



# Information and Communication Technology and Sustainable Performance of Selected Listed Deposits Money Banks in Lagos State, Nigeria

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**Abstract:** In recent times, performance declined in the Nigerian banks with an imminent systemic poor operational and financial performance of the financial sector, could have a grave effect on the economy entirely. Also, lack of knowledge and inappropriate applications of ICT tools and techniques has resulted to poor sustainable performance of most Nigeria banks and this has led to continuous low profitability of the banks. Hence, the need to examine how ICT tools can enhance sustainable performance of banks. This research study adopted a cross-sectional survey research design with the use of structured questionnaire, which was designed to obtain data from respondents. The study population comprised all top and middle strategic managers of the 19 quoted deposit money banks in Nigeria as at the end of 2019 with a total of 3,407 staff, Stratified random sampling method was also used for the selection of 510 deposit money banks' employees from the selected banks branches. The result of findings show that ICT dimensions (mobile banking, online banking, automated teller machine and bankers automated clearing service) has significant effect on customer loyalty ( $Adj. R^2$  of 0.938  $F$ -statistic $_{(4, 470)}=180.142$ ,  $p<0.05$ ). Also on customer satisfaction ( $Adj. R^2$  of 0.903 000 ( $F$ -statistic $_{(4, 470)}=149.584$ ,  $p<0.05$ ). Also on profitability of selected deposit money banks in Lagos state, Nigeria ( $Adj. R^2$  of 0.915, ( $F$ -statistic $_{(4, 470)}=160.440$ ,  $p<0.05$ ). The result also shows that ICT dimensions have significant effect on service delivery ( $Adj. R^2$  of 0.635,  $F$ -statistic $_{(4, 470)}=206.603$ ,  $p<0.05$ ). These implies that deposit money banks should improve policies that strengthen its employment of ICT dimensions as this will enhance the overall performance and performance sustainability of the deposit money banks in Nigeria.

**Keywords:** Information Communication Technology (ICT), Sustainable Performance, Banks

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## 1. Introduction

### 1.1. Background to the Study

Globally, information technology has become a key element in economic development of many countries in the world. Over the years, many innovations have taken place in the world, the most striking and most celebrated is the aspect of information technology [1]. Technology is affecting the life of every individual and organization both qualitatively and quantitatively in the present age [66]. The advent of electronic business and information and communication technology has heralded some fundamental changes in the way existing businesses operate [34]. Online technology

holds the potential to fundamentally change banks and the banking industry [60]. The past two decades have witnessed a significant shift in banking practice and operation towards online banking. Qureshi [57] observed this shift and noted that many banks have shifted from the traditional arm chair banking to online banking system, where customers can use self-service channels such as automated teller machines (ATM) and online to satisfy their financial needs.

The advent of electronic business and information and communication technology has heralded some fundamental changes in the way existing businesses operate [34]. Online technology holds the potential to fundamentally change banks and the banking industry [60]. The past two decades have witnessed a significant shift in banking practice and

operation towards online banking. [57] observed this shift and noted that many banks have shifted from the traditional arm chair banking to online banking system, where customers can use self-service channels such as automated teller machines (ATM) and online to satisfy their financial needs. The main reason for this dramatic shift has been its perceived usefulness in terms of ease of transaction, security and privacy provided by online banking. But unfortunately, despite the importance attached or attributed to online banking in a number of ways, there seems to be fewer studies about online banking especially in the Nigerian banking context [5]. Worse still, there have been a low adoption level among consumers and its usage has not really brought any significant change in business relationship between the banks and their customers. Existing literature on online banking in Nigeria indicates that despite its growing use and adoption by many banks attempting to be technologically driven, no significant effort has been made to understand whether the customers whom the technology are meant are satisfied or not and what factor (s) determine their satisfaction. Moreover, although some banks have attempted implementing full online banking services, its adoption by consumers has been quite slow, perhaps either because consumers are not aware of such services or are reluctant adopting them because of some seeming problems associated with online banking [8]. In the United States, most modern banks have deployed internet banking capabilities in an attempt to reduce costs while improving customer service. Despite the potential benefits that online banking offers consumers, the adoption of online banking has been limited and, in many cases, which have fallen short of expectations [18, 62]. While all of the top 50 largest banks in the US offered Internet banking by 2012 and approximately 91% of US households had a bank account [43], only 17% of consumers adopted online banking. At the time, analysts estimated that this online banking penetration would not exceed 30% of all bank households by 2013 [14]. This prediction appears to have been realized. An American Bankers Association survey in the summer of 2013 found that only 23% of US customers use online banking as their primary banking method [29]. Prior research on On-line banking adoption has principally used survey methods to attribute social and technical dimensions such as attitudes towards new technology, awareness, access and usability to the variation in internet banking adoption and usage, [31, 38, 45, 46].

Report on e-banking system in Nigeria reveals that e-payment machinery, especially the card technology is presently enjoying the highest popularity in Nigeria banking market. ATM in Nigeria has risen to 83% in 2006 to 289% in 2007. According to inter-switch statistics, Nigeria has 30million ATM card holders who conduct over 100 million transactions on the machines every month. Nigeria's 24 banks operate over 9,000 ATM machines across the country's 36 states and Federal Capital Territory. Also to enhance effective security measure, banks have since early this year been upgrading their ATM cards from the magnetic stripe to the Euro-Visa-Master card standard, popularly known as Verve

Card [3].

Banks face serious challenges in managing the dynamic nature of their customers who are now sophisticated and knowledgeable in the banking relationship. Thus, banks have developed so many strategies to be more responsive to the demand of their customers and to manage the situation for survival and growth through reduced costs of operation, significant share of customer's transaction, profitability [3]. Eventually, the ICT became the lifeblood of any organization for growth and development. Thus, the entire world is moving away from traditional banking to computerized banking applications. Consequently, there has been huge investment in ICT infrastructures and personnel. Related to this, there have been significant influxes of ICT companies, consultants and service providers over the years. Furthermore organizations have deployed state of the art ICT infrastructures and experienced personnel for competitive reasons over the years Abubakar & Haruna, [3]. They have developed, applied and implemented the best ICT policy accordingly. Banks have been facing the top challenges of required ICT capital investments in human capacity building, deployment of equipment's, systems or designing applications, due to the ever rapid changing ICT technology and the dynamism of the global ICT industry in particular. Over the years, banks have invested huge capital in deployment of ICT solutions for front office and back office automation accordingly. However the ever increasing challenges of ICT deployment with the right choice had remained a burning issue in the banking industry with the ever increasing need of interdependence [3].

The relationship between investment in ICT and business performance has received massive attention from researchers in various countries over the years. The results from these studies have been markedly conflicting. Thus, whether the level of investment in ICT actually brings real benefits to the banks or not is still a matter of concern in academic circles. This is because while some posit a positive relationship between ICT investment and performance [17, 34, 42] some others argue to the contrary [52]. Hence, there is a need for further studies to contribute to the ongoing debate on the nature of the relationship between ICT investment and bank performance. Furthermore, while most of the previous studies have focused on the relationship between ICT investment and bank performance, none of the studies have attempted to investigate the relationship between ICT cost efficiency and bank performance – an approach that is completely different from investigating the same relationship from ICT investment perspective. This new dimension to the investigation is to extend the investigation further for robustness, complementary or confirmatory purposes. Moreover, investigation of the relationship between ICT investment and ICT cost efficiency and bank performance has never been carried out in Nigeria from available stock of documented studies in this area. These are the contributions that the study stands to make to the body of existing

knowledge on the subject matter. To achieve these objectives, the study examines the relationship between ICT investments; ICT cost efficiency and bank sustainable performance in Nigerian banking industry. Based on these persistent issues of unstable bank performance and poor application of ICT system dominating the Nigeria banking industry, this study will examine the effect of information and communication technology and sustainable performance of selected listed deposits money banks in Lagos state, Nigeria.

