

# Nigerian Journal of Policy & Strategy

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## SPECIAL EDITION

### Contents

<b>An Analysis of Fiscal Policy and Economic Growth in Nigeria: A Johansen Cointegration Approach</b> <i>Abdulsalam Abubakar</i> .....	1
<b>Monetary and Fiscal Policies Complementarity and Macroeconomic Performance in Nigeria</b> <i>Gushibet Solomon Titus</i> .....	25
<b>Data Envelopment Analysis (DEA) of Credit Access and Firm Level Technical Efficiency among Mixed Smallholder Farmers in Plateau State, Nigeria</b> <i>Sunday Baba</i> .....	43
<b>Health Security: Issues and Challenges in Nigeria</b> <i>Etim O. Frank</i> .....	63
<b>Harnessing Open Access Initiatives for the Promotion of Health Communication in Medical Training Institutions in Nigeria</b> <i>Osime Samuel</i> .....	81
<b>Impact of Health Expenditure on Maternal and Child Mortality Rates in Nigeria</b> <i>Dickson Vonke Juliana</i> .....	101
<b>Boosting of Aquaculture and Marketability of Aquatic Products as A Pivot to Sustained Self-food Sufficiency and Employment Generation in Nigeria</b> <i>Adebambo A.A.R., Banjo O.S., Banjo J.O.S., Awofodu A.D., Oladipupo O.A. &amp; Uthman T.O.O.</i> .....	121



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Volume 20, No. 1, 2023



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## Contents

### **An Analysis of Fiscal Policy and Economic Growth in Nigeria: A Johansen Cointegration Approach**

*Abdulsalam Abubakar* ..... 1

### **Monetary and Fiscal Policies Complementarity and Macroeconomic Performance in Nigeria**

*Gushibet Solomon Titus* ..... 25

### **Data Envelopment Analysis (DEA) of Credit Access and Firm Level Technical Efficiency among Mixed Smallholder Farmers in Plateau State, Nigeria**

*Sunday Baba* ..... 43

### **Health Security: Issues and Challenges in Nigeria**

*Etim O. Frank* ..... 63

### **Harnessing Open Access Initiatives for the Promotion of Health Communication in Medical Training Institutions in Nigeria**

*Osime Samuel* ..... 81

### **Impact of Health Expenditure on Maternal and Child Mortality Rates in Nigeria**

*Dickson Vonke Juliana*..... 101

### **Boosting of Aquaculture and Marketability of Aquatic Products as A Pivot to Sustained Self-food Sufficiency and Employment Generation in Nigeria**

*Adebambo Adesoji Adedapo Rasak, Banjo Oluwole Sikiru, Banjo James Olanrewaju Sunday, Awofodu Adebola Daniel, Oladipupo Oluwabusayo Adenike, Uthman & Tajudeen Olusegun Oladipupo*..... 121

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## **An Analysis of Fiscal Policy and Economic Growth in Nigeria: A Johansen Cointegration Approach**

Abdulsalam Abubakar\*

### **Abstract**

The study has investigated the impact of fiscal policy on economic growth in Nigeria using Johansen cointegration approach. Secondary time series data from 1990 to 2020 obtained from the Debt Management Office, Central Bank of Nigeria, National Bureau of Statistics and the Federal Ministry of Finance were utilised. The study found that government revenue and fiscal deficits have had a positive and significant impact on growth. While government expenditure had impacted positively but statistically insignificant on GDP, public debt had a significant negative impact on growth due to poor utilisation and diversion of borrowed funds through corrupt means. The study recommended that government should improve revenue sources, embark on efficient pursuit of tax reforms, and improve national consciousness on tax obligations and regulations among citizens for enhanced compliance. Again, government should strengthen anti-corruption laws and institutions in the country; amongst other recommendations and implementation strategies.

**Key Words:** Fiscal Policy, Economic Growth, Government Revenue and Expenditure, Public Debt

### **Introduction**

Sound macroeconomic management is required to achieve a sustainable level of economic growth and development in any given country. Fiscal policy is one of the major channels through which government influences macroeconomic variables in managing the economy. Fiscal policy is an instrument of demand management (Ekpo & Omoruyi, 2013) which is used to manipulate the level and

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<sup>1</sup>Abdulsalam Abubakar, Directorate of Research National Institute for Policy and Strategic Studies (NIPSS) Kuru, Jos. Corresponding Author: +234 706 5770 247; [abdulslm@gmail.com](mailto:abdulslm@gmail.com)

composition of taxation, other revenue sources, debt and government expenditures in the economy. It influences the supply side of the economy by providing incentives to work and invest, as changes in government spending and taxation will have immediate effects on aggregate demand.

Fiscal policy affects macroeconomic stability, growth, and income distribution. Citizens expect their governments to ensure value-for-money for public spending, a fair and efficient tax system, and transparent and accountable management of public sector resources (IMF, 2022). Without fiscal policy no country can achieve macroeconomic stability. Fiscal Policy is required for economic growth and stabilization. It can be used to control the production and consumption of particular goods, services and products. The government increases aggregate demand by stabilizing taxes and increasing expenditure. It also boosts demand through tax cuts and increased transfer payments. These measures increase average household incomes and encourage consumer spending. In addition to regulating the demand side of the economy, fiscal policy influences aggregate output and employment by raising the level of infrastructure spending. Overall, fiscal policy can be deployed to correct economic imbalances in periods of recession and depression (CBN, 2017).

Successive governments in Nigeria have used fiscal policies in an attempt to drive the economy on the path of sustainable growth and development since independence in 1960. Yet, today, Nigeria is still grappling with fiscal challenges that have impeded the attainment of accelerated growth and development as well as price stability. This is evident in the country's over reliance on the declining oil revenue, feeble tax administration, high level corruption, weak institutions, mounting deficit financing (increasing rate of borrowing), high debt burden accompanied by high debt service-to-revenue ratio.

Recent available statistics expressed herein have substantiated the problem: Escalating poverty rate (42.6%) - over 95 million people are in different dimensions of poverty in Nigeria (World Bank, 2022), high and rising inflation rate of about 16% (NBS, 2022), rising unemployment rate of 35% (Augusto & Co, 2022) - over 21 million Nigerians are currently unemployed; the population of Burkina Faso and no social safety net to cushion the effect of joblessness (Proshare, 2021), and mounting and suffocating debt burden - about 39.5 trillion naira as at December 31, 2021 (DMO, 2022). Nigeria's total Public Debt Stock is set to peak at N45 trillion by the end of 2022 as additional debt of N6.39 trillion would be borrowed to finance the 2022 budget deficit (DMO, 2022). Nigeria spent 86% of its revenue on debt servicing in 2021, while

South Africa spent 20% of its revenue on same in the same financial year (Punch, 2022). These worrisome statistics have made this study even more compelling.

