT development and research exist between developed nations and developing countries including Nigeria. Nigerian banks are seeking competitive advantage in rapidly expanding globalized market and continue substantial investment in IT, expecting a rise in profitability as IT spending increases. However, little or no knowledge exists that defines clearly the impact of investment in IT on the financial performance of banks in Nigeria. To overcome this, the study investigates the impact of investment in IT on the financial performance of banks in Nigeria using financial performance measures such as return on assets, return on equity, earning per share and net profit margin with IT cost and the number of ATMs as the independent variable.

In the past few years, banks in Nigeria have increasingly depended on the deployment of (IT) infrastructure to drive their processes in order to deliver superior financial performance to meet and surpass customer expectations. Customer's insatiable appetite for efficient services has compelled financial institutions to make the transition from the traditional 'brick and mortar banking to the e-platform and in the process they have occasioned a more radical transformation of their business systems and models by embracing e-banking .With their transition to the e-business, e-commerce and e-banking platform, Nigerian banks are aggressively moving towards reduction of cash transactions (Ovia, 2007). Statistics indicate that the Nigerian banking sector is the biggest spender on IT, having committed well over $500 million USD since 2001 in the deployment of IT infrastructure- hardware, software and solution far above what the oil and gas industry- Nigeria's largest Forex earner has committed to IT (Ovia, 2007).

It would be fascinating to know whether such investment in IT infrastructure when compared with other factors has led to remarkable improvement in the profitability of banks. Unfortunately, a survey of existing literature worldwide revealed conflicting results. Some studies show there is a significant positive relationship between investment in IT infrastructure and bank profitability, while other state the contrary.

LITERATURE REVIEW

The term information technology usually refers to a computer-based system, one that is designed to support the operations, management, and decision functions of an organization. Information systems in organizations thus provide information support for decision makers. Information systems encompass transaction processing systems, Management information system, decision support systems, and strategic information systems (Laudon and Laudon, 2006). Information consists of data that have been processed and are meaningful to a user. Information Technology (IT), therefore, produces information that supports the management functions of an organization (Davis and Olson, 1985; Lucas, 1993; McLeod, 1995). In recent years, the utilization of information technology has been magnificently increased in service industries, particularly, the banking industry, which by using Information Technology related products such as internet banking, electronic payments, security investments, information exchanges can deliver high quality services to clients with less effort, thereby enhancing their financial performance (Berger, 2003). Ahituv and Neumann (1993) stated that an information system is a set of components (people, hardware, software, data, and procedures) that operate together to produce information that supports the operation and management functions of an organization. Laudon and Laudon (2006) defined IT as the study of information systems focusing on their use in business and management.

There is a large body of literature on the general subject of information technology (IT). Clarke (1994) describes how the applications of IT have evolved over the years: from the initial role of IT in the 1960's as a way of automating business processes, through recognition (in the 1970's) of IT's role in helping to better manage and control an organization, to the ideas in the 1980's of using IT for strategic advantage. Zuboff (1985) uses the terms automate, informate, and transform to categorize different ways IT can be used. Automate is the label that covers transaction processing and other IT applications designed to support and facilitate normal everyday business processes.

Informate describes management support, decision support, and data warehousing types of applications, while transform refers to IT applications that significantly change the market and business environment, often labeled as strategic applications. Existing studies generally note that IT has three distinct features which can change dramatically the way work is organized (Adler, 1992). They are automate, infomating and networking capabilities. Automation means the replacement of manual labor by the IT system accomplish menial work tasks. The info mating ability refers to the capability of IT to generate detailed information of the work process.

According to Zuboff (1988), this info mating ability distinguishes IT from the automation technology which characterizes the early phase of industrial revolution: "The informating ability generates[s] information about the underlying productive and administrative processes through which an organization accomplishes its work. It [IT] provides a deeper level of transparency to activities that had been either partially or completely opaque. In this way, IT supersedes the traditional logic of automation.... Activities, events, and objects are translated into and made visible by information when a technology informates as well as automates."

The impact of IT in the banking sector is very evident in the nature of products and service delivery channels. The introduction of direct banking and Internet-based financial services over the past decade has spurred profound changes in customer behavior and service expectations. In today's Financial Services (FS), customers demand immediate fulfillment. In short, they want to conduct real-time transactions from any location, through any device, for any product all at their convenience. At the same time, they demand consistent levels of service across all delivery channels.

The industry has coined a new term to describe this growing breed of consumer – "the transactional customer" (Rotella, 2001). Brynjolfsson and Hitt (2000) stated that "Information Technology contribute significantly to firm level of output." They stated that IT capital contributes an 81% marginal increase in output, whereas non IT capital contributes 6%. Likewise they illustrated that Information System professionals are more than twice as productive as non-Information System professionals. Although Information Technology (IT) expenditure is regarded as costly and risky, financial institutions are one of the largest investors in IT (Robson, 1997). An interesting finding of Morton (1991) supported by Hitt and Brynjolfsson (1996) and by Hallgarten, Heyward, Ross and Tambini (2001), is that benefits from IT do in fact exist, but are not captured by the organization.

