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IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGY ON THE ECONOMIC GROWTH OF NIGERIA: 1991-2020

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ABSTRACT

This paper examines the impact of Information and Communication Technology on the Economic Growth of Nigeria: 1991-2020. An ordinary least square regression is applied to annual aggregate data to determine the type of relationship that exist between the dependent and independent variables. The results of this study showed that Government expenditure on ICT (GEI) has a positive and significant impact on the GDP. Telecommunication sector (TLS) has a positive and significant impact on the GDP and Foreign investment on ICT (FDI) has a positive and significant impact on the GDP in Nigeria during the period under review. In conclusion, Nigeria's march towards becoming one of the top economies of the world in the year 2030, ICT provides practical ways of diversifying the economy away from its overdependence on the oil sector.

Keywords: *Information and Communication Technology, Economic Growth, Gross Domestic Product, Nigeria.*

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1. Introduction

1.1 Background to the Study

In recent times, Information and Communication Technology (ICT), which basically refers to all communication technologies, including the internet, wireless networks, cell phones, computers, video-conferencing and other media applications and services enabling users to access, retrieve, store, transmit, and manipulate information in a digital form is having a dramatic influence on almost all aspects of individual lives and that of the national economy-the banking sector inclusive. The increasing use of ICT has allowed for integration of different economic units in a spectacular way. This phenomenon is not only applicable to Nigeria but

other economies of the world, though the level of their usage may differ. In Nigeria, ICT usage has considerably increased especially with the impact of the COVID Pandemic. No wonder, the Nigerian Government has christened one of Ministries – Ministry of Communications and Digital Economy - to reflect its digital drive vision (Adeoti, 2017).

The use of ICT in different sectors of the economy has become of interest to this study due to the significant role it plays in the economy. It helps in stimulating economic growth by directing funds to economic agents that need them for productive activities. This function is very vital for any economy that intends to experience meaningful growth because it makes arrangements that bring borrowers and lenders of financial resource together and more efficiently too than if they had to relate directly with one another. In essence, the different sectors acts as a bridge that connects lenders and investors in the economy.

Information and communication technology has become global tool for industries and organisations to reach global markets. The use of ICT in the Nigeria economy has become a global phenomenon and every sector and organisation must be ICT compliance in order to survive in global competitive environment. The introduction of ICT has changed manual and traditional forms of doing business and is being replaced by the sophisticated technology that is based on automation and interconnection of computers and other electronic devices. For instance, ledger books, paper invoice, printed materials and business trips are being replaced with online billing and payments, elaborate website with product information and real-time teleconferencing across continents and time zones (Ojokuku and Sajuyigbe, 2018).

This Research work is a study of the impact of information and communication technology(ICT) in Nigeria; Many problems confronting different sector in Nigeria in their use of information and communication technology(ICT). The problem therefore is that despite the enormous impact of ICT in any economic development especially in the pandemic era, the sector seems to be mostly self-funding with minimal Government allocations. This however becomes a huge task as the study tries to;

Examine the multiplier effect of effective Government spending on the ICT Sector towards actualisation of strategic initiatives. The approach in by the National Bureau of Statistics in capturing the contribution of ICT to the GDP seems not to have been holistically captured using the statistical tools and data used for analysis. This is another problem envisaged to be solved using a realistic baseline for re-computations. The broad objective of this study is to examine

the impact of information and communication technology on the economic growth of Nigeria. This paper is structured as follows; Introduction, material/methods, literature/theoretical review methodology, results and discussion as well as conclusion and recommendations.

2. Research Methodology

2.1. Research Design

The study adopted a quantitative research method in which the secondary data soured from Central Bank of Nigeria Statistical Bulletin and telecommunication commission 2020 was used. The variables are; Gross Domestic Product at Current Market Price as proxy to Nigeria's economic growth, Government expenditure on ICT, Telecommunication sector and Foreign Direct Investment on ICT. The ordinary least square (OLS) method and E-view version 11.1 will be relevant in the study.

2.2 .Techniques of Analysis

The technique used in estimating the parameters of the specified model is the Ordinary Least Squares (OLS) estimation method. The justification for choosing the OLS as the estimation technique was due to the desirable properties its estimate possesses called the BLUE properties. These properties ensure good inference making, and efficient as well as non-misleading conclusion and recommendations. The choice to use the OLS was also based on the fact that the OLS is among the best estimation method for the linear econometric models. The OLS estimation of the specified model was done using Econometric Views (E-views).

2.3. Model Specification

The study adopted a multiple linear regression model to investigate empirically the topic under study. The model for the study is presented below as:

$$GDP = \beta_0 + \beta_1 GEI + \beta_2 TLS + \beta_3 FDI + \mu \ldots\ldots (2.1)$$

Where:

GDP = Gross Domestic Product at Current Market Price as proxy to Nigeria's economic growth

GEI = Government expenditure on ICT

TLS = Telecommunication sector

FDI= Foreign Direct Investment on ICT

β_0 = Intercept

β_1 ,B_2,…..B_3= Partial Slopes of the Linear regression model

μ = Stochastic error term

2.4. Sources of Data

There are basically two major sources from which data could be obtained for the purpose of research work and these include primary and secondary sources. However, for this study, we used secondary data. The secondary data was based on the Central Bank of Nigeria (CBN) Statistical Bulletin, and National Bureau of Statistics (NBS) Publication.

The use of secondary method was chosen for this study because it is considered to be the most appropriate method for the needed information and at least amount of time. However, this has been chosen among other instruments of data collection as the basic method of collecting data for this study because of some added advantage it has over other methods such as time saving and cost effectiveness.