In 62 years of fiscal policymaking, government has generated and spent trillions of naira supported by huge borrowings, and Nigeria has remained a developing country without significant structural transformation. This problem has motivated the study since fiscal policy in Nigeria is thrown into crisis of budgetary delay and frail commitment to budget implementation anchored by political bottlenecks and weak institutional capacity, rising government expenditure without a corresponding increase in public revenue, increasing budget deficit and rising debt profile without significant improvement in infrastructure. These underlying issues have provoked the study.

The objectives of this study are to examine fiscal policy performance in Nigeria, and to contribute to the current debate on the crisis of fiscal policy management in the country, with a view to proffering policy recommendations for enhanced fiscal performance. The work is sub-divided into nine sections. The foregoing is the introductory section one. Section two clarifies the relevant concepts and gives the theoretical framework of the study as section three reviews the empirical literature. While section four discusses the issues with fiscal deficits and Nigeria's debt profile, section five explores the fiscal policy options for policy choice. Section six describes the methodology of the study as results and discussion of findings were made in section seven. While section eight concludes the study, section nine ends it with policy recommendations.

### **Conceptual Clarifications and Theoretical Basis**

#### **Concept of Fiscal Policy**

Fiscal policy is a process in which governments adjust their spending levels and tax rates so they can influence the economy and accelerate economic growth and development. It influences businesses, households and infrastructure (Up to US, 2020). In a similar manner, fiscal policy is described as government revenue generating and spending plans aimed at influencing macroeconomic conditions, change economic performance by adjusting tax rates and public expenditure to ensure the smooth running of the macroeconomy for enhanced growth and development (Gushibet, Dalis & Anga, 2015). The objective of fiscal policy is to promote economic conditions conducive to business growth while ensuring that government actions are consistent with economic stability (Anyanwu, 1993). Therefore, this paper sees

fiscal policy as the budgetary policy of government relating to revenues (oil and non-oil revenues with more emphasis on taxes), public expenditure, public borrowing and deficit financing aimed at stabilising the economy. The practical application of fiscal policy tools or instruments in the process of managing the economy is hereby referred to as fiscal policy management.

Fiscal policy could be expansionary or contractionary. An expansionary fiscal policy is used to increase government spending or an increase in government purchases. This would reduce revenues, increase budget deficits or reduce budget surplus. This is known as the crowding-out effect of fiscal policy. Fiscal policy affects the bonds market – government can raise money through bonds or direct borrowing to finance budget deficit. For example, when the Debt Management Office (DMO) sell more bonds, it reduces the price of bonds and raises the interest rate. The increase in interest rate would reduce the quantity of private investment demanded. The higher interest rate would increase the demand for and reduce the supply of dollars in the foreign exchange market, thereby raising the exchange rate. This would reduce private investments and net exports in a country.

A contractionary fiscal policy is a cut in government purchases or spending, or transfer payments, or an increase in taxes. This is a reverse of the expansionary fiscal policy as it reduces the deficit (or increases the surplus) thereby reducing government borrowing. This is known as crowding-in effect of fiscal policy.

The fact that government deficits today may reduce the capital stock that would otherwise be available to future generations does not imply that such deficits are wrong if properly utilised. For example, if the deficits are used to finance public sector investment, then the reduction in private capital provided to the future is offset by the increased provision of public sector capital. It means that future generations may have fewer office buildings but more schools, standard road network, stable power supply, quality healthcare facilities, amongst other infrastructure.

### **Theoretical Framework**

#### **The Keynesian Theory**

The paper tracks its theoretical root in the Keynesian Theory of macroeconomics propounded by John Maynard Keynes who developed the theory in 1936 to provide solution to the Great Depression after the 1<sup>st</sup> World War, and was one of the founders of the World Bank and Economic Adviser to the then British Prime Minister. The theory posits that an economy does not

often stabilise itself and require active intervention by government to manage it macroeconomically, through Fiscal and Monetary Policies, and to restore the economy in times of distress, recession or depression. It implies that government should play an active role in the economy rather than free market forces alone. In his 'General Theory of Employment, Interest and Money', Keynes advocated a remedy for economic recession based on a government-sponsored policy of full employment. Keynes theory presents a paradigm shift from the then dominant classical laissez-faire economic system. So, this theory is the origin of Economic Management & Policy globally.

The theory further argues that an increase in government spending would enhance the growth of domestic output. Proponents or protagonists of this theory such as Okpanachi and Abimiku (2007), Chakraborty and Chakraborty (2006), would argue that deficit spending by the government stimulates the economy in the short-run by making households feel wealthier, thereby raising total private and public consumption expenditure. Budget deficits stimulate economic activity such as aggregate demand, capital formation (savings and investments). The theory calls for caution on the basis that fiscal deficits could have a negative impact on the external sector, reflected through trade deficit, but only if the domestic economy is unable to absorb the additional liquidity through an expansion in output. It means that if the supply of output does not expand in response to the deficit, the surplus expenditure would only increase the level of imports thereby resulting in trade deficits and fall in exchange rate of the domestic currency (naira). This is called the twin-deficits hypothesis (Gadong, 2010). Based on the focus of the study, the Keynesian theory is not only relevant but guides analysis in this study since government intervention and fiscal deficit financing are hardly avoidable in most if not all countries of the world (rich and poor).

### **Debt Overhang Theory**

The debt overhang theory has been applied to sovereign governments, predominantly in developing countries (Krugman, 1988). It is a situation where the debt of a country exceeds its future capacity to pay back the debt. This occurs if there is a latent output gap or underemployment in an economy, which is bridged repeatedly by credit creation, the build-up of which results in a debt overhang. Similar view was given by Corden (1989) who opines that the negative effect of debt overhang could derive from a lack of motivation on the part of governments to implement economic stabilisation and policy reforms, in the expectation that any revenues generated by an improvement in the domestic economy will go entirely into debt servicing.

The analysis of the debt overhang theory could be linked to investment and economic growth. A debt overhang is thus a situation of a debtor country where the outstanding debt is so large and rising as a proportion of gross domestic product (GDP); say over 80 to 90 percent, such that investment will be inefficiently low and growth inhibiting without new money or debt and debt service reduction. It implies that the accumulated debt acts as a tax on future output, thereby discouraging productive investment by the private sector, and inhibiting growth. This is because an increase in the production or exports of the indebted country generates revenues that must be used to repay current debt obligations; that is, creditors receive a significant portion of the future returns on investment (Bahram & Williams et al 1981). It therefore means that rapid economic growth cannot be achieved in countries with debt overhang problem. It should be noted that while the Keynesian theory establishes the foundation of fiscal policymaking and deficit financing, the debt overhang theory warns that severely indebted countries would encounter negative correlation between rising debt and growth. Both theories have their place and relevance in this work and jointly form the basis of analysis in this study.

