

## **The role of Technology in improving Public Sector Performance in Nigeria**

### ***Abstract***

Over the years, the public sector in Nigeria has faced various challenges, including bureaucracy, corruption, and inefficiencies in service delivery, which have dampened the efficiency of the public sector, especially in revenue generation. However, the rapid advancement of technology globally, the increasing rise of globalization, and the contagion effect across the globe led to the adaptation of technology to a great extent in Nigeria. Nigeria, as a developing economy, relies on the Western world for most of its technology, which is accompanied by a huge cost of the transfer, and is left with the dilemma of whether technology truly promotes public sector efficiency in Nigeria or not. Against this backdrop, this study seeks to investigate the impact of technology on public sector efficiency in Nigeria. The study employed monthly data ranging from 2010 to 2022 and was extracted from the database of the Central Bank of Nigeria. The independent variables are Information, Communication, and Technology which served as a proxy for Technology, while Foreign Direct Investment, Exchange Rate, and Inflation were also included as the control variables in the model. The result of the unit root showed that the variables are stationary at levels and first difference, hence the use of the ARDL model which established a short-run relationship among the variables. The result, in the long run, ARDL showed that technology had a positive and significant impact on public sector efficiency. The study, therefore, recommends that the Government needs to intensify efforts in the process of acquisition and implementation of technology in the public sector to improve revenue generation for the Government and, invariably, output. A large portion of government budgetary allocations should be channeled more towards adequate IT infrastructure development for increased efficiency. Ultimately, the Monetary and Fiscal Authorities should collaborate in churning out policies that will improve economic parameters such as exchange rate, Inflation, output, etc.

***Keywords: Public sector, Technology, ARDL, Nigeria***

## Introduction

In recent years, the global economy has witnessed rapid advancement in technology, revolutionizing various sectors and transforming the way governments operate. Technological advancement supports public organizations in providing higher-quality public goods and services at lower average prices, Propheter (2019). Though he asserts the existence of a large body of literature that has examined the factors that influence technology adoption and diffusion, it is far less clear whether technological advancements can enhance the outputs and efficiency of the public sector. On the contrary, Hinkley (2022), opined that technology poses the most risk when it is merely added on top of overburdened personnel and procedures because there is no provision for evaluation and recalibration to make sure technology is operating as intended. The size, resource capability, mission, political and social backdrop of the public sector vary greatly, which has an impact on whether and how technology is adopted.

Before independence, the Nigerian public service was founded as a means of enforcing the British colonial masters' administrative system. Also, it has evolved into a vast and intricate system for utilizing the nation's resources to promote economic development (Inyang, 2008). Therefore, policymakers and stakeholders in both the public and private sectors have emphasized the need for employee talent, and skills development, to deal with the mounting demands brought on by economic and technological change.

Over time, the public sector plays a critical role in Nigeria's socio-economic development, encompassing government agencies, institutions, and services responsible for delivering essential public goods and services to its citizens. It is worthy of note that, the effectiveness of the sector has been constrained and daunted with challenges such as shortfall in revenue, bureaucratic red tape, corruption, inefficiency, and limited access to **Information Communication and Technology (ICT)** services. However, due to technological

breakthroughs, advancements in technology have presented a promising solution and addressed some of these issues, hence improving the efficiency and productivity of the public sector. The performances of workers in both private and government institutions which were hitherto low, have now been expected to be enhanced through increased access to **(ICT)** and improved work tools.

In addition, the place of ICT in terms of its contribution to the growth of the Nigerian economy cannot be overemphasized. Most Economic growth theories predict that investments in ICT drive economic growth. Early studies, dating back to the late 1980s and early 1990s, indicated that ICT's share contribution to growth in most countries was insignificant (Roach, 1989 1991; Oliner & Sichel, 1994; Jorgenson & Stiroh, 1995). However, later studies showed that investments in ICT had a considerable effect on the labor force's productivity, thus resulting in efficiency in service deliveries and invariably generation of revenue (Jorgenson, 2001; Oliner and Sichel, 2004).

According to Lawan, Ramli, and Razali (2018), ICT literature promotes good service delivery to Nigerian residents, and technology aids in lowering leakages and corruption in the public sector through the e-government system. This is supported by the work of Fountain (2001), which infers that ICT improves, coordinates, manages, and redirects the production process in the public service towards achieving efficiency. They discovered that the usage of information technology is beneficial to the Nigerian public sector since it enhances employee performance. Before coming to these conclusions, they studied the literature, which is not an empirical or scientific process.

However, practically all employers in the public sector have had to watch as revenue falls short of the costs of running the government during the past few decades. Nigeria, Africa's most populous nation and rapidly developing economy has experienced challenges in technology advancement on public sector efficiency. Therefore, this paper aims to explore and analyse the role of technology in promoting efficiency within Nigeria's public sector.

## **Literature Review**

The literature review focuses on both theoretical and empirical literature. Though, they are relevant IT theories such as the Technology Acceptance Model (TAM), Cybernetics Theory, New Public Management Theory, Cobb-Douglas, and the theory of efficient growth. The

theory of efficient growth is more relevant to this study and will be discussed under the theoretical literature, which is also adopted in the study. A review of studies relating to technology and public sector efficiency will be explained under the empirical literature.