Several frameworks have been proposed to guide the choice among Information System evaluation methodologies. Akoka (1981) uses the Gorry and Scott-Morton (1972) framework for IT as a contingency model for choosing among evaluation methodologies, proposing that structured operational control problems should be evaluated using cost-benefit analysis, while unstructured strategic planning problems should be evaluated using an edictal reports and managerial assessment of system value. Mitra and Chaya (1996) found that IT investments reduce average production costs, and increase average overhead costs in firms. Alpar and Kim (1990) reports that investments in information technology decrease total costs in the banking industry. Harris and Katz (1991) found that higher information technology spending is associated with lower growth in operating cost of insurance `companies. Morison and Brendt (1990) found

from government data that technology provides only marginal returns and concluded that there was over-investment in IT. A major assumption in the current study was that revenue and profit growth could be achieved through increased IT spending. IT infrastructure, which encompasses hardware, software, networks, and database, represents one of the core influences on IT implementation and applications to improve transaction processing, customer service, and organizational performance (Brynjolfsson and Hitt, 2000).

Agbolade (2011) stated that the rapid expansion of a mass of diversified information has born the term "information explosion" and gave rise to a scientific approach in information and elucidation of its most characteristic properties which has led to principal changes in interpretation of the concept of information. It was broadened to include information exchange not only among men but also among machines as well as the exchange of signals in the animal and plant worlds. The pace of change brought by new technologies has had a significant effect on the way people live, work, and play globally. Furthermore, he stated that Today's business environment is very dynamic and experiences rapid changes as a result of creativity, innovation, technological changes, increased awareness and demands from customers. Business organizations, especially the banking industry of the 21st century operates in a complex and competitive environment characterized by these changing conditions and highly unpredictable economic climate with Information and Communication Technology (ICT) is at the centre of this global change curve.

In Nigeria, IT is playing great role in bank operations and decision making policies, and has the potential performance, to change the business process, towards greater financial performance. It was noted that Nigerian banks have increased annual IT spending dramatically from $150,000 in 2003 (Ehikhamenor, 2003) to $107 million in 2009 (Ekata, 2011). Sophisticated information systems specifically the widespread use by management of personal computers that can tap into large centralized data bases that are linked together as part of a larger computer network is changing the way business is done in the Nigerian banking industry. Woherem (2000) revealed that Nigeria banks since 1980s have performed better in their investment profile and use of ICT systems, than the rest of 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 personal computers (PCs), local area networks (LANs), and wide area networks (WANs) and 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 capital ratio of 0.18.

Frank and Oluwafemi (2012) stated that studies have shown that effective and efficient use of Information Technology (IT) helps to distinguish between business equivalents. For example, IT was an important distinction between banks that were doing well in the mid-1980s as compared to those that was less profitable (Anandhi and Bharadwaj, 2000). Hence, the need to survive, for global relevance, to maintain existing market share and sustainable development has called for the exploitation of IT and its many advantages. In the banking industry, a list of IT products that have been adopted range from teller printers, Automated Teller Machines (ATMs), smart cards, Magnetic Ink

Character Reader (MICR).

A list of IT services also includes internet banking, mail, telephone banking, and mobile banking. Accounting for a greater percentage of what could be regarded as IT in banks is its internetworking. This internetworking refers to the internet, extranet and intranet and interbank networking. Intranet exists in branches such that transactions taking place in a branch is only accessible in that branch alone. For example, a branch has a VPN of 10.108.108.0 and another has a VPN of 10.103.103.0. A transaction taking place at 108 networks is exclusively for that network, it cannot be seen from the 103 network. Extranet exists such that a customer is not restricted to the branch he opened his account. He could bank anywhere since such information is made securely available within the bank regardless of its network. Internet is the unsecured channel wherein both the secured intranet and extranet exists. Here, every other information aimed for the public is made available since they are not confidential (Frank and Oluwafemi, 2012).

The financial sector has been an interesting case for service innovation as it moves towards using the web for commercial purpose through internet banking and IT. The impact of price clarity and consumer empowerment afforded by information technology eventually led to product and price competition. IT has made banks not just being profit-centric but also customer-centric banks (Accad, 2009). The web based banking operations has made it possible to accommodate functions and processes in other sectors like in government (vehicle license registration) and education (payment of fees). With the aid of information technology, banks are closer to their customers to find out what they really need and deliver such needs. Information technology has made it possible for customers to gain access to their account balance, buy recharge cards and pay bills using their mobile phones anytime from anywhere. Online banking allows customers to get their current account balance at any time. Information technology leads to a reduction in cash transactions which lead to reduction in crime (Ovia, 2000).

According to Wali (2010) the relationship between ICT and the various organizational activities is similar to government & civil servants while Governments outlines policies and civil servants execute those policies. ICT acts as a tool for the actualization of various organizational activities in order to implement and enforce policies. Osabuohien,(2008) established that while the gender of the bank officials does not affect efficiency in ICT use, factors such as age, educational qualification, computer literacy and type of ICT gadgets, were significant in influencing banks" intensity of ICT usage. Also ICT was found to impact positively the speed of banking service delivery, as well as productivity and profitability. Isizoh *et al*. (2012) stated that in Nigeria, many government agencies are now using websites to provide information on the activities of government. Today people of Nigeria can go to the internet and get any information they want. Jobs, contracts, and government activities are posted to websites for public knowledge. This has greatly improved productivity, thereby making the economy of Nigeria high. Nigerians can now ask questions about public issues and make their views known to government. Isizoh *et al*. (2012) further stated that the use of ICT in combating crime and terrorism cannot be undermined. Under the leadership of Governor Siriake Dickson of Bayelsa State, Nigeria, in 2012 the state signed a Memorandum of Understanding (MOU) with Huawei Chinese Company to install CCTV (Closed Circuit Television) in the whole of the State capital, Yenegoa. This will help to keep surveillance on the State capital. It will also go a long way in reducing crime in the state. Car trackers, demobilizers, timers, etc also made vehicle theft a thing of the past. R

emote sensing and the use of Global Positioning Systems (GPS) have helped in tracking heavy duty vehicles and locating specific positions on the earth surface, foiling of terrorism and ensuring safe delivery of goods and properties. These and more are few gains of ICT in the Nigerian economic growth and development.