In the United States, most modern banks have deployed internet banking capabilities in an attempt to reduce costs while improving customer service. Despite the potential benefits that online banking offers consumers, the adoption of online banking has been limited and, in many cases, which have fallen short of expectations [18, 62]. While all of the top 50 largest banks in the US offered Internet banking by 2012 and approximately 91% of US households had a bank account [43], only 17% of consumers adopted online banking. At the time, analysts estimated that this online banking penetration would not exceed 30% of all bank households by 2013 [14]. This prediction appears to have been realized. An American Bankers Association survey in the summer of 2013 found that only 23% of US customers use online banking as their primary banking method. Prior research on On-line banking adoption has principally used survey methods to attribute social and technical dimensions such as attitudes towards new technology, awareness, access and usability to the variation in internet banking adoption and usage. [38, 31, 45, 46] on e-banking system in Nigeria reveal that e-payment machinery, especially the card technology is presently enjoying the highest popularity in Nigeria banking market. ATM in Nigeria has risen to 83% in 2006 to 289% in 2007. According to inter-switch statistics, Nigeria has 30million ATM card holders who conduct over 100 million transactions on the machines every month. Nigeria's 24 banks operate over 9,000 ATM machines across the country's 36 states and Federal Capital Territory. Also to enhance effective security measure, banks have since early this year been upgrading their ATM cards from the magnetic stripe to the Euro-Visa-Master card standard, popularly known as Verve Card (NBS, 2016). This latter technological device is more fraud resistant because all the data of the customer are recorded on the chip. The union of technology and finance has recorded huge success and has impacted on financial transactions. E-banking system has become the main technology-driven revolution in conducting financial transactions. However, banks have made huge investments in telecommunication and electronic systems, users have also been validated to accept e- banking system as useful and easy to use [5]. Banks face serious challenges in managing the dynamic nature of their customers who are now sophisticated and knowledgeable in the banking relationship. Thus, banks have developed so many strategies to be more responsive to the demand of their customers and to manage the situation for survival and growth through reduced costs of operation, significant share of customer's transaction, profitability [3]. Eventually, the ICT became the lifeblood of any organization

for growth and development. Thus, the entire world is moving away from traditional banking to computerized banking applications. Consequently, there has been huge investment in ICT infrastructures and personnel.

### **1.2. Statement of the Problem**

The Nigerian banking industry is characterized by high degree of inefficiency and ineffectiveness. Banks in Nigeria render substandard and non-qualitative services to their customers, and their distribution systems are antiquated and poor ICT facilities [60]. Many banks in Nigeria have failed to retain their customer due to failure of ICT application and this had caused continuous declined in their financial and non-financial performance. This is owing to the fact that banks still depend on ledger card and branch local network banking transactions when banking transactions is now do it yourself affairs in the advanced countries through network and online service provider [8]. Additionally, precise records are not maintained in most of the banks, prompt and fair attention is not granted to customers. All these lapses and deficiencies has accounted for the underdevelopment information, communication and technology that is being experienced in the Nigerian banking sector. And this has made it arduous for the Nigerian banking sector to withstand ecumenical competition from other banks in developed nations. The quandary arises as to how information technology can be applied to banking operations in order to develop and amend the Nigerian banking industry [11]. Lack of knowledge and inappropriate applications of ICT tools and techniques has resulted to poor sustainable performance of most Nigeria banks and this has led to continuous low profitability of the banks. Most banks in Nigeria lack the technical knowhow and thus reduced customer loyalty [56]. They believe that Information and Communications Technology has brought about the use of computer system in all areas of human endeavors and that this application will lead to retrenchment or loss of jobs.

The banking industry being very competitive and homogeneous, it is difficult to maintain a customer. Much literature has focused on loyalty of customers an analysis of strategic responses to increased competition amongst commercial banks in Nigeria and competitive strategies adopted by commercial bank and factors determining brand loyalty in commercial banks [57]. Past studies have not been done on the effect of ICT application on customer loyalty of deposit money banks in Lagos state Nigeria. Attracting and keeping customer has become a great challenge for many organizations following an upsurge in competition arising from increased globalization and internationalization of firms [7]. As the competitive environment increasingly becomes fierce, the most important issue banks face is no longer to provide excellent, good quality products or services, but also to keep loyal customers who will contribute long-term profit to organizations [1]. Therefore the study will answer the question: what is the effect ICT dimension on customer loyalty of the selected deposits money banks in Lagos state, Nigeria?

In a competitive marketplace where businesses compete for customers, customer satisfaction is seen as a key differentiator and increasingly has become a key element of business strategy. Commercial banks, assaulted by the pressures of globalization, competition from non-banking financial institutions, and volatile market dynamics are constantly seeking new ways to add value to their services [12]. The bank has a large customer base and branches in the country. The services of the bank continue to be felt in every community in the country. With regard to its large deposit base, there is ever-growing pressure on its service delivery and Customer satisfaction across the country. Thus the need to introduce agency banking becomes paramount [40]. The long queues and huge crowds in the banking halls can be highly devastating and discouraging most times, especially when the weekend is near. Banking hours is a challenge that cuts across, most banks operate between 8.30am – 4.00pm on week days, 8.30-12pm on Saturdays and remain closed on Sundays and public holidays. This implies that outside the banking hours customers cannot access services. Many business people would wish to deposit and withdraw funds as need arises and would prefer a 24 hour bank. Customers are taking greater control of their banking relationships. They are switching banks, changing their behavior and demanding improvements ([40]. Therefore the study will answer the question: how does ICT dimension affect customer satisfaction of the selected deposits money banks in Lagos state, Nigeria? A strong banking sector is able to confront negative shocks and contribute to the stability of the financial system. The financial institutions are affected by numerous of factors, among these factors are internal and external factors which has direct impact on it is performance [28]. The internal factors such as the management decisions on (balance sheets and/or profit and loss accounts), size of the bank, capital, risk management and expenses management affect the profitability of the bank directly, because most of these factors remain confidential. Other internal factors, such as credit or liquidity are considered as bank specific factors, which closely related to bank management, especially the risk management [29]. The external factors affecting the profitability of banks are represented in economic situations and institutional background. The macroeconomic environment, such as inflation, interest rates and cyclical output, and variables that represent market characteristics such as market concentration, industry size and ownership status [31]. Therefore the study will answer the question: how does ICT dimension affect profitability of the selected deposits money banks in Lagos state, Nigeria?

Research on service quality in service sector like banking has been drawing high attention in this era. In early 90s, service sector has transformed greatly because of change in marketing environment [11]. Additionally, maximum number of the research has been accompanied in developed countries. Hence, there is a need for more authentication of service quality in service sector like banking particularly for developing countries like Nigeria [11]. Likewise, number of research that has been conducted in past have also identified

that customer expectations are higher and customer perceived service quality is low [11]. The basic problems faced by Nigerian banking sector are lack of qualified and well trained human resources leading to a low quality of bank services as well as traditional structure and outdated technology creating obstacles while delivering quality services to the customer. By considering this reason, nowadays many banks are working hard to resolve these problems. Also, banking sector in developing countries like Nigeria is facing the challenge of creating quality services, satisfying customer and customer loyalty because skilled human resources are lacking and banking culture lacks structure. Consequently, banking sector in Nigeria requires further research, innovation and development activities so as to satisfy customer and create loyalty. Therefore the study will answer the question: what is the effect of ICT dimension on service delivery of the selected deposits money banks in Lagos state, Nigeria? Base on these problem identified, this study will investigate the effect of ICT dimensions (mobile banking, online banking, automated teller machine and bankers automated clearing service) on bank sustainability performance.

### **1.3. Objective of the Study**

The general objective of this study was to investigate the effect of information and communication technology and sustainable performance of selected listed deposits money banks in Lagos state, Nigeria. The specific objectives based on the identified problems were to:

1. determine the effect of ICT dimensions (mobile banking, online banking, automated teller machine and bankers automated clearing service) on customer loyalty of the selected deposits money banks in Lagos state, Nigeria;
2. evaluate the effect of ICT dimensions (mobile banking, online banking, automated teller machine and bankers automated clearing service) on customer satisfaction of the selected deposits money banks in Lagos state, Nigeria;
3. examine the effect of ICT dimensions (mobile banking, online banking, automated teller machine and bankers automated clearing service) on profitability of the selected deposits money banks in Lagos state, Nigeria;
4. assess the effect of ICT dimensions (mobile banking, online banking, automated teller machine and bankers automated clearing service) on service delivery of the selected deposits money banks in Lagos state, Nigeria; and

### **1.4. Hypotheses of the Study**

In order to validate data analysis, the following hypotheses were tested in this study.

H<sub>01</sub>: ICT dimension (mobile banking, online banking, automated teller machine and bankers automated clearing service) do not significantly affect customer loyalty of the selected deposits money banks in Lagos state, Nigeria.

H<sub>02</sub>: There is no significant effect of ICT dimension (mobile banking, online banking, automated teller machine

and banker's automated clearing service) on customer satisfaction of the selected deposits money banks in Lagos state, Nigeria.