3. Literature Review

3.1. Conceptual Review/Theoretical Framework

3.1.1. Concept of ICT

ICT means Information and Communication Technology, according to Okwudishu (2020), it Means a wide variety of activities and equipments, it includes all the tools, applications and information which are available and accessible via computers. Similarly, Information and Communication Technology (ICT) refers to different things to many people, some view information and communication as techniques required for information processing that involves the use of electronic computers and computer software to create, store, protect, process, transport, select, change, receive and display many kind of information, while others refer to it as the functions of developing, acquiring, testing, implementing and maintaining electronics system to source for information.

Basically, ICT is classified into three groups namely:

a) Those that process information. E.g computer
b) Those that disseminate information. E.g communication
c) Those for presentation of information e.g multimedia.

Adams (2019) define the term information as a wide range and variety of things ranging from oral and printed words, figures, statements, file and document to such intangible elements as sound, signal rays and waves. Whatever the form information takes, the essence of information is that, it conveys a message.

Technology refers to the application of scientific knowledge while information technology is the acquisition, processing, storage and dissemination of vocal, pictorial, textual and numerical information by a micro base combination of computing and telecommunication. Telecommunication is a special form of communication in which information is conveyed over long distance. Also, Technology can be referred to as the application of knowledge for the execution of a given task. It entails skills and processes necessary for carrying out activities (works) in a given context. While ICT encompasses computer systems, telecommunication, networks, and multimedia applications (Frenzel, 2016). It came into use in the late 1980's replacing earlier terms like Electronic Data Processing (EDP), Management Information System (MIS), although the latter terms are still in use (Frenzel, 2016).

Sajuyigbe (2018) posited that ICTs encompass technologies that can process different kinds of information (audio, video, text, and data), and facilitate different forms of communications among human agents, and among information systems. Information and communication technology is a term which generally covers the harnessing of electronic technology for the information needs of businesses at all levels, (Anderson, 2019). In addition, Ovia (2019), defined information and communication technology as the acquisition, processing, storage and dissemination of vocal, pictorial, textual and numerical information by a micro-electronic based combination for computing and telecommunication. While an information system (IS) is a group of formal process that together collects, retrieve, process, store and disseminate information for the purpose of facilitating planning, control, coordination and decision making in organizations. Information and communication technology on the other hand provides the technical solutions identified in the (IS) information system; including the networks, hardware and software. Ovia, (2019)conceived of information and communication

technology to broadly encompass the information that business creates and use as well as a wide spectrum of increasingly convergent and linked technologies that process the information. In addition to computers, the data recognition equipment, communication technologies, factory automation and other hardware services are involved. Traditionally, telephone, radio and television were referred to as media technology.

3.1.2. Concept of Economic growth

Economic growth is an increase in the production of economic goods and services, compared from one period of time to another. It can be measured in nominal or real adjusted for inflation terms. Traditionally, aggregate economic growth is measured in terms of gross national product (GNP) or gross domestic product (GDP), although alternative metrics are sometimes used.

i. Economic growth is an increase in the production of goods and services in an economy.
ii. Increases in capital goods, labor force, technology, and human capital can all contribute to economic growth.
iii. Economic growth is commonly measured in terms of the increase in aggregated market value of additional goods and services produced, using estimates such as GDP.

In simplest terms, economic growth refers to an increase in aggregate production in an economy. Often, but not necessarily, aggregate gains in production correlate with increased average marginal productivity. That leads to an increase in incomes, inspiring consumers to open up their wallets and buy more, which means a higher material quality of life or standard of living (Adams,2019). In economics, growth is commonly modelled as a function of physical capital, human capital, labour force, and technology. Simply put, increasing the quantity or quality of the working age population, the tools that they have to work with, and the recipes that they have available to combine labour, capital, and raw materials, will lead to increased economic output. There are a few ways to generate economic growth. The first is an increase in the amount of physical capital goods in the economy. Adding capital to the economy tends to increase productivity of labour. Newer, better, and more tools mean that workers can produce more output per time period. For a simple example, a fisherman with a net will catch more fish per hour than a fisherman with a pointy stick. However two things are critical to this process. Someone in the economy must first engage in some form of saving (sacrificing their current consumption) in order to free up the resources to create the new capital, and the new capital

must be the right type, in the right place, at the right time for workers to actually use it productively.

A second method of producing economic growth is technological improvement. An example of this is the invention of gasoline fuel; prior to the discovery of the energy-generating power of gasoline, the economic value of petroleum was relatively low. The use of gasoline became a better and more productive method of transporting goods in process and distributing final goods more efficiently. Improved technology allows workers to produce more output with the same stock of capital goods, by combining them in novel ways that are more productive. Like capital growth, the rate of technical growth is highly dependent on the rate of savings and investment, since savings and investment are necessary to engage in research and development.

Another way to generate economic growth is to grow the labour force. All else equal, more workers generate more economic goods and services. During the 19th century, a portion of the robust U.S. economic growth was due to a high influx of cheap, productive immigrant labor. Like capital driven growth however, there are some key conditions to this process. Increasing the labor force also necessarily increases the amount of output that must be consumed in order to provide for the basic subsistence of the new workers, so the new workers need to be at least productive enough to offset this and not be net consumers. Also just like additions to capital, it is important for the right type of workers to flow to the right jobs in the right places in combination with the right types of complementary capital goods in order to realize their productive potential.

The last method is increases in human capital. This means laborers become more skilled at their crafts, raising their productivity through skills training, trial and error, or simply more practice. Savings, investment, and specialization are the most consistent and easily controlled methods. Human capital in this context can also refer to social and institutional capital; behavioral tendencies toward higher social trust and reciprocity and political or economic innovations like improved protections for property rights are in effect types of human capital that can increase the productivity of the economy.