Despite the adverse advantages of IT there have been notable challenges in its application to the banking system, Frank and Oluwafemi (2012) presented some of these challenges faced by Nigerian banks which includes; the need to build a better infrastructure that will serve as backbone for communication within the banks; the need to collaborate in sourcing for new technological equipment that will provide common standard; the need to get better at information technology system development and operation by bank management; The need to impress by improving the present telecommunications infrastructure.

THEORITICAL FRAMEWORK

In this paper we are interested to know the impact of IT on banks performance where profitability is a major factor for decision. Hence, the theory of profit and profitability as it relates to IT and the banking sector is presented below.

Theory of Profit and Profitability

Profit in its general form or sense, is regarded as income accruing to equity holders, in the same sense as wages accrue to the workers, rent accrues to owners of rentable assets, and interest accrues to the money lenders (Dwivedi, 2002). The term *profit* means different things to different people and school of thought. The tax collector, employees, accountants, economist, businessmen and women, etc, have their individual view to the meaning of profit. We will restrict to two schools of thought that is the accountants and economist.

Accountants' defined profit as the excess of revenue over all paid out costs, such as manufacturing and overhead expenses. It is more like what is referred to a "net profit". In accounting sense business income refers to profit (Dwivedi, 2002). According to Pyle and Kermit, profit in accounting is the difference between the purchase and the component costs of delivered goods and/or services and any operating or other expenses (Pyle and Kermit, 1981).

Dwivedi (2002) stated that economist's concept of profit is the pure profit or economic profit. He defined economic profit as the return over and above the opportunity cost that is the income expected from the second alternative investment or use of business resources.

To accountants, *Economic Profit*, or EP, is a single-period metric to determine the value created by a company in one period—usually a year. It is *Earnings after Tax* less the *Equity Charge*, a risk-weighted cost of capital. This is almost identical to the economists' definition of economic profit (Salmi and Virtanen, 1997). Business or accounting profit is often measured as a percentage of sales revenue, called profit margin. The economist's concept of a normal rate of profit is typically assessed in terms of the realized rate of return on stockholders' equity (ROE). ROE is defined as accounting net income divided

by the book value of the firm. Hirschey (2008) stated that many firms earn significant economic profits or experience meaningful losses.
This varying form of profit could be attributed to the type of theory adopted and applied. In this research paper the disequilibrium and compensatory profit theory is adopted.

One explanation of economic profits or losses is frictional profit theory. It states that markets are sometimes in disequilibrium because of unanticipated changes in demand or cost conditions. Unanticipated shocks produce positive or negative economic profits for some firms (Hirschey, 2008). Hirschey (2008) gave a related example to the frictional profit theory, he stated that for example, automated teller machines (ATMs) make it possible for customers of financial institutions to easily obtain cash, enter deposits, and make loan payments. Through ATMs render obsolete many of the functions that used to be carried out at branch offices; they foster ongoing consolidation in the industry. Similarly, new user-friendly software increases demand for high-powered personal computers (PCs) and boosts returns for efficient PC manufacturers and software vendors. A rise in the use of plastics and aluminum in automobiles drives down the profits of steel manufacturers. Over time, barring impassable barriers to entry and exit, resources flow into or out of financial institutions, computer manufacturers, and steel manufacturers, thus driving rates of return back to normal levels. During interim periods, profits might be above or below normal because of frictional factors that prevent instantaneous adjustment to new market conditions (Hirschey, 2008).

A further explanation of above-normal profits is the *monopoly* profit theory, an extension of frictional profit theory. Hirschey (2008) stated that some firms earn above-normal profits because they are sheltered from competition by high barriers to entry. Economies of scale, high capital requirements, patents, or import protection enable some firms to build monopoly positions that allow above-normal profits for extended periods. This means that every bank have the monopoly of their IT design and implementation for profit and customers satisfaction. Dwivedi (2002) stated that an extreme opposite of perfect competition is the existence of monopoly in the market and it arises due to such factors as economies of scale, sole ownership, legal sanction and protection, and mergers and acquisition. Based on these factors Dwivedi posit that a monopolist can earn pure or monopoly profit and maintain it in the long run by using its monopoly powers which include powers to control price and supply, powers to prevent entry of competitors by price cutting and monopoly power in certain input markets. According to Hirschey monopoly profits can also arise because of luck (being in the right industry at the right time) of from anticompetitive behavior. Unlike other potential sources of above-normal profits, monopoly profits are often seen as unwanted and subject to heavy taxes or otherwise regulated (Hirschey, 2008). This is a typical attribute to the banking industry where all commercial and merchant banks are regulated by a central bank.