H<sub>03</sub>: ICT dimension (mobile banking, online banking, automated teller machine and bankers automated clearing service) do not significantly affect profitability of the selected deposits money banks in Lagos state, Nigeria.

H<sub>04</sub>: There is no significant effect of ICT dimension (mobile banking, online banking, automated teller machine and banker's automated clearing service) on service delivery of selected deposits money banks in Lagos state, Nigeria.

## 2. Literature Review

### 2.1. Conceptual Review

#### 2.1.1. Information and Communication Technology (ICT)

Efforts to define ICTs often provide a range of descriptions. There is not one agreed definition of ICTs. However, the concept of ICTs has been applied to several situations (poverty reduction, development, empowerment, social change) with circumstances different to each other. More often, ICTs are associated with the Internet, computers and the World Wide Web [32]. Information and communication technology usually called ICT is often used as an extended synonym for information technology (IT). But it is usually a more general term that stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), intelligent building management systems and audio-visual systems in modern information technology. ICT consists of all technical means used to handle information and aid communication, including computer and network hardware, communication middleware as well as necessary software. In other words, ICT consists of IT as well as telephony, broadcast media, all types of audio and video processing and transmission, and network based control and monitoring functions [20, 64] (2012) defined information communication technology as a broad-based term that encompasses the gathering, acquiring, organization, packaging, storage and retrieval, dissemination of above multi-media, using a combination of computers and telecommunications. Information communication technology (ICT) is the automation of processes, controls, and information production using computers, telecommunications, software and ancillary equipment such as automated teller machine and debit cards [40]. It is a term that generally covers the harnessing of electronic technology for the information needs of a business at all levels.

#### 2.1.2. Mobile Banking

Mobile banking is an innovative technology that has gained popularity in Africa and other parts of the world [45]. Mobile banking services consist of things such as balance enquiry, fund transfer among other services. The adoption of mobile banking has brought about changes in banking operations following the advancement of mobile communication techniques and the collaboration with mobile service providers as a result; the mobile banking technology

has become more conducive to individuals and banking sector [45]. Mobile banking is an electronic banking system which allows customers to get access to their bank accounts via SMS (supported by telecommunication networks), website of the bank (internet) and smart phone applications. The service offered when using mobile banking is such as withdrawal, deposits and bill payments. [15] defined mobile banking as a situation whereby the customer interacts with a bank via mobile device, such as mobile phone and Personal Digital Assistant (PDA).

#### 2.1.3. Online Banking

Online banking according to [29] is to give customers access to their bank accounts via a web site and to enable them to enact certain transactions on their account, given compliance with stringent security checks. [6] view online banking as an outgrowth of personal computer banking. According to [6], online banking makes use of the Online as its delivery channel where it enables electronic banking by connecting to the bank for variety of services. Online banking literally means the setting up of good webpage in a bank to offer information about its variety of products and services. Through the Online users can access their account from browser software that carries out online banking programs situated on the bank world wide web server. Online banking offer more convenience and a great deal flexibility to customers as the can have a greater degree over their banking activities. Online banking has been described by various authors in various ways, but popular among the various definitions is the one developed by [12]. These authors described online banking as a banking process where a customer can access his or her bank account via the online using personal computer, mobile phone or Web browser.

#### 2.1.4. Automated Teller Machine (ATM)

Automatic Teller Machines (ATMs), according to El-haddad and Mahmeed, (1992) is one of the essential the technological innovations introduced in banking. According to them ATMs are probably the most obvious pieces of electronic device used to provide financial services and is indeed growing rapidly. The growth in ATM usage actually reveals it acceptability among customers as a means of accessing banking services. ATMs is described as: an ATM combines a computer terminal, record-keeping system and cash vault in one unit, permitting customers to enter the bank's book keeping system with a plastic card containing a Personal Identification Number (PIN) or by punching a special code number into the computer terminal linked to the bank's computerized records 24 hours a day (Rose, 1999). Adewale and Afolabi (2013) described "automated teller machine as a machine built into a well with a computerized system connected to the bank that is providing it". The automated teller machine is self-service terminals usually at viable locations mainly to provide the services of a cashier and customer related services during and after banking hours.

### **2.1.5. Bankers Automated Clearing Service**

Bankers automated clearing service are the physical hardware, transmission media, and software used to interconnect computers and users in the cyber world which includes internet servers, web servers, internet storage, internet network equipment, and infrastructure software [8]. IT infrastructure is a shared set of capital resources that provides the foundation on which specific IT applications are built [26]. According to [25] information technology (IT) infrastructures are shared technology and technology services across the organization. [63] Describe IT infrastructure as the foundation of IT capability, delivered as reliable services shared throughout the firm and coordinated centrally, usually by the information systems group. Hence, infrastructure can be said to mirror an organization's historic process with the use of IT and tends to be highly path-dependent in its accumulation [39].

### **2.1.6. Sustainable Bank Performance**

The concept of sustainability with regard to organizational change can be defined in various ways. [17], considered sustainability as a continuum of work methods, goal attainment and process of development. Sustainability performance can be defined as the performance of a company in all dimensions and for all drivers of corporate sustainability [4]. It extends beyond the boundaries of a single company and typically addresses the performance of both upstream suppliers and downstream customers in the value chain. Performance is an extensively used concept in many areas. Usually, performance is a measure of how well a mechanism or a process accomplishes its objective. Performance is claimed to be a multidimensional and complex construct that has been measured using an array of indicators [49]. In organizational point of view, performance means how well the organization is managed and the value the organization delivers for customers and other stakeholders [65, 58], stated that measuring performance allows organizations to focus on units that need improvement by evaluating the level of work progress in terms of cost, quality and time as well as consolidating in areas with higher output.

### **2.1.7. Customer Satisfaction**

According to [2], customer satisfaction is transaction-specific affective response resulting from the customer's comparison of product performance to some pre-purchase standard. According to [50], customer satisfaction is an attitude - like post consumption evaluative judgment varying along the hedonic continuum. He said further that customer satisfaction is the overall post-purchase evaluation. According to [56], customer satisfaction is a summary attribute phenomenon coexisting with other consumption emotions. Customer satisfaction is a post-choice evaluative judgment concerning a specific purchase selection. According to [56], customer satisfaction is the evaluation of the perceived discrepancy between prior expectations (or some norm of performance) and the actual performance of the product as perceived after its consumption.

According to [22], customer satisfaction is conceptualized as a feeling developed from an evaluation of the use experience. According to [24], customer satisfaction is the evaluative response to the current consumption event. the consumer's response in a particular consumption experience to the evaluation of the perceived discrepancy between prior expectations (or some other norm of performance) and the actual performance of the product perceived after its acquisition. He explained that customer satisfaction is conceptually, an outcome of purchase and use resulting from the buyer's comparison of the rewards and costs of the purchase relative to anticipated consequences. Operationally, similar to attitude in that it can be assessed as a summation of satisfactions with various attributes. According to [56] Oliver (2013), customer satisfaction is an evaluation of the surprise inherent in a product acquisition and/or consumption experience. In essence, the summary psychological state resulting when the emotion surrounding disconfirmed expectations is coupled with the consumer's prior feelings about the consumption experience.

Businesses monitor customer satisfaction in order to determine how to increase their customer base, customer loyalty, revenue, profits, market share and survival. Although greater profit is the primary driver, exemplary businesses focus on the customer and his/her experience with the organization. They work to make their customers happy and see customer satisfaction as the key to survival and profit. Customer satisfaction in turn hinges on the quality and effects of their experiences and the goods or services they receive. According to [41], customer satisfaction is a person's feelings of pleasure or disappointment resulting from comparing a product's perceived performance in relation to his or her expectations. Customer satisfaction is defined as a customer's overall evaluation of the performance of an offering to date. This overall satisfaction has a strong positive effect on customer loyalty intentions across a wide range of product and service categories.

### **2.1.8. Customer Loyalty**

A pivotal factor of relationship marketing is customer loyalty. Loyalty theory assumes that the development of trust, commitment, and responsiveness or engagement will lead to customer behavioral and psychological commitment to the organization [23]. Some studies state that high customer involvement creates loyalty in the long run [19]. Loyalty is often described to exhibit as a repeat purchase from one supplier when others are available, increased amount of transactions with the supplier, engaging in dialogue with the supplier, referring the supplier in positive manner, experiencing beneficial outcomes from the exchange, and many other manifestations [23, 33, 19] conceptualized a framework where two distinct paths to loyalty are identified, divided by the differences between repeated purchaser and a new customer. [19] concludes that customer segment specific marketing strategies with natural loyalty progression should be conducted if relationship marketing is to become truly effective.