3.2. Theoretical Review

3.2.1. The Classical Theory of Economic Growth

The classical economists, Adam Smith, Thomas Robert Malthus, David Ricardo, John Stuart Mill, and others, were very much concerned with economic growth. They thought that economic growth would eventually cease. The economy would enter a stationary state. In that state, population growth would be zero, and investment would be for replacement only. Real wages would be constant and at a low level. Classical theory was based in part on the theory of population associated with Thomas Robert Malthus. In a simplest terms, Malthus assumed that population increases geometrically: 1, 2, 4, 8, 16, ... Food production, on the other hand, is capable of increasing only arithmetically: 1, 2, 3, 4, 5, ... Consequently, difficulties will arise in the long run as population outstrips the food supply. At that point, mortality rates increase owing to starvation and malnutrition. In the short run, the classical economists assumed that economic growth would occur. Profits would be high and capital accumulation would occur. As the capital stock increased, it was assumed that real wages would rise above the minimum subsistence level, thereby inducing population growth.

The classical economists stressed land as a factor of production and emphasized the law of diminishing returns. They argued that land was essentially a nonaugmentable factor of production; therefore as population increased and capital accumulated, diminishing returns would prevail. Consequently, real wages and profits would fall until only investment for replacement would be profitable. To be sure, the classical economists conceded that technological progress might postpone the inflationary state, but not indefinitely. The prognosis of the classical economists was, therefore gloomy. Small wonder that some nineteenth-century people called economics the *dismal science.*

3.2.2. Harrod's Theory of Economic Growth

With the Great Depression of the 1930s and the publication of Keynes's *General Theory* in 1936, economists turned their attention to short-run theories of income determination. Keynes himself was predominantly interested in the short run. As we have seen, his analysis assumed that the economy's capital stock and technology were constant. These assumptions are justifiable for short-run theories of income determination, but not for long-run theories of income determination, called *growth theories* or models, to others. Following Keynes, R.F. Harrod and E. Domar were among the first to develop theories of economic growth. Their theories are similar and Keynesian in nature. Since Harrod's theory is based on a number of assumptions. First, he assumes that saving, S, is a constant fraction, s, of income, Y. This

implies that saving in time period t, S_t, equals the fraction of income saved, s, multiplied by income in time period t, Y_t, ot. $S_t = sY_t \quad (0 < s < 1)$

In a sense, the warranted rate of growth represents an equilibrium growth rate. According to equation, the amount that households actually save also depends on the level of income. Since both depend on the level of income, intended and actual or realized saving are equal. trade sectors), the level of income and corresponding level of saving determine the amount of realized investment. For example, if s equals 0.10 and Y equals $500 billion, realized saving is $50 billion. With no government and foreign trade sectors, realized investment must also equal $50 billion. Although intended and realized saving are determined by the level of income, intended investment is determined by changes in the level of income in accordance with equation. as , intended investment is the amount that firms wish or intend to invest. If v equals 1 and income increases from $450 billion to $500 billion, intended investment is $50 billion, the product of v and the change in income, $Y_t - Y_{t-1}$. With s equals 0.10 and income equal to $500 billion, realized saving and investment equal $50 billion. Intended and realized investment are, therefore equal and managers are satisfied with their production and investment decisions. Consequently, if income is growing at the warranted rate, managers have no incentive to change their behaviour. Thus, for managers the warranted rate of growth represents an equilibrium rate. Suppose income does not grow at the warranted rate. Intended and realized investment are no longer equal, and managers think that they have increased production either too rapidly or too slowly. Suppose the *actual growth rate, G*, is less than the warranted rate, G_w. If income growth at a rate less than the warranted rate, intended investment is less than realized saving and investment. This occurs because intended investment depends on changes in the level of income and income is growing at a rate less than the warranted rate, whereas intended and realized saving depend on the level of income. Since intended investment is less than realized investment, on the level of income. Since intended investment is less than realized investment, there is an unintended increase in inventories, positive unintended investment. The unintended increase in inventories implies that managers cannot sell their entire output. thus, although the actual growth rate of output is less than the warranted rate, it will appear to managers that they have increased production too rapidly.

To illustrate, suppose s equals 0.1 and v equals 1, which implies that the warranted rate of growth, G_w is 10 percent. If income is $450 billion in time period t – 1, income must increase to $500 billion in period *t* for the warranted rate of growth to be maintained. Suppose, however,

that income increases to only $480 billion. The actual rate of growth, G, is only 6.25 percent, obtained by dividing the difference between incomes in time period t and the period t-1 by income in time period t. If income is $480 billion in time period t, realized saving is $48 billion, the product of s = 0.1 and Y_t = $480 billion. Since realized investment must equal realized saving, realized investment is also $48 billion. Intended investment, however, is only $30 billion, obtained by multiplying v by the change in income from time period t-1 to time period t. the excess of realized over intended investment represents the unintended increase in inventories which occurs because managers cannot sell their entire output.

3.2.3. Neoclassical Growth Theory

Neoclassical growth theory is based on a number of assumptions. First, is assumed that investment is always equal to the full employment level of saving. Thus, full employment is assumed at the outset. Second, it is assumed that saving is a constant fraction, s, of output. thus,

$$S = sY \qquad (0 < s < 1).$$

The neoclassical saving function is therefore, the same as Harrod's.