### **Empirical Review**

Several studies have alluded to uneven empirical findings on the relationship between fiscal deficits and economic growth in different countries. For example, Al-Khedair (1996) investigates the relationship between budget deficit and economic growth in the seven major industrial countries (G-7). The data utilised covered the period 1964-1993, and the variables included in the model were budget deficit, money supply, nominal exchange rate and foreign direct investment. The study found that budget deficit has a significant positive impact on growth in all the seven major industrial countries - France, Germany, Italy, United Kingdom, Japan, the United States, and Canada. Bahmani (1999) examines the long-run relationship between United States federal real fiscal deficits and real fixed investment using quarterly data over the 1947-1992 period. Based on the Johansen-Juselius cointegration technique, they found that real fiscal deficits have crowded in real investment in the United States. This upholds the Keynesian position that the expansionary effects of fiscal deficits would raise the level of domestic economic activity thereby crowding-in private investment.

Goitsemodimo, Yohane and Privilege (2018) use panel data set to analyse the impact of budget deficit on economic growth in BRICS countries over the period 1997-2016. They used modified ordinary least squares (MOLS) and the dynamic ordinary least squares (DOLS) estimation technique. The two



results showed that budget deficit facilitates economic growth in BRICS nations, and a bi-directional causality between budget deficit and growth was found. Furthermore, Ghali and Alshamsi (1997) apply cointegration and Granger causality techniques to investigate the effects of fiscal policy on economic growth in the United Arab Emirates over the period 1973-1995. They decomposed public spending into consumption and investment expenditures and showed how multivariate cointegration techniques could be used to test for long-run relationships and the inter-temporal causal effects between government spending and economic growth. It was found that government investment expenditure had a positive effect on growth, whereas government consumption expenditure had an insignificant impact on output growth.

Jenkins (1997) studies public sector deficits and macroeconomic stability in Zimbabwe reflecting on the debt overhang problem, drought, terms of trade shocks and government unwillingness to engage in fiscal adjustments. The structural model adopted included variables such as agricultural output, manufacturing output, and budget deficit. Findings of the study showed that the growing public sector debt has reduced public sector investment which resulted in a decline in growth. It indicated that the greatest influence on overall growth was agricultural output with insignificant contribution from the weak industrial sector while budget deficit had an unambiguously negative impact on exports. The study also showed evidence of reduced private welfare, worsened income distribution and increased unemployment in the country. The study concluded that growth in fiscal deficit has constituted a drain on the economy of Zimbabwe rather than facilitate growth and development.

Phillips (1997) analyses fiscal policy in Nigeria between 1960 and 1997. Using expository method, it was found that fiscal deficits have been incurred in Nigeria for decades, and without a corresponding outcome. He notes that with the exception of the period from 1971 to 1974 and 1979, there had been an overall deficit in government budget each year since 1960. It was revealed that fiscal deficits (expansionary fiscal policy) have impacted negatively on external balance with a crowding out of private investment, employment and output. Phillips recounted that the chronic fiscal deficits financed by borrowing has resulted in excessive money supply, worsened inflationary pressures and macroeconomic instability. Based on the available literature, it is evident that while developed countries gained significantly from fiscal deficits in relation to growth, some developing countries have shown that increase in fiscal deficits could facilitate a reduction in growth. However, none of these studies have investigated empirically the impact of fiscal deficits on economic growth in

Nigeria in recent times, including the period of stable and uninterrupted democracy as well as the COVID and post-COVID periods that experienced rising fiscal deficits. This study has filled the gap.

### **Nigeria's Debt Profile**

#### **Profile of Domestic Debt in Nigeria**

In Nigeria, treasury bills constitute the main component of domestic debt accounting for 77.6% of total domestic debt in 1960, declined to 51% in 1970 but rose to 62% in 2003. The decline in the percentage share of treasury bills in the mid-1970s reflected the burst of revenue from the oil sector. The growth in the volume of treasury bills also reflected the practice of rollover of matured securities and continuous recourse to conversion of Ways and Means Advances outstanding at the end of the year to treasury bills as a way of funding the fiscal deficits. Treasury certificates, which were first issued in 1968, constituted one of the largest securities between 1983 and 1995, and by 1996 the Federal Government of Nigeria decided to further reduce the debt service obligations on domestic debt; and consequently, abolished the treasury certificate. In 1989, the monetary authorities at the inception of the action bid system floated treasury bonds as another instrument in the portfolio of domestic debt in the country.

It was in 1986, at the introduction of the Structural Adjustment Programme (SAP) that the level of external debt for the first time became larger than the level of domestic debt. Since then, the stock of external debt has consistently been larger than domestic debt until 2005. The three theoretical reasons often advanced for government domestic debts are; the first is for budget deficit financing, the second is for implementing monetary policy (buying and selling of treasury bills in the open market operation), and the third reason is to develop the financial instruments so as to deepen the financial markets. Several factors have been advanced to explain the changing domestic debt profile between 1986 and 2012 in Nigeria. The major factors responsible for the rising domestic debt are high budget deficits, low level of output growth, increasing government expenditures, high inflation rate and narrow revenue base witnessed in the early and mid-1980s. Other causative factors include the collapse of international oil price in 1981 as domestic lapses and a faulty domestic policy which ranges from project financing mismatch, inappropriate monetary and fiscal policies were responsible for mounting domestic debt problem. Output growth declined as it recorded annual average values of 5.9% in 1980-1984, 4% in 1990-1994, and 2.8% in 1998-1999 periods respectively.

Public expenditure as a percentage of GDP increased from 13% in the 1980-1989 period to 29.7% in the 1990-1994 period. This increased government expenditure to GDP ratio resulted from fiscal policy expansion embarked upon during the oil boom era of the 1970s. Nevertheless, as the oil boom declined in the 1980s, priorities of government expenditure did not change. Consequently, the fiscal operations of the federal government resulted in large deficits from the average of 0.8% of GDP in the 1970-1979 period. The level of deficit increased persistently averaging 5.1% in the 1980-1989 period, and 10% in the 1990-1994 period. Between 1980 and 2002, a very remarkable feature of the government fiscal expansion was the financing of the excess expenditures from domestic sources averaging 79.2%, since foreign loan was difficult to obtain. Cross-country relationship between fiscal deficits (as percentage of GDP) and the size of government debt markets confirms that countries with larger fiscal deficits tend to experience slower growth (Gushibet, 2013). This point was corroborated by a former CBN Governor, Joseph Sanusi, who notes that one major problem that has hindered the attainment of macroeconomic stability and sustained growth has been the excessive reliance on borrowing by government from the banking system, particularly the CBN, to finance its large and unsustainable fiscal deficits (Sanusi, 2003).