### 2.1.9. Profitability

Sometimes, the terms 'Profit' and 'Profitability' are used interchangeably. But in real sense, there is a difference between the two. Profit is an absolute term, whereas, the profitability is a relative concept, (Harward, 2014). Profitability is an important yardstick for measuring bank performance, the extent of profitability cannot be taken as a final proof of overall bank performance. There are other non-financial indicators that determine bank performance such as; bank customer satisfaction, bank service delivery, cost of bank product and service, customer loyalty etc. According to [51], profitability means ability to make profit from all the business activities of an organization, company, firm, or an enterprise. It shows how efficiently the management can make profit by using all the resources available in the market. According to [36] profitability is the ability of a given investment to earn a return from its use. Profitability has been given considerable importance in the finance and accounting literatures. According to [37], Profitability is one of the most important objectives of financial management since one goal of financial management is to maximize the owners' wealth, and, profitability is very important determinant of performance.

## 2.2. Theoretical Review: The Two Theories Were Used for This Study

### 2.2.1. Innovation Diffusion Theory (IDT)

Diffusion of Innovation (DOI) Theory by [67], is one of the oldest social science theories. It originated in communication to explain how, over time, an idea or product gains momentum and diffuses (or spreads) through a specific population or social system. The end result of this diffusion is that people, as part of a social system, adopt a new idea, behavior, or product. Adoption of a new idea, behavior, or product (i.e. innovation) does not happen simultaneously in a social system; rather it is a process whereby some people are more apt to adopt the innovation than others. Researchers have found that people who adopt an innovation early have different characteristics than people who adopt an innovation later. When promoting an innovation to a target population, it is important to understand the characteristics of the target population that will help or hinder adoption of the innovation. Rogers' diffusion of innovations theory is the most appropriate theory among all theories for investigating the adoption of technologies in banking sector and bank environments.

### 2.2.2. Contingency Theory

Contingency theory by [68]) suggests that an information system should be designed in a flexible manner so as to consider the environment and organizational structure confronting an organization. Information systems also need to be adapting to the specific decisions being considered. In other words, information systems need to be designed within an adaptive framework. Review of accounting information system literature also indicate that most Artificial Intelligence System (AIS) studies have incorporated contingency factors

such as organizational structure, business strategy, and environmental condition in their research model but have neglected the influence of IT on AIS design. Furthermore, the few studies that have examined the relationship between AIS design and IT have defined IT in a narrow perspective [68]. Similar to IT researches, these studies viewed IT from the technological perspective only but failed to incorporate other perspectives of IT sophistication such as informational, functional and managerial.

## 2.3. Empirical Review

[15] Investigated the complex factors that prevent customers from adopting and using mobile banking services in Mauritius. The researchers used a quantitative approach, they also combined the TAM and IDT together with perceived risk and cost construct to investigate perception of m-banking in Mauritius. The study revealed that age, gender and salary had no influence on adoption but rather, Convenience, compatibility and banking needs influenced banking adoption. On the other hand, Perceived security risk and reliability were found to be the only obstacles to m-banking usage but also that m-banking usage is not associated with age, gender and salary. [3] The researchers investigated on the factors that influence the use of mobile banking in Bangladesh. The approach for this study was quantitative. During the course of the research a self-administrated questionnaire was given to the clients of two full-fledged mobile banking service providers of Bangladesh called Brac Bank Limited and Dutch Bangla Bank Limited. 100 questionnaires were distributed but only 64 useable questionnaires were returned giving a response rate of 64 percent. The data was analyzed using multiple regressions and the outcome of the research was that, Variables such as ability, integrity, benevolence, perceived usefulness, perceived ease of use relative cost and time advantages were found to influence the adoption of mobile banking. [38] Pakistan inspected those factors that affect Pakistan customers from adopting mobile banking services. Data collection was done by surveying 372 respondents from the two largest cities (Karachi and Hyderabad) of the province Sindh by use of judgment sampling method. The researcher used a correlation research design and the analysis was done using multiple regression in order to come up with the findings. TAM model played a big role in this research, variables such as social influence, perceived risk, perceived usefulness, and perceived ease of use to study whether they affected the adoption of mobile banking in Pakistan. According to [40] this research investigated those factors that affect Isfahanian Mobile Banking Adoption in Iran, Based on the Decomposed Theory of Planned Behavior. The result of this study suggested that there were only two important factors which are Attitude and perceived behavioral control under which factors such as perceived usefulness, perceived ease of use, compatibility and trust have an influence on behavioral attitude to adopt mobile banking. [39] Investigated on the barriers towards Mobile Banking System adoption among young people in Germany. This study was

based on the Technology acceptance model (TAM) model. They received 155 responses from all the questionnaires that were sent, they also used a structure equation modeling (SEM) approach to test the hypothesis. The results of the study indicated that compatibility, perceived usefulness, and risk are significant indicators for the adoption of Mobile banking systems in Germany.

Evidence from other empirical studies conducted on the contribution of automated teller machines (ATMs) to banks' profitability reveal that investment in ATMs increases both the volume and value of deposit accounts, reduces banking transaction costs, reduce the number of staff and the number of branches and consequently improves banks' profitability [2]. Several authors have conducted investigation on the impact of ICT on the banking sector. [48] Empirically revealed that the effect of bank ICT on customer deposits and profitability in the respondent's bank is positive. Additionally, the study established that ICT has led to a positive effect on the total income of the banks specifically in relation to increasing commission fee based income, increase of interest based income and expanding the income generating potential of the bank enhancing the performance of the organizations. In addition, debit & credit cards have the highest effect on the total income of the banks followed closely by mobile banking, Automated Teller Machines (ATMs) and Point of Sale (POS) Terminals respectively. The study also ascribed that the use of ICT has led to a positive effect on the return on assets of the banks. Internet banking has the highest effect on the return on assets of the banks followed by automated teller machines (ATMs), point of sale (POS) terminals, electronic funds transfer, debit & credit cards as well as mobile banking respectively.

[8] Discussed the dimensions in which automation in the banking industry is manifested in Nigeria. They include (i) bankers automated clearing services, which involves the use of magnetic ink character reader (MICR) for cheques processing. It is capable of encoding, reading and sorting cheques: automated payment systems; devices used here include automatic teller machine (ATM), plastic cards and electronic funds transfer and automated delivery channels: These include interactive television and the Internet.[16] investigated the relationship between information and communication technology investments and small firms' performance. His study reveals that there was a significant performance difference between firms that adopt ICT and those that do not adopt the technology. Furthermore, [56] in their study (covering fifteen banks over a period of ten years) on investments in ICT and bank business performance in Ghana find that investment in ICT tend to increase profitability (ROA and ROE) for high ICT level banks than for lower ICT level banks.

[14] Examined the impact of information and communication technology (ICT) on commercial bank performance. The study found that the use of ICT increases return on capital employed as well as return on assets of the South African banking industry. The study discovers that more of the contribution to performance comes from

information and communication technology cost efficiency compared to investment in information and communication technology. [13] empirically examines the impact of e-banking in Nigeria's economy and found customers are satisfied with e-banking system which provides convenience and flexible advantages such as easy transfer, speedy transfer, less cost and time saving benefits. He further established that e-banking enhance bank profitability.

[3] Studied impact analysis of information and communication technology on finance and economic growth in Nigeria (2001 – 2011). 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 [11]. But 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 will have superior efficiency at any point in time.

[20] In their study was about an analysis of the factors that influence mobile banking adoption in the rural Zimbabwe through extending the technology acceptance model. The researcher adopted use of stratified random sampling and the results of the study suggested that factors such as perceived usefulness, PEOU, relative advantage, personal innovativeness and social norms influenced the intention to accept and use mobile banking. [21] Taiwan, investigation of the factors that affect individual need to adopt mobile banking through use of the UTAUT model. Factors such as social influence, perceived financial cost, performance expectancy, and perceived credibility were found to be the major influencing factors for the adoption of mobile banking.

[54] They conducted an investigation to study the factors that influence the adoption of mobile banking in Pune city. They used the UTAUT model in their study, the research was Exploratory and adopted the use of quantitative design, the results suggested that mobile banking in Pune city was mostly adopted by married people particularly men. Experience and interface in mobile banking was also found to be non-user friendly people thought it was inconvenient to use it unlike other services. [53], this was an empirical study that was conducted with the aim of investigation on the factors that affect the Malaysian consumers from adopting mobile banking services. From the study, variables such as perceived ease of use, Perceived usefulness and relative advantage were found to be positively and significantly related to the intention to adopt mobile banking services while a constructs such as perceived risk was found to be negatively correlated with the adoption of mobile banking.