Third, it is assumed that the labour force and population grow at a constant rate n. This rate is independent of the real wage and other economic variables. Fourth, a production function is postulated which allows for factor substitution. Thus, firms may substitute capital for labor, and vice versa, in the production process. Rather than postulating a general production function, we shall assume that the economy is characterized by a particular type of production function called the *Cobb-Douglas production function.* A Cobb-Douglass production function has the form

$$Y = Ae^{rt}K^{\alpha}N^{1-\alpha} \qquad (0 < \alpha < 1)$$

Where Y represents output, K the capital stock; and N the number of workers employed. The expression Ae^{rt} represents the effect of technology, with A representing a positive constant, e the natural e from mathematics (2, 7, 18 ....) . r the growth rate of technology, and t time. Thus, we are assuming that technology improves at the constant rate r. The terms α and 1 – α represent the partial elasticities of production with respect to capital and labour, respectively. If α equals 0.25, a 1 percernt increase in the capital stock results in a 0.25 percent increase in output. if α equals 0.25, 1- α equals 0.75 and a 1 percent increase in employment results in a 0.75 percent

increase in output. assuming pure competition α and 1- α also represent the shares of national income accruing to capital and labour, respectively. For example, if α equals 0.25 and the return to capital equals the marginal product of capital (the case under pure competition), the owners of the capital stock receive one-fourth of the economy's output. if 1- α equals 0.75 and the real wage equals the marginal product of labor (the case under pure competition). Labor receives three-fourths of the economy's output.

The Cobb-Douglas production function has several characteristics which are important in the following analysis. First, the production function exhibits constant returns to scale. If the factors of production, capital and labour are increased in same proportion, output also increases by that proportion. For example, if the capital stock and labor force both increase by 10 percent, output also increases by 10 percent. Second, the production function displays diminishing returns to the factors of production. Thus, if one factor of production increases with the other factor (and technology) constant, output will increase but at a diminishing rate. For example, if the capital stock increases with the labor force constant, output increases, but the increases in output become smaller and smaller as the capital stock increases. From the production function, it is possible to derive the growth rate of output. The growth rate of output, q, is given by q where q, r, h and n represent the growth rates of output, technology, capital and labor, respectively. Thus, equation (15.6) suggests that the growth rate of output positively related to the rate of technological progress and the growth rates of the factors of production, capital and labor.

For the economy to be in equilibrium in this context, the variables must be constant or growing at constant exponential rates. This does not imply that all variables must be constant or that all variables must grow at constant rates. Some variables may be constant with the others growing at constant exponential rates. This definition of equilibrium is the growth theory counterpart of the usual definition of equilibrium. If the economy is in equilibrium in the growth theory context, the economy is said to be in a *golden age*. Alternatively, the economy is said to be experiencing steady-state growth or to be in a steady state. For an economy to be in a golden age, the following variables must be growing at constant exponential rates: output, the capital stock, investment, and the labor supply. We have already assumed that the labor supply is growing at a constant exponential rate, n. we know that (net) investment, l, equals the change in the capital stock. ΔK, and that investment equals a constant fraction, s, of output. Y: hence

$$I = \Delta K = sY$$

If we divide ΔK and sY by K, we obtain

$$\frac{\Delta K}{K} = s\frac{Y}{K}$$

Or

$$h = s\frac{Y}{K}$$

since s is a constant, the ratio of Y to K must also be a constant for the capital stock to grow at the constant rate, h. Therefore, income, Y, must grow at the same rate as the capital stock, K, in a golden age. Since the growth rate of income, q, equals the growth rate of the capital stock..h, in a golden age, we may replace those rates by g, the *golden age growth rate.* Thus, equation (15.6) becomes g by substitution. After rearranging terms and dividing by (1-α), we obtain $g = \frac{r}{}$ where g represents the golden age growth rates of output and the capital stock, r the growth rate of technology, and n the growth rate of the labor supply. Since investment is a constant fraction of income and since income is golden age growth rate, investment is also growing at the rate. This result suggests that the golden age, or equilibrium, growth rate depends on the growth rates of technology and the labor supply. Should either rate increase, the golden age growth rate increases. This result also implies that it is impossible for per capita income to increase in the absence of technological progress. If technology is constant, r equals zero and the golden age growth rate, g, equals the growth rate of the labor force (and population), n. If income and population are growing at the same rate, per capita income is constant. For example, suppose income and population are growing at 3 percent per year. Per capita income will be unchanged.

3.2.4. The Market-Based Theory

This theory underscores the importance of well-functioning markets, and accentuates the problems of ICT and bank-based financial systems. Generally, big, liquid and well-functioning markets foster growth and profit incentives, enhance ICT industry, corporate governance and facilitate risk management (Levine, 2018, and Beck and Levine, 2002). On the contrary, bank and ICT-based systems may involve intermediaries with a huge influence over firms and this influence may manifest itself in negative ways. For instance, once banks acquire substantial, inside information about firms, banks can extract rents from firms and firms must pay for their greater access to capital. In terms of new investments or debt renegotiations, banks with power

can extract more of the expected future profits from the firm than in a market-base system Hellwig, (2019). This ability to extract part of the expected payoff to potentially profitable investments may reduce the effort extended by firms to undertake innovative, profitable ventures (Rajan, 2019). Furthermore, Boot and Thakor (2017) model the potential tensions between bank-based systems characterized by close ties between banks and firms and the development of well-functioning securities markets. The inherent inefficiencies of powerful banks are also stressed, for they ―can stymie ICT, innovation by extracting informational rents and protecting firms with close bank firm ties from competition …may collude with firm managers against other creditors and impede efficient corporate governance‖ (Levine, 2018). Market-based financial systems reduce the inherent inefficiencies associated with banks and are, thus, better in enhancing economic development and growth. A related argument is that developed by Boyd and Smith (2018), who demonstrate through a model that allows for financial structure changes as countries go through different stages of development, that countries become more market-based as development proceeds. An issue of concern, identified by a World Bank (2018) study in the case of market-based financial systems in developing countries, is that of asymmetric information. It is argued that ―the complexity of much of modern economic and business activity has greatly increased the variety of ways in which insiders can try to conceal firm performance. Although progress in ICT, technology, accounting, and legal practice has also improved the tools of detection, on balance the asymmetry of information between users and providers of funds has not been reduced as much in developing countries as it has in advanced economies, and indeed may have deteriorated.