Innovation profit theory describes above-normal profits that arise following successful invention or modernization. This theory is due to Joseph A. Schumpter. Schumpter was of the opinion that factors such as emergence of interest and profits, recurrence of trade circles are only incidental to a distinct process of economic development, and certain principles which could explain the process of economic development would also explain these economic variables or factors. schumpeter's theory of profit is thus embedded in his theory of economic growth (Dwivedi, 2002). According to Dwivedi (2002) Schumpeter's explanation of the process of economic growth, he began with the state of

stationary equilibrium, characterized by equilibrium in all spheres. Under conditions of stationary equilibrium, total receipts from the business are exactly equal to the total cost outlay, and there is no profit. According to the Schumpeter's theory, profit can be made only by introducing innovations in manufacturing technique, as well as in the methods of supplying the goods (Dwivedi, 2002). Based on Schumpeter's postulation Hirschey (2008) stated that innovation theory suggest that Microsoft Corporation has earned superior rates of return because it successfully introduced and marketed the graphical user interface, a superior image-based rather than command-based approach to computer software instructions. Microsoft has continued to earn above-normal returns as other firms scramble to offer a wide variety of "user friendly" software for personal and business applications. Only after competitors have introduced and successfully saturated the market for user-friendly software will Microsoft profits be driven down to normal levels. Similarly, Apple Corporation has earned above-normal rates of return as an early innovator with iPod line of portable digital music and video players. With increased competition from Microsoft's line of Zune devices, among others, it remains to be seen if Apple can maintain its position in the portable digital device market, or will instead see its market dominance and above-normal returns decline. As in the case of frictional or disequilibrium profits, profits that are due to innovation are susceptible to the onslaught of competition from new and established competitors (Hirschey, 2008).

The innovation theory can be seen to be in line with Clark's dynamic theory, J. B. Clark's theory is of the opinion that profits arises in a dynamic economy, not in a static economy. A static economy is defined as the one in which there is absolute freedom of competition; population and capital are stationary; production process remains unchanged over time; goods continue to remain homogeneous; there is freedom of factor mobility; there is no uncertainty and no risk; and if risk exists, it is insurable. In a static economy therefore, firms make only the *normal profit* or the wages of management. A dynamic economy on the other hand, is characterized by the following generic changes; population increase; increase in capital; improvement in production technique; changes in the forms of business organizations; and multiplication of consumer wants (Dwivedi, 2008). Dwivedi (2008) stated that the major functions of entrepreneurs or managers in a dynamic environment are in taking advantage of the generic changes and promoting their businesses, expanding sales, and reducing costs.

The entrepreneurs who successfully take advantage of changing conditions in a dynamic economy make pure profit. From Clark's point of view, pure profit exists only in the short-run. In the long-run, competition forces other firms to imitate changes made by the leading firms, leading to a rise in demand for factors of production. Consequently, production costs rise, thus reducing profits, especially when revenue remains unchanged (Dwivedi, 2002). This is purely the type of profit realized from the IT world where technological progress is never ending due to improved designs, new innovations, market demand and IT cost from new firms with similar design and operation capabilities of existing design from old firm or firms. In general, Hirschey (2008) stated that compensatory profit theory describes above-normal rates of return that reward firms for extraordinary success in meeting customer needs and maintaining efficient operations. If firms that operate at the industry's average level of efficiency receive normal rates of return, it is reasonable to expect firms operating at above-average levels of efficiency to earn above-normal rates of return. Inefficient firms earn below-normal rates of return. Also, the theory recognizes economic profit as an important reward to the

entrepreneurial function of owners and managers. Every product starts as an idea for serving better some established or perceived need of existing or potential customers. This need remains unmet until someone designs, plans, and implements a solution. The opportunity for economic profits is an important motivation for such entrepreneurial activity (Hirschey, 2008).

METHODOLOGY

The population of this study comprised the 24 licensed banks in Nigeria as at 2010. Out of this, forty (40) per cent of the banks were deliberately selected for analysis. This arbitrary number was considered as appropriate for the study for two reasons. One, it is a compromise between the conventional benchmark of at least one-third of the population in studies like this and fifty (50) per cent which half of the total population of banks in Nigeria. Secondly, collecting statistics on the operations of the banks in Nigeria, like most private companies, was a serious setback to this study. Though substantial data were collected from the twenty four banks, only about twenty one (21) companies had released consistent and time series data for the period covered. Others were laced with gaps, thereby making it impossible to cover more than forty (40) per cent of the companies in the study. For a serious study like this, a time series data covering only five years and just twenty banks would have produced pre-emptive statistical problems. To go round the problem, pooling the available data was considered. Instead of having just a 5-year time series data for just twenty companies, the pooling of the data produced a 50-data unit, making it possible to use conventional statistical tools and techniques for analyses. The sample of the study is drawn in a manner that ensures accuracy and reliability of data and eliminates chances of bias in the selection process. The selected banks that make up the 10 sampled banks are; First Bank, First City Monument Bank, United Bank for Africa, Access Bank, Afribank, Wema Bank, Union Bank, Guarantee Trust Bank, Diamond Bank and Intercontinental Bank.

Data used in this study were obtained from the annual reports and accounts of the banks and other statistical documents/records maintained by the Nigeria Stock Exchange and Central Bank of Nigeria.

Research Hypotheses
H_{01} There is no significant impact of investment in Information Technology on financial performance of Nigerian banks as measured by ROA.
H_{02} There is no significant impact of investment in Information Technology on financial performance of Nigerian banks as measured by NPM
H_{03} There is no significant impact of investment in Information Technology on financial performance of Nigerian banks as measured by ROE.
H_{04} There is no significant impact of investment in Information Technology on financial performance of Nigerian banks as measured by EPS.

