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Effect of Information and Communication Technology on the Nigerian Economy: Evidence from the Banking Sector

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ABSTRACT

This paper investigated the impact of information and communication technology on the Nigerian economy, taking evidence from the banking sector. Ordinary least squares method of regression for the period 2004-2017 was employed. Generally, the paper found that there was positive relationship between bank related information and communication technology components used and economic growth, except the automated teller machine component, under a fixed effect modeling. However, using the Breusch Godfrey (BG) dynamic modeling to remove serial autocorrelation, the paper revealed that only the mobile banking payment component positively and significantly affected the gross domestic product. On the basis of the findings, the researcher recommended that the Central Bank of Nigeria, banks and stakeholders should collaborate to strengthen the information and communication infrastructures and security systems in the country to reduce frauds, make the environment user friendly and improve public confidence.

Keywords: Information and communication technology, bank performance, economic growth.

1. INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Information has always played a prominent role in human life but the emergence of social progress and the vigorous development in science and technology has immeasurably increased the role of information in every facet of human endeavor. The rapid expansions of mass, diversified information have been termed ‘information explosion’ and this has given rise to a scientific approach to information, its most characteristics and changes in interpretation of the concept of information. Information explosion 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 world.

The pace of changes brought by new information technology has had a significant effect on the way people live, work and play globally. Today’s business environment is very dynamic and it experiences rapid changes as a result of information creativity, innovation, technological changes, increased awareness and demand from customers.

Every organization, industry and government uses information technology to convert its input in the computer hardware into output to attain its organizational objectives, structures and strategic goals (Robert and Murrell, 2007). The quality of strategic planning is limited by the quality of Information and Communication Technology available to the decision makers. Organizations like the Nigerian banking sector are not an exception.

Information and communication technology (ICT) is one of the resources needed in the banking sector for effective management. It can significantly improve the ability of the manager to monitor individual or team performance and allow employees to have more complete information to make faster decisions.

Information and communication technology services can offer banks and their customers a unified access to manage their personal financial information. The adoption of information and communication technology (ICT) by these banks can increased their operational efficiencies, reduce costs through high utilization rates in the ICT environment to ensure compliance with changing time and for competitive advantage (Haqqani, 2003).

Methods of handling financial services have changed from old manual transactions and data processing to a faster, more effective and efficient electronic data processing and Electronic Fund Transfers (EFT). Deposits, withdrawals, bills-pay-in, purchase of draft, value for cheques, third party transactions, funds transfer and inquiries, which are all done electronically within seconds.

The adoption of information and communication technology can also help banks to keep pace with changing customer needs and market dynamics and create a competitive differentiation in products and services. The competitive nature of the banking system, its products and services have made it necessary for banks to embrace ICT world as quick as possible since this medium of banking in most countries, has proven to be very efficiency-friendly. Indeed, the impact of ICT has reshaped the banking industry in terms of providing and delivering effective services to enhance its operations and general performance, and to a greater extent the economic growth of nations.

Countless observers have suggested that efficient and sound banking in a knowledge-driven economy is a key to future economic growth. Banks with efficient ICT environment could play a larger role in economic growth. Wih a relatively high premium in innovation, ICT-driven banks can transform the economy. For Nigeria, it would appear that the banking ICT-soundness is imperative if the country is to hold its own against regional competitors. This research paper is therefore, an attempt to access the impact of information and communication technology on the Nigerian Economy, taking evidence from the banking sector.

1.2 STATEMENT OF THE PROBLEM

Information and communication technology has become a potential tool in the hands of banks for sustainable growth. It has revolutionized the banking industry and its advent has enormously increased the capabilities of banks as they are now able to offer wider range of services to their customers through internet banking, mobile banking, ATMs, etc. Despite all these innovations in the banking industry, it is highly disheartening to observe that banks are still finding it difficult to meet the expectations of their customers as regards service delivery in Nigeria. It is not uncommon to find long queues in banks, delay in attending to customers, inability to properly sort out transaction and customer's general loss of trust in banks. Also, banks have found it difficult to meet up with its overall objectives and responsibilities.

Concerns about the strength and durability of the Nigerian economic recovery from recent economic recessions and growth slow-down, uncertain prospects for bank corporate profitability in the midst of unsettled political conditions and rise in e-banking frauds, this paper evaluates the impact of the banking sector's ICT related activities on the economic growth over the last one decade. The interest of the researcher is to see if the banking sector, through its ICT-driven activity, has made a significant impact on the main growth index of the Nigerian economy over the years.

1.3 OBJECTIVE OF THE STUDY

The aim of this study is to assess the impact of Information and Communication Technology on the Nigerian economy, using evidence from the banking sector. Specifically, the objectives are to:

- Determine how Automated Teller Machine affects the aggregate economic performance of Nigeria.
- Investigate how Mobile banking impact on Nigeria's economic growth.
- Assess the effect of Nigerian Inter-Bank Settlement System on the economic growth of Nigeria.
- Examine the relationship between National Electronic Fund Transfer and economic growth in Nigeria.

1.4 RESEARCH QUESTIONS

In the light of the preceding objectives, the study sought to answer the following questions:

- `To what extent does the adoption of mobile banking influence economic growth in Nigeria?
- To what extent has Automated Teller Machine banking influenced the economic performance in Nigeria?
- How does National Electronic Fund Transfer affect Nigeria's economic growth?
- What is the impact of Nigeria Inter-Bank Settlement System on Nigeria's economic growth?

1.5 HYPOTHESES

Ho_1: The adoption of mobile banking has no significant effect on Nigeria's economic performance.

Ho_2: There is no significant impact of Automated Teller Machine banking on Nigeria's economic growth.

Ho_3: There is no significant and positive relationship between National Electronic Fund Transfer and the Nigerian economic growth.

Ho_4:The Nigerian Inter-Bank Settlement System has no impact on Nigeria's economic growth.