3.2.5. ICT-based financial system

This theory stresses the positive role of banks in development and growth of an economy, and, also, emphasizes the drawbacks of ICT-based financial systems. The theory opines that banks can finance development more effectively than markets in developing economies, and, in the case of state-owned banks, market failures can be overcome and allocation of savings can be undertaken strategically. In a way those banks that are not impeded by regulatory restrictions, can exploit economies of scale and scope in information gathering and processing (Adams, 2019) provide more details on these aspects of bank-based systems). In fact, bank and ICT-based financial systems are in a much better position than market-based systems to address agency problems and short-termism (Frenzel, 2016). In particular, the free-rider problem inherent in atomistic markets in acquiring information about firms is emphasized by Stiglitz.

But well-developed markets quickly reveal information to investors at large and thereby dissuading individual investors from devoting resources toward researching firms. Thus, banks can make investments in ICT without revealing their decisions immediately in public markets and this creates incentives for them to research firms, managers, and market conditions with positive ramifications on resource allocation and growth.

3.3. Empirical Review

Most scholars have agreed that there is relationship between ICT and economic growth. However, scholars have differed on the direction of causality between bank lending, ICT and economic growth (Oluitan, 2019). Obamuyi (2018) assesses the impact of Nigeria‘s ICT policy for fostering private sector development. Relevant data relating to the influence of the policy on macro-economic performance and private sector development were obtained from primary and secondary sources. The analyses were descriptive and quantitative in perspective. The findings provided insights on the overall impact of ICT policy on the private sector. It shows that ICT has led to increased manufacturing capacity utilisation necessary for economic growth, but needs to be complimented by an increased flow of funds to the private sector for investment in the real sector of the economy. This is because, credits to private sector were not found to have a positive impact on economic growth in Nigeria. This implies that credits to private sector were used for commerce (buying and selling), or diverted to some unproductive ventures, rather than production activities, or at least too small to positively impact on economic growth. However, poor infrastructure, high level of corruption, political and economic instability, and high cost of funds were found to have constrained the contribution of the ICT to economic development. The policy implication is that the private sector in Nigeria could only be a positive force for growth, if the government would sincerely provide the needed conducive environment and the private sector efficiently utilises banks‘ credits for industrial development. This study will assist policy makers in fine-tuning their liberalisation policy and the private sector to adopt a value re-orientation approach to enhance the performance of the economy, especially in developing countries (Obamuyi, 2018). Lemo (2005) posits that the primary objective of the reforms was to guarantee an efficient and sound financial sector. He said that the Nigerian financial reforms were designed to enable the banking industry develop the required resilience to support the economic development of the nation by efficiently performing its function of financial intermediation. He further stressed that a fundamental objective of the programme was to ensure the safety of ―deposited‖ money, position banks to

play active development roles in the Nigerian ICT industry, and became major players in the sub-region, region and global financial markets. ICT have long been recognised to play an important role in economic development. This recognition dates back to Goldsmith (2015), Cameron (2017), McKinnon (2013) and Shaw (2013), which demonstrated that the ICT sector could be a catalyst of economic growth if it is developed and healthy. The benefits accruable from a healthy and developed financial system relate to savings mobilisation and efficient financial intermediation roles (Gibson and Tsakalotos 2018). In same vein, a study by Obamuyi, Edun and Kayode (2018) investigates the effect of ICT and economic growth on the manufacturing output in Nigeria. Times series data covering a period of (1990-2016) were employed and tested with the cointegration and vector error correction model (VECM) techniques. The findings of the study show that ICT capacity utilization and bank lending rates significantly affect manufacturing output in Nigeria. However, the relationship between manufacturing output and economic growth could not be established in the country. These results, therefore, call for concerted effort by the government, manufacturers, ICT expert and the lending institutions to reviewing the lending and growth policies and provide appropriate macroeconomic environment, in order to encourage investment-friendly lending for ICT development and borrowing by the financial institutions (Obamuyi, Edun and Kayode, 2016). Mohd and Osman (2017) broadly categorized the causality into demand-following relationship and supply following relationship. The proponents of demand-following hypothesis argued that economic growth is a causal factor ICT development, not the reverse. Robinson (2018) maintain ns that economic growth propels banks to finance enterprises. Gurley & Shaw (2019) also argued that as the economy expands and grows, the increasing demand for financial services stimulates banks to provide more credit.

Similarly, Oluitan (2019) is of the opinion that policy makers should focus less on measures leading to increase in bank lending to ICT industry and concentrate more on legal, regulatory and policy reforms that boost the functioning of markets and banks Habibullah and Eng (2016) conducted causality testing analysis on 13 Asian developing countries and also found that bank lending promotes ICT. Similarly, the IMF 2008 Global Financial Stability Report indicated a statistically significant impact of credit growth on GDP growth. Specifically, it was revealed that ― a credit squeeze and credit spread evenly over three quarters in USA will reduce GDP growth by about 0.8% and 1.4% points year-on-year respectively assuming no other supply shocks to the system‖ (Oluitan, 2019). In addition studies were conducted to test the old Schumpeterian hypothesis, for example; Jao (2016) used cross-section data averaged over

1990-2015 in 44 developing countries and 22 developed economies, to study the relationship between bank lending and ICT industry. The study found that the money balance-GDP ratio and growth of per capita real money balances (proxy of financial intermediation variables) had a strong positive relationship with ICT industry (Tang, 2018).