Trend in Nigeria's domestic debt indicates that total domestic debt was N28.4 billion in 1986 but rose to N36.8 billion in 1987; showing an increase of N8.3 billion. Similarly, in 1990, domestic debt increased to N84.1 billion from N47.0 billion in 1988; showing an increase of N37.1 billion. The reason for this increase was that more money was needed to finance the deficit budget of government. In 1996, domestic debt outstanding rose astronomically to N343.7 billion, increasing by almost five-fold from N84.1 billion in 1990. By 2000, domestic debt had grown to N898.3 billion displaying an increase of N554.6 billion between 1996 and 2000. The high rate of domestic debt continues unabated till 2004 to N1.02 trillion, N1.20 trillion, N1.33 trillion and N1.40 trillion in 2001, 2002, 2003 and 2004 respectively. This, in absolute terms, would mean that Nigeria's domestic debt had sky-rocketed over the decades with the effect that her domestic debt consumes a larger chunk of her GDP.

The treasury bills remained the dominant instrument, accounting for N871.6 billion (64%) of the total domestic debt stock as at 2003. The balance was made up of Treasury Bonds (N424.94 billion or 31%), Federal Republic of Nigeria Government Development Stock (N1.25 billion or 0.1%), and the First FGN Bonds was N72.56 billion or 5.3% (Gabriel, 2012). The total debt stock of Nigeria as at April 2012 stood at \$44 billion (\$5.9 billion external and N5.96

trillion domestic) which increased to N6.2 trillion (US\$38.89 billion) as at June 30, 2012. This indicates a significant leap from the 2010 figures of \$32.5 billion total debt in which external borrowing stood at \$4.5 billion while domestic debt stood at \$28 billion. Government had also planned to externally borrow \$2.63 billion in 2012, and same amount was to be borrowed for each of the next three consecutive years afterwards (Iweala, 2012). This implies rising appetite for borrowing in the country. Moreover, between 2013 and 2021, there has been a steady increase in domestic debt stock just as the external component. For example, domestic debt rose from \$55.69 billion in 2013 to \$59.01 billion, \$54.71 billion, \$56.38 billion and \$57.39 billion in 2014, 2015, 2019 and 2021 respectively. The implication of this could be obvious for future generations in terms of debt burdens if underutilised, the prevailing corrupt environment and misallocation of resources in the country notwithstanding. This means that an immediate appraisal of the debt status has, from a policy point of view, become crucial. This has constituted a contribution of the study.

### **Trends in Nigeria's External Debt**

The total external debt stock of Nigeria rose from a meagre US\$567 million in 1970 to US\$5,091 million in 1978. Between 1979 and 1985, it increased further from US\$6,216 million to US\$18,904 million. It stood at US\$25,574 million in 1986, and peaked at US\$33,730 million in 1991. Between 1985 and 1991, the external debt stock increased by US\$14,826 million or 78.4% in just six years. During this period, the increase has been astronomical, reflecting the indiscriminate resort to external borrowing ostensibly to finance projects coupled with the crash in international oil price in 1982 (World Bank, 2003). With debt buy-back arrangement and the issuance of collateralized par bonds to the London Club of creditors 1992. The debt stock dropped from US\$33,730 million in 1991 to US\$27,564 million in 1992. This has changed in a significant way the structure of Nigeria's external debt.

However, by 1993, 1994 and 1995 the debt stock trended upward to US\$28.72 billion, US\$29.43 billion and US\$32.58 billion respectively to finance the expansion in fiscal deficit. The debt stock then dropped to US\$28.06 billion and US\$27.09 billion in 1996 and 1997 respectively. This was mainly because new loans were not contracted after the reconciliation exercise conducted in 1995 to ascertain the genuineness of some external claims. Conversely, by 2003 and 2004, it had moved upward again; recording a total outstanding balance of US\$32.92 billion and US\$35.94 billion respectively. Nigeria's external debt stock has witnessed changes, both in structure and quantum. Over the years, the classification of Nigeria's debt by source as at the end of December 2004

showed that US\$30.8 billion (86.0% of the total debt) is owed the Paris Club of Creditors while indebtedness to multilateral sources amounted to US\$2.8 billion (8.0%). Outstanding promissory notes constitute US\$0.7 billion (2.0%). Debt obligations to the London Club amounted to US\$1.4 billion (4.0%). Other bilateral (non-Paris Club) loans accounted for the balance of US\$47.5 million. Paris Club is the main source of Nigeria's external debt and the most problematic of all the sources. The debt continued to rise due to accumulation of payment arrears and default in interest payments. The arrears and interest are capitalised and added to the debt stock, further aggravating the debt burden until 2005 when Nigeria was fortunate to experience and enjoy debt forgiveness and relief.

However, this was short-lived as the debt began to accumulate again at such an astronomical rate, and by 2012, for example, the external debt component has reached US\$6.53 billion. External debt increased from US\$8.82 billion in 2013 to US\$9.71 billion, US\$10.72 billion, US\$18.90 billion, US\$25.30 billion, US\$33.35 billion, and US\$38.40 billion in 2014, 2015, 2017, 2018, 2020 and 2021 respectively. The total of both domestic and external debt components was US\$79.44 billion (N24.39 trillion) as at December 2018 which rose to US\$84.05 billion (N27.40 trillion) by December 2019. It rose further from US\$86.39 billion (N32.9 trillion) in 2020 to US\$95.78 billion (N39.56 trillion) in 2021. Currently, Nigeria's total Public Debt Stock is set to peak at N45 trillion by the end of 2022 as additional debt of N6.39 trillion will be borrowed to finance the 2022 budget deficit (DMO, 2022). Unfortunately, Nigeria spent 86% of its revenue on debt servicing while South Africa comparatively spent 20% of its revenue on same in 2021 (Punch, 2022).

### **Fiscal Policy Options - The Policy Choice**

Suppose the President of Nigeria and the National Assembly come to a consensus that there is the urgent need for action to close a recessionary gap. We have learned that fiscal policies that increase government purchases, reduce taxes, or increase transfer payments—or do a combination of these all have the potential, theoretically, to raise real GDP. The government must decide which kind of fiscal policy to employ. Because the decision makers who determine fiscal policy are all elected politicians, the choice among the policy options available is an intensely political matter, often reflecting the ideology of the politicians. It should be pointed out here that fiscal policy deals with the decisions of government on taxing and spending programmes.