1.6 SIGNIFICANCE OF THE STUDY

Every organization is concerned with the best possible way of improving performance to guarantee sustainable growth that will lead to the achievement of organizational goals. Therefore, the knowledge that would be obtained from this research will assist management of organizations and banks to appreciate the importance and use of information and communication technology products to achieve overall efficiency and effectiveness in their operations. The bank could get hints on how to further deploy information technology to enhance profitability, operational efficiency and service delivery. This paper would contribute positively to policy framework with which proper system upgrades could be carried out by the Nigerian government.

Students of management sciences and other researchers who intend to carry out further studies would find this paper useful as a reference material. Finally, it is hoped that the conclusion arrived at would assist other organizations in their ICT applications so as to meet their desired organizational goals and objectives.

1.7 SCOPE AND JUSTIFICATION OF THE STUDY

The paper covers the banking sector that trades their shares on the floor of the Nigerian Stock Exchange. The performance values of their ATM, e-banking and mobile services were selected for 13 years each between 2004 and 2017. The researcher selected the years because they coincided with the beginning of recapitalization and post-ICT policy of the deposit money banks (DMBs) in Nigeria. The study is justified in the fact that the Nigerian banks, since 1980s, have continued to perform better in their investment profiles and in the use of ICT than the rest of the industrial sectors of the economy. The various studies of the African Development Consulting Group (ADCG) on ICT diffusion in Nigeria shows that banks have invested more in ICT, have more personnel, more installed bases for PCs and internets than any other sector of the economy Woherem, 2000).

1.8 LIMITATIONS OF THE PAPER

In this paper, the researcher is limited to the use of Central Bank of Nigeria (CBN) Statistical Bulletin aggregated data on the banks' ICT indices. The researcher is also limited by secrecy of information of the banks' individual ICT portfolios, which require permission of the banks' highest authorities; hence most information was regarded as classified information.

This paper takes a greater, keen interest in the study of the aggregated data simply to reduce the risk of generalization bias and inconsistency inherent in the use of disaggregated data. Such a bias is an imperfect target for a policy aimed at aggregate measure (Bryan and Cocchetti, 1993). The fact that the banking sector is a major focal point in CBN's economic policy, the results of this work cannot be biased in terms of policy generalization. Using a simple statistical framework, the paper analyzed a panel data that is immune to the bias inherent in aggregated data set used in generalizing a research policy. Generally, the paper is limited to the assessment of the impact of ICT on the Nigerian economy taking evidence from the ICT performance of the banking sector.

2. REVIEW OF RELATED LITERATURE

2.1 CONCEPTUAL FRAMEWORK

Information and communication technology (ICT) is a mechanism for aiding and coordinating collective decisions in the light of the overall objectives of the banking sector. It is a branch of engineering dealing with the use of computers and telecommunications equipment to store, retrieve, transmit, and manipulate data. The information technology association of America has defined information technology as "the study, design, development application, implementation, support or management of computer based information systems". The term is commonly used as a synonym for computers and computer networks, but it also encompasses other information distribution technologies such as television and telephones. Stewart (1977) , opines that information technology is a process requiring a specific body of knowledge, skills and procedures which serve as cultural trade turn for attaining set objective in an efficient and timely manner.

According to Ayatse (2006), Information Technology include all those computer base activity that are derived from the convergence discipline of micro-electronics, computer and telecommunication which have led to the organization of process of production, distribution and circulation in the society.

Banking is defined as a financial institution where money and other valuables are kept for safe keeping. It is the granting of monetary loans, accepting deposits, purchasing and selling of short-term securities, bills, cheques, incurring of the obligation to acquire claims in respect of loans and effecting transfers and clearing of such with the Central Bank. Longman's dictionary defines a bank as a business that keeps and lends money, and provides other financial services. The Business Dictionary also defines a bank as any financial institution offering financial services such as keeping of money, conversion of domestic currencies into foreign currencies, lending of money at interest and acceptance of bills of exchange on behalf of their customers which may include private/individual businesses, organizations and even the government.

From these definitions above, we can conclude that banking is the act of providing the following services: Receipt of funds from customers for safe keeping, provision/ extension of credit/loan facilities to clients, assurance of guarantees and facilities of international transactions, and engagement in debt factoring and equipment leasing.

2.2 THE THEORIES

THEORY OF PLANNED BEHAVIOUR (TPB): This is also known as the theory of reasoned action (TRA). The theory suggests that a human behavior is determined by intention to perform. The behavior is affected jointly by attitude, subjective norm and perceived control (Ajzen, 1991). The desirability or undesirability of an attitude expresses the perceived organizational or a social pressure of a person who intends to perform a specific behaviour.

BANK−FOCUSED THEORY: This theory anchors on the premise that banks use non−traditional but conventional low−cost delivery channels to offer services to their customers. Such channels include the automated teller machines (ATM), mobile phone banking, and point of sale (POS) among others. In using these channels, banks offer a wide range of services to their customers regardless of location and branch attachments. All that is required is to enter the needed information into the system and the transaction is done.

BANK−LED THEORY: The bank−led theory was postulated by Lyman, et al (2006), and it emphasizes the role of an agent who acts as a link between the bank and the customers. In this case the retail agents have direct interactions with the bank customers and they perform the role expected of the bank by either paying cash or collecting deposits. Finally, this agent is expected to transmit all his dealings with the bank customer to the bank he is representing through electronic means (such as phones, internet, etc).

NON BANK−LED THEORY: This theory was popularized by Hogan (1991). Here customers do not deal with any bank and they do not maintain any bank account. All that the customers have to deal with is a non−bank firm such as mobile network operator or prepaid card issuer who they exchange their cash with for e−money account. The e−money account is then stored in the server of this non−bank agent. This tends to represent the most risky platform in the electronic payment methods because of lack of existing regulatory framework upon which these e−agents operate.