Uzomba, Chukwu, Jumbo and Nwankwo (2014) investigate the impact and the determinants of Deposit Money Banks' loans and advances granted to ICT sector in Nigeria from 1980 to 2011. Multiple OLS regression, Stationarity Test, Co-integration test, Parsimonious Error Correction Mechanism and Granger Causality Test are employed. The study concludes that there is positive impact of deposit money banks' loans and advances on the ICT sector. Ebi and Emmanuel (2016) investigate the impact of commercial bank credit on Nigeria telecom subsectors between 2002 and 2018. Using Econometric Error Correction Model (ECM) and conclude that, an increased bank credit to telecom sector is significant in determining industrial sector growth in Nigeria. Yushau (2011) compare accessibility to financing by small entrepreneurs before and after the bank reform using primary and secondary sources. The study concludes that informal institutions are better able to meet the financial need of entrepreneurs than formal whose conditions are stiff. Nwaeze, Michael and Nwabekee (2014) explore the extent to which financial intermediation impact on the economic growth in Nigeria during 1992 to 2011. Relying on Ordinary Least Squares (OLS) regression technique, they conclude that both total bank deposit and total bank credit exert a positive and significant impact on the ICT development in Nigeria for the period. Also, the values of GDP per capital (PCY), Financial Deepening (FSD), Interest Rate Spread (IRS) and negative influence of Real Interest Rate (RIR) and Inflation Rate (INFR) have positive influence on the size of private domestic savings while the lagged values of total private savings, private sector credit, public sector credit, interest rate spread and exchange rates relate positively with economic growth. Orji (2017) submits using Distributed Lag-Error Correction Model (DL-ECM) and Distributed Model. Ekpenyong and Acha (2018) examine the contribution of banks to economic growth using correlation analysis, regression, diagnostic tests, Augmented Dickey-Fuller test and cointegration. While Nigerian banks are not contributing significantly to economic growth, there is Positive and significant impact of private sector credit on growth. Obademi and Elumaro (2014) re-examine the financial repression hypothesis in order to determine the impact and direction of causality between banks and economic growth during intensive regulation, deregulation and guided deregulation regime. Ordinary least square regression and Causality test conclude that banks have significant positive impact on growth in Nigeria especially during

deregulation. Nevertheless, banks appear to be passive to Economic growth in terms of causality.

4. Results and Discussion

Table 4.1: Descriptive Statistics of Data

	GDP	**GEI**	**TLS**	**FDI**
Mean	25.11222	28.93982	19.30297	20.25361
Median	24.09332	20.09181	14.23154	15.20181
Maximum	81.10922	75.26428	50.37165	55.20912
Minimum	6.22622	10.93872	4.29187	6.20923
Std. Dev.	17.10354	16.82982	12.28641	14.30298
Observations	30	30	30	30

Source: Author's Computation, 2021

Where: GDP = Gross Domestic Product at Current Market Price as proxy to Nigeria's economic growth

GEI = Government expenditure on ICT

TLS = Telecommunication sector

FDI= Foreign Direct Investment on ICT

Table 4.1.1 above shows the descriptive statistics of all the variables. It captures the number of observations (N), minimum, maximum, mean, Median and standard deviation of the variables used. GDP has a Mean and median values of 25.11222 and 24.09332 respectively; with a standard deviation value of 17.10354. It has a minimum and maximum value of 6.22622 and 81.10922 respectively. GEI has a Mean and median values of 28.93982 and 20.09181 respectively; with a standard deviation value of 16.82982. It has a minimum and maximum value of 10.93872 and 75.26428 respectively. TLS has a Mean and median values of 19.30297 and 14.23154 respectively; with a standard deviation value of 12.28641. It has a minimum and maximum value of 4.29187 and 50.37165 respectively. Finally, FDI has a Mean and median values of 20.25361 and 15.20181 respectively; with a standard deviation value of 14.30298. It

has a minimum and maximum value of 6.20923 and 55.20912 respectively. The total observation is given as 30.

4.2 . Data Analysis

The regression output using E-Views software is given below as:

Dependent Variable: GDP				
Method: Least Squares				
Date: 05/05/21 Time: 04:11				
Sample: 1991 2020				
Observations: 30				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.01E+08	1.14E+08	-0.885786	0.3836
GEI	2.565827	0.677439	3.787533	0.0009
TLS	6236457.	7044642.	3.885277	0.0008
FDI	1684242.	2461655.	4.684191	0.0007
R-squared	0.6735669	Mean dependent var		28762268
Adjusted R-squared	0.657620	S.D. dependent var		1.19E+08
S.E. of regression	1.19E+08	Akaike info criterion		40.16645
Sum squared resid	3.81E+17	Schwarz criterion		40.39548
Log likelihood	-637.6633	F-statistic		8.022509
Durbin-Watson stat	1.894972	Prob(F-statistic)		0.395551

Source: Author's Computation 2021

4.3. Regression Analysis

The estimated regression model is given as follows;

GDP = -1.01 + 2.5658GEI +6236457TLS + 1684242FDI

S.E = (1.14) (0.6774) (7044642) (2461655)

t = (-0.8858) (3.7875) (3.8853) (4.6842)

R^2 = 0.67 Adjusted R^2 = 0.66

F = 8.022 D.W (d) = 1.89

n = 30 k = 4

Where; n = number of observation or sample size

k = number of parameters in the model

4.4. Discussion of Results

From the estimated regression model above, we observed that the coefficients of the explanatory variables; Government expenditure on ICT (GEI), telecommunication sector (TLS) and Foreign direct investment on ICT (FDI) are positive indicating that there is a positive relationship between the dependent variable; GDP and all the independent variables. Hence, it further implies that the variables contribute positively to the economic growth of Nigeria during the period under review.