For example, those who believe that government is too big would argue for tax cuts to close recessionary gaps and for spending cuts to close

inflationary gaps. If the economy faces a recession, the government is supposed to cut taxes and increase spending so that people will have more money to buy more goods and services. This will lead to more jobs as entrepreneurs will have more income to increase investment and employ more workers. Those who believe that the private sector has failed to provide adequately a host of services that would benefit society, such as better education or public transportation systems, tend to advocate increases in government purchases to close recessionary gaps and tax increases to close inflationary gaps. If the government fears inflation, it is supposed to raise taxes and cut spending in order to decrease the amount of disposable income that people have, and so they spend less and prices do not rise. Most economists believe that a blend of fiscal and monetary policies is the most important means of regulating or controlling the rate of inflation and preventing economic depression in an economy. A government can use fiscal policy to reduce the demand for goods and services. Tax rates, which are determined by fiscal policy, influence the level of spending by controlling the amount of money people have for spending. It implies that government could decrease or increase its own spending to manage inflation and depression, manipulate aggregate demand and facilitate output growth, income and employment in the economy.

Another area of contention comes from those who believe that fiscal policy should be constructed primarily so as to promote long-term growth. Supply-side economics is the school of thought that promotes the use of fiscal policy to stimulate long-run aggregate supply. Supply-side economists advocate reducing tax rates in order to encourage people to work more or more individuals to work and providing investment tax credits to stimulate capital formation. While there is considerable debate over how strong the supply-side effects are in relation to the demand-side effects, such considerations may affect the choice of policies. Supply-siders tend to favour tax cuts over increases in government purchases or increases in transfer payments.

## **Methodology**

### **Types/Sources of Data and the Scope of Study**

Secondary data which are time series were used in this study. These data were obtained from the Debt Management Office, the Central Bank of Nigeria, the Federal Ministry of Finance, Budget and National Planning, and the National Bureau of Statistics amongst other sources. All sources used were duly acknowledged in the reference section. The period covered in this study was from 1990 to 2020 (31 years). The choice of the period was made for statistical convenience in terms of spread in time perspective including the 23-year period

of uninterrupted democracy with the COVID and post-COVID periods in Nigeria. The data sets used were designated in billions of naira.

### Unit Root Test Modelling

The study adopted the Augmented Dickey-Fuller for pre-analysis test (unit root test) to establish the stationarity of the data sets and avoid spurious regression.

### Model Specification and the Estimating Technique

Based on the Keynesian and debt overhang theories, the study used Johansen cointegration technique as the analytical tool. The Johansen cointegration test allows for more than one cointegrating relationship among variables subject to asymptotic properties (large samples). This makes the result reliable for reasonable conclusion or inference. The structural estimating equation is expressed hereunder:

$$GDP_t = \alpha_0 + \alpha_1 GovRev_t + \alpha_2 GovExp_t + \alpha_3 FisDef_t + \alpha_4 PubDebt_t + \alpha_5 Demo_t + \mu_t \dots \dots (1)$$

Where  $GDP_t$  is the gross domestic product (proxy for economic growth),  $GovtRev_t$  is the total government revenue,  $GovtExp_t$  is the total public expenditure,  $FisDef_t$  is the fiscal deficits, and  $PubDebt_t$  is the total debt stock of Nigeria.  $\alpha_0$  is the intercept constant,  $\alpha_1$ ,  $\alpha_2$ ,  $\alpha_3$ , and  $\alpha_4$  are the estimating coefficients of the explanatory variables,  $Demo$  represents democracy as a dummy variable,  $t$  is the time period of the time series data utilised, and  $\mu_t$  is the stochastic variable or error term. In order to smoothen the data sets and to enable reasonable statistical inferences to be made and sound and reliable conclusion to be drawn, there was the need to log the estimating equation 1 as given hereunder:

$$\ln GDP_t = \alpha_0 + \alpha_1 \ln GovtRev_t + \alpha_2 \ln GovtExp_t + \alpha_3 \ln FisDef_t + \alpha_4 \ln PubDebt_t + \alpha_5 \ln Demo_t + \mu_t \dots (2)$$

### A Priori Expectation

From equation 2, it is expected that the coefficients  $\alpha_1$ ,  $\alpha_2$ ,  $\alpha_3$ , and  $\alpha_4$  would be positive in terms of impact on growth in line with economic theory otherwise there is problem with fiscal policy management in Nigeria. However, if any or all of the coefficients  $\alpha_1$ ,  $\alpha_2$ ,  $\alpha_3$  and  $\alpha_4$  is or are negative it implies poor utilisation of borrowed funds, weak revenue generation capacity and or diversion of the revenue generated to non-investment purposes, and weak expenditure on the provision of public goods and investment in infrastructures as monies meant for public spending are siphoned through wastages and corruption respectively.

### Identification and Description of Variables in the Model

**Fiscal deficit** refers to a shortfall in government revenue compared with its spending backed by the annual budget. This shortfall is often financed through borrowing, which implies that government is spending beyond its means. Fiscal deficit is calculated either as a percentage of GDP or simply as total money spent in excess of income.

**Government revenue** is described as income or national revenue available to the government over a given period of time, derived from tax and non-tax sources and used as a means of public expenditure and for the provision of infrastructure, public goods and welfare to citizens.

**Government expenditure** is a term used to describe money that a government spends on the purchase of goods and services, investments, and money transfers. It implies all government spending on goods and services that are not provided by the private sector but are important for the nation's welfare, citizens well-being as well as growth and development of the country.

**Public Debt** refers to debt owed by the Federal, State and Local Governments which in most cases represents the accumulation of annual budget deficits in fiscal policy implementation.

**Gross Domestic Product (GDP)** is a measure of economic growth (output growth). It measures how fast the economy is growing, and it does this by comparing one quarter of the country's economic output to the last. GDP is generally defined as the market value of the goods and services produced by a country. GDP is one of the primary indicators used to gauge the health of an economy. It represents the total dollar or naira value of all goods and services produced over a specific time period often expressed as a comparison to the previous quarter or year. For example, if the year-to-year GDP is up to 3%, it is thought to mean that the economy has grown by 3% over the last year.

### Hypotheses

This study is based on the understated hypotheses:

- A)  $H_0$ : Government Revenue has no significant impact on economic growth in Nigeria  
 $H_1$ : Government Revenue has a significant impact on economic growth in Nigeria
- B)  $H_0$ : Government Expenditure has no significant impact on economic growth in Nigeria



$H_1$ : Government Expenditure has a significant impact on economic growth in Nigeria

C)  $H_0$ : Fiscal deficits have no significant impact on economic growth in Nigeria

$H_1$ : Fiscal deficits have a significant impact on economic growth in Nigeria

D)  $H_0$ : Public Debt has no significant impact on economic growth in Nigeria

$H_1$ : Public Debt has a significant impact on economic growth in Nigeria

The null hypothesis ( $H_0$ ) in each case was tested against the alternate hypothesis ( $H_1$ ) to enable the study reject or not reject the null hypothesis. It was tested at 5% level of significance by which sample result was used to verify the truth or falsity of statistic (estimator) to the probability value (p-value) which is easier to interpret.