2.3 INFORMATION AND COMMUNICATION TECHNOLOGY, BANKING SECTOR AND THE ECONOMY.

Banking has come of age. Competition has allowed banks to start looking for innovation that will keep their customers and even win more. In recent years, the financial sector has been an interesting case for service innovation as it moves towards using the web for commercial purposes through internet services. Information and communication technology is all about automation. Essentially, information technology puts an end to manual operations, applying electronic mechanization to hordes of statistical operations among others. Today, information technology has become a key element in economic development, and the banks contribute in terms of operations, quality delivery and productivity of services (Agboola, 2003). Therefore, taking advantage of information and communication technology is an increasing challenge to developing countries. There is now growing evidence that knowledge driven innovation is a decisive factor in the competiveness of nations, industries, organizations and firms. Organizations like the banking sector, have benefited substantially from e-banking which is one among the information technology applications of strengthening the competitiveness of the organizations. The current trend in the application of information and communication technology in the banking industry in Nigeria has given an insight into how quality banking has been enhanced via information technology.

The development of information and communication technology facilities in the Nigerian banking industry has brought about fundamental changes in the content and quality of banking process in the country. This analysis and clarification of how Nigerian banks have used information and communication technology to reengineer their operations is detailed in subsequent literature reviews and observations.

Another major area where the role of information technology has tremendously assisted the banking sector is the provision of various financial services. Money transfer locally and internationally are made possible by information technology. Money gram and western union and other money transfer operators are run internationally. The western money transfer operator, as a common information technology in the Nigeria banking landscape, has enjoyed a significant patronage in the provision of source of foreign exchange for the banking system.

According to Ovia (2005), the introduction of smart card, plastic money and ATM debit/credit cards further extended human ingenuity and imagination within the family of ICT. He observed that information technology has led to reduction in cash transaction with long-term prospect of minimum cash handling and the subsequent reduction in robbery risk and such other vices. He further stated that fund transaction was faster, more accurate and cheaper under ICT.

According to Wali, (2010) the relationship between ICT and the various organizational activities is similar to government and civil servants. While governments outline policies civil servants execute those policies. ICT acts as a tool for the actualization of various organizational policy activities. This means that the banking sectors implements and enforces government policies in the use of ICT in their organizations.

Banks and the Government cannot ignore information systems because they play a critical role in contemporary economies. The application of information and communication technology concepts and techniques, policies and implementation strategies to banking services has become a subject of fundamental importance and concern to all banks and indeed a prerequisite for local and global competitiveness. ICT directly affects how managers make

decisions, how they plan and what products and services are offered in the industry. It has continued to change the way banks and their corporate relationships are organized worldwide and the variety of innovative devices available to enhance the speed and quality of service delivery.

The emerging of computer and telecommunication after about four decades of applying computers to routine data processing, mainly in information storage and retrieval, has created a new development where information has become the engine of growth around the world. This development has created catch-up opportunities for developing countries such as Nigeria to attain desired level of development without necessarily "reinventing the wheels" of economic growth. This new technology has brought far-reaching impacts on societies, which has tremendously transformed most banking businesses (Ovia, 2005).

Brucher, et al. (2003), opined that ICT adoption has improve three critical domains which are efficiency, quality and transparency in the banks. Agboola and Adodeji (2002), discussed the dimensions in which automation in banking industry manifest in Nigeria. They include; bankers Automated Clearing services, Automated payment systems and Automated Delivery Channels.

2.4 TYPES OF ICT USES IN BANKS

There are many examples of information applications in the banking industry that has helped build new markets and fuel the economy (Okpaku, 2003). The following are relevant applications of information technology in the operation of banking industry: Electronic Fund Transfer (EFT), Telephone banking or telex-banking, Internet banking, online real time banking, Personal computer banking (pc-banking), Automated Teller Machine (ATM), etc. Below is a brief explanation and meaning of each type and how it functions:

ELECTRONIC FUND TRANSFER

Banks and other financial institutions began to offer electronic fund transfer services to customers through Automated Teller Machines (ATM) in 1989. At the same time efforts were made to introduce the use of debit cards at point of sale. Through the installation of highly sophisticated computer systems for network data communication in the banks, the banks have been able to provide data linkage amongst their branches, thereby making it possible to connect numerous customers nationwide.

TELEPHONE BANKING

New technologies have been harmonized with established practices. The idea of harmonization is fast becoming popular. Customers can perform a number of transactions anywhere they have access to network data using phones. All a customer needs to do is to download the application in his phone. As said earlier, to use a financial institution's telephone banking facility, a customer is required to download the application in his phone. This type of financial transaction which a customer may transact through telephone banking include obtaining account balances and list of latest transactions, electronic bill payments, and funds transfer between a customer or another account. Cash withdrawals and deposits require the customers to visit an automated teller machine.

ONLINE REAL TIME BANKING

This aspect of electronic banking allows a customer to transact business in any branch, irrespective of the branch the customer's account remains domiciled. A computer works online if input data is processed immediately (real time

processing operation mode) and offline if there is significant time period between input and output and processing time.

PERSONAL COMPUTER BANKING

Personal computer banking allows customers access information on their accounts through a dial-up connection with their banks. Customers can perform basically all the transactions that are available to them with telephone banking. However, this enables the customers to access their accounts, in some specific cases, download information and manipulate it in their own financial management software. This is especially beneficial for business customers with reconciling their statements, checking deposits and cheques that have to be cleared and so on.

AUTOMATED TELLER MACHINE (ATM)

The ATM performs self-service and related services around the clock to holders of smart cards. The automated teller machine can perform any function depending on the application installed by the acquirer (Owner). Any ATM system can allow cash transaction at any time and place including non-working hours and days, that is, 24 hours, 7 days of the week to perform any of the banking services. They are usually installed in banks and busy locations where people can have access to them. The system also allows for the withdrawal of cash and purchase of airtime (recharge vouchers).

Here customers do not deal with any bank and they do not maintain any bank account. All that the customers have to deal with is a non−bank firm such as mobile network operator or prepaid card issuer who they exchange their cash with for e−money account. The e−money account is then stored in the server of this non−bank agent. This tends to represent the most risky platform in the electronic payment methods because of lack of existing regulatory framework upon which these e−agents operate.