Model Specification
Investment in information and communications technology affects bank's profitability through well-defined and indirect channels. Directly, it could lead to the bank's profitability if the latter makes a direct investment in the former. Otherwise, like any other expense, IT could be observed to transmit its capacity to stimulate bank's profitability in three stages. Our review of relevant literature in the previous chapter has shown that in

production analysis, IT has the capacity to improve the productivity of a company's productive forces via labour and capital inputs. By either using new or improved technology, workers' productivity as the production process is enhanced, in the average as well as marginal productivity of labour inputs increase with each IT 'dose'. The schema in Figure 1 below shows the processes through which IT influences bank's profitability.
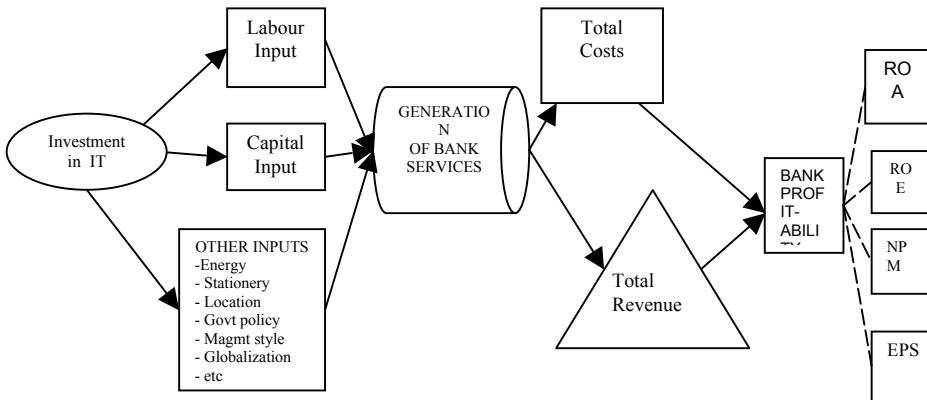

Figure 1: A schematic depiction of the relationship between IT and Bank Profitability

For this research a logarithm transformed linear model for the panel data was adopted as shown below;

$$\ln(\pi) = \alpha + \beta_1 \ln(InvIT) + \beta_2 \ln(TR) + \beta_3 \ln(TC) + \mu_t \dots\dots\dots\dots\dots\dots\dots \text{(1)}$$

where; *InvIT* is investment in IT, *TR* is total revenue, *TC* is total cost and μ_t is the error term.

Equation (1) is still not adequate for the regression analysis due to banks individuality in terms of banks policies on ICT hence, a one-way effect is to be assumed with specification being dependent only on the cross-section (bank) unit to which the observation belong because the use of pooled data to estimate equation (1), the regression results may distort the true picture of the relationship between ICT and financial performance of banks in Nigeria. To see this, we write equation (1) as:

$$\pi^* = \beta_{1i} + \beta_2 InvIT_{ij}^* + \beta_3 TR_{ij}^* + \beta_4 TC_{ij}^* + \mu_{ij} \dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(2)}$$

where; $\Pi^* = ln(\Pi)$; $B_{1i} = ln(\alpha)$; $Inv\ IT^* = ln(Inv\ sIT)$; $TR^* = ln(TR)$; $TC^* = ln(TC)$

The subscript *i* on the intercept term suggests that the intercepts of the banks selected may be different; the differences may be due to the special features of each bank, such as managerial style and *ICT* policy of each bank. To actually allow for the 'fixed effect' intercept to vary between banks, we adopt the 'differential intercept dummies' technique (Gujarati, 2002) which allows us to transform equation (2) to:

$$\pi_{ij}^* = \alpha_1 + \alpha_2 D_{2j} + \alpha_3 D_{3j} + \dots + \alpha_n D_{nj} + \beta_2 InvIT_{ij}^* + \beta_3 TR_{ij}^* + \beta_4 TC_{ij}^* + u_{ij} \dots\dots \text{(3)}$$

Where β_{1i} is spread across α's. D_{21} = 1 if the observation belongs to the first (reference) bank, 0 for otherwise; D_{3i} = 1 if the observation belong to the second bank, *0* otherwise; and so on. To avoid falling into the 'dummy-variable trap' or perfect collinearity, the number of dummies should be the total number of banks included in the sample minus one. α_1 represents the intercept of first (reference) bank, and α_2, α_3, … α_n, the differential intercept coefficients. There is no dummy for the reference bank because the other

intercept should tell us how the impact of ICT spending on the financial performance of the reference bank differs from those of other banks.

Examining the relationship between investment in information and communications technology and banks' profitability is an exercise in cause-effect relationship. Under this circumstance, a regression analysis is most appropriate. Thus, this study used a regression analysis to examine the impact of investment in IT on financial performance of banks in Nigeria. In particular, a panel data regression model was developed, and data fitted, to analyze the overall (average) impact of investment in IT on banks' financial performance. Except for total costs (TC), it is expected that the relationships between profitability and other variables should be positive.

Along the line of Economides and Salop (1992), Saloner and Shepard (1995) and Shu and Strassmanm (2005), the quality of investment in IT is estimated as a function of the bank information technology characteristics, which is the investment in ATMs and computer cost (software and hardware investment made by the banks). Financial performance was surrogated by the following variables: Return on Equity (ROE), Net Profit Margin (NPM), Earnings per Share (EPS) and Return on Assets (ROA). The statistical packages used (STATA 9.0 and SPSS 15.0) produced basic statistics such as coefficients, standard errors and t-statistics from which their p-values were used to test for their statistical significance at 5% significance level.

