DOES INFORMATION AND COMMUNICATION TECHNOLOGY MATTER IN PUBLIC SECTOR EFFICIENCY IN NIGERIA?

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ABSTRACT
This paper examined whether ICT matters in Public Sector Efficiency in Nigeria using secondary data from 2000 and 2019. The objective of the study is to determine whether or not ICT is relevant in improving public sector efficiency in Nigeria. The paper also employed the co-integration regression technique to analyze the results. Relevant theories and literature were reviewed to give relevance to the study area. The result suggests that ICT had a significant positive relationship with Public Sector Efficiency in Nigeria. It further revealed that ICT and efficiency are co-integrated suggesting the existence of a long-run equilibrium relationship in the public sector of Nigeria. The coefficient of ICT is inelastic suggesting that an increase or decrease in ICT contribution to GDP will increase or reduce the efficiency of the Public Sector in Nigeria. The relationship between ICT and efficiency extends to the long run. Government policies on ICTs influence efficiency in the public sector of the economy especially when there are ICT investment and ICT use. There are also evidences that capital stock, labour, educational output, foreign direct investments and corruption perception index scores were significant in determining public sector efficiency in Nigeria. The paper concludes that the ICT sector has not been fully utilized given its potentials in the country. The government could perform better with the suggestions of this paper.

Keywords: ICT, Efficiency, Public Sector, Economic growth, Nigeria
JEL Classification: C51, D73, H11, O33

1. INTRODUCTION

The role of Information and Communication Technology (ICT) in promoting efficient service delivery in the Public Sector is well known in developed countries.[1] But the rising inefficiencies in the Public Sector management in developing countries (Nigeria inclusive), call for concern among policymakers and researchers. According to Nwokorie, (2017), Public Sector institutions or organizations if not well managed, destroy democratic settings by breeding corruption and creating a totalitarian state. But when the Public Sector is effectively and efficiently managed, it promotes good governance and accountability. At the heart of Public-Sector management is the deployment of ICTs for maximum performance and efficiency. Recent data showed that the telecommunication industry's contribution to

[1] *ICT is rapidly changing governance in both private and public organizations and making government more accountable and transparent in many countries.*

GDP was 10.88% and 11.20% in 2020Q1 and 2020Q2 respectively. Also, broadband penetration rose from 38.49% in January 2020 to 45.07% in November 2020 (NCC, 2020). This suggested that the ICT sector is growing fast in Nigeria. Dimelis and Papaioannou, (2011) argued that a low level of technical efficiency in the Public Sector would imply that the country could produce more output with the same level of inputs to achieve high economic growth. Conversely, a highly efficient Public Sector would imply that the country should rely more on technical progress (use of ICTs inclusive) and innovative activities to achieve higher economic growth. This suggests that ICTs contributes to reducing Public Sector inefficiencies in many countries.

Nigeria had prioritized Public Sector reforms since the return of democracy in 1999 to remove inefficiency in public administration. The reform measures included civil service reforms, constitutional reforms, Police reforms, anti-corruption crusades, Due process, minimum wage reforms, telecommunications and e-governance reforms, etc. Most of the reform measures failed to improve Public Sector Efficiency as the country is still confronted with widespread insecurity, corruption, bureaucracy, harsh business environment, slow and redundant Public Service and lack of proper accountability and transparency in public sector management. The Public Sector reforms measures are gradually becoming a matter of Public Policy because of the growing inefficiencies being experienced by various administrations in Nigeria. The global environment is gradually changing due to technological innovations, forces of globalization and the outbreak of Corona Virus Disease in 2019 (COVID-19). Public Sector institutions across the world have been subjected to incomplete information, risks and uncertainties. The Public Sector needs information and technology to respond efficiently, strategically and cooperate with other countries to bounce back on the path of economic prosperity. But, does ICTs matter in reducing the Public Sector inefficiency in Nigeria? The objective of this study is to investigate whether ICT is a prolific tool for promoting Public Sector Efficiency in Nigeria.