**Theoretical Literature**

**Cobb-Douglas Theory:**

According to economic theory, the production function, the definition of profit, and the conditions for profit maximization influence a firm's output, inputs, and profit. According to Greer (2022), the Cobb-Douglas Production Function, created by Cobb and Douglas (1928), is a function that sums up the relationship between inputs and outputs. In more detail, the production function (f) shows the maximum output (y) that can be produced from any combination of inputs. ( $x_i, i = 1, \dots, n$ ). That is

$$y = fX_1X_2 \dots \dots X_nA \dots \dots \dots (1)$$

where A is a technical knowledge variable that reflects advancements in both human and technological resources. The most popular Cobb-Douglas Production Functions are estimated as such:

$$Y = A * K^\alpha L^{1-\alpha} \dots \dots \dots (2)$$

**The Theory of Efficient Growth:**

Van (2022) is of the view that Economic rules are applied to the market as part of the public sector's connection to the economy. Economic laws don't immediately benefit the taxpayer in the sense that they add value to his life. When it comes to the private sector, the value created by the goods and services that are consumed directly benefits the taxpayer, who is also the consumer.

Therefore, to maximize his welfare, the taxpayer invests and consumes in the private sector. This is not to say that there is no value produced by the public sector. Quite the opposite, it does. However, the value generated by the public and private sectors is inherently distinct. Because of the value the public sector creates, economic activity can take place inside a set of laws that safeguard both producers and consumers. By funding national defence, intelligence services, and infrastructure, the public sector supports economic expansion. Taxes and the government budget serve as the foundation for public sector economic investments. The following function could be used to represent these two factors:

$$PB = f(T!, GB) \dots\dots\dots(3)$$

The functional relationship can be reformed into a mathematical relationship, and can then be denoted as :

$$PB = T! + GB \dots\dots\dots(4)$$

In this case, (PB) stands for the public sector, (Tt) for absolute tax at a specific point in time, and (GB) for the government budget. The two components of the government budget are spending and revenue, which is represented by the letters (GS) and (GR), respectively. As a result, the function can be rewritten as:

$$PB = T! + G_s + G_r \dots\dots\dots(5)$$

The government budget determines how the public sector performs regularly. A budget deficit results when public spending exceeds public earnings, which are derived from taxes. Additionally, when public earnings surpass public spending, a budget surplus arises. The following set of equations, where (BD) stands for budget deficit and (BS) for budget surplus, could be used to describe this relationship:

$$BD = G_s > GR \dots\dots\dots(6)$$

$$BS = G_s < GR \dots\dots\dots(7)$$

A budget deficit typically results in lower investments, which harms the economy. The economy is penalized as a whole by excessive government expenditure since it generates debt that needs to be repaid. In doing so, the government neglects to make investments in public services and infrastructure that would promote economic growth.

**Empirical Literature**

This section reviews studies relating to the interactions between information technology and public sector efficiency from various scholars and researchers. However, most empirical studies of this prediction have produced positive results, depending on the research methodology employed and the geographical configuration considered.

For instance, Aliyu (2021) investigated the Effect of Information Technology on the Organizational Performance of the Nigerian Immigration Service, Kebbi State Command, employing primary data collected from 214 personnel. The study revealed that IT and

organizational performance are positively correlated and demonstrated that IT has a significant impact on organizational performance. The study found that the usage of IT aided in improving data gathering and reporting by NIS staff, and also increased the Agency's revenue. This enhanced communication in the provision of services hastened the decision-making process, increased operational efficiency and productivity of the staff, hastened information security, and overall, improved organizational performance.

Van et al., (2006), posit that IT governance, also known as Information Systems (IS) governance, is made up of organizational leadership, structures, and procedures that make sure an organization's IT supports and advances its strategy and goals. Hence, setting up a robust IT structure is fundamental to the success of that organization.

Garicano and Heaton (2010), opine that public organizations seem likely to benefit from Information Technology only when they recognize the precise ways in which new information and data availability interact with current organizational practices and make adjustments as necessary.

Samphina Academy (2023) investigated the Effect of ICT on the Performance of Public Service Organisations in Nigeria. Primary data was collected through a survey employing the chi-square technique. The result showed that ICT has a significant impact on public sector performance, hence it was recommended the government should have a political will towards ICT in the public service by investing in robust ICT equipment to enhance its productivity. Training of public sector employees on ICT to enhance efficiency was also recommended.

This is also evident in the work of Referen et al., (2016) which states that ICT through the New Public Management Model (NPM) channel is aimed at improving service delivery in the public service through transparency, elimination of bureaucratic bottlenecks, accountability, and prompt responsiveness to issues. Thus, the adaptation of the ICT has strengthened the public sector mechanism and provided competent organizational procedure thereby leading to a more efficient public service in Nigeria.

Further, the impact of the share of IT costs on the cost efficiency of cities using a stochastic frontier analysis (SFA) plays a relevant role in public sector cost containment (Cokky et al., 2022). SFA is a frequently used technique for the analysis of efficiency in public sector research (e.g., Geys, 2006; Worthington, 2000). SFA, an IT tool, has been used to investigate the effectiveness of municipalities in the context of local government, including the

effectiveness of local police forces (Davis & Hayes, 1993), as well as the effectiveness of local governments in several structural and political factors.

Greater public value is thought to be one of the main goals of increasing public service delivery efficiency (Moore, 1995). Thus, Cokky et al., (2022) demonstrate to scholars how IT may significantly enhance this value for public officials.