RESULTS AND DISCUSSION

Before the Panel data regression analysis was done we carried out a normality test using skewness and kurtosis statistics for the untransformed and transformed variables. The panel data regression by fitting the data to the model specification of equation (2) and (3) disregarded time (temporal-sectional effect) rather paneled by cross-sectional effect (bank). The results for equation (3) model specification are not presented and discussed because from the analysis it was observed that none of the individual banks effect was significant. Hence, equation (2) model specification results are presented and discussed. Four models are been generated from the analysis and R^2 (coefficient of determination) will be determined to assess the contribution of the independent variables to each of the dependent variables (model adequacy).

Table 1: Statistics for Normality Test Assumption

	Original Variables				Logarithmic Transformed Variables			
	Skewness		Kurtosis		Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error	Statistic	Std. Error	Statistic	Std. Error
ROA (%)	3.472	0.337	15.418	0.662	0.320	0.337	0.123	0.662
NPM (%)	5.015	0.337	27.970	0.662	0.637	0.337	2.286	0.662
ROE (%)	2.754	0.337	8.235	0.662	-0.602	0.337	1.722	0.662
EPS (₦)	3.004	0.337	8.218	0.662	-1.204	0.337	1.607	0.662
InvIT (₦)	3.515	0.337	12.907	0.662	0.979	0.337	-0.778	0.662
TR (₦)	3.165	0.337	12.012	0.662	0.228	0.337	-0.146	0.662
TC (₦)	3.508	0.337	14.174	0.662	0.495	0.337	0.843	0.662

Source: Author's computation using SPSS 15.0

The skewness and kurtosis statistics were used as a test for the normality assumption, for the panel data. Since for all the variables, the computed skewness values are more than twice their standard error (S.E.) of 0.337 hence, it indicates a departure from symmetry. Likewise, the kurtosis values for all the variables indicates non-normality since the ratio of each variable kurtosis value to the kurtosis standard error (S.E.) are all greater than 2. Hence, the positive kurtosis values imply that the data are more clustered and have longer tails than those in the normal distribution. This failure of the panel data series to pass the normality assumption should not come as a surprise however; the logarithmic transformation of the variables cured the sickness of the data. The skewness values for each variable are not more than twice their S.E. values and the ratio of the kurtosis values to their S.E. values lies between – 2 and + 2.

Table 2: Regression Results for Impact of Investment in IT on ROA

Variable	Symbol	RETURN ON ASSEETS (ROA)			
		Coefficient	Std. Error	t-value	*p*-Value
Intercept	*C*	4.318	3.424	1.26	0.215
Investment in IT	*Log(InvIT)*	-0.479	0.182	-2.63	0.012
Total Earnings	*Log(TR)*	1.587	0.459	3.46	0.001
Total Costs	*Log(TC)*	-1.813	0.493	-3.68	0.001
Regression	F_{cal}	6.19			0.0016
F-test that all $U_i = 0$	F_{cal}	2.46			0.0259
R-squared statistic	R^2	0.334			

Source: Author's computation using Stata 9.1

Table 2 above present results for the regression analysis to check if there is a significant relationship between banks profit measured by ROA and IT investment, TR and TC. Also, to know which of the independent variables (IT, TR and TC) contributed to the regression model and fixed effects parameters test that all fixed effects equals to zero. The regression model from the analysis is;

Log(ROA) = 4.318 – 0.479Log(Inv IT) + 1.587Log(TR) – 1.813Log(TC) ……………….. (4)

The probability (p) value 0.0016 for the regression is less than 5% significance level hence; it indicates that there is a significant relationship between ROA and IT investment, TR and TC. Also, the p-value 0.0259 for the fixed effects parameter test is less than 5% significance level hence; it indicates that all fixed effects are different from zero. While the t-test result reveals the impact of IT investment on ROA. First, the coefficient for IT investment is negative and is not the expected sign (positive). Secondly, its effect on ROA is statistically significant. This implies that one percent increase in IT investment decreases banks ROA by 0.479 percent. But the sign for TR (positive) and TC (negative) conforms to the prior signs and their effects on ROA are statistically significant. One percent increase in banks total earnings (TR) increases banks ROA by 1.587 percent. And one percent increase in banks total cost (TC) decreases banks ROA by 1.813 percent. In other words as banks TC decreases there is an increase in ROA by about 98 percent. Hence, we reject our first null hypothesis and conclude that there is a significant impact of IT investment on financial performance of Nigerian banks as measured by ROA. But the impact is negative meaning that IT investment failed to show productivity gain; higher IT investments are not associated with higher profit efficiency in Nigerian banks. This confirms the productivity paradox, and implies that banks with higher IT investments are not able to achieve higher profit

despite the higher quality of their outputs.