[13] Empirically examines the impact of e-banking in

Nigeria's economy and found customers are satisfied with e-banking system which provides convenience and flexible advantages such as easy transfer, speedy transfer, less cost and time saving benefits. [50] also provide an understanding of how and why specific factors affect the consumer decision about Online banking in an Australian context and found convenience as the main motivator for consumers to bank online.[30] analyzed how perceptions of consumers about traditional bank influence their decision to adopt the services offered by the same bank on the online and found consumer trust in a traditional bank as well as income, age and sex of the respondents as the major factors that influence consumer decision to work with the same bank via the online. Thus, online banking service has recently become very effective offering sophisticated tools, including account aggregation, stock quotes, rate alerts and portfolio managing programs to help their customers manage all their assets more effectively and on time.

#### 2.4. Justification for the Study

Several studies such as [3, 9, 7, 16, 55, 50, 54] among others have examine how ICT affect firm/bank performance. Most of these past studies failed to investigate how application of ICT determines sustainability performance of deposit money banks. Furthermore, most of these past studies in Nigeria have not established the link between application of ICT and sustainability performance of deposit money banks in Nigeria and also they have not employed bank customer loyalty as a measure for sustainable bank performance. In the light of this, there is a need to investigate the link between application of ICT and sustainability performance measure by bank customer loyalty of deposit money banks in Nigeria. Several studies such as [58, 55, 38, 42, 50, 59, 54] among others have examine the link between ICT and firm/bank performance. Most of these past studies do not examine how application of ICT enhances sustainability performance of deposit money banks. Similarly, most of these past studies in Nigeria have not established the link between application of ICT and sustainability performance of deposit money banks in Nigeria and also they have not employed bank customer satisfaction as a measure for sustainable bank performance. In the light of this, there is a need to examine the link between application of ICT and bank customer satisfaction of deposit money banks in Nigeria. Several studies such as [13, 42, 49, 30, 57, 54] among others have examine the link between ICT and firm/bank performance. Most of these past studies do not examine how application of ICT enhances sustainability performance of deposit money banks. Similarly, most of these past studies in Nigeria have not established the link between application of ICT and sustainability performance of deposit money banks in Nigeria and also they have not employed bank profitability as a measure for sustainable bank performance. In the light of this, there was the need to examine the link between application of ICT and bank profitability of deposit money banks in Nig.

### 3. Methodology

#### 3.1. Research Design

This research study adopted a cross-sectional survey research design with the use of structured questionnaire, which is designed to obtain data from respondents. The study population cuts across all top and middle strategic managers of the 19 quoted deposit money banks in Nigeria as at the end of 2019 with a total of 3,407 staff, the banks are categorized into international and national deposit money banks in Nigeria. The characteristic of the study population is mixed at every top and middle management level of the deposit money banks irrespective of gender, age, marital status, highest educational qualification, job status and years worked in the bank. The deposit money banks in Lagos State were considered in this study. Three deposit money banks were selected from each national and international categorization of deposit money bank by Central Bank of Nigeria (2015). These banks were selected based on their five years' financial performance, number of staff strength and year of establishment. The sample size was drawn from the sampling frame of the selected six banks among the 19 quoted deposit money banks in Nigeria i.e three banks were selected from national and international banks. The sampling frame for this study was among six selected deposit money categorized into national and international authorization. In this study three leading banks were selected based on their financial performance, total asset and year of establishment from each categorization of deposit money banks in Nigeria.

The sample size was determined from sampling frame using Cochran (1997) formula sample size determination. The sample size for this study was determined by applying the Cochran (1997) formula as is standard method of randomization and identify the limits of errors considered as the most essential items in the survey. This helped the researcher obtain the sample and use the results to make sampling decisions based on the data.

The formula is:

$$n = \frac{NZ^2pq}{d^2(N-1) + Z^2pq}$$

Where:

n=sample size

N=Population of staff of the selected banks (N=3,407)

Z=95% Confidence Interval (Z=1.96),

p=0.5,=p is the estimated proportion of an attribute that is present in the population. q Is 1-p. (p) (q) are the estimate of variance

$$q=1-p$$

d=degree of accuracy or estimation (d=0.04)

Therefore;

$$n = \frac{3,407 (1.96)^2 (0.5) (0.5)}{(0.04)^2 (3,407- 1) + (1.96)^2 (0.5) (0.5)} = 510$$

n=510

Stratified random sampling method was used for the selection of 510 deposit money banks' employees from the selected banks branches.

A pilot study was conducted to pre-test the questionnaire on deposit money banks that are not selected in this study (10% of the sample size) which were randomly selected from the sample across categorized banks that are not part of this study. In this study, Access Bank Limited was selected from international bank categorization and Unity Bank Limited was selected for national categorization of banks for pilot study. The purpose of the pilot study is to adjust the questionnaire so that respondents will have no problems in answering the questions and will be no problems in recording the data. Data analysis for this study was done in two stages: the descriptive and inferential analysis. The research instrument was subjected to expert opinion validity as recommended by Raza and Nawaz (2011). In order to make

sure that the research instrument is valid, the instrument was subjected to content validity.

Following the research suggestions of Malik (2011) Cronbach's alpha establish the internal consistency of the research instrument. In order to determine the internal consistency reliability of each variable, coefficient alpha was applied on the pilot test conducted. The construct validity of the research instrument will further be established through confirmatory factor analysis. Average Variance Extracted (AVE), greater than 0.5 was used as an additional evidence of construct validity of all variables in the research instrument. The Cronbach's Alpha coefficient for all the study variables are above 0.70, which suggests that the instrument used for evaluation was highly reliable. Hence, the researcher affirms that the research instrument used is reliable. The result of the Cronbach alpha for each of the variable is presented in Table 1.

*Table 1. Validity and Reliability Statistics.*

S/N	Variables	No of Items	KMO	Bartlett's Test	Average Variance Explained	Cronbach's Alpha
1.	Mobile Banking	6	0.816	564.543	0.714	0.810
2.	Online Banking	6	0.691	662.243	0.861	0.722
3.	Automated Teller Machine	7	0.752	514.287	0.874	0.761
4.	Bankers Automated Clearing Service	7	0.682	630.218	0.799	0.759
5.	Customer Loyalty	7	0.813	524.238	0.882	0.713
6.	Customer Satisfaction	7	0.758	513.714	0.839	0.821
7.	Profitability	5	0.651	689.563	0.856	0.792
8.	Service Delivery	6	0.841	721.921	0.710	0.823

Source: Researcher's Field Survey (2019).

Data analysis for this study was done in two stages: the descriptive and inferential analysis. The first stage (the descriptive analysis) featured descriptions of the properties of the data to show the variations in responses of the study's participants using such tools as frequencies and percentage distribution tables, bar charts, means and standard deviations. It also provided the views and opinions of the respondents on ICT system and their effect on bank sustainable performance. The second stage (the inferential analysis) is the analysis of the responses on the quantitative data and the relationships. This was carried out using statistical tools of multiple regression method of analysis using SPSS (Statistical Package for Social Sciences) software version 22.0 to test the effect link between the independent variables on the dependent variable. The multiple regression method of analysis was employed to examine the effect of ICT dimensions (independent variables) on bank performance (dependent variables) that are used in this study. The multiple regression method of analysis was used for hypotheses one to four. The study also examined hypothesis five of the multiple effect of ICT components on sustainable bank performance through multiple regression.