Cokky et al., (2022) in their study of efficiency improvements in the delivery of public services to municipalities through information technology found evidence to support their claim that a €1 rise in the share of IT costs is connected with a €1 increase in cost-effectiveness for municipalities' provision of public services. According to their findings, every increase of €1 in favor of the IT cost share results in a €1.08 net cost efficiency improvement. Thus, attesting to their claims.

In summary, there exist few empirical studies on the subject matter, and only (Leo 2022) has adopted the use of ICT contribution to GDP as a proxy to measure Technology developments. Furthermore, the use of public revenue as a proxy to capture public sector efficiency would invariably fill the gaps in the literature and serve as a contribution to the body of knowledge in terms of variables employed and the extended scope of the study.

### **Research question**

Based on the gap to knowledge stated, our gap to study becomes, what is the role of technology in improving public sector performance in Nigeria.

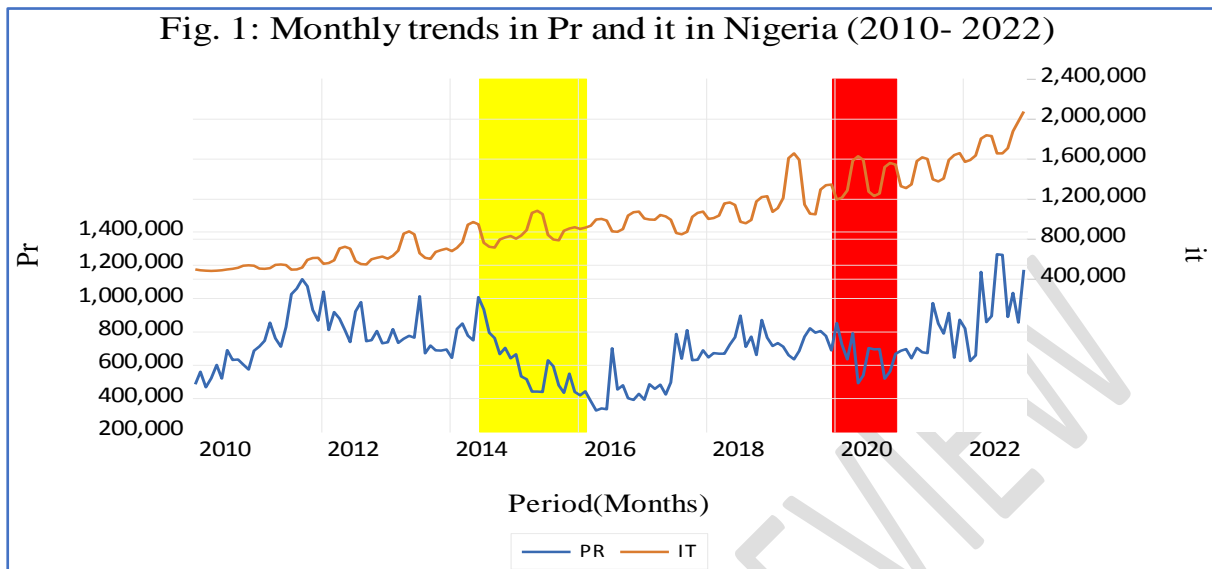
### **Stylized Facts**

This section provides the trend analysis of the variables used in the study. This involves the movements of the variables vis-à-vis some economic milestones and disruptions from the period M12010 to M122022.

### **Information Technology and Public Revenue**

Data from Figure 1 shows the trajectory of Public Revenue and Information Technology (value of ICT on GDP). The chart demonstrates a co-movement between the two variables

between 2010 and 2011, however in 2012, Infotech grew progressively indicating that information technology was a key contributor to GDP within the period 2010-2011.



**Fig1: Monthly trends in PR and IT in Nigeria (2010-2020)**

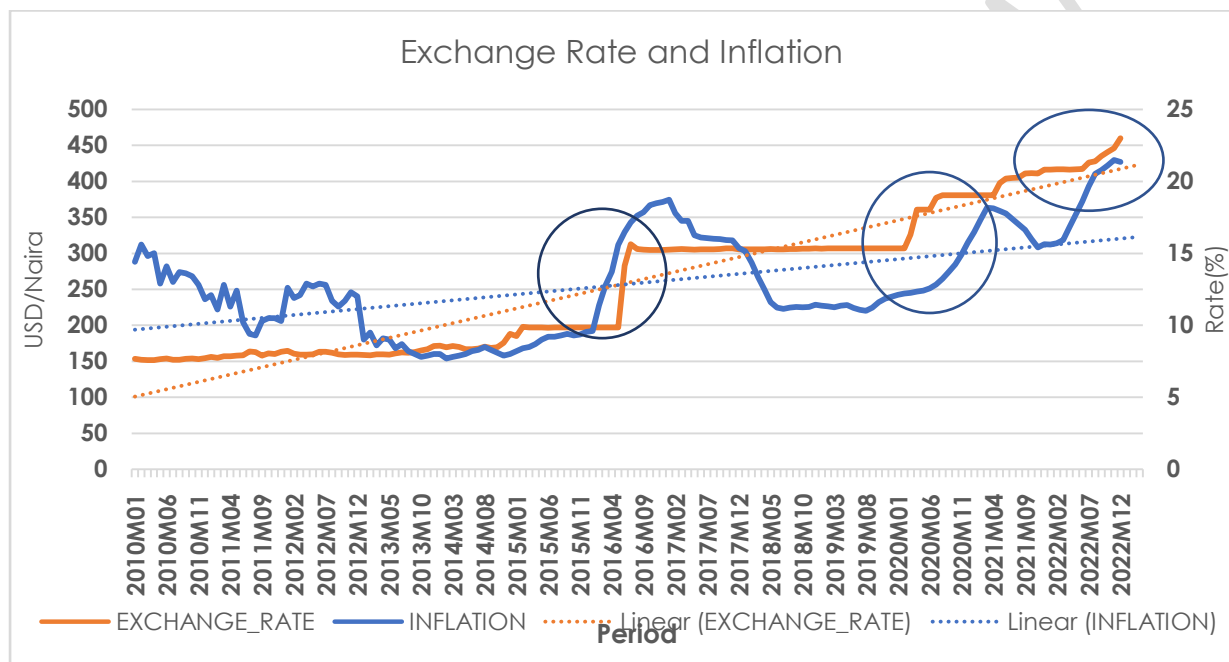
Source: Linear trend with data gotten from CBN statistical bulletin