2.5. EMPIRICAL STUDIES

Saeid (2011) investigated the effect of information technology (IT) on the banking system of Bank Keshavarzi, Iran, using data obtained both through the customers and employees, using exact % and the 5-point Likert Scale. He found that IT contributed to the banking system through conspicuously customer and employee's time savings, cutting down expenses and facilitating network transactions.

Elena and Beccalli (2003) studied the influence of IT (in terms of hardware, software and IT services) on the performance of banks and found that there is an insignificant positive correlation and the existence of a productivity paradox.

Using an annual data of selected commercial banks in Nigeria for an eleven-year period (2001-2011), Abubakar and Haruna (2014) studied the impact of ICT on bank performance and economic growth. Applying the ordinary least squares (OLS) models, they found that the use of ICT from the random effect did not improve bank performance, hence the economy.

Moradi and Kebryaee (2007) investigated the impact of ICT on economic growth in fourty-eight Islamic countries. Using the standard Solow Growth model, Steady-state, Income Regression and Economic Growth Regression, they found out that ICT capital (ICT investment) had positive and significant effect on economic growth when modeled on non-ICT control variables of inflation, economic openness and population growth index.

Cron ad Sobol (1983) examined the relationship between computerization and several measures of overall medical wholesalers' performance. Using correlation analysis the results showed that computerization was related to overall performance of users. However, non-users tended to be small firms **with** average overall performance.

Alpar and Kim (1990) utilized 424-759 US banks during 1979-1986 to analyze the impact of IT on economic performance. Applying cost functions approach, they found that IT was able to reduce operating costs, increase capital expenditures of banks, save personnel costs, reduce demand deposits and increase time deposits.

3. RESEARCH METHODOLOGY

3.1 DATA

Secondary data were used in the course of this research work. Data were primarily collected from the banks' financial reports. Generally, they were sourced from CBN Statistical Bulletins (various years). As stated in the introductory section of this paper, the banking sector was chosen based on the fact that the sector seems to exact more impact on the economy than any other sector in Nigeria.

3.2 MODEL SPECIFICATION

The model specification in this work is time series analysis. The basic model specification is shown thus: $Y = f(X_1, X_2, X_3, \ldots X_n)$….Equation 1, where Y= aggregated Nigeria's nominal gross domestic products (GDP) and X_1, X_2, X_3,….X_n represent the banks' aggregated ICT components. Rewriting equation 1, we have GDP = f (Bank ICT performance components)….Equation 2.

In further explanation, the specification is: GDP = f (Bank's ATM, MB, NEFT, NIBSS) ….. Equation 3, where ATM=Automated Teller Machine; MB= Mobile Banking; NEFT= National electronic fund transfer; and NIBSS = Nigerian inter-bank settlement system.

Establishing a linear relationship, we rewrite equation 3 as:

$Y_1 = a_0 + a_1 (ATM) + a_2 (MB) + a_3 (NIBSS) + a_4(NEFT) + e_1$, that is,

$GDP = a_0 + a_1(ATM) + a_2(MB) + a_3(NIBSS) + a_4(NEFT) + e_t$.....Equation4.

The a priori expectation is that, all things being equal, the Nigerian economy is dependent on the banking sector's information and communication technology over the years.

The data, as presented in the model specification above, were analyzed using multiple regression analysis. The E-View computer software package was used to do the analysis.

4 DATA PRESENTATION, ANALYSIS AND INTERPRETATION

TABLE 1 NIGERIAN BANKING SECTOR ICT AND ECONOMIC GROWTH INDICES

Year	GDP	ATMV	MPV	NIBSSV	NEFTV
2004	17321.3	17321.3	261.1	15.3	1.1
2005	22270.1	299.1	1.1	21.2	1.3
2006	28662.5	265.2	1.3	12.1	1.2
2007	32995.4	108.2	1.5	11.4	25.6
2008	39157.9	204.1	2.1	111.5	51.1
2009	44285.6	548.6	1.3	201.5	2501.3
2010	54612.3	399.7	6.7	230.1	5661.5
2011	62980.4	1561.7	19	1,300.20	10511.1
2012	71713.9	1984.7	31.5	3891.1	13660.1
2013	80092.6	2828.9	142.8	10844.9	14307.3
2014	89043.6	3679.9	346.5	19921.5	14616.6
2015	94145.1	3970.3	442.4	25649.1	13087.1
2016	115042.3	7561.1	650.2	29581.2	14212.3
2017	194135.5	6440.1	592.8	37111.3	18203.4

Source: CBN Statistical Bulletins (various years)

Table 1 above shows the economic growth indicator, GDP, in nominal value (N'billion) and the ICT indices – ATM, MB, NIBSS, NEFT – in billion naira. The large values of the indices were transformed into logged values, thereby reducing the largeness into smaller values (see table 2).

TABLE 2 LOGGED VALUES OF DATA FOR REGRESSION

Year	LATMV	LGDP	LMPV	LNEFTV	LNIBSSV
2004	5.56490	9. 75969	0.33647	0.09531	2.40694
2005	5.70077	10.01100	0.09531	0.26236	3.05400
2006	5.58048	10.26334	0.26236	0.18232	2.49320
2007	4.68490	10.40412	0.40546	3.24259	2.43361
2008	5.31861	10.57535	0.74193	3.93378	4.71402
2009	6.30736	10.69841	0.26236	7.82456	5.30578
2010	5.99071	10.90801	1.90210	8.64144	5.43851
2011	7.35353	11.05057	2.94443	9.26018	7.17027
2012	7.59322	11.18043	3.44998	9.52223	8.26644
2013	7.94764	11.29093	4.96144	9.56852	9.29145
2014	8.21064	11.39688	5.84988	9.58991	9.89955
2015	8.28659	11.45259	6.09221	9.47938	10.15226
2016	8.93077	11.6505	6.47728	9.56186	10.29489
2017	8.77029	12.17631	6.38485	9.80936	10.52167

SOURCE: E-VIEW COMPUTATION

In table 2, the ATM value dropped from 8.93077 billion in 2016 to 8.77029 billion in 2017. Also there was a slight drop in the mobile payment value from 6.47728 billion in 2016 to 6.38485 billion in the year 2017. In the case of NEFT value and NIBSS value, they all experienced a rise in the total value at the end of the years 2016 and 2017. In spite of the drop experienced in both ATM and MP values in 2017, the Gross Domestic Product (GDP) didn't drop in value.