2. Literature Review

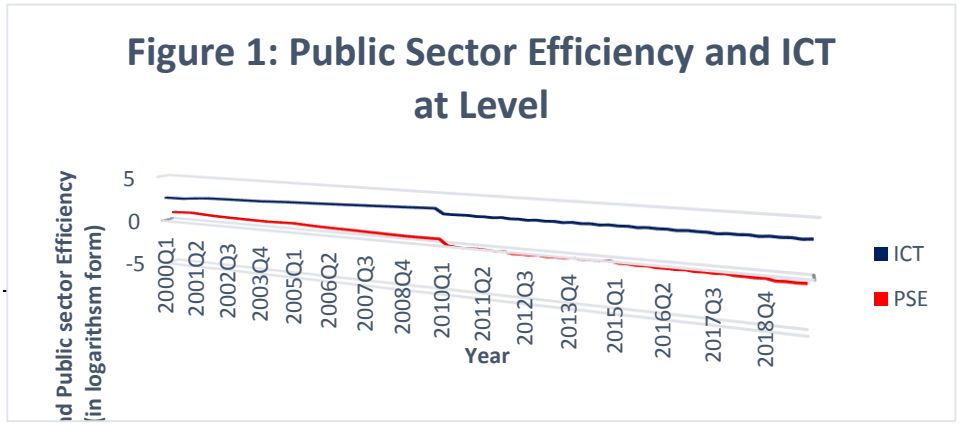
The Public Sector is made up of the civil service (Ministries, Departments and Agencies (MDAs)), statutory corporations or Parastatals, Judiciary, Legislature, Educational and Research Institutions belonging to Federal and State Governments, Healthcare institutions at Federal and State level, Nigerian Police Force, Armed Forces, other Para-Military institutions such as Nigerian Correctional Service, Immigration, Nigerian Customs Service, Nigerian Civil Defense Corps, etc. and other organizations in which the Federal or State Governments owned or controlling share or interest (the Federal Republic of Nigeria, 1999). The Public Sector renders essential services to the citizens to maximized welfare. Public Sector institutions are agencies, entities and related Government organizations that deliver public programmes, goods or services whose sources of funds are from taxes, fees, charges and direct financial allocation or subsidies from Government (Nwokorie, 2017).

However, Public Sector Efficiency has to do with the ability of the Government to produce maximum output with a given level of inputs to satisfy the needs of the citizens. According to Stone (2013), Public Sector Efficiency is Government doing the work they are

doing with the fewest possible resources, getting more for less, or value for money. So that every item that is produced or service that is provided, is done with the least expenditure of time, money, materials etc.[2] In other words, Public Sector Efficiency refers to the inverse of the ratio of Government production inputs or expenditures to the total Government output of goods or services produced. ICT is the technological innovations that comprise both hardware and software components which are capable of receiving (storing), processing and transmitting data and information. According to Chidi and Sunny, (2015), ICT is one of the means of deliverying Public Service and its use in the Federal Public Service has increased over the year in Nigeria. ICT includes computers, television, internet broadband, radios, calculators, mobile phones, digital platforms, artificial intelligence, robotics etc. The Federal Government via e-governance initiative had improved service delivery between the Government and its client or customers (Fashedemi, 2018). But the inefficiencies that are still manifesting in the Public Sector make one to wonder whether the utilization of ICT to drive efficiency and transparency in governance and improve the quality and cost-effectiveness of public service delivery, has yielded any results.

Figure 1 showed the graph of ICT and Public Sector Efficiency at levels. It appears that both ICT and Public Sector Efficiency graphs are moving in the same direction. But empirical data also suggests that Public Sector Efficiency has been decreasing consistently from the year 2000 to 2019 while ICT has been relatively stable and gradually rising over the period. Public Sector Efficiency decreased from 7.89 in 2000 to 2.38 in 2009 and further declined to 0.19 in 2019.[3] The decline in Public Sector efficiency was due to rising administrative cost and decline in productivity (or output) in Nigeria.