### 3.2. Model Specification

In this study, there were two constructs; independent and dependent variables. Application of ICT serves as the

independent variable, and measured by mobile banking, online banking, automated teller machine and bankers automated clearing service while the dependent variable is sustainable bank performance measure with customer loyalty, customer satisfaction, profitability and service delivery. The model for the variables is denoted in the equations below:

Y=Dependent Variable

X=Independent Variable

Y=Sustainable Bank Performance (SBP)

Y=(y<sub>1</sub>, y<sub>2</sub>, y<sub>3</sub>, y<sub>4</sub>)

y<sub>1</sub>=Customer Loyalty (CL)

y<sub>2</sub>=Customer Satisfaction (CS)

y<sub>3</sub>=Profitability (Pr)

y<sub>4</sub>=Service Delivery (SD)

X=(x<sub>1</sub>, x<sub>2</sub>, x<sub>3</sub>, x<sub>4</sub>)

x<sub>1</sub>=Mobile Banking (MB)

x<sub>2</sub>=Online Banking (OB)

x<sub>3</sub>=Automated Teller Machine (ATM)

x<sub>4</sub>=Bankers Automated Clearing Service (BACS)

Functional Relationship

y<sub>1</sub>=f(x<sub>1</sub>, x<sub>2</sub>, x<sub>3</sub>, x<sub>4</sub>)

$$CL=f(MB, OB, ATM, BACS) \quad (1)$$

y<sub>2</sub>=f(x<sub>1</sub>, x<sub>2</sub>, x<sub>3</sub>, x<sub>4</sub>)

$$CS=f(MB, OB, ATM, BACS) \quad (2)$$

$$y_3=f(x_1, x_2, x_3, x_4)$$

$$Pr=f(MB, OB, ATM, BACS) \tag{3}$$

$$y_4=f(x_1, x_2, x_3, x_4)$$

$$SD=f(MB, OB, ATM, BACS) \tag{4}$$

The models formulated for each of the hypotheses are written as:

Hypothesis One

$$y_1=f(x_1, x_2, x_3, x_4)$$

$$CL=\beta_0+\beta_1MB+\beta_2OB+\beta_3ATM+\beta_4BACS+\epsilon_i$$

Hypothesis Two

$$y_2=f(x_1, x_2, x_3, x_4)$$

$$CS=\beta_0+\beta_1MB+\beta_2OB+\beta_3ATM+\beta_4BACS+\epsilon_i$$

Hypothesis Three

$$y_3=f(x_1, x_2, x_3, x_4)$$

$$Pr=\beta_0+\beta_1MB+\beta_2OB+\beta_3ATM+\beta_4BACS+\epsilon_i$$

Hypothesis Four

$$y_1=f(x_1, x_2, x_3, x_4)$$

$$SD=\beta_0+\beta_1MB+\beta_2OB+\beta_3ATM+\beta_4BACS+\epsilon_i$$

Where  $\beta$ =the constant of the equation  
 $\beta_1$ - $\beta_4$ =the coefficient of variables in the equations;  
 $\epsilon_i$ =the stochastic function that accounts for the errors that may arise in the equation.

## 4. Results, Interpretation and Discussion of Findings

### 4.1. Normality Tests of the Study Variables

Table 2 shows the normality of data distribution which was assessed by examining its skewness and kurtosis (Kline, 2005). A variable with an absolute skew-index value greater than 3.0 is extremely skewed while a kurtosis index greater than 8.0 is an extreme kurtosis (Kline, 2005). Cunningham (2008) stated that an index smaller than an absolute value of 2.0 for skewness and an absolute value of 7.0 for kurtosis is the least violation of the assumption of normality. The results of the normality test of the dependent and independent variables indicated skewness and kurtosis in the range of -1 and +1 as shown in Table 2. This implies that the assumption of normality was satisfied. Therefore, the data was found to be suitable for inferential analysis.

Table 2. Normality Test of the Study Variables.

Variables	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
Customer Loyalty	510	-0.564	0.111	0.458	0.222
Customer Satisfaction	510	-0.335	0.111	0.239	0.222
Profitability	510	0.000	0.111	-0.482	0.222
Service Delivery	510	-0.181	0.111	-0.328	0.222
Mobile Banking	510	-0.238	0.111	0.234	0.222
Online Banking	510	-0.262	0.111	-0.277	0.222
Automated Teller Machine	510	-0.337	0.111	0.412	0.222
Bankers Automated Clearing Service	510	-1.089	0.111	4.697	0.222

Source: Survey Data (2019).

### 4.2. Multicollinearity

To test whether multicollinearity would pose a serious challenge to the study, tests based on Variance Inflation Factor (VIF) and their reciprocal tolerances were conducted. The results of the tests are presented in Table 3.

Table 3. Multicollinearity Test Results.

Variables	Tolerance	VIF	Remark
Mobile Banking	0.521	1.918	No multicollinearity
Online Banking	0.567	1.762	No multicollinearity
Automated Teller Machine	0.619	1.615	No multicollinearity
Bankers Automated Clearing Service	0.560	1.785	No multicollinearity
Aggregate Mean Score	0.583	1.725	No multicollinearity

Dependent Variable: Information and Communication Technology (ICT) Banking.

Source: Survey Data (2019).

Table 3 shows that the variables have a VIF that is less than 10 and tolerance value more than 0.1 ruling out the possibility of multicollinearity. The aggregate mean score for tolerance=0.583 and VIF=1.725. All the predictor variables

had a VIF of less than 10. The explanatory variables were not highly correlated and could not pose a serious problem. The data was thus suitable for hypotheses testing using regression analysis.

### 4.3. Test of Hypothesis

#### 4.3.1. Test of Hypothesis One

Objective One: determine the effect of ICT dimensions (mobile banking, online banking, automated teller machine and bankers automated clearing service) on customer loyalty of the selected deposits money banks in Lagos state, Nigeria;

Research Question One: What is the effect ICT dimension

(mobile banking, online banking, automated teller machine and banker's automated clearing service) on customer loyalty of the selected deposits money banks in Lagos state, Nigeria?

Hypothesis One: ICT dimension (mobile banking, online banking, automated teller machine and bankers automated clearing service) do not significantly affect customer loyalty of the selected deposits money banks in Lagos state, Nigeria.

**Table 4.** Multiple Regression Results on the Effect of ICT dimension on customer loyalty of selected deposit money banks in Nigeria.  $n=474$ .

Model	B	Std. Error	Beta	t	Sig.	R	Adj. R <sup>2</sup>	F (4,470) Value	Sig.	Durbin-Watson
(Constant)	.633	.304		2.081	.038					
Mobile Banking	.105	.047	.107	2.208	.028					
Online Banking	.218	.047	.214	4.660	.000	0.969	0.938	180.142	0.000	1.725
Automated Teller Machine	-.030	.052	-.031	-.587	.557					
Bankers Automated Clearing Services	.585	.040	.690	14.458	.000					

Dependent Variable: Customer Loyalty.

Table 4 reveals the model summary with value of R, R-square and Adjusted R – Square. The coefficient of multiple correlation ( $R=0.969$ ) shows a strong positive correlation exists between ICT dimensions and customer loyalty. The adjusted coefficient of determination ( $Adj. R^2$ ) of 0.938 shows that a combination of mobile banking, online banking, automated teller machine and bankers automated clearing service can only be explained by 93.8% of variation in customer loyalty. However the model did not explain 6.2% of the variation in customer loyalty, implying that there are other factors associated with customer loyalty which were not captured in the model.

Table 4 also shows the ANOVA result. The result revealed that overall, the explanatory power of the model was considered statistically significant with the F-statistic output of the model reporting a p-value of .000 ( $F\text{-statistic}_{(4, 470)}=180.142, p<0.05$ ). Table 4. gives beta coefficient to enable the researcher construct regression equation. As depicted in the table best predictors are Mobile Banking, Online Banking, Automated Teller Machine and Bankers Automated Clearing Service. The results reveal that mobile banking ( $\beta=0.105, p=0.028$ ), online banking ( $\beta=0.218, p=0.000$ ) and bankers automated clearing service ( $\beta=0.585, p=0.000$ ) were positively and statistically significant to customer loyalty at 5% level of significance.

Regression Model One

$$CL=0.633+0.105MB+0.218OB+0.585BACS \quad (5)$$

Where;

CL=Customer Loyalty

MB=Mobile Banking

OB=Online Banking

BACS=Bankers Automated Clearing Service

From the above regression equation, it was revealed that holding mobile banking, online banking and bankers automated clearing service, customer loyalty would be at 0.633. A unit increase in mobile banking would lead to 0.105

increases customer loyalty, a unit increase in online banking would lead to 0.218 increase in customer loyalty and also a unit increase in bankers automated clearing service would lead to 0.585 increase in customer loyalty. The results show that mobile banking, online banking and banker's automated clearing service were significant and automated teller machine was insignificant. Since, most of regression coefficients were significant as indicated in table 4, at significant of 0.05 the f-statistics is 180.142 while the p-value of the f-statistics is 0.000 which is less than 0.05. Therefore, the null hypothesis one which states that ICT dimension (mobile banking, online banking, automated teller machine and bankers automated clearing service) do not significantly affect customer loyalty of the selected deposits money banks in Lagos state, Nigeria is hereby rejected and we accepted the alternate which means that the ICT dimensions (mobile banking, online banking, automated teller machine and bankers automated clearing service) has significant effect on customer loyalty of selected deposit money banks in Lagos state, Nigeria.