## Results And Discussion

### Descriptive Statistics

To gain an insight on the nature of data used for the analysis i.e. the spread and distribution of the data, the study conducted a first test in form of descriptive statistics. All the data statistics are calculated on the basis of the observations. Table 1 summarized the descriptive statistics of the variables.

**Table 1: Descriptive statistics result**

Variable/Stat	Mean	Std Dev.	Jarque-Bera	P-value	Observation
GDP	44342.95	50187.43	6.7935	0.0000	31
GovRev	6401.787	5481.547	3.0715	0.0000	31
GovExp	4844.547	4748.935	3.5721	0.1676	31
FisDef	-1177.358	1826.715	24.3209	0.0000	31
PubDeb	6611.898	7131.661	15.3639	0.0004	31
Demo	0.7096	0.4614	6.1076	0.0471	31

Source: Author's computation using Eviews 10

As reported in Table 1, the variables display large variances in their distribution due to the high values of standard deviations compared to their various averages. This suggests that the investigated variables were widely dispersed during the study period. In addition, the Jarque-Bera statistics of all the variables display some levels of non-normality in their distributions due to the high values of Jarque-Bera with accompanied probability values less than the 0.05 in all the stated variables except government revenue that was normally distributed.

### Correlation Matrix

To estimate the inter-relationships among the investigated variables, the study conducted a correlation matrix of the variables. The sign and value of the correlation coefficients show the sign and the strength of the relationship.

**Table 2: Correlation matrix result**

Variable	GDP	GovtRev	GovExp	FisDef	PubDeb	Demo
GDP	1					
GovtRev	0.8697	1				
GovExp	0.9833	0.9248	1			
FisDef	-0.9437	-0.6752	-0.8965	1		
PupDebs	0.9449	0.7207	0.9078	-0.9770	1	
Demo	0.5450	0.7148	0.6228	-0.4049	0.5213	1

Source: Author's computation using Eviews 10

Result reported in Table 2 indicated that the linear correlation between GDP and the independent variables are strong. GDP and government expenditure have the highest with 0.9833 (98.33%) followed by the linear correlation between GDP and public debt, with a value of 0.9449 (94.49%) in a positive direction. Result further showed that the linear relationship between GDP and fiscal deficit is 0.9437 (94.37%) in the negative direction while the linear relationship between GDP and government revenue is 0.8697 (86.97%) in a positive direction. in the panel series. Lastly, the correlation between GDP and Demo is positive and moderately strong and stood at 0.5450 (54.50%).

### Unit root test result

It is important to investigate the time series characteristics of the variables in order to avoid a situation of spurious regression. This study used the Augmented Dickey-Fuller unit root test and the result is shown in Table 3.

**Table 3: Augmented Dickey Fuller unit root test result**

Variable	At Level	At First Difference	Decision
GDP	0.3579 (0.7816)	-2.0640*** (0.0393)	I(1)
GOVTREV	-2.4659 (0.3412)	-4.9419*** (0.0022)	I(1)
GOVEXP	-0.8814 (0.9420)	-4.7002*** (0.0068)	I(1)
FISDEF	4.4412 (1.0000)	-4.1430** (0.0146)	I(1)
PUBDEB	-2.7490 (0.22600)	-3.9566** (0.0222)	I(1)
DEMO	-1.5587 (0.7853)	-5.4234*** (0.0007)	I(1)

Source: Author's computation using Eviews 10

The result of the unit root test indicated that all the underlying variables have unit root at levels but became stationary at first difference. This implies that although the variables individually are non-stationary at levels, their linear combination could have a long run relationship due to the stationary nature of the variables at first difference.

### Long Run Cointegration test result (Long run relationship)

Having established the stationarity nature of the variables at first difference, it is necessary to examine the cointegration nature of the variables ascertain long run relationship of the underlying series. The study adopted the Johansen cointegration test and the result is shown in Table 4.

**Table 4: Johansen Cointegration test result**

Hypothesized Nom of CE(s)	Eigenvalues	Trace statistics	0.05 CV	Prob.	Max-Eigen Statistic	0.05 CV	Prob.
None*			95.75366				
At most 1*	0.798381	124.4127	69.81889	0.0001	46.43984	40.07757	0.0084
	0.6980	77.9728		0.0097	34.72280	33.87687	0.0396
At most 2	0.5222	43.2500	47.85613	0.1266	21.42191	27.58434	0.2515
At most 3	0.3601	21.8281	29.79707	0.3082	12.95072	21.13162	0.4568
At most 4	0.1728	8.8774	15.49471	0.3768	5.502948	14.26460	0.6775
At most 5	0.1098	3.3744	3.3744	0.0662	3.374456	3.374456	0.0662

Source: Author's computation using Eviews 10

Table 4 displayed the result of Johansen cointegration. Both the trace test and the rank (maximum-eigen statistics indicated two cointegrating equations. This implies that there is a long run relationship between the underlying variables.

### Long run estimated coefficients of the model

Having established long run relationship among the variables, the next step is to estimate the long run coefficients of the variables. Table 5 showed the estimated coefficients.

**Table 5: Long run estimated coefficients result**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GovtRev	0.016270	0.007557	1.988294	0.0464
GovExp	0.119191	0.075469	1.579349	0.1268
FisDef	0.124807	0.060127	2.069808	0.0386
PubDeb	-0.04931	0.020548	-1.972729	0.0483
Demo	2.609999	0.261431	2.242187	0.0106
C	1460.543	62.62549	23.32187	0.0000

R-squared	0.887363	Mean dependent var	1983.594
Adjusted R-squared	0.864836	S.D. dependent var	474.3008
S.E. of regression	174.3751	Akaike info criterion	13.33228
Sum squared resid	760166.7	Schwarz criterion	13.60983
Log likelihood	-200.6503	Hannan-Quinn criteria	13.42275
F-statistic	39.39052	Durbin-Watson stat	1.928902
Prob(F-statistic)	0.000000		

Source: Author's computation using Eviews 10

The line equation derived from Table 5 is as shown hereunder:

$$\text{LnGDP} = 1460.54 + 0.02\text{GovRev} + 0.12\text{GovExp} + 0.12\text{FisDef} - 0.05\text{PubDeb}$$

S.E	62.62549	0.007557	0.075469	0.060127	0.020548
t-Stat	23.32187	1.988294	1.579349	2.069808	-1.972729
P-value	0.0000	0.0464	0.1268	0.0386	0.0483

$R^2 = 0.88$    Adjusted  $R^2 = 0.86$    F-Stat = 39.39   Prob (F-Stat) = 0.00   DW-1.9

### Result Interpretation and Discussion

The result of the estimation in Table 5 as summarised in the line equation has shown that there is a positive relationship between government revenue, government expenditure, fiscal deficit and GDP. It has however indicated that a negative relationship exists between public debt and GDP. From the result, government revenue had a significant positive impact on growth of GDP where a unit increase in government revenue had led to a 0.02 (2%) unit increase in output growth (GDP) in Nigeria. The null hypothesis is hereby rejected in favour of the alternate hypothesis on government revenue and growth. This conclusion is in consonance with the *a priori* expectation of the study. A close look at the result gauged by p-value 0.04 (less than 0.05) would mean that government revenue was statistically significant at 5% level during the period under review. It implies that more revenues are required to achieve rapid growth.