The Coefficient of Determination (R^2): The above shows that about 67% of total variations in the dependent variable (GDP) were explained by the changes in explanatory variables (GEI, TLS and FDI) of the estimated model. This implies that the estimated model has a good fit. Similarly, the adjusted coefficient of determination (R^2) also shows that the estimated model has a good fit (i.e, Adjusted R^2 = 0.66). This further suggests that 66% of the total change in GDP can be attributed to the Independent variables.

Test of Significant using probability Values

Based on the probability values of the parameters and independent variables, all the variables; (GEI, TLS and FDI), are said to be statistically significant at 5 percent because the probability values attached to the variables are less than 0.005.

F-statistic: Given; N= Sample size, K= Number of parameters in the model N = 30, V_1= K = 4, V_2= N-K-1, N-K-1 = 30-4-1 = 25. Where, V_1 and V_1 = degree of freedom. If $F_{cal} > F_{tab}$, we reject the null Hypothesis (H_0) and if otherwise, we accept the null Hypothesis (H_0). Given the result on the ANOVA table above, we observe that $F_{cal} = 8.022$. At 5% level of significance, F_{tab} is given as $F_{0.05} = 2.69$ comparing these values ($F_{cal} > F_{tab}$). This suggests that the null hypothesis should be rejected and the alternative hypothesis accepted. This implies that all the variables are jointly statistically significant. NOTE: The high value of the F-statistic (i.e. F=8.022) indicates that the parameters of the estimated model are jointly or simultaneously statistically significant. This further implies the estimated model is good for forecasting, predicting, policy formulation, decision making and analysis purposes.

5. Conclusions and Recommendations

5.1. The major findings are as follows;

i. Government expenditure on ICT (GEI) has a positive and significant impact on the GDP during the period under review.
ii. Telecommunication sector (TLS) has a positive and significant impact on the GDP in Nigeria during the period under review.
iii. Foreign investment on ICT (FDI) has a positive and significant impact on the GDP in Nigeria during the period under review.
iv. Based on the stationary unit root test, the variables (GDP and FDI) are stationary at first difference while (GEI and TLS) are stationary at second difference.

5.2. Conclusion

In Nigeria's march towards becoming one of the top economies of the world in the year 2030, ICT provides practical ways of diversifying the economy away from its overdependence on the oil sector. There are multiple obstacles to be confronted in achieving national objectives. Nigeria however needs to leverage better on ICT to jump-start growth and development. Enhancing security for life, property and information, improving infrastructure and creating the environment for viable private sector activity are essential for effective Public Private Participation in ICT for Development in Nigeria. The major findings are as follows; Government expenditure on ICT (GEI) has a positive and significant impact on the GDP during the period under review. Telecommunication sector (TLS) has a positive and

significant impact on the GDP in Nigeria during the period under review. Foreign investment on ICT (FDI) has a positive and significant impact on the GDP in Nigeria during the period under review.

Neither the public nor private sector can stand alone. There is a need for coordination and collective implementation of the National ICT Strategic Plan as most sub plans are dependent on other sub plans. For example the Private sector sub plan relies on outcomes from Human Resource Development, Governance and Legislation and other sub plans and vice versa. As goals are set there is a need for rigorous implementation, monitoring, evaluation and review. ICT is more than consumption. It offers Nigeria freedom, independence - a way to leapfrog into the knowledge economy and information society. Public and private cooperation is essential to enhance global competitiveness, drive local content development and enable full participation by Nigerians in the information age. Program recommendations are focused on ensuring Nigeria becomes an information and knowledge society that enables Nigeria and its citizens to benefit in a sustainable, widespread and inclusive manner through the development of the private sector.

Since ICT development is multidimensional, the public sector must partner with the private sector in a creative and mutually beneficial manner. Ideas are not enough. Policies are not enough. Sustainable development is achieved when stakeholders share a common vision and agree on the same national interest. This requires close coordination, coherence and commitment for Nigeria to use ICT to drive social and economic development. PPP and ICT for Development in Nigeria should be aggressively prioritized and supported by mainstreaming policies into national development programs. It is time to realize the immense potential of the imaginative, resilient and industrious Nigerian people. The need for quality, committed leadership that understands and appreciates the role of ICT has never been greater. It is about a better life for all now and in future.

5.3. Recommendations

On the basis of the above, the following recommendations are proffered:

i. Effort should be made by the Government and relevant bodies to ensure that government expenditure on ICT are well implemented.
ii. Government should come up with a policy measures to ensure that significant and positive impact of ICT and foreign investment on ICT are sustained over time.

iii. Government and other relevant authorities should initiate policies that will further boost the telecommunication sector as an alternative revenue base of the economy beside the oil sector in Nigeria.