#### 4.3.2. Test of Hypothesis Two

Objective Two: evaluate the effect of ICT dimensions (mobile banking, online banking, automated teller machine and bankers automated clearing service) on customer satisfaction of the selected deposits money banks in Lagos state, Nigeria;

Research Question Two: How does ICT dimension (mobile banking, online banking, automated teller machine and banker's automated clearing service) affect customer satisfaction of the selected deposits money banks in Lagos state, Nigeria?

Hypothesis Two: There is no significant effect of ICT dimension (mobile banking, online banking, automated teller machine and banker's automated clearing service) on customer satisfaction of the selected deposits money banks in Lagos state, Nigeria.

**Table 5.** Multiple Regression Results on the Effect of ICT dimension on customer satisfaction of selected deposit money banks in Nigeria. n=474.

Model	B	Std. Error	Beta	T	Sig.	R	Adj. R <sup>2</sup>	F (4,470) Value	Sig.	Durbin-Watson
(Constant)	-.212	.308		-.690	.490					
Mobile Banking	-.003	.048	-.003	-.071	.943					
Online Banking	.158	.047	.147	3.334	.001	0.971	0.90	149.584	0.000	1.913
Automated Teller Machine	.179	.052	.176	3.437	.001					
Bankers Automated Clearing Services	.589	.041	.662	14.39	.000					

Dependent Variable: Customer Satisfaction.

Table 5 reveals the model summary with value of R, R-square and Adjusted R – Square. The coefficient of multiple correlation (R=0.971) shows a strong positive correlation exists between ICT dimensions and customer satisfaction. The adjusted coefficient of determination (Adj. R<sup>2</sup>) of 0.903 shows that a combination of mobile banking, online banking, automated teller machine and bankers automated clearing service can only be explained by 90.3% of variation in customer satisfaction. However the model did not explain 9.7% of the variation in customer satisfaction, implying that there are other factors associated with customer satisfaction which were not captured in the model.

Table 5 also shows the ANOVA result. The result revealed that overall, the explanatory power of the model was considered statistically significant with the F-statistic output of the model reporting a p-value of 0.000 ( $F\text{-statistic}_{(4, 470)}=149.584, p<0.05$ ). Table 5 gives beta coefficient to enable the researcher construct regression equation. As depicted in the table best predictors are Mobile Banking, Online Banking, Automated Teller Machine and Bankers Automated Clearing Service. The results reveal that online banking ( $\beta=0.158, p=0.001$ ), automated teller machine ( $\beta=0.179, p=0.001$ ) and bankers automated clearing service ( $\beta=0.589, p=0.000$ ) were positively and statistically significant to customer satisfaction at 5% level of significance.

Regression Model Two

$$CS=0.212+0.158OB+0.179ATM+0.589BACS \quad (6)$$

Where;

CS=Customer Satisfaction

OB=Online Banking

ATM=Automated Teller Machine

BACS=Bankers Automated Clearing Service

From the above regression equation, it was revealed that holding online banking, automated teller machine and bankers automated clearing service, customer satisfaction

would be at 0.212. A unit increase in online banking would lead to 0.158 increases customer satisfaction, a unit increase in automated teller machine would lead to 0.179 increase in customer satisfaction and also a unit increase in bankers automated clearing service would lead to 0.589 increase in customer satisfaction. The results show that online banking, automated teller machine and banker’s automated clearing service were significant and mobile banking was insignificant. Since, most of regression coefficients were significant as indicated in table 5, at significant of 0.00 the F-statistics is 149.584 while the p-value of the f-statistics is 0.000 which is less than 0.05. Therefore, the null hypothesis two which states that There is no significant effect of ICT dimension (mobile banking, online banking, automated teller machine and banker’s automated clearing service) on customer satisfaction of the selected deposits money banks in Lagos state, Nigeria is hereby rejected and we accepted the alternate which means that the There is significant effect of ICT dimension (mobile banking, online banking, automated teller machine and banker’s automated clearing service) on customer satisfaction of the selected deposits money banks in Lagos state, Nigeria.

**4.3.3. Test of Hypothesis Three**

Objective Three: examine the effect of ICT dimensions (mobile banking, online banking, automated teller machine and bankers automated clearing service) on profitability of the selected deposits money banks in Lagos state, Nigeria;

Research Question Three: How does ICT dimension (mobile banking, online banking, automated teller machine and banker’s automated clearing service) affect profitability of the selected deposits money banks in Lagos state, Nigeria?

Hypothesis Three: ICT dimension (mobile banking, online banking, automated teller machine and bankers automated clearing service) do not significantly affect profitability of the selected deposits money banks in Lagos state, Nigeria.

**Table 6.** Multiple Regression Results on the Effect of ICT dimension on profitability of selected deposit money banks in Nigeria. n=474.

Model	B	Std. Error	Beta	t	Sig.	R	Adj. R <sup>2</sup>	F (4,470) Value	Sig.	Durbin-Watson
(Constant)	-.521	.278		-1.877	.061					
Mobile Banking	.901	.003	.102	3.028	.008					
Online Banking	.121	.043	.154	2.843	.005	0.957	0.915	160.440	0.000	1.896
Automated Teller Machine	.039	.047	.052	.838	.403					
Bankers Automated Clearing Services	.497	.037	.757	13.433	.000					

Dependent Variable: Profitability.

Table 6 reveals the model summary with value of R, R-square and Adjusted R – Square. The coefficient of multiple correlation ( $R=0.967$ ) shows a strong positive correlation exists between ICT dimensions and profitability. The adjusted coefficient of determination ( $Adj. R^2$ ) of 0.915 shows that a combination of mobile banking, online banking, automated teller machine and bankers automated clearing service can only be explained by 91.5% of variation in profitability. However the model did not explain 8.5% of the variation in profitability, implying that there are other factors associated with profitability which were not captured in the model. Table 6 also shows the ANOVA result. The result revealed that overall, the explanatory power of the model was considered statistically significant with the F-statistic output of the model reporting a p-value of 0.000 ( $F$ -statistic<sub>(4, 470)</sub>=160.440,  $p<0.05$ ). Table 6 gives beta coefficient to enable the researcher construct regression equation. As depicted in the table best predictors are Mobile Banking, Online Banking, Automated Teller Machine and Bankers Automated Clearing Service. The results reveal that mobile banking ( $\beta=0.901$ ,  $p=0.008$ ), online banking ( $\beta=0.121$ ,  $p=0.005$ ), automated teller machine ( $\beta=0.039$ ,  $p=0.403$ ) and bankers automated clearing service ( $\beta=0.497$ ,  $p=0.000$ ) were positively and statistically significant to profitability at 5% level of significance.

Regression Model Three

$$P=0.521+0.901MB+0.121OB+0.039ATM+0.497BACS \quad (7)$$

Where;

P=Profitability

MB=Mobile Banking

OB=Online Banking

ATM=Automated Teller Machine

BACS=Bankers Automated Clearing Service

From the above regression equation, it was revealed that holding mobile banking, online banking, automated teller machine and bankers automated clearing service, profitability would be at 0.521. A unit increase in mobile banking would

lead to 0.901 increase in profitability, online banking would lead to 0.121 increase profitability, a unit increase in automated teller machine would lead to 0.039 increase in profitability while a unit increase in banker's automated clearing service would lead to 0.497 increases in profitability. The results show that mobile banking, online banking, automated teller machine and banker's automated clearing service were significant. Since, all of the regression coefficients were significant as indicated in table 6, at significant of 0.00 the f-statistics is 160.440 while the p-value of the f-statistics is 0.000 which is less than 0.05. Therefore, the null hypothesis three which states that ICT dimension (mobile banking, online banking, automated teller machine and bankers automated clearing service) do not significantly affect profitability of the selected deposits money banks in Lagos state, Nigeria is hereby rejected and we accepted the alternate which means that the ICT dimension (mobile banking, online banking, automated teller machine and bankers automated clearing service) significantly affect profitability of the selected deposits money banks in Lagos state, Nigeria.

#### 4.3.4. Test of Hypothesis Four

Objective Four: assess the effect of ICT dimensions (mobile banking, online banking, automated teller machine and bankers automated clearing service) on service delivery of the selected deposits money banks in Lagos state, Nigeria;

Research Question Four: What is the effect of ICT dimension (mobile banking, online banking, automated teller machine and banker's automated clearing service) on service delivery of the selected deposits money banks in Lagos state, Nigeria?