Figure 1: Public Sector Efficiency and ICT at Level

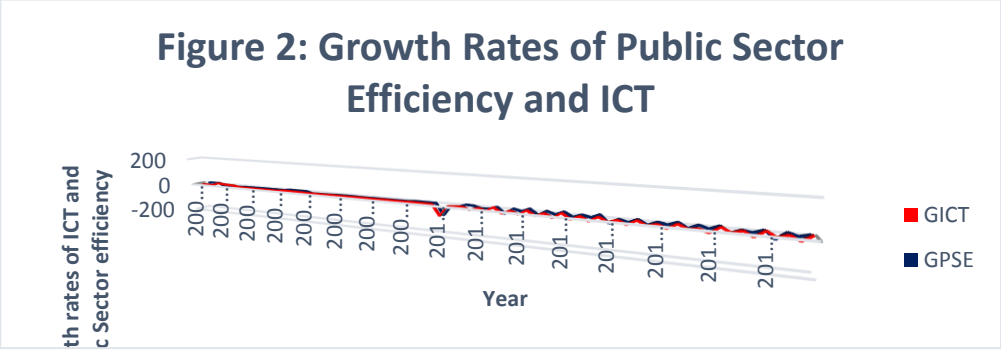


[2] *It should be noted that public sector efficiency may require a reduction in government monetary outlay for inputs or privatization of existing assets which may not improve efficiency after all due to the misconception of the term by the government (Stone, 2013).*

[3] *Note that the graph captured the empirical data in natural logarithms. The antilog of each point value will give the exact value of the data used for the analysis.*

Source: Author's computation from CBN (2019); NBS, (2006)

Labour or personnel cost constituted a major source of administrative cost in the Public Sector that was not back up by more productive outputs. The rising expenditures were not supported by an increase in Public Sector output in Nigeria. However, ICT contributes ₦455.91 billion in GDP in 2000. By 2009 and 2019, the contribution of ICT to GDP had risen ₦4,596.1 billion and ₦9,309.92 billion respectively in Nigeria. It is worthy to note that the growth rate of ICT (GICT) and growth rate of Public Sector Efficiency (GPSE) behave similarly (see Figure 2). That is, growth rates in ICTs rises or falls with a rise or fall in Public Sector Efficiency respectively. In Figure 2, the ICTs contribution to GDP rose tremendously as positive growth rate were recorded between 2000 and 2009. Even in periods of low efficiency in the Public Sector, the growth rates of ICTs contribution in GDP continued to rise till 2019. The wavelike curves of the GICT and GPSE suggest that they are positively related.



There is much theoretical consideration on the effect of ICT on Public Sector Efficiency and growth. While many Economist generally believes that ICT is positively related to efficiency, productivity and economic growth, others believe that there is a negative relationship between ICT and efficiency. Early works of Neo-classical Economist such as Solow, (1956) attributed the United States of America's economic growth to technical progress and population growth as opposed to the Harrod-Domar model that considered only investments. They ignore technological innovation. But modern-day Neo-classical Economist (Romer 1990) have emphasized the role of human capital, technology, knowledge, idea, skills and the technical progress in achieving efficiency and economic growth. Unlike the exogenous models, the endogenous growth model recognized the crucial role of human capital and technological innovation, research and development, technical progress, knowledge, ideas and skills in economic growth.

Few empirical studies have found evidence that ICT is positively related to efficiency and growth. Dimelis and Papaioannou, (2015) undertook a Panel Data analysis of the effects of ICTs on aggregate technical inefficiency using a maximum likelihood and translog stochastic production frontier between 1993 and 2001. They reported that ICT had a

significant impact on efficiency and labour productivity (i.e. ICT was effective in reducing country inefficiencies). Similarly, Lee et al., (2017) measured the efficiencies levels of the hardware and software industries in China, Japan, South Korea and the USA using stochastic frontier analysis and Meta frontier analysis in a Tobit regression. They reported that the USA significantly performed better than other countries with the highest technology gap ratios in both hardware and software. South Korea which had the most hardware-centric industrial structure among the four countries, recorded the highest efficiency gap between the hardware and software industries. The Tobit regression further showed that an equitable ecosystem is crucial in achieving high efficiency in both hardware and software industries. Bhatnagar, (2014) investigated the ways of improving governance through the use of ICT in delivering Public Services (i.e. improving efficiency, accountability and transparency, and reducing corruption). He concluded that ICT can in one hand increase the efficiency, speed and transparency of Public Service delivery and on the other hand assist in the generation and dissemination of knowledge.