Furthermore, there was volatility in Public Revenue between 2014 to 2016 attributable to the fallout of the global oil crisis which witnessed a sharp drop in oil prices impacting the global economy, including Nigeria, a major revenue earner from crude oil sales. Public Revenue dropped tremendously from a high of N100Bn to N40Bn in 2015. This behaviour affected the economy negatively as output dipped further shrinking public revenue, thus, distorting, and plunging the economy into another recession after the global financial crises of 2008-2009.

However, oil price, a major contributor gradually recovered at N80Bn in 2017 indicating gradual economic recovery post-2016 recession, hence, impacting positively revenue generation driven by information technology which has consistently grown within the period.

This chart reflected a consistent trend until 2020 when revenue dropped significantly to N50Bn. This is attributable to a downturn in economic activities globally, as a result of the impact of the Covid-19 pandemic which caused serious economic disruptions in the world. The impact of the pandemic made economies all over the globe to shut down activities, to prevent further spread of the virus leading to several lockdown in movements. This impacted on global businesses thereby, dipping revenue earnings, shrinking output, and plummeted global economies, including Nigeria into another round of recession. However, the ICT continued on the path of consistent growth despite volatility in revenue as a result of the

impact of the pandemic in 2020. Additionally, 2021 witnessed improved economic performance as economies gradually recovered from the pandemic world over including Nigeria and was globally sustained until the emergence of the Russia-Ukraine war took its toll. In conclusion, the consistent growth of the IT has enhanced the public revenue growth positively, though disruptions during economic recessions stunted revenue growth in Nigeria.



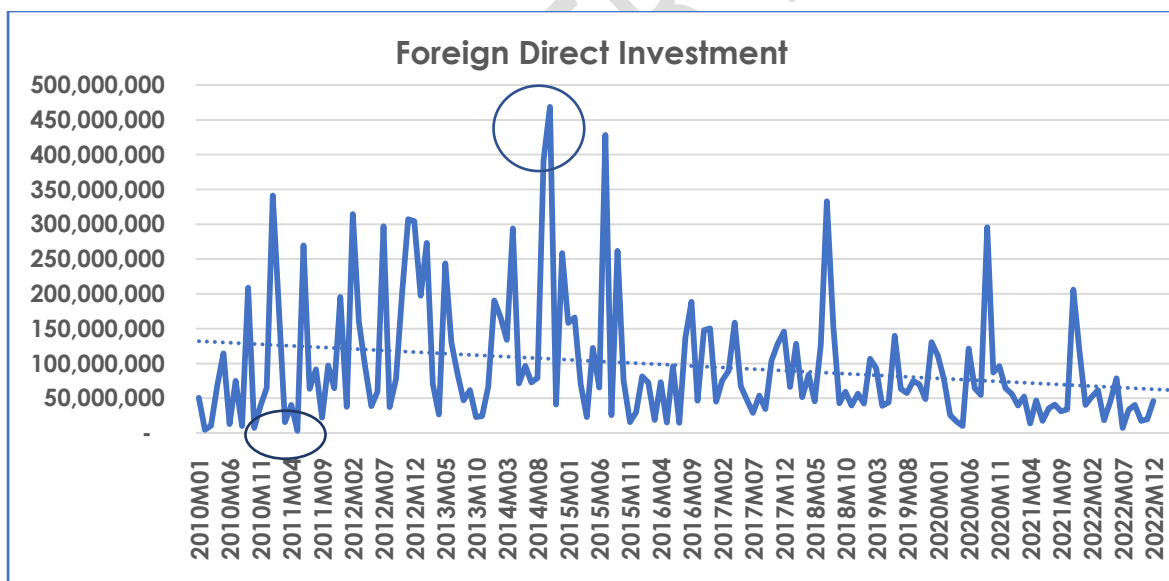
**Fig. 2: Relationship between Exchange Rate and Inflation**

Source: Linear trend with data gotten from CBN statistical bulletin

Figure 2 Demonstrates the trend of the exchange rate of the dollar to the Naira using the official window and inflation trajectory from the period M12010 to M122022. The trajectory reflects a direct relationship between inflation and exchange rate during the period under review. The chart revealed that while the exchange rate initially had a negative relationship with inflation between 2010 and 2016, it became vice versa from 2017 to 2021. This indicates that the exchange rate rose marginally from N154.57/1 USD in January 2012 to N197/1 USD in May 2016. Inflation was moderate and stable during the same period and achieved an all-time low of 7.7 percent in February 2014, however, it elevated moderately to 9.62 percent in January 2016 and thereafter surged to 15.58 in May 2016 when the economy

plunged into recession due to global economic meltdown amidst the decline in global oil price and the currency crises.