Table 3: Regression Results for Impact of Investment in IT on NPM

Variable	Symbol	NET PROFIT MARGIN (NPM)			
		Coefficient	Std. Error	t-value	*p*-Value
Intercept	*C*	-1.415	2.823	-0.5	0.619
Investment in IT	*Log(InvIT)*	-0.179	0.15	-1.19	0.241
Total Earnings	*Log(TR)*	1.251	0.378	3.30	0.002
Total Costs	*Log(TC)*	-0.956	0.406	-2.35	0.024
Regression	F_{cal}	3.99			0.0147
F-test that all U_i = 0	F_{cal}	1.94			0.0758
R-squared statistic	R^2	0.244			

Source: Author's computation using Stata 9.1

Table 3 above present results for the regression analysis to check if there is a significant relationship between banks profit measured by NPM and IT investment, TR and TC. Also, to know which of the independent variables (IT, TR and TC) contributed to the regression model and fixed effects parameters test that all fixed effects equals to zero. The regression model from the analysis is;

Log(NPM) = – 1.415 – 0.179Log(Inv IT) + 1.251Log(TR) – 0.956Log(TC) ………………… (5)

The probability (p) value 0.0147 for the regression is less than 5% significance level hence; it indicates that there is a significant relationship between ROA and IT investment, TR and TC. Also, the p-value 0.0758 for the fixed effects parameter test is greater than 5% significance level but less than 10% significance level hence; it indicates that all fixed effects are different from zero only at 10% significance level. While the t-test result reveals the impact of IT investment on NPM. First, the coefficient for IT investment is negative and is not the expected sign (positive). Secondly, its effect on NPM is statistically not significant. This implies that one percent increase in IT investment decreases banks NPM by 0.179 percent although, it is not statistically significant hence it's not enough evidence. But the sign for TR (positive) and TC (negative) conforms to the prior signs and their effects on NPM are statistically significant. One percent increase in banks total earnings (TR) increases banks NPM by 1.251 percent. And one percent increase in banks total cost (TC) decreases banks NPM by 0.956 percent. In other words as banks TC decreases there is an increase in NPM by about 99 percent. Hence, we do not reject our second null hypothesis and conclude that there is no significant impact of IT investment on financial performance of Nigerian banks as measured by NPM. But again the effect is negative as observed for ROA hence; banks IT investment failed to show productivity gain; higher IT investments are not associated with higher profit efficiency in Nigerian banks. This confirms the productivity paradox as observed with ROA.

Table 4: Regression Results for Impact of Investment in IT on ROE

Variable	Symbol	RETURN ON EQUITY (ROE)			
		Coefficient	Std. Error	t-value	*p*-Value
Intercept	*C*	6.722	2.657	2.53	0.016
Investment in IT	*Log(InvIT)*	-0.341	0.1412	-2.42	0.021
Total Earnings	*Log(TR)*	1.387	0.356	3.89	0.0001
Total Costs	*Log(TC)*	-1.817	0.382	4.75	0.0001
Regression	F_{cal}	8.39			0.0002

F-test that all $U_i = 0$	F_{cal}	3.52		0.0031
R-squared statistic	R^2	0.405		

Source: Author's computation using Stata 9.1

Table 4 above present results for the regression analysis to check if there is a significant relationship between banks profit measured by ROE and IT investment, TR and TC. Also, to know which of the independent variables (IT, TR and TC) contributed to the regression model and fixed effects parameters test that all fixed effects equals to zero. The regression model from the analysis is;

$$Log(ROE) = 6.722 - 0.341Log(Inv~IT) + 1.387Log(TR) - 1.817Log(TC)$$
…………………….. (6)

The probability (p) value 0.0002 for the regression is less than 5% significance level hence; it indicates that there is a significant relationship between ROE and IT investment, TR and TC. Also, the p-value 0.0031 for the fixed effects parameter test is less than 5% significance level hence; it indicates that all fixed effects are different from zero. While the t-test result reveals the impact of IT investment on ROE. First, the coefficient for IT investment is negative and is not the expected sign (positive). Secondly, its effect on ROE is statistically significant. This implies that one percent increase in IT investment decreases banks ROE by 0.341 percent. But the sign for TR (positive) and TC (negative) conforms to the prior signs and their effects on ROE are statistically significant. One percent increase in banks total earnings (TR) increases banks ROE by 1.387 percent. And one percent increase in banks total cost (TC) decreases banks ROE by 1.817 percent. In other words as banks TC decreases there is an increase in ROE by about 98 percent. Hence, we reject our third null hypothesis and conclude that there is a significant impact of IT investment on financial performance of Nigerian banks as measured by ROE. But the impact is negative meaning that IT investment failed to show productivity gain; higher IT investments are not associated with higher profit efficiency in Nigerian banks. This confirms the productivity paradox as observed for ROA and NPM.

Table 5: Regression Results for Impact of Investment in IT on EPS

Variable	Symbol	EARNINGS PER SHARE (EPS)			
		Coefficient	Std. Error	t-value	*p*-Value
Intercept	C	-2.859	3.1955	-0.89	0.377
Investment in IT	Log(InvIT)	-0.360	0.1698	-2.12	0.041
Total Earnings	Log(TR)	1.596	0.428	3.73	0.001
Total Costs	Log(TC)	-1.077	0.4598	-2.34	0.025
Regression	F_{cal}	6.19			0.0016
F-test that all $U_i = 0$	F_{cal}	22.23			0.00001
R-squared statistic	R^2	0.334			

Source: Author's computation using Stata 9.1

Table 5 above present results for the regression analysis to check if there is a significant relationship between banks profit measured by EPS and IT investment, TR and TC. Also, to know which of the independent variables (IT, TR and TC) contributed to the regression model and fixed effects parameters test that all fixed effects equals to zero. The regression model from the analysis is;

$$Log(EPS) = -2.859 - 0.360Log(Inv~IT) + 1.596~Log(TR) - 1.077~Log(TC)$$

.... (7)