Izevbigie, et al., (2019) tried to explain the extent to which ICT has been deployed in tax administration using descriptive statistics in Nigeria. The study reported that ICT was positively correlated with tax revenues in Nigeria. They further showed that ICT has not been fully utilized in tax administration because of the low compliance rate in Nigeria. Also, Nneka, et al., (2020), used random effect regression analysis to show that investment in ICT hardware and software have significant positive effects on the financial performance of listed insurance companies in Nigeria. Although, the study is not on Public Sector Efficiency, it however provided some insight on the effects of ICT investment in Nigeria. According to EPSU, FSESP and EGOD (2014), recent studies have shown no significant difference in efficiency between public and privately-owned companies in Public Services across the world. Most of the studies they reviewed showed no significant difference in efficiency between public or private companies in most countries. Therefore, Public Sector Efficiency remains an issue of debate among scholars and organizing Public Sector institutions for optimal performance also remains the objective of public policy. However, ample evidence exists on the effects of ICTs on economic growth. Gordon (2012), Posu, (2006), Akinwale et al., (2018), Okogun, et al., (2012) and Klonner, et al., (2008) have shown that ICT is positively related to economic growth and productivity. None of the empirical studies investigated whether ICT matters in Public Sector Efficiency in Nigeria.

3. Methodology

This paper investigates whether ICT matters in Public Sector Efficiency in Nigeria. The data collected range from 2000 to 2019. The sources of data included the Nigerian Communication Commission (NCC), Central Bank of Nigeria (CBN), Transparency International, National Bureau of Statistics (NBS) and Federal Ministry of Communication and Digital Economy.[4] Online materials and information were also used in this paper. Therefore, Government ICTs policies tend to influence public sector investment and

[4] *The data were quarterly secondary data. The sample size is sufficiently large to represent the true population and justifies the use of time series data in a regression model.*

adoption of ICTs. The adoption and usage of ICTs increase the efficiency of the Public Sector in terms of productivity and growth.[5] Hughes and Scott-Morton, (2005) argued that the impact of ICTs on the economy may lie on ICT production, ICT use and the lags between ICT investment and efficiency or productivity growth. The endogenous growth model follows a Cobb-Douglas production function which captured technological innovations (ICTs) in achieving economic growth and will form the foundation of this paper. This paper adopted Romer (1990)[6] and Katz and Koutroumpis (2012), but differs from them because the model incorporated more variables that could explain Public Sector Efficiency or inefficiency as the case may be in Nigeria.[7]

The model tried to capture the major sources of Public Sector inefficiencies in Nigeria. The paper specified Public Sector Efficiency to depend on capital stock, labour, ICTs, educational output, foreign direct investment (FDI), power supply (electricity generation), general price level (consumer price index) and corruption perception index score. The aggregate Public Sector function is expressed mathematically in a Cobb-Douglas production function as in equation (1);

$$PSE_t = K^{\propto 1} L^{\propto 2} ICT^{\propto 3} EDU^{\propto 4} FDI^{\propto 5} ES^{\propto 6} P^{\propto 7} CP^{\propto 8} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

To linearize the variables in the short run, equation (1) is transformed into equation (2) as follows;

$$\Delta LPSE_t = \propto_0 + \propto_1 \Delta LK_t + \propto_2 \Delta LL_t + \propto_3 \Delta LICT_t + \propto_4 \Delta LEDU_t + \propto_5 \Delta LFDI_t + \propto_6 \Delta LES_t + \propto_7 \Delta LP_t + \propto_8 \Delta LCP_t + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

In the long run, the linear combination of equation (2) cancels out the stochastic trends in the variables under investigation. If the error terms in equation (3) are stationary at levels, then there is a long term relationship in the equation (Gujarati and Porter, 2009). .