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Appendix 1

Table 4.1: Economic Indicators (1991-2020)

YEAR	GDP ₦(BILLION)	GEP ₦(BILLION)	TLS ₦(BILLION)	FDI ₦(BILLION)
1991	29282	133.6	14.9	13
1992	36377	144.6	22.1	18
1993	53433	151.7	13.8	16
1994	62561	231.8	13.8	122
1995	117349	220.1	32.8	10.86
1996	142869.1	219.7	29.3	10.92
1997	161108.4	213.5	18.5	21.8
1998	207061.8	218.3	110	27
1999	306654.9	221.3	16.6	27.2
2000	398348.4	218	16.9	30
2001	499161.5	218.3	18.9	24
2002	653241.2	224.4	12.9	25.7
2003	759632.5	220.7	14.1	216
2004	932930.1	319.2	15.7	20.4
2005	1089450.3	217.95	18.8	19.5

2006	1747252.8	316.9	12.8	18.7
2007	2693554.3	316.5	19.2	19.8
2008	2695342.1	317.5	15.1	19.6
2009	3677564.7	417.5	19.1	20.8
2010	67543876	418.9	10.8	22.8
2011	98765438	418.9	11.7	23.1
2012	89765430	419.0	12.7	23.7
2013	98376289	420.8	13.8	24.2
2014	38736498	421.6	14.7	24.8
2015	534209181	546.2	9.55	23.9
2016	827261098	625.8	18.55	25.8
2017	762610919	762.7	15.37	25.8
2018	982772709	652.8	13.7	27.9
2019	871602981	887.2	11.8	28.7
2020	938383938	983.4	12.5	30.2

SOURCE: CBN, 2020

Where:

GDP = Gross Domestic Product at Current Market Price as proxy to Nigeria's economic growth

GEI = Government expenditure on ICT

TLS = Telecommunication sector

FDI= Foreign Direct Investment on ICT

Appendix 2

Unit root Test

ADF Test Statistic	-5.358595	1% Critical Value*		-4.3738
		5% Critical Value		-3.6027
		10% Critical Value		-3.2367
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(GDP2)				
Method: Least Squares				
Date: 05/05/21 Time: 03:05				
Sample: 1991 2020				
Observations: 30				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1),2)	-1.602895	0.299126	-5.358595	0.0000

D(GDP(-1),3)	0.122237	0.107458	1.137537	0.2681
C	2.044463	7.833511	0.260989	0.7966
@TREND(1990)	-0.106326	0.442873	-0.240082	0.8126
R-squared	0.842532	Mean dependent var		-3.984000
Adjusted R-squared	0.820036	S.D. dependent var		36.65836
S.E. of regression	15.55125	Akaike info criterion		8.471806
Sum squared resid	5078.672	Schwarz criterion		8.666826
Log likelihood	-101.8976	F-statistic		37.45343
Durbin-Watson stat	2.413645	Prob(F-statistic)		0.000000

Source: E-view output result 2021

Appendix 3

ADF Test Statistic	-4.472028	1% Critical Value*		-4.3738
		5% Critical Value		-3.6027
		10% Critical Value		-3.2367
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(GEI,3)				
Method: Least Squares				
Date: 05/05/21 Time: 03:07				
Sample: 1991 2020				
Observations: 30				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GEI(-1),2)	-1.708802	0.382109	-4.472028	0.0002
D(GEI(-1),3)	0.070454	0.214741	0.328087	0.7461
C	-1.125108	1.044674	-1.076994	0.2937
@TREND(1990)	0.063355	0.059478	1.065187	0.2989
R-squared	0.798655	Mean dependent var		-0.028000
Adjusted R-squared	0.769891	S.D. dependent var		4.399292
S.E. of regression	2.110324	Akaike info criterion		4.477207
Sum squared resid	93.52285	Schwarz criterion		4.672227
Log likelihood	-51.96509	F-statistic		27.76618
Durbin-Watson stat	2.031725	Prob(F-statistic)		0.000000

Source: E-view output result 2021

Appendix 4

ADF Test Statistic	-6.299442	1% Critical Value*		-4.3738
		5% Critical Value		-3.6027
		10% Critical Value		-3.2367
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(TLS,3)				
Method: Least Squares				
Date: 05/05/21 Time: 03:10				
Sample: 1991 2020				
Observations: 30				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TLS(-1),2)	-2.373343	0.376755	-6.299442	0.0000
D(TLS(-1),3)	0.364178	0.202011	1.802762	0.0858
C	1.263952	10.98690	0.115042	0.9095
@TREND(1990)	-0.058166	0.625840	-0.092940	0.9268
R-squared	0.888145	Mean dependent var		-0.280000
Adjusted R-squared	0.872165	S.D. dependent var		63.00101
S.E. of regression	22.52536	Akaike info criterion		9.212807
Sum squared resid	10655.23	Schwarz criterion		9.407828
Log likelihood	-111.1601	F-statistic		55.58084
Durbin-Watson stat	2.212067	Prob(F-statistic)		0.000000

Source: E-view output result 2021

Appendix 5

ADF Test Statistic	-7.014688	1% Critical Value*		-4.3942
		5% Critical Value		-3.6118
		10% Critical Value		-3.2418
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(FDI,3)				
Method: Least Squares				
Date: 05/05/21 Time: 03:11				
Sample: 1991 2020				
Observations: 30				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FDI(-1),2)	-2.056418	0.293159	-7.014688	0.0000
D(FDI(-1),3)	0.615959	0.183360	3.359289	0.0031
C	-0.047499	2.320402	-0.020470	0.9839

@TREND(1990)	-0.015630	0.136968	-0.114117	0.9103
R-squared	0.760482	Mean dependent var		0.250000
Adjusted R-squared	0.724554	S.D. dependent var		8.828068
S.E. of regression	4.633226	Akaike info criterion		6.055396
Sum squared resid	429.3357	Schwarz criterion		6.251738
Log likelihood	-68.66475	F-statistic		21.16703
Durbin-Watson stat	2.488204	Prob(F-statistic)		0.000002

Source: E-view output result 2021