The probability (p) value 0.0016 for the regression is less than 5% significance level hence; it indicates that there is a significant relationship between EPS and IT investment, TR and TC. Also, the p-value 0.00001 for the fixed effects parameter test is less than 5% significance level hence; it indicates that all fixed effects are different from zero. While the t-test result reveals the impact of IT investment on EPS. First, the coefficient for IT investment is negative and is not the expected sign (positive). Secondly, its effect on EPS is statistically significant. This implies that one percent increase in IT investment decreases banks EPS by 0.360 percent. But the sign for TR (positive) and TC (negative) conforms to the prior signs and their effects on EPS are statistically significant. One percent increase in banks total earnings (TR) increases banks EPS by 1.596 percent. And one percent increase in banks total cost (TC) decreases banks EPS by 1.077 percent. In other words as banks TC decreases there is an increase in EPS by about 98 percent. Hence, we reject our fourth null hypothesis and conclude that there is a significant impact of IT investment on financial performance of Nigerian banks as measured by EPS. But the impact is negative meaning that IT investment failed to show productivity gain; higher IT investments are not associated with higher profit efficiency in Nigerian banks. This confirms the productivity paradox as observed for ROA, NPM and ROE.

SUMMARY OF FINDINGS

The regression analysis performed produced four regression models and it was observed that all the four models had a significant relationship between the Nigerian bank performance measured by ROA, NPM, ROE, and EPS and the independent variables (IT investment, TR and TC) because the P-values obtained for the four models are less than α = 0.05 significance level. Also, an F-test to test the four models fixed effects parameters that all the fixed effects parameters are zero was performed and it was observed that all the fixed effects parameters for the four models are significantly different from zero because their P-values obtained are less than α = 0.05 and 0.1 significance level. T-test statistic for testing the individual coefficients for the four models developed to see if the independent variables, that is IT investment TR and TC has significant impact on the financial performance of Nigerian banks. It was observed that IT investment has a significant negative impact on Nigerian banks performance except for NPM which was not significant but also carried a negative sign. But TR and TC are all statistically significant for the four models carrying positive and negative signs respectively and these signs for TR and TC are the expected signs meaning that there is significant increase in total earnings (TR) and decrease in total cost (TC) by Nigerian banks hence; their impact on banks performance are significantly adequate.

However, the case of IT investment turned out differently because the signs (negative) obtained for the four models are not the expected signs (positive). These findings confirmed that the impact of IT on Nigerian banks performance is negative on the profit side as measured by ROA, NPM, ROE and EPS: higher IT investments are not associated with higher profit (Beccalli, 2006; Casolaro and Gobbi, 2007; Ekata, 2012). This confirms the IT productivity paradox exist in the Nigerian banking system and implies that despite heavy IT investment the premium price has yet not been paid given the higher IT quality of their output. As Beccalli (2006) stated the findings points to the role of IT as a strategic necessity, rather than a variable to generate a competitive

advantage. The adoption of increasingly expensive IT infrastructures becomes a structural component of the competition in the banking industry.

The result obtained is in line with Shu and Strassmann (2005) where they studied the role of IT in the financial profitability of banks in the United States using 12 banks in a period of 8 years which is between 1989 and 1997, their regression result showed that IT expenditure had the most marginal productive effect among all the input (independent) variables that contributed to profitability.

In a similar study by Ho and Mallick (2006) where they applied cost reduction concept they developed an IT investment profitability model for studying the effects of IT investment on profits that accrue to banks. They tested the model using 68 United States banks covering 1985 through 2005 and their results indicated that IT could lead to cost savings such as payroll expenses also, that increased IT spending, deployment, and use could introduce network effects, which reduced profits. In addition, the study showed no relationship between IT spending and market share. They inferred that network effects influenced the relationship between IT investment and profitability that is a "product displays positive network effects when more use of the product by any user increases the product's value for the other users" (Sundararajan, 2006). The inverse of the relationship is true, negative network effects imply that a product decreases in value if fewer people use the product and in Nigeria, where the cost of IT limits computer ownership and use, the impact of network effect could be noticeable. In a most recent research by Ekata (2012) who studied the impact of IT on the Nigerian financial sector concluded from the findings of his research that IT investment does not improve the financial performance of the banking sector it only increase customer satisfaction.

CONCLUSION

Despite banks in Nigeria being among the major investors in IT, it was found that there was a significant relationship between investment in IT and financial performance of Nigerian banks when measured by ROA, ROE and EPS. While the financial performance is measured by NPM there was no evidence of the significance of IT investment on Nigerian banks financial performance. However, the impact effect of IT investment on banks performance is negative indicating the existence of a profitability paradox. This evidence could be as a result of certain factors highlighted by Beccalli (2006) that it could be that IT investment by Nigerian banks is predominantly used for strategic reasons – either to lower or increase entry barriers – and these countervailing forces balance each other out (or even the former outweigh the latter resulting in lowering market power).

The IT productivity paradox result obtained in this research work could be another evidence for supporting Agboola and Salawu (2008), they stated that Nigerian commercial banks were yet to optimize the utilization of IT in transaction processing consisting of deposit, withdrawal, account enquiries, new account processing, loans, and overdraft processing. They further stated that until Nigerian banks optimize the capacity of their IT investments, the full benefits of technology may be elusive to them.

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