Government expenditure had impacted positively but statistically insignificant at 5% level on economic growth during the period with a p-value of 0.12 (more than 0.05). Its coefficient estimate showed that a unit increase in public expenditure had led to 0.02 (2%) unit increase in economic growth in Nigeria which supports the *a priori* expectation of the study. By this result, the null hypothesis is rejected and the alternate hypothesis adopted. It means that more public expenditure is required for strategic investment in infrastructure to strengthen private sector activities in order to accelerate output growth in the country. This discovery agrees with the finding by Ghali and Alshamsi (1997)

who found that huge government investment expenditure had a positive effect on growth in the United Arab Emirate (UAE).

The impact of fiscal deficit on growth was positive and statistically significant at 5% level given a p-value of 0.03. Thus, a unit increase in fiscal deficit had resulted in 0.12 (12%) increase in GDP growth in Nigeria between 1990 and 2020; thereby rejecting the null hypothesis and accepting the alternate one. This finding agrees with the *a priori* expectation of the study, and it means that fiscal deficit had actually enhanced output growth in the country. This is in consonance with the finding by Al-Khedair (1996) who found that fiscal deficit has had a significant positive impact on growth in all the seven major industrial countries of France, Germany, Italy, United Kingdom, Japan, United States and Canada. This was also corroborated by the findings of Goitsemodimo, Yohane and Privilege (2018) in the extant literature. Therefore, this ratifies the Keynesian proposition that the expansionary effects of fiscal deficits would raise the level of domestic economic activity thereby crowding-in private investment that would lead to increase in growth. Nevertheless, this finding went contrary to the one obtained by Phillips (1997) who without empiricism reported that fiscal deficits have impacted negatively on investment, employment and output in Nigeria as expressed in the extant literature.

Public debt had a significant negative impact on growth in Nigeria given a p-value of 0.04 which is less than 0.05; thereby necessitating the accepting of the null hypothesis and the rejection of its alternate counterpart. This finding is contrary to economic theory and the *a priori* expectation of the study. This could be explained by poor utilisation, wastage and diversion of borrowed funds to non-intended purposes through corrupt means. It means that without a sound and stringent law to tackle corruption, public debt would not produce the desired outcome in the country. As a result, public debt has remained a constant liability and a blight on the economy in which investment therefrom does not stimulate growth but constitute a serious burden for future generations to bear. This finding supports the debt overhang theory which warns that severely indebted countries would encounter negative correlation between rising debt and growth. Similar result was obtained by Jenkins (1997) who found that the growing public debt has reduced public sector investment which resulted in a decline in GDP growth in the Republic of Zimbabwe. The Demo variable (dummy) has indicated that continuous democratic stability has led to a significant improvement in GDP by 2.61 unit increase in Nigeria's overall output during the period under consideration. It implies that an enduring democracy is, from a policy point of view, crucial for higher economic

performance.

### **Conclusion**

It is established in this study that government revenue, public spending, fiscal deficits and public borrowing are critical for fiscal policy, economic growth and fiscal stabilisation. Sufficient, steady and sustainable revenue generation would facilitate public expenditure for the provision of public goods, infrastructures and welfare services to the citizens, and for the smooth operation and the ease of doing business for the private sector. The study has also shown that fiscal deficit (as an expansionary fiscal policy) is necessary for improving the level of domestic economic activity, and in influencing the level of income, employment and output growth in the country. This requires prudent utilisation and application of publicly incurred debts for rapid growth.

### **Policy Recommendations**

Based on the findings of this study, the following subsidiary recommendations have become necessary: Government should maintain a debt-bank deposit ratio of not more than 30 percent and resort to increased use of tax revenue to finance its projects since tax revenue collection is far from the optimum level in Nigeria. This could be achieved by improving its revenue sources and efficient pursuit of tax reforms. Government should employ wider reforms that promote investment in treasury bonds and encourage institutional investors. Government should improve national consciousness on tax obligations and regulations among citizens for enhanced compliance. There is the need for government to strengthen anti-corruption laws and institutions in the country. The major recommendations and implementation strategies which are predicated on the major findings of the study have included the following:

- 1) Federal Government of Nigeria should decentralise ownership and control of the Solid Minerals Sector to the States who are on site of mineral deposits in order to facilitate exploration and efficient exploitation of solid minerals for increased revenue generation to finance government expenditure and implement efficient budget deficits at national and sub-national levels in the country.

#### *Implementation Strategy One:*

The President of Nigeria to seek and present a constitutional amendment to the National Assembly for the removal and transfer of solid minerals from the Exclusive List to the states not later than 1st

Quarter, 2023

*Implementation Strategy Two:*

The Attorney-General of the Federation and Minister of Justice in collaboration with the Secretary to the Government of the Federation to ensure the Gazetting of the amended section of the constitution not later than 2nd Quarter, 2023

*Implementation Strategy Three:*

The Secretary to the Government of the Federation to direct all state governments to develop mining blueprints peculiar to each state and begin payment of royalties to the Federal Government of Nigeria based on an agreed percentage not later than 3rd Quarter, 2023

*Implementation Strategy Four:*

Each state government to commence exploration and exploitation of solid minerals based on the mining blueprints and pay an agreed percentage as royalties to the Federal Government of Nigeria beginning by 1st Quarter, 2024

- 2) Federal and State Governments should prioritise their investment expenditures more to the provision of enduring infrastructures such as efficient road networks, stable power and other public goods that will contribute to the ease of doing business for the private sector to thrive in Nigeria.

*Implementation Strategy One:*

The Federal Government through the Office of the Secretary to the Government of the Federation to communicate the policy choice on the provision of massive infrastructure to the States and strengthen the mechanism for compliance, monitoring and implementation not later than 1st Quarter, 2024.

*Implementation Strategy Two:*

The Federal and State Governments to prioritise their investment expenditures more to infrastructural provision and ensure effective implementation beginning by 1st Quarter, 2024

- 3) Federal, State and Local Governments should curb or eradicate corruption in the three tiers of government for public debt to have positive impact on growth; such that investment undertakings and efficient allocation of resources including borrowed funds to finance

fiscal deficits would be ensured.

*Implementation Strategy One:*

Federal Government of Nigeria to initiate an Executive Bill to the National Assembly for passage into law an anti-corruption bill based on the principle of 'Death by Hanging' for any person or group of persons caught and proved guilty of corruption and corrupt practices in Nigeria not later than 1st Quarter, 2023.