CHART 1 LGDP Variable

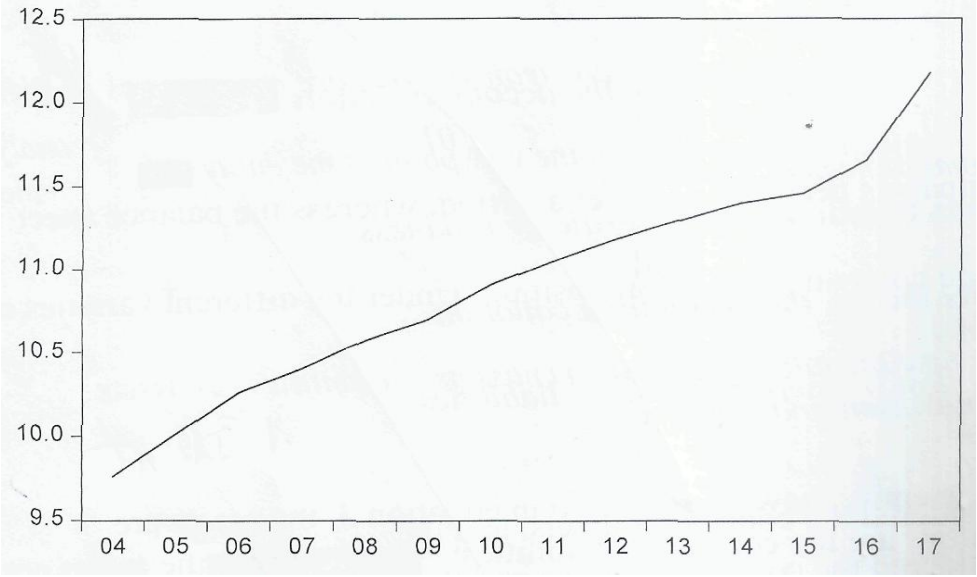


Chart 1 shows the behavior of logged GDP over the period of study. It showed an increasing trend with time. It has no intercept. This feature of LGDP behavior is exploited in conducting further tests.

CHART 2. LATMV Variable

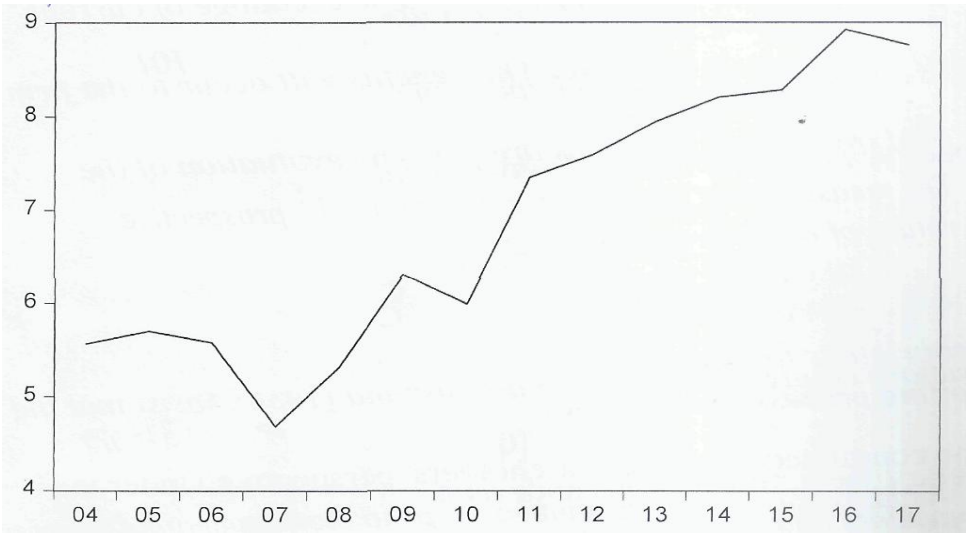


Chart 2 also shows a fluctuating behavior of LATMV. On the average, there was a rising trend of LATMV over the study period, with no defined intercept.

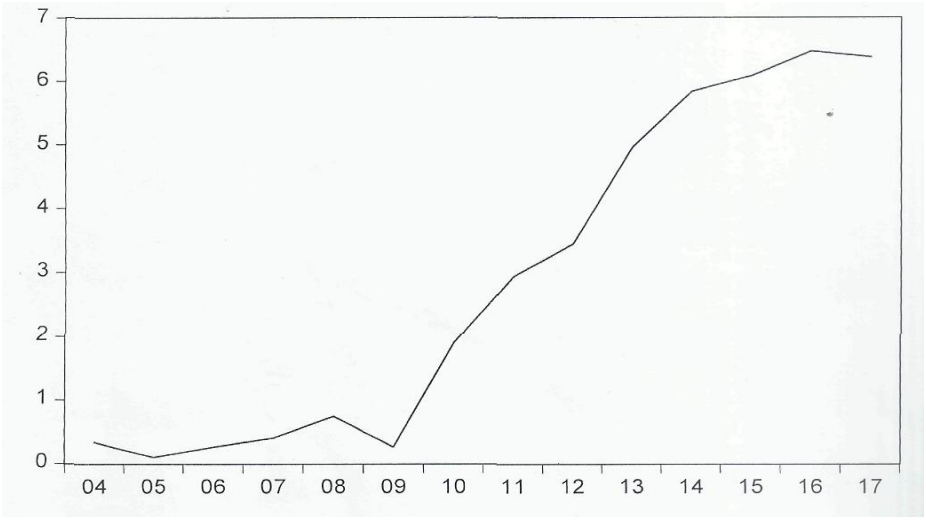


Chart 3 shows that there was a major leap in the trend of LMPV from 2009. The trend has no intercept.