$$\varepsilon_t = \Delta LPSE_t - \propto_0 - \propto_1 \Delta LK_t - \propto_2 \Delta LL_t - \propto_3 \Delta LICT_t - \propto_4 \Delta LEDU_t - \propto_5 \Delta LFDI_t - \propto_6 \Delta LES_t - \propto_7 \Delta LP_t - \propto_8 \Delta LCP_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3)$$

The disequilibrium error term, $\varepsilon_t$becomes zero in the long run. The co-integrating regression method account for serial correlation effects and for the endogeneity in the explanatory variables that results from the existence of a co-integrating relationship (Phillips, 1993). The co-integrating regression is written as in equation 4;

$$\Delta LPSE_t = \propto_0 + \propto_1 \Delta LK_{t-3} + \propto_2 \Delta LL_{t-3} + \propto_3 \Delta LICT_t + \propto_4 \Delta LEDU_{t-1} + \propto_5 \Delta LFDI_t + \propto_6 \Delta LES_{t-1} + \propto_7 \Delta LP_{t-1} + \propto_8 \Delta LCP_{t-2} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

The a-priori expectation requires that; $\propto_1 > 0,\ \propto_2 > 0, \propto_3 > 0, \propto_4 > 0, \propto_5 > 0, \propto_6 > 0, \propto_7 < 0$ and $\propto_8 > 0$. Where; Δ = change, L = natural logarithms of numbers, PSE_t = Public

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[5] *Gordon (2012) however discovered a slowdown in productivity growth in the USA in the 1970s and 1980s despite the surge in ICTs development, suggesting that economic efficiency may not depend on ICTs adoption and use in the public sector economy at large. Yet, the proponent of the endogenous growth sees growth arising from technological innovation and human capital development.*

[6] *Romer (1990) and Katz and Koutroumpis (2012) specified a three-component endogenous growth production function that is similar to the Solow model but differs in its foundations and assumptions.*

[7] *The slowdown in productivity growth did not stagnate economic growth in most economies in the world. Many countries (including Nigeria) are still witnessing high economic growth arising from the ICTs revolution*

Sector Efficiency (defined as the ratio of Public Sector output to Public Sector inputs (expenditures on administration and transport and communication)) at time t, K_{t-3} = capital stock (proxied by gross capital formation) at time t-3, L_{t-3} = labour (proxied by labour force) at time t-3, ICT_t = information and communication technology in GDP at time t, EDU_{t-1} = educational output in GDP at time t-1, FDI_t = foreign direct investment at time t, ES_{t-1} = electricity generation at time t-1, P_{t-1} = general price level (proxied by a consumer price index) at time t-1, CP_{t-2} = corruption perception index score at time t-2, ε_t = the error term at time t, $\propto_0$ = the intercept term and $\propto_1, \propto_2, \ldots, \propto_8$ = respective elasticity coefficients of the explanatory variables with k = 1, 2, …., 8.

The paper justified the model on the ground that the Public Sector production inputs include capital resource, labour, ICTs infrastructures, education and research outputs, foreign direct investments, electricity generation, general price level and corruption perception index score.[8] Availability of capital lubricates investment decisions through an increase in productivity and hence greater efficiency in the Public Sector. Labour is the most crucial factor of production in the Public Sector. However, the skills, quality and quantity of labour in the Public Sector determines also the extent of its efficiency. ICT provides the infrastructure that stimulates efficiency, productivity and performance in the Public Sector. It facilitates Public Sector Efficiency by improving transparency and accountability in Public Sector management. FDI brings new technology into a country via the transfer of technology and adds to the country's stock of existing capital. Uninterrupted power supply promotes efficiency by guaranteeing continuous production in the Public Sector. Also, when the general price level is high, inefficiencies emerge in the Public Sector because it makes contract enforcements difficult and the ease of doing business is worsening. Efficiency is promoted in sectors where corruption perception is low (i.e. high corruption perception index score) and inefficiencies are experienced where the sector is perceived to be highly corrupt (i.e. low corruption perception index score). Therefore, the utilization of these inputs determines the extent to which Public Sector Efficiency could be achieved in Nigeria.