However, from 2022, there seems to be a co-movement between the two variables, as inflation and exchange rates continue to show volatility. The behaviour of the variables as circled indicated a period of high instability, attributable to the 2016 and 2020 recessions, resulting from the impact of the oil price crises and covid-19 pandemic respectively. This concludes that inflation has grown from 14.4 percent in January 2010 to 21.34 percent in December 2022. Also, the exchange rate spiked over time from N153/1 USD in 2010 to N460/1 USD in December 2022. Additionally, the trajectory for both variables has reflected an elevation in their behaviours over time, especially during periods of recessions in 2016 and 2020. However, during the period of recoveries in 2017 and 2020, they trended moderately and slowly, indicating co-movement in their behaviours. This confirms the general argument that high inflation weakens a country's currency, discourages investment, and harms the exchange rate. However, when a country's currency is stronger, its exchange rate is better, and inflation is low.



**Fig 3. Trend of Foreign Direct Investment**

Source: Linear trend with data gotten from CBN statistical bulletin

Figure 3 shows the movement of foreign direct investment in Nigeria. Though having witnessed continuous volatility amidst fluctuation during the period under review, the movement in the external reserve position reflected a decline from N50.78Bn in M12010 to N462.7Bn in M122022.

However, the monthly trends within the review period displayed a continuous fluctuation especially during periods of recession in 2016 and 2020 due to low economic climate. In May 2016 and 2020, external reserves dropped significantly to N152.5bn and N101.8Bn respectively, attributable to the impact of the global oil crises and covid-19 pandemic which plunged economies into recession during these periods depicting low growth. However, the highest reserve performance within the period was achieved in October 2014 with a position of N468.48 Bn while the lowest stood at N336Bn in May 2011 attributable to exchange rate crises in 2014. In addition to the demand pressure from the foreign exchange market, largely due to market volatility, the general decline in external reserve position was attributable to the settlement of high import receipts and inflow of low export revenue amongst other factors.

## Methodology

### *Scope and Sources of Data*

We examined "the impact of technology on public sector efficiency in Nigeria" in this paper from January 2010 to December 2022. The sample size was chosen because it has a large enough population to accurately reflect the data. The Central Bank of Nigeria's (CBN) statistical bulletin was used to gather the information. The lists of variables for which data were gathered for the study are shown in Table 1. The study employed the use of government revenue as a proxy for "*public sector efficiency*," as adopted in the works of Aliyu (2021) and Leo (2022), who used revenue generation as one of the indicators for Organizational Performance. *We assumed that improved public sector efficiency will invariably lead to increased revenue generation for the government/private entities.*

**Table 1: Description of Variable**

Variable	Description	Source
IT	Information, communication, and Technology; a broad range of technological resources and tools used to transmit, store, generate, distribute, or exchange information. This serves as a proxy for Technology, a value of ICT on GDP.	CBN statistical Bulletin
Pr	Public revenue; describes the government's revenue from numerous sources. This serves as a proxy for Public Sector Efficiency.	CBN statistical Bulletin

Fdi	Foreign Direct Investment which depicts a sizeable volume of cross-border investment into an economy	CBN statistical Bulletin
Exc	Exchange rate; the rate at which one unit of foreign currency is worth one unit of currency.	CBN Statistical Bulletin
Inf	Inflation rate; the rate of increase in product and service prices in an economy	CBN Statistical Bulletin

### ***Theoretical Framework and Specification of the Model***

This work would adopt the ARDL model as proposed by Peseran et al (2001) for its analysis, and this was derived from the theoretical framework of equation (5). Therefore, the theory of efficient growth can be expressed as:

$$PB = T! + G_s + G_r \dots \dots \dots (8)$$

Equation (8) can be further modified into the public sector efficiency model, this means the functional form of the production function efficiency model can be expressed as

$$Pr = f(It, inf, fdi, exc) \dots \dots \dots (9)$$

This means that the equation's specified form is that of the aggregate Cobb-Douglas production function. Equation 2 can then be specified to:

$$Pr_t = L^{b1} K^{b2} it^{b3} inf^{b4} fdi^{b5} exc^{b6} Pr_{t-1}^{b6} \dots \dots \dots (10)$$

The first-order autoregressive (AR (1)) process in equation 1 can be converted into a stationary econometric model in equation 2 by doing the following:

$$Pr_t = \beta_0 + \beta_1 Pr_{t-1} + \beta_2 Pr_{t-2} + \beta_3 Pr_{t-3} + \alpha_0 It_t + \alpha_1 It_{t-1} + \beta_0 inf_t + \theta_0 fdi_t + \beta_0 exc_t + U_t \dots \dots \dots (11)$$

The economic apriori expectation of the model is  $\beta_1 > 0, \beta_2 > 0, \beta_3 > 0, \beta_4 > 0$ . Where  $\Delta = change$ ,  $ict = technology$ ,  $fdi = foreign direct investment$ ,  $Exc = Exchange rate$ ,  $inf = inflation rate$ .