CHART 4. LNEFTV Variable

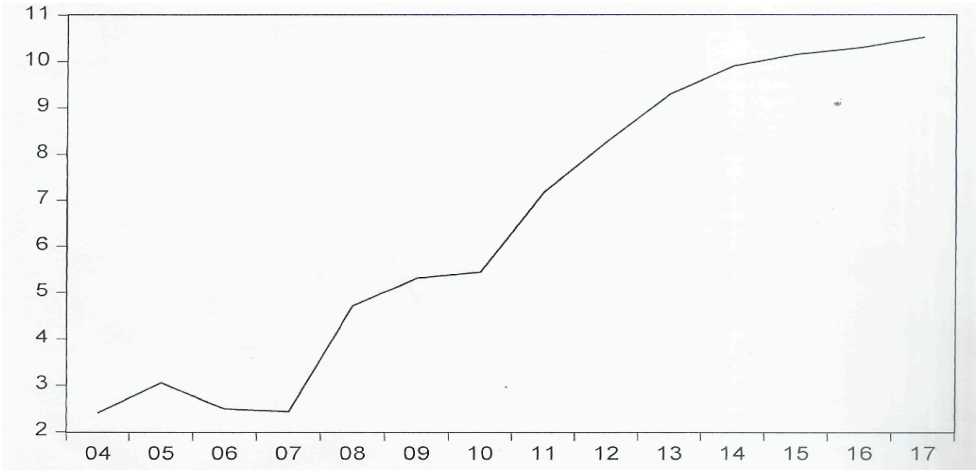


Chart 4 shows the non-linear trend of LNEFTV over the study period. A major leap started in 2006 but became almost flat at the top from 2011. The variable has no intercept.

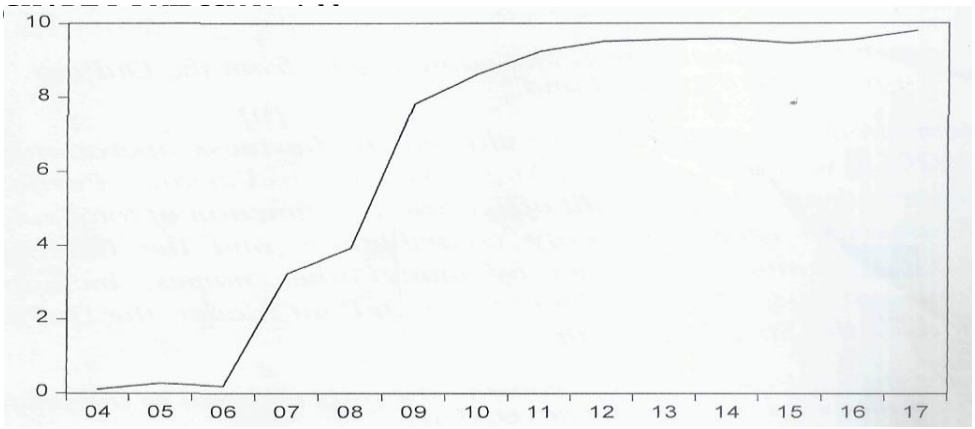


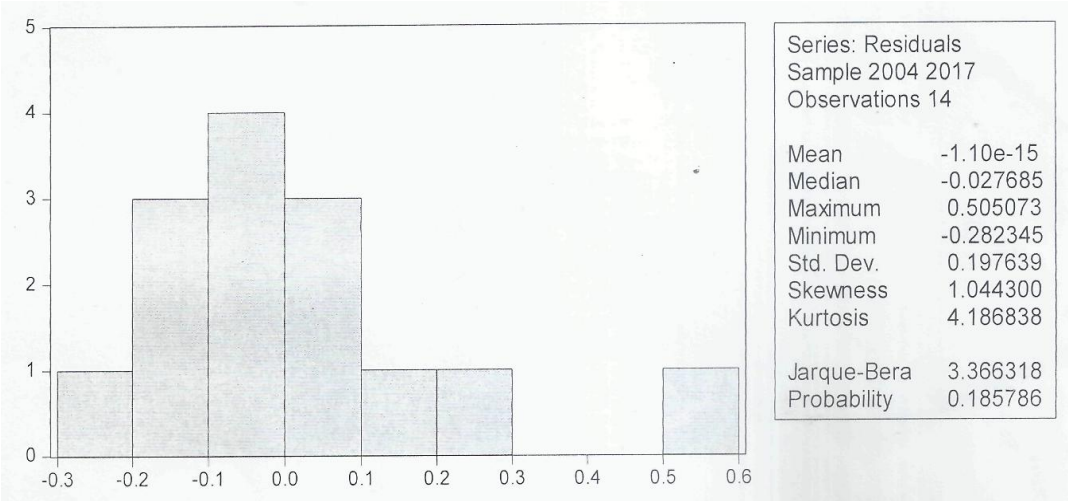
Chart 5 shows a Chart 5fluctuating trend of LNIBSSV variable over the period of study. It has no intercept.

Table 3: Descriptive Statistics and Normality Test

	ATMV	GDP	MPV	NEFTV	NIBSSV
Mean	6.874319	10.91577	2.868866	6.498132	6.531618
Median	6.830450	10.97930	2.423273	8.950816	6.304394
Maximum	8.930772	12.17631	6.477280	9.809364	10.52168
Minimum	4.684905	9.759692	0.095310	0.095310	2.406945
Std. Dev.	1.430015	0.672934	2.610479	4.002856	3.207916
Skewness	0.034779	-0.000916	0.274940	-0.743417	-0.065475
Kurtosis	1.521544	2.304151	1.389873	1 .798268	1 .423775
Jarque-Bera	1.277891	0.282456	1.688678	2.131989	1 .459286
Probability	0.527849	0.868291	0.429841	0.344385	0.482081
Sum	96.24047	152.8207	40.16413	90.97385	91.44265
Sum Sq. Dev.	26.58424	5.886925	88.58979	208.2971	133.7794
Observations	14	14	14	14	14

From table 3, the normality test, using skewness, kurtosis and Jargue-Bera tests, is used to establish the normal distribution of error terms. The skewness coefficients of the variables approximated to zero, showing normally distributed variables. The Kurtosis, which is expected to be 3, falls below 3, an indication of non-normality of the variables. Based on the OLS residuals, the computed p-values of LATMV, LGDP LMPV and LNIBSSV are sufficiently or reasonably high, we do not reject the normality assumption.