The estimation technique of this paper begins with the Augmented Dickey-Fuller (ADF) test of unit-roots. The null hypothesis of no unit roots is rejected if the ADF test statistics is greater than the 1%, 5% and10% critical values. The Johansson co-integration test was used to determine the existence of a long-run relationship between ICTs and Public Sector efficiency in Nigeria. In addition to the above, the Engle-Granger (EG) test for co-integration was also used.[9] The null hypothesis of no co-integration is rejected if the Trace statistics is greater than the 5% critical values. Most economic relationships are expressed in terms of long-run equilibrium relationships to determine their reliability in predicting the

[88] *One-quarter lag was placed on education output, electric power generation and the general price level while three-quarter lags were on the capital stock and labour stock. Two-quarter lag was also placed on corruption perception index score. The effects of ICTs on the lagged variables may not be instantaneous but emerges with considerable lag (Hughes and Scott-Marton, 2005).*

[9] *The Engle-Granger and augmented Engle-Granger test subject the residuals of a co-integrating regression to unit root test. If the residuals are stationary, then the variables under consideration are co-integrated (Engle and Granger, 1987).*

behaviour of variables in an economic system. For ICT to matters in public sector efficiency, there must be a significant long term equilibrium relationship in the co-integrating regression. This is to avoid spurious result and maintain the efficiency of the estimate. Next is the use of ordinary least square method to estimate the co-integrating regression (i.e. equation 2). The fully modified ordinary least square method was chosen because of its unbiasedness, consistency, efficiency and sufficiency features.

4. Results and Discussion of Findings

Stationarity Test Results

Table 1 showed the stationarity results of the variable using the ADF test. The stationarity test results showed that unit-roots exist in the data. The variables under investigation are integrated of order one (i.e. I (1)). This suggests that the variables are stationary at first difference. The null hypothesis of no unit roots is therefore rejected at 1% and 5% levels of significance respectively. The stationarity test suggests that there could be co-integration in the variables under investigation since they are integrated of the same order.

Table 1: Augmented-Dickey Fuller (ADF) Test Results

Variable	ADF Test Statistics	Order of Integration	Level of significance		
			1%	5%	10%
ICT_t	-10.9043*	I (1)	-3.5166	-2.8991	-2.5869
K_t	-3.0687**	I (1)	-3.5203	-2.9001	-2.5877
L_t	-3.8716*	I (1)	-3.5167	-2.8991	-2.5869
EDU_t	-3.4548**	I (1)	-3.5203	-2.9001	-2.5877
FDI_t	-12.2978*	I (1)	-3.5167	-2.8991	-2.5869
ES_t	-4.8203*	I (1)	-3.5167	-2.8991	-2.5869
P_t	-8.5419*	I (1)	-3.5178	-2.8996	-2.5871
CP_t	-4.3227*	I (1)	-3.5216	-2.9012	-2.5879
PSE_t	-10.0790*	I (1)	-3.5167	-2.8991	-2.5869
Residual	-7.9216*	I (0)	-3.5203	-2.9007	-2.5877

Source: Author's computation from E-views 9; Note * and ** = significant at 1% and 5% level of significance respectively

Co-integration Test Result

In Table 2, we presented the co-integration test results. The results indicated that the variables under investigation are co-integrated. This means that a long-run equilibrium relationship exists between the co-integrating variables. The residual test further confirms that the error terms are stationary at levels (i.e. I (0)). Therefore, hypothesis of no co-integration is rejected at 5% level of significance. This means that ICT and Public Sector Efficiency are co-integrated. This finding implies that ICT matters in Public Sector Efficiency in Nigeria. Since long term relationship exists, ICT is capable of improving efficiency in the Public Sector in Nigeria.