Hypothesis Four: There is no significant effect of ICT dimension (mobile banking, online banking, automated teller machine and banker's automated clearing service) on service delivery of selected deposits money banks in Lagos state, Nigeria.

**Table 7.** Multiple Regression Results on the Effect of ICT dimension on service delivery of selected deposit money banks in Nigeria.  $n=474$ .

Model	B	Std. Error	Beta	t	Sig.	R	Adj. R <sup>2</sup>	F (4,470) Value	Sig.	Durbin-Watson
(Constant)	-.107	.132		-.809	.419					
Mobile Banking	.027	.021	.153	1.296	.195					
Online Banking	.192	.020	.120	3.074	.004	0.799	0.635	206.603	0.000	2.203
Automated Teller Machine	.129	.022	.165	2.277	.002					
Bankers Automated Clearing Services	.057	.018	.373	3.207	.001					

Dependent Variable: Service Delivery.

Table 7 reveals the model summary with value of R, R-square and Adjusted R – Square. The coefficient of multiple correlation ( $R=0.799$ ) shows a strong positive correlation exists between ICT dimensions and service delivery. The adjusted coefficient of determination ( $Adj. R^2$ ) of 0.635 shows that a combination of mobile banking, online banking, automated teller machine and bankers automated clearing

service can only be explained by 63.5% of variation in service delivery. However the model did not explain 36.5% of the variation in service delivery, implying that there are other factors associated with service delivery which were not captured in the model.

Table 7 also shows the ANOVA result. The result revealed that overall, the explanatory power of the model was

considered statistically significant with the F-statistic output of the model reporting a p-value of 0.000 ( $F\text{-statistic}_{(4, 470)}=206.603, p<0.05$ ). Table 7 gives beta coefficient to enable the researcher construct regression equation. As depicted in the table best predictors are Mobile Banking, Online Banking, Automated Teller Machine and Bankers Automated Clearing Service. The results reveal that mobile banking ( $\beta=0.027, p=0.195$ ), online banking ( $\beta=0.192, p=0.004$ ), automated teller machine ( $\beta=0.129, p=0.002$ ) and bankers automated clearing service ( $\beta=0.057, p=0.001$ ) were positively and statistically significant to service delivery at 5% level of significance.

Regression Model Four

$$SD=0.107+0.027MB+0.192OB+0.129ATM+0.057BACS \quad (8)$$

Where;

SD=Service delivery

MB=Mobile Banking

OB=Online Banking

ATM=Automated Teller Machine

BACS=Bankers Automated Clearing Service

From the above regression equation, it was revealed that holding mobile banking, online banking, automated teller machine and bankers automated clearing service, service delivery would be at 0.107. A unit increase in mobile banking would lead to 0.027 increases in service delivery, online banking would lead to 0.192 increase service delivery, and a unit increase in automated teller machine would lead to 0.129 increase in service delivery while a unit increase in banker's automated clearing service would lead to 0.057 increases in service delivery. The results show that mobile banking, online banking, automated teller machine and banker's automated clearing service were significant. Since, all of the regression coefficients were significant as indicated in table 7 at significant of 0.00 the f-statistics is 206.603 while the p-value of the f-statistics is 0.000 which is less than 0.05. Therefore, the null hypothesis four which states that There is no significant effect of ICT dimension (mobile banking, online banking, automated teller machine and banker's automated clearing service) on service delivery of selected deposits money banks in Lagos state, Nigeria is hereby rejected and we accepted the alternate which means that there is significant effect of ICT dimension (mobile banking, online banking, automated teller machine and banker's automated clearing service) on service delivery of selected deposits money banks in Lagos state, Nigeria.

#### 4.4. Discussion of Findings

The study revealed that ICT dimensions (mobile banking, online banking, automated teller machine and bankers automated clearing service) has positive and significant effect on customer loyalty of the selected deposits money banks in Lagos state, Nigeria. In line with [1, 4, 7], and not in tandem with [15, 17, 26]. The second objective established that ICT dimensions (mobile banking, online banking, automated teller machine and banker's automated clearing service) have

positive and significant effect on customer satisfaction of the selected deposits money banks in Lagos state, Nigeria in tandem with [16, 41] but not in tandem with [57, 44, 30, 13]. The objective three of this study proved that ICT measures employed by banks, and contribution of automated teller machines (ATMs) positively enhance banks' profitability and ICT measure also revealed that investment in ATMs increases both the volume and value of deposit accounts, reduces banking transaction costs, reduce the number of staff and the number of branches and consequently improves banks' profitability going with the study of [5, 56, 3, 21], but not in tandem with [22] who recorded negative effect.

The objective four of this found that ICT dimension (mobile banking, online banking, automated teller machine and banker's automated clearing service), significantly affect service delivery of selected deposits money banks in Lagos state, Nigeria in line with the studies of [4, 7, 57], (2013), [10].

#### 4.5. Implications of Findings

The findings of this study have implications for the banking industry in Nigeria, the general public and prospective researchers.

**Bank Operational Manager:** The finding of this study implies that deposit money banks should improve policies that strengthen its employment of ICT dimensions as this will enhance the overall performance and performance sustainability of the deposit money banks in Nigeria.

**Regulators:** Deposit money banks regulators such as Central Bank of Nigeria (CBN) and Nigeria Deposit Insurance Corporation (NDIC) in line with the findings of this study should put effective and efficient policies in place that will enhance and improve ICT banking, this should be tested frequently by examiners to know if they are in place and adequate. The oversights functions of regulators will help put banks in check and prevent the erosion of poor ICT banking services as we have seen in time past.

**Academics:** The findings of this study show valuable impact to other researchers because it show the statistical effect of ICT dimensions on bank performance sustainability of deposit money banks in Nigeria.

**General Public:** The finding of this study gives insight to the general public that deposit money banks sustainable performance measures like customer loyalty, profitability, customer satisfaction and bank service delivery could improve putting in place adequate and effective ICT banking system. The confidence of the public or bank customer will be restored if the above is in place as their funds and investment will be better secured.

## 5. Conclusion, Recommendations and Contribution to Knowledge

### 5.1. Conclusion

The study examined the effect of ICT dimensions (mobile

banking, online banking, automated teller machine and banker's automated clearing service) on sustainability performance of selected deposit money banks in Lagos State, Nigeria. From the multiple regression estimates, the study concluded that ICT dimensions have positive and significant effect on customer loyalty of selected deposit money banks in Lagos State, Nigeria. Also, the study established that ICT dimensions have positive and significant effect on profitability of selected deposit money banks in Lagos State, Nigeria.

### 5.2. Recommendations

Therefore, the study recommended that:

1. The management of deposit money banks should exert collective efforts and put effective policies in place in improving application of ICT measures, as this will serve as an effective and efficient improvement of customer loyalty.
2. The management of deposit money banks should exert collective efforts and put policies in place for adequate utilization of ICT measure so as to increase level of profitability.
3. The management of deposit money banks should exert collective efforts and put policies in place for adequate utilization of ICT measure so as to increase level of profitability.
4. The management should also ensure that their banks have strong and effective ICT measures and internal control environment where ICT application measures and internal control activities inform of policies and procedures are adequate, objective and effective. This is to provide management with the assurance on the adequacy and effectiveness of ICT application measures in order to increase bank customer service delivery.
5. To achieve competitive advantage in the global market, each bank should install mobile banking, online banking, automated teller machine and bankers automated clearing service. This will enhance customer loyalty, customer satisfaction, increased capacity utilization and overall improvement in performance.

### 5.3. Contribution to Knowledge

Empirically, the study provided empirical evidence of the importance and effect of ICT banking practices on not just the financial and non-financial performance but also on other factors that sustain bank performance such as customer loyalty, bank customer satisfaction, bank profitability and bank service delivery. The study contributed to policy by giving knowledge to the policy makers especially the Central Bank of Nigeria and other relevant stakeholders in financial system on the significant effects of information and communication technology on bank target to gain sustainable performance. Theoretically, the study was able to establish the nexus between the underlying theories of the work. The innovation diffusion theoretical model is mainly based on the idea of technology adoption in terms of features, perceived

usefulness and perceived ease of use which have been proven to be of significance to the adoption of technologies, thus increase overall bank performance sustainability. The study discovered that information technology is the only invention in the banking sector that has reshaped the business of banking and the attitude of human beings.

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