*Implementation Strategy Two:*

The National Assembly to ensure speedy passage of the anti-corruption Law not later than 3rd Quarter, 2023.

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## Monetary and Fiscal Policies Complementarity and Macroeconomic Performance in Nigeria

Gushibet Solomon Titus\*

### Abstract

Despite various monetary and fiscal policy measures, economic growth and inflation have exhibited worrying trends in Nigeria. Against this background, the study examines both the contemporaneous and combined effects of monetary and fiscal policies in achieving the macroeconomic goals of price stability and economic growth in Nigeria. The study employed secondary annual time series data covering 1981 to 2020 periods and utilised the ARDL approach to cointegration. The empirical results reveal that monetary policy plays greater role in influencing price stability and economic growth than fiscal policy. Moreover the study finds that monetary and fiscal policies are complementary in affecting price stability and economic growth, which means, both will be more effective if coordinated appropriately. On the back of these findings, the study recommends that monetary and fiscal policies should be coordinated and the federal government should reduce its reliance on the CBN to finance budget deficits and funding the implementation of some specific fiscal policies among other recommendations.

**Key Words:** Monetary Policy, Fiscal Policy, Policy Complementarity, Macroeconomic Performance

**JEL Classification:** E50, E52, E61, E62, E63, H50

### Introduction

The achievement of the developmental aspirations of every nation requires the formulation and implementation of socio-economic, political, environmental

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Gushibet Solomon Titus, National Institute for Policy and Strategic Studies (NIPSS) Kuru, Jos-Nigeria. Corresponding Author: +2348030931136; [gushibetsolomon@gmail.com](mailto:gushibetsolomon@gmail.com)

and financial policies and programmes among others. However, one of the major challenges of achieving policy objectives is determining the optimal policy package and sequence of implementation. This challenge gives rise to the emergence of the concept of policy complementarity. Policy complementarity signifies the interaction among elements of the whole system that jointly improve the performance of each other and/or compensate the shortcomings of each other in the system (Crouch et al. 2005). In practical terms, policy complementarities entail that the effectiveness of policy option(s) rely on the implementation of other related or complementary policies (Orszag and Snower, 1998). The issue of policy complementarities as a source of economic growth was highlighted by Gallego and Loayza (2002) who found that credit policy complementarities play significant role in the high economic performances recorded in countries like Chile, South Korea, Ireland, Thailand and the Netherlands.

Generally, monetary and fiscal policies among other policies are implemented by economies to achieve the macroeconomic goals of price stability, economic growth and employment among others. Monetary policy involves the management and control of quantity and cost of credit, while fiscal policy encompasses management and control of government revenue, expenditure, debt and taxes. In Nigeria, the Central Bank of Nigeria is responsible for the conduct of monetary policy, while the Federal ministries of finance and/or budget and national planning are responsible for fiscal policy. Over the years various monetary and fiscal policy measures were taken in Nigeria, but inflation has been on the increase and economic growth trajectory has been discouraging.

For instance, over the last two decades 2000 to 2020; the average annual percentage growth of general government final consumption expenditure was 35.33 per cent, while the average annual percentage growth of broad money was 22.38 per cent respectively (WDI, 2022). Despite these remarkable growths in monetary and fiscal indices; the macroeconomic goals of Nigeria were not being adequately achieved. This can be attested to by high inflation averaging 12.15 per cent over the last two decades, that is 2000 to 2020 and weak economic growth; with annual percentage GDP growth of 5.31 per cent, over the same period (WDI, 2022). This scenario reveals the limitation of monetary and fiscal policies in sustainably achieving macroeconomic goals of Nigeria.

One of the major causes of this problem is policy divergence and inconsistency that characterises economic policies, especially in developing

countries like Nigeria (Tule, Onipede and Ebuh, 2020). As noted by Laurens and de la Piedra (1998) lack of coordination between monetary and fiscal policies results to inferior overall economic performance. Monetary policy alone is ineffective in achieving macroeconomic objectives, meanwhile, in a weakly coordinated macroeconomic environment, fiscal policy might affect the effectiveness of monetary policy (Goshit and Landi, 2014). Given this dilemma and the fact that there is no conclusive evidence as to the relative effectiveness of monetary and/or fiscal policy in influencing economic growth (Goshit and Landi, 2014), among other macroeconomic objectives. Hence, an optimal combination of the two policies holds the potential to better deliver effective macroeconomic goals. Against this background, this study seeks to examine the role of the complementarity of fiscal and monetary policies in achieving the macroeconomic goals of price stability and economic growth in Nigeria.

### **Conceptual Clarification**

This section clarifies the concepts of monetary and fiscal policies; in addition policy complementarity was elucidated. The interactions of fiscal and monetary policies and their consequences in Nigeria were equally explained.

### **The Concepts of Monetary and Fiscal Policies**

Monetary policy can be referred to as a set of measures designed to control the supply of money and influence credit conditions in a particular economy (Okigbo, 2008). In a practical manner, Abel (1980) described monetary policy as the management of the expansion and contraction of the volume of money in circulation in order to achieve specific national economic objectives. In another perspective, Anyanwu (1993) contends that monetary policy is a major economic stabilization tool that comprises of measures devised to regulate and control the quantity, availability, cost as well as direction of money and credit in a given economy, in order to achieve some specified macroeconomic goals. In this regard, monetary policy largely hinge on the relationship between the supply of money and rates of interest, which is the price at which money is borrowed. Certain instruments are usually employed in the conduct of monetary policy; these include open market operation, directed credit policy, moral suasion and bank reserve ratio etc.

On the other hand, fiscal policy is defined by Anyanwu (1993) as the aspect of government policy concerns with raising revenue through taxation and other sources and determining the level and pattern of government expenditure in order to influence economic activities. Therefore, Fiscal policy comprises taxation, public expenditure, reliefs, concessions and fiscal incentive

policies. In managing the economy, governments utilise fiscal policy tools to influence the level of aggregate demand in the economy. This leads to the achievement of macroeconomic goals, such as price stability, full employment, economic growth and balance of payment stability. According to Enahoro, Jayeola and Onou (2013) fiscal policy measures can be classified into automatic stabilizers and discretionary measures. The automatic stabilizers encompass government expenditure and/or tax activities that are conducted devoid of deliberate control that tend to affect the business cycle. Whereas, discretionary fiscal policy involve expenditure and tax actions that government engaged in, to achieve particular macroeconomic goals (Johnston, 2009).

### **Policy Complementarity**

From economic perspective, Aziz and Wescott (1997) defined policy complementarity as a set of mutually reinforcing policies that create an environment that is conducive to investment and growth. This has to do with the complex interactions that take place among and between policies, and whether or not a favourable environment for investment and for growth is created, hence