Table 2: Johansen Co-Integration Test Results
Series: PSE_t, K_t, L_t, ICT_t, EDU_t, FDI_t, ES_t, P_t, CP_t

Hypothesis: No. of co-integrating equations	**Eigenvalue**	**Trace Statistics**	**0.05 critical value**	**P-values**
None	0.5936	284.28*	197.37	0.000
At most 1	0.5018	214.94*	159.52	0.000
At most 2	0.4482	161.29*	125.62	0.000
At most 3	0.4093	115.51*	95.74	0.001
At most 4	0.3616	74.97*	69.82	0.018
At most 5	0.2303	40.41	47.86	0.208
At most 6	0.1339	20.24	29.79	0.407
At most 7	0.1122	9.17	15.49	0.349
At most 8	0.0002	0.01	3.84	0.911

Source: Author's computation from E-views 9; Note: * denotes rejection of the null hypothesis of no co-integrating equations in the series

Impact of ICT on Public Sector Efficiency

Table 3 presented the co-integrating regression results of the effects of ICTs on Public Sector Efficiency in Nigeria. Theoretical perspectives have linked ICTs to economic growth but in this paper, we linked ICTs to efficiency in the Public Sector in Nigeria. Greater efficiency in the Public Sector goes a long way in improving productivity and economic growth via investments, use and production of ICTs. This also depends on the right combination of factor inputs. The intercept or constant term is significant at 1% level of significance. However, the coefficient of three quarter lag capital stock did not meet the a-priori expectation of the model but was also significant at 5% level of significance. The coefficient of capital stock is inelastic. This means that a 1% change in three quarter lag capital stocks, will change current Public Sector Efficiency by -0.239%. In a practical sense, an increase in capital stocks is associated with an increase in Public Sector Efficiency. This is because the increase in capital stock add to the national existing capital stock thereby having a multiplier effect on investments, productivity and output, but the empirical results suggest otherwise. The coefficient of three quarter lag labour stock is elastic and met the a-priori expectation of the model. This showed that labour had a significant positive relationship with Public Sector Efficiency, at 5% level of significance in Nigeria. A 1% change in three quarter lag labour stock will result in a change of 1.820% in current Public Sector Efficiency in Nigeria. That is to say that labour is an important determinant of Public Sector Efficiency in Nigeria. Although rising personnel cost is reducing Public Sector Efficiency, labour, however, had a significant impact on efficiency in Nigeria. The issue is about raising output in the public sector in Nigeria.

The ICT coefficient is inelastic and meets the a-priori expectation of the model. It is significant at 1% level of significance. ICT is positively related to Public Sector Efficiency

in Nigeria. A change in ICT contribution to GDP by 1% will result in a change of 0.891% in Public Sector Efficiency in Nigeria. This means that ICT positively and significantly influence Public Sector Efficiency in Nigeria. This finding is consistent with Demilis and Papaiannou, (2015) who showed that ICT had significant effects on efficiency and labour productivity and Bhatnagar, (2014) who reported that ICT was significant in improving efficiency, speed, accountability and transparency of public service delivery and dissemination of knowledge.[10] Accountability and transparency are improved in sectors where there are ICTs investments and ICTs use. The Public Sector in Nigeria undertook the ICT reforms, e-governance initiative and the national broadband plan to improve the efficiency and productivity of the Public Sector in Nigeria. It appears that the reforms measures yielded some dividends. The dividends included greater ICTs contribution to GDP and wider broadband coverage and penetration in Nigeria. Data from NCC Websites indicated that the telecommunication industry's contribution to GDP was 10.88% and 11.20% in 2020Q1 and 2020Q2 respectively. Also, broadband penetration rose from 38.49% in January 2020 to 45.07% in November 2020 (NCC, 2020). The problem is the persistent inefficiencies in public sector management in Nigeria.

Table 3: Long-Run Co-Integrating Regression Results
Dependent variable: D(PSE_t)

Variable	**Coefficient**	**Standard error**	**t- Statistic**	**P-Value**
C	-0.0322*	0.0077	-4.1620	0.0001
$D(K_{t-3})$	-0.2394**	0.0969	-2.4694	0.0161
$D(L_{t-3})$	1.8204**	0.8996	2.0235	0.0471
$D(ICT_t)$	0.8912*	0.0624	14.279	0.0000
$D(EDU_{t-1})$	-0.0884**	0.0423	-2.0884	0.0406
$D(FDI_t)$	0.0417*	0.0151	2.7666	0.0073
$D(ES_{t-1})$	0.0682	0.0692	0.9855	0.3280
$D(P_{t-1})$	-0.1591	0.4268	-0.3728	0.7104
$D(CP_{t-2})$	0.4353***	0.2513	1.7320	0.0879
R^2 = 0.8332	Adj. R^2 = 0.8121	S.E. of Regression = 0.0373	Long run variance = 0.00115	Sum of Squ. Resid. = 0.0919