CHART 6: Residual Diagnostic Histogram Test.



With the chart above, we observe the estimated residuals from the regression. The residuals from the GDP regression seem to be asymmetrically distributed. The Jargue- Bera (JB) test shows that the JB- statistic is about 3.3663, and the probability of obtaining such a statistic under the normality assumption is about 19%. Therefore, we reject the H^0 that the error terms are not normally distributed.

Table 4: Correlation Matrix

	LATMV	LGDP	LMPV	LNEFTV	LNIBSSV
LATMV	1.000000	0.892435	0.954011	0.807085	0.965885
LGDP	0.892435	1.000000	0.915242	0.892230	0.943899
LMPV	0.954011	0.915242	1.000000	0.793754	0.964257
LNEFTV	0.807085	0.892230	0.793754	1.000000	0.892987
LNIBSSV	0.965885	0.943899	0.964257	0.892987	1.000000

Table 4 gives us the correlation matrix (zero- order correlation or pair-wise correlation). On the main diagonal are the correlations of the variables with themselves. This is always 1 by definition. Off the main diagonal are the pair-wise correlations among the variables. Taking the first row of the table, 0.892435 is the correlation between LATMV and LGDP, 0.954011, is the correlation between LATMV and LMPV, and so on.

As observed above, all the pair-wise correlations are quite high, suggesting that there may be a severe collinearity problem. However, we must bear in mind that such pair-wise correlations may be sufficient but not a necessary condition for the existence of multicollinearity (Gujarati; 2013). Again, the fact that R^2 in the OLS model is high and the explanatory variables are statistically insignificant is an indication of less classic symptoms of multicollinearity.

Table 5: OLS Model

Dependent Variable: LGDP
Method: Least Squares
Date: 05/09/18 Time: 21:48
Sample: 2004 2017
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.22207	0.891457	11.46670	0.0000
LATMV	-0.069942	0.202965	-0.344602	0.7383
LMPV	0.119110	0.115799	1.028592	0.3305
LNEFTV	0.059921	0.047709	1.255967	0.2408
LNIBSSV	0.067888	0.161197	0.421151	0.6835

R-squared	0.913742	Mean dependent var	10.91577
Adjusted R-squared	0.875405	S.D. dependent var	0.672934
S.E. of regression	0.237533	Akaike info criterion	0.235429
Sum squared resid	0.507796	Schwarz criterion	0.463664
Log likelihood	3.351994	Hannan-Quinn criter.	0.214302
F-statistic	23.83447	Durbin-Watson stat	0.865674
Prob(F-statistic)	0.000083		

The results of the OLS model estimation are shown as follows:

GDP= 10.222-0.070ATMV+0.119MPV+0.060NEFTV+0.68NIBSSV

Se: 0.891 0.203 0.116 0.048 0.161

t-stat: 11.467 -0.344 1.029 1.256 0.421

p-value: 0.000 0.738 0.331 0.241 0.684

R^2: 0.914

Adjusted R^2: 0.875

Durbin-Watson (DW): 0.866

F-stat- 23.834

In the above OLS estimations, the regression coefficients are not statistically significant, except the intercept or autonomous variable. The p-values show that 0.05% level. This means that the growth of ICT in the banking sector, on its own, could not influence economic growth in Nigeria. R^2, a summary measure, shows that the proportion of the variation in GDP explained by the variables – MV, MPV, NEFTV and NIBSSV jointly - is 91%. When the researcher adjusted for the degree of freedom (df) associated with the sum of squares entering the model, involving four parameters of the independent variables and the intercept term, the adjusted R^2 was 88%. Since adjusted R^2 followed the convention that adjusted $R^2 < R^2$ and that it is another summary statistic of R^2, the high goodness of fit and adequacy of the regression model are proven.

The Durbin-Watson (DW) test result of 0.866 is low suggesting that we have positive serial correlation (pure autocorrelation) in the residuals of the error terms. The presence of auto correlation in our model is an indication of the lack of efficiency of our OLS estimators, and this renders our OLS model spurious and nonsensical.

Table 6

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	6.313536	Prob. F(6,3)	0.0795
Obs*R-squared	12.97263	Prob. Chi-Square(6)	0.0435

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 05/29/18 Time: 21:24
Sample: 2004 2017
Included observations: 14
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.583744	0.667279	-2.373437	0.0982
LATMV	0.017606	0.136062	0.129400	0.9052
LMPV	-0.604753	0.178800	-3.382287	0.0430
LNEFTV	-0.108597	0.082949	-1.309208	0.2817
LNIBSSV	0.590079	0.246842	2.390513	0.0967
RESID(-1)	1.022246	0.618126	1.653783	0.1967
RESID(-2)	-1.589198	0.476810	-3.332981	0.0446
RESID(-3)	-1.671475	0.644201	-2.594648	0.0807
RESID(-4)	0.526381	0.902415	0.583302	0.6006
RESID(-5)	0.395416	0.395324	1.000233	0.3909
RESID(-6)	-1.667971	0.456021	-3.657662	0.0353

R-squared	0.926617	Mean dependent var	-1.10E-15
Adjusted R-squared	0.682006	S.D. dependent var	0.197639
S.E. of regression	0.111451	Akaike info criterion	-1.519486
Sum squared resid	0.037264	Schwarz criterion	-1.017370
Log likelihood	21.63640	Hannan-Quinn criter.	-1.565966
F-statistic	3.788122	Durbin-Watson stat	3.181218
Prob(F-statistic)	0.150176		

To avoid some of the pitfalls in the model as exemplified by the low DW test result of the presence of serial autocorrelation, the researcher further applied the Breusch-Godfrey Serial Correlation LM Residual Diagnostics Test. Simply called BG test or the LM test, the test is based on the Lagrange Multiplier Principle. The test is general in the sense that it allows for (1) nonstochastic regressors, such as the lagged values of the regressand, (2) higher-order autoregressive schemes, such as AR (1), AR (2), etc, and (3) simple or higher-order moving averages of white-noise error terms, (Godfrey, 1978; Gujarati; 2013). Using an AR (6) scheme (see table 6 above), the researcher obtained the following results: R^2= 0.927 and adjusted R^2= 0.682. The prob. chi-square value, 0.0435, is significant. Therefore, for our model, at least, one of the 6 auto correlations must be nonzero.