Equation (11) can be expressed into the short-run and long-run form of ardl according to Peseran (2001). Also, by adopting Ardl (3,1,0,0,0), which was selected as the optimum lag based on our criterion, the model would further be specified to

$$\Delta lPr_t = \beta_0 + \beta_1 lPr_{t-1} + \beta_2 lPr_{t-2} + \beta_3 lPr_{t-3} + \alpha_0 ll_t + \alpha_1 ll_{t-1} + \beta_0 inf_t + \theta_0 fdi_t + \beta_0 lexr_t + \beta_1 \Delta lPr_{t-1} + \beta_2 \Delta lPr_{t-2} + \beta_3 \Delta lPr_{t-3} + \alpha_0 \Delta ll_t + \alpha_1 \Delta ll_{t-1} + \beta_0 \Delta inf_t + \theta_0 \Delta fdi_t + \beta_0 \Delta lexr_t + U_t \dots \dots \dots (12)$$

Equation (7), can be specified into the ardl-ecm , that is if the bound test shows to have a long-run relationship among the variables.

$$\Delta lPr_t = - \beta_0 ECT_{t-1} + \beta_1 \Delta lPr_{t-1} + \beta_2 \Delta lPr_{t-2} + \beta_3 \Delta lPr_{t-3} + \alpha_0 \Delta ll_t + \alpha_1 \Delta ll_{t-1} + \beta_0 \Delta inf_t + \theta_0 \Delta fdi_t + \beta_0 \Delta lexr_t + U_t \dots \dots \dots (13)$$

Exchange rate was logged because it's a relative price and not in rate as inflation. Inflation cannot be logged because its differenced from the consumer price index. According to Alberto (2017), exchange rate is a relative price, the price of a currency in terms of another currency, therefore it cannot be negative and you can take logs of it.

**Results and Discussion of findings**

The explanatory variables in the analysis, is explained below, basically the mean, median, maximum, minimum, and standard deviation is explained below in the table

Table 2: Explanatory statistics

<i>Variables</i>	<i>Pr</i>	<i>It</i>	<i>fdi</i>	<i>inf</i>	<i>Exc</i>
Mean	13.42869	13.73555	18.00159	12.85410	258.9901
Median	13.45497	13.77322	18.01210	12.28000	294.0000
Maximum	14.04804	14.54279	19.96502	21.47000	460.000
Minimum	12.68790	13.07278	15.02892	7.700000	151.8500
Standard dev.	0.2744	0.398	0.941	3.510	96.60
Observation	156	156	156	156	156

Source: authors computation EViews

The descriptive statistics results presented in table 2, indicate that Public Revenue in Nigeria during the period of (2010 to 2022) monthly series. The variable shows that public revenue has a maximum value of 14.04 and a minimum value of 12.68, the median showed to have a value of 13.45, and an average of 13.42, while the standard deviation has a value of 0.274, which shows a great difference between the mean and standard deviation. Technology on the other hand, has a mean value of 13.73, a median of 13.77, with a maximum value of 14.54, minimum value of 13.07, standard deviation of 0.398. The values of the descriptive statistics show that both variables are moving on the same direction. The value of the independent variable of foreign direct investment is 18.00 as mean, with a median value of 18.01, a maximum value of 19.97, minimum value of 15.02 and standard deviation 0.94. Inflation and Exchange rate has a mean of 12.85 and 258.99 mean respectively. A median of 12.28 and 294.00, maximum of 21.47 and 460.00 respectively, a minimum value of 7.700 and 151.85 for inflation and exchange rate. Standard deviation on the other hand has a value of 3.51 for inflation and 96.60 for exchange rate.

### Unit root test

Table 3: The unit root test

Variable			Level			First difference			
n	c	ct	n	c	ct	n	c	ct	
<i>lPr</i>	0.58	-2.26	-2.26	-12.87***	-12.85***	-12.82***			
<i>It</i>	4.69	0.12	-6.62***	-	-	-			
<i>lFdi</i>	-0.15	-10.59***	-10.72***	-	-	-			
<i>Inf</i>		0.09	-1.37	-2.42	-5.36***	-5.36***	-5.55***		
<i>lExc</i>	2.11	-0.16	-2.73	-9.70***	-10.04***	-10.04***			

*note: \* represents 10 percent significance, \*\* represents 5 percent significance, while \*\*\* represents 1 percent significance.*

All the variables were logged to reduce skewness of measurement variable and consistency.

The above table shows that *lpr*, *inf* and *lexc* are significant at first different on a 1 percent level. On the other hand, *It* and *Fdi* are significant at level. This shows a combination of I(0) and I(1), and according to Peseran et al (2001), a combination of I(0) and I(1) is appropriate for the estimation of the autoregressive distributed lag model.

### Bounds test

The bound testis used to show the long-run relationship among the variables, this test shows if the variables are cointegrated in the longrun and the need to estimate the error correction model.

**Table 4 : The bound test**

Test Statistics	Value	Sig	I(0)	I(1)
F-Statistics	2.45			
K	4	5%	3.47	4.57

Source: authors computation using EViews

From the above graph, it shows that value f-statistics is below the lower bound test that is 2.45 is below 3.47, this shows that the short run ardl model would be estimated.

### Estimation

The ARDL short-run analysis was estimated based on the result of the bounds test. The wald test was used to estimate the probability of the various independent variables in the model.