Source: Author's computation from E-views 9; Note: *, ** and *** = significant at 1%, 5% and 10% levels of significance respectively

The coefficient of education output is inelastic. The coefficient of education did not meet the a-priori expectation of the model but was also significant at 5% level of significance. A 1% change in educational output will result in a change in Public Sector

[10]*Although studies by EPSU, FSESP and EGOD (2014) showed no significant difference in efficiency between public and privately-owned companies in public services across the world, the empirical evidence in Nigeria is compiling that ICT matters in public sector efficiency in Nigeria.*

Efficiency by 0.0884% in Nigeria. That educational output had a significant negative effect on efficiency in Nigeria. In practice, educational output is positively related to efficiency of the public sector. Similarly, the coefficient of FDI meet the a-priori expectation and was significant at 1% level of significances. A 1% change in FDI will result in a change in Public Sector Efficiency by 0.0417% in Nigeria. Educational output and foreign direct investments influence Public Sector Efficiency by improving productivity in the ICT sector which may lead to more output being produced in the Public Sector. The coefficients for one quarter lag electricity power supply and one-quarter lag general price level were not significant but met the a-priori expectation of the model. Their impact on efficiency is not significant statistically but also accounts for the inefficiencies in the Public Sector in Nigeria. The coefficient for two-quarter lag corruption perception index score meets the a-priori expectation and also significant at the 10% level of significance. That is a 1% change in three quarter lag corruption perception index score will result in a change in current Public Sector Efficiency by 0.435% in Nigeria. High corruption perception index scores are associated with high Public Sector Efficiency and conversely, low corruption perception index scores with low Public Sector efficiency in Nigeria. Efficiency is high in countries where corruption is perceived low. The coefficient of determination showed that the model has the goodness of fit. About 83.24% of the variations in Public Sector Efficiency are explained by variations in capital stock, labour stock, ICTs, educational output, foreign direct investment, electricity generation, general price level and corruption perception index scores. The standard error of regression is small and good, meaning that the average distance of the observed values or data fall from the regression line is 0.0373. The long run variance is also very small indicating that the extent to which the long run observed values deviate from the mean value is 0.00115. The sum of square residuals of 0.0919 showed the square of the deviations of public sector efficiency data from the predicted model or co-integrating regression.

5. Conclusion and Policy Recommendations

This paper examined whether ICT matters in Public Sector Efficiency in Nigeria. The results of the study showed that ICTs are positively related to Public Sector Efficiency in Nigeria. The coefficient of ICT is inelastic suggesting that an increase or decrease in ICT contribution to GDP will increase or reduce the efficiency of the Public Sector in Nigeria. The relationship between ICT and efficiency extends to the long-run. The co-integration test confirms that ICT matters in Public Sector Efficiency in Nigeria. Increases in ICTs usage, investment and production are associated with an increase in efficiency of the Public Sector. Conversely, a decrease in ICT usage, investments and production are associated with a decrease in efficiency in the Public Sector. There is no doubt that Government policies on ICTs influence efficiency in Government administration in the Public Sector of Nigeria. The Public Sector has not fully utilized the potentials embedded in the ICTs sector in Nigeria. The ICT sector can perform better with the right combination of factor inputs such as capital, labour, ICT adoption and use, quality education, foreign direct investments, stable electricity generation, general price stability, and anti-corruption measures in Nigeria. The paper

recommends that government policy should seek to improve the existing capital stock, control population growth, improve digital education, attracts foreign investments in ICTs, and improve electricity supply, price stabilization, and anti-corruption crusade to improve Public Sector Efficiency in Nigeria.

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