Varying lag lengths from 1 to 6, the researcher found that AR (2) and AR (6) coefficient are significant, all suggesting that there is no need to consider more than two lag. The DW has improved to 3.181, removing serial auto correlation in the model. At this level, only MPV coefficient is significant, implying a high influence on GDP.

The model that gave us the result or finding, as shown above, and one devoid of serial autocorrelation and spuriousity (or nonsensical estimations) is:

LGDP = −1.5837+0.0176LATMV−0.60475LMPV−0.10859LNEFTV+0.59008LNIBSSV+0..02225R(−1)

−1.5892 R(−2) −1.67148R(−3)+0.52638 R(−4) +0.39542 R(−5) −1.66797 R(−6)

R^2 = 93%

Adjusted R^2 = 68%

In the above model the coefficients of three (3) variables - LMPV, Resid(- 2) and Resid (- 6) - are significant, while the coefficients of the remaining five (5) are not significant. This is an over-parametarized model in which less than 50% of the variable coefficients are significant.

TABLE

Pairwise Granger Causality Tests
Date: 05/09/18 Time: 22:18
Sample: 2004 2017
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LGDP does not Granger Cause LATMV	12	3.58795	0.0846
LATMV does not Granger Cause LGDP		0.09200	0.9132
LMPV does not Granger Cause LATMV	12	3.25627	0.1001
LATMV does not Granger Cause LMPV		3.51895	0.0876
LNEFTV does not Granger Cause LATMV	12	8.35349	0.0140
LATMV does not Granger Cause LNEFTV		1.33833	0.3220
LNIBSSV does not Granger Cause LATMV	12	8.89571	0.0120
LATMV does not Granger Cause LNIBSSV		1.92793	0.2153
LMPV does not Granger Cause LGDP	12	4.69504	0.0509
LGDP does not Granger Cause LMPV		1.97859	0.2084
LNEFTV does not Granger Cause LGDP	12	3.11428	0.1078
LGDP does not Granger Cause LNEFTV		0.06667	0.9361
LNIBSSV does not Granger Cause LGDP	12	0.21950	0.8082
LGDP does not Granger Cause LNIBSSV		8.48370	0.0135
LNEFTV does not Granger Cause LMPV	12	4.54174	0.0544
LMPV does not Granger Cause LNEFTV		0.27742	0.7657
LNIBSSV does not Granger Cause LMPV	12	12.4159	0.0050
LMPV does not Granger Cause LNIBSSV		1.58759	0.2701
LNIBSSV does not Granger Cause LNEFTV	12	0.55768	0.5960
LNEFTV does not Granger Cause LNIBSSV		3.69769	0.0802

So far, the researcher has looked at the dependence of LGDP on the Banking Sector ICT (independent) variables. However, dependence does not necessarily imply causation or direction of influence. The question is: Is GDP, over time, affecting or causing changes in the banking sector ICT? From table 7 above, the following relationships are shown:

S/N	Direction of Causality	F-Value	P-value	Decision
1	GDP → ATMV	3.59	0.084	Do not reject H0
	LATMV → GDP	0.09	0.913	Do not reject H0
2	GDP → MPV	1.98	0.208	Do not reject H0
	MPV → GDP	4.70	0.051	Do not reject H0
3	GDP → NEFTV	0.07	0.936	Do not reject H0
	NEFTV → GDP	3.11	0.108	Do not reject H0
4	GDP → NIBSSV	8.48	0.0135	Reject H0
	NIBSSV → GDP	0.22	0.808	Do not reject H0

These results suggest that the direction of causality is from GDP→NIBSSV since the estimated F-stat is significant at the 5% level. This indicates that there is a reverse causation between GDP and NIBSSV.

4. DISCUSSION OF FINDINGS

The result of this study revealed that most of the bank- related ICT indices used have positive influence on the Nigerian economy, except the automated teller machine. In the first instance, using a fixed effect OLS model (table 5), none of the ICT indices was statistically significant in influencing GDP, except the autonomous variable. The presence of serial autocorrelation in the model (table 5) rendered the analysis spurious and biased. When the serial autocorrelation was removed, using BG dynamic tests, only one of the ICT indices, mobile payment, statistically influenced GDP.

It is not surprising that, most bank-related ICT indices did not impact significantly on the Nigerian economy. In the first instance, the banking sector ICT related activities may be insignificant in the aggregated ICT uses in Nigeria. This is an indication that Nigerians are yet to embrace total e-banking, even in this 21st century. Probably, the rising ICT related frauds and fraudster activities scare Nigerians. Analogue banking still persists.

Our results are consistent with the works of Abubakar and Haruna (2014) and Elena (2007). However, they are not in line with the works of Moradi and Kebryaee (2007), Cron and Sobol (1983) and Alpar and KIM (1990). The inconsistence could be traced to development index differentials between Nigeria and developed countries.

5. RECOMMENDATIONS

Since our findings indicated that mobile payments statistically influenced the GDP, the banks, as a matter of urgency, should strengthen their ICT systems, security and integrity. This is capable of boosting public confidence in e−payments and reduction of frauds.

The Central Bank of Nigeria and banks should collaborate with stakeholders to ensure that ICT infrastructures and internet availability that show weak relationships with bank and economic performances are strengthened and made customer user friendly. Finally, there is need for careful and constant monitoring of sector developments and stakeholder consultation in order to fine tune ICT policy for desired effects on the economy.

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