Table 5: Ardl Estimation

Variable	Coefficient	Standard Error
LIT	0.00***	0.00
INF	-0.07***	0.16
LFDI	-0.43	0.61
LEXC	8.68	11.54

note: \* represents 10 percent significance, \*\* represents 5 percent significance, while \*\*\* represents 1 percent significance.

The above table shows that LIT and INF, are significant at 1 percent while LFDI and LEXC were not significant in the model. The result shows a positive relationship between LIT and Pr, implying that, a unit change in LIT, would bring about a 0.00 increase in Pr, while a unit change in INF, would lead to a 7 percent decrease in Pr, which shows to be significant at 1 percent. Lfdi and Lexc on the other hand shows not to be significant at 10, 5 and 1 percent in the analysis. The result showed that a unit change in lfdi would bring about a 0.43 decrease in

Pr. On the other hand, Lexc portrayed a positive impact on Pr, it showed that a unit change in Lexc would bring about a positive impact of about 8.68 increase on Pr.

### **Post estimation Test**

The significance of the model is determined by the post-estimation test, which in this analysis are serial correlation, Heteroskedasticity, and the Cusum Squared.

Table 6: Post Estimation

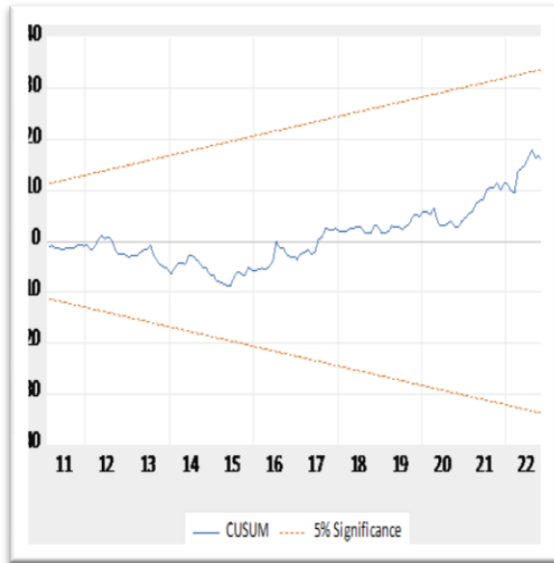
Test	Prob
Heteroskedasticity	(0.76)
Serial Correlation	(0.38)

Null hypothesis: No serial correlation at up to 6 lags

From the above test, the null hypothesis would be accepted because the probability test is greater than 0.05 percent level of significance. This shows that the model is free from heteroskedasticity and multicollinearity. This means that the model is robust, and the result of the estimation is reliable.

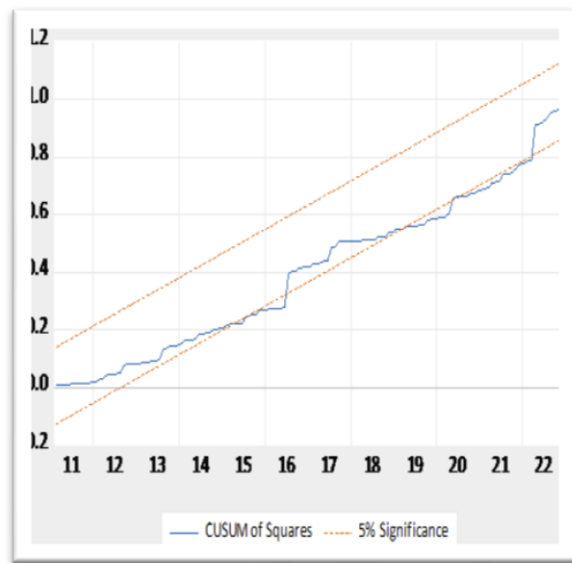
### **Cusum and CusumSquared Test**

Cusum and Cusum Squared test are both statistical tests used to detect structural changes in the relationship between the dependent and independent variables. Cusum test is used to determine if the coefficients of a regression model remain stable over time, while Cusum squared test is an extension of the Cusum test that is more sensitive to small changes in the regression coefficients. Both tests are useful in econometrics for detecting changes in the relationship between the variables over time.



**Figure 4: Cusum test**

Source: EViews Computation



**Figure 5: Cusum squared test**

Figure 4 in the model, shows that the analysis is robust and the stability of the model is justified, figure 5 on the other hand which portrays cusum squared test showed some shocks in the model, this could be seen especially in 2020 to 2021, this might be because of the covid shock, and the lockdown of most activities which slowed down production, though the cusum squared its showing that the model has readjusted, this is because the cusum of squares is moving currently between the 5% level of significance after 2022.

## Conclusions

The study investigated the impact of technology on public sector efficiency in Nigeria. The study revealed that there is a positive relationship between technology and public sector efficiency using revenue generation as proxy for efficiency. The study revealed that the use of technology contributed to increase in revenue generation, thus, efficiency of the public sector. The result conforms to the study of Leo (2022), which also found a positive impact of technology on public sector productivity. The post estimation test showed that the model is free from heteroscedasticity, and serial correlation. The cusum and cusum test results also shows that the model is stable and well specified.

Finally, based on the findings, the study therefore, recommends government's needs to intensify efforts in in the process of acquisition and implementation of technology in the public sector to improve revenue generation for Government and invariably output.

### **Policy Recommendations**

The study revealed that technology had a positive and significant contribution to public sector efficiency, which significantly impacts on the economy's output.

- Therefore, the government should intensify efforts in in the process of acquisition and implementation of technology in the public sector to improve output and increased revenue generation for Government.
- Government budgetary allocations should be channelled more towards adequate IT infrastructural development for increased efficiency.
- It is recommended that, a comprehensive planning, and assessment of the technology be implemented in all government/private subsidiaries/units for efficient output.
- Adequate training and capacity building on the usage of technology, and robust cybersecurity measures should be carried out in all government and private sub-sectors.
- Foreign Direct Investment (FDI) is expected to enhance technological innovations through transfers. Government is therefore charged to create enabling environments to attract more FDI into the economy.
- Both the Monetary and Fiscal Authorities should collaborate in churning out policies that will improve economic parameters such as exchange rate, Inflation, output etc. These would create an enabling environment for business to thrive and also attract foreign portfolio investments to the economy.
- There is need for the provision of up-to-date technology in computers and improved the data collection process for government/private sector personnel. This helped in making decision making process faster, and improved the operational efficiencies, productivity of the personnel, and facilitation of better communication in service delivery.

### **Future Research Direction**

For, future research, this work advises for a much better proxy for technology and public-sector performance, if there is. Also, the scope of study should be increased to capture more recent activities and also to be able to see a more economical impact.

## COMPETING INTERESTS

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

## References

- Africa, E. (2012, September). The Transformational Use of Information and Communication Technologies in Africa. <http://hdl.handle.net/10986/26791>
- Alberto.B.(2017). Log Transformation of variables in Rates or Percentage. *Universita Degli Studi G, Research Gate*
- Aliyu, Y, R. (2021). The Impact of Information Technology on Organizational Performance of Nigerian Immigration Service, Kebbi State Command. *Equity Journal of Science and Technology*.8(1).
- Cobb, C.W. and Douglas, P.H. (1928). A Theory of Production. *American Economics Review*, 18(1), 139-165.

- Cokky, H., Chris B., Erik B., &Lineke, S. (2022). Efficiency gains in public service delivery through information technology in municipalities. *Government Information Quarterly*, Volume 39(, Issue 4), 101724, ISSN 0740-624X, <https://doi.org/10.1016/j.giq.2022.101724>.  
(<https://www.sciencedirect.com/science/article/pii/S0740624X22000570>)
- Davis, M. L., & Hayes, K. (1993). The demand for good government. *The review of economics and statistics*, 148-152.
- Ewuim, N. C., Igbokwe-Ibeto, C. J., and Nkomah, B. H. (2016). *Singaporean Journal of Business Economics and Management Studies*. Vol. 5.( No. 1).
- Fountain, J. E. (2001). Building the Virtual State: Information Technology and Institutional Change. *Brookings Institution*. Pp ages: 256.  
<https://www.jstor.org/stable/10.7864/j.ctvc59n3>
- Geys, B. (2006). Looking across borders: A test of spatial policy interdependence using local government efficiency ratings. *Journal of Urban Economics*, 60(3), 443-462.
- Greer, M. (2022). The Economics and Econometrics of Cost Modelling. *ScienceDirect*.
- Hinkley. S. (2022). Technology in the Public Sector and the Future of Government Work. *Berkeley: UC Berkeley Labor Center*. <https://laborcenter.berkeley.edu/technology-in-the-public-sectorand-the-future-of-government-work>
- Inyang, B. (2008). Human resource capacity building: an imperative for effective performance in the public service. *MRL Journal*, 1(2), 50-64.
- Lawan A. M., Ramli. R. M., & Razali. S. Z. (2018). The Impact of Information and Communication Technology (ICT) on Structural Adjustments in Public Service of Nigeria. *Asia Proceedings of Social Sciences (APSS)*.3(2).30-34.
- Leo, G. J. (2022). Impact of Information and Communication Technology on Public Sector Productivity Growth in Nigeria. *International Journal of Research and Scientific Innovation (IJRSI)*.9(12).
- level relationship. *J. Appl. Econ*. 16, 289–326.
- Luis Garicano and Paul Heaton (2010). Information Technology, Organization, and Productivity in the Public Sector: Evidence from Police Departments. *Journal of Labor Economics*. Volume 28(, Number 1), January. Published for the Society of Labor Economists, Economics Research Center/ NORC. Article D.OI. <https://doi.org/10.1086/649844>

- Mamser, D. (2012). Social transformation for self-reliance: *proceedings of a national conference*. Ibadan: Foundation Publications.
- Pesaran, M., Shin, Y., Smith, R., (2001). Bound testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*.16(3).
- Propheter. G.(2019). Technological Innovation and its Impact on Private Sector Efficiency and Performance: Aerial Imagery in Property Tax Assessment Administration. *International Journal of Public Administration*.43(7).
- Samphina Academy (2023). Effect of Information and Communication Technology on the Performance of Public Sector Organisations. *A publication of Samphina Academy*.
- Van Grembergen, W., De Haes, S., &Guldentops, E. (2004). Structures, Processes and Relational Mechanisms for IT Governance. *In Strategies for information technology governance* (pp. 1-36). Igi Global.
- Van.G(2022).The Theory of Efficient Growth. *Munich Personal Repec Archive (MPRA)*
- Worthington, P. (2000). Technology support for authentic assessment in the new millennia: A case study on implementing digital portfolios. *In Proceedings of the Australasian Conference on Computing Education* (pp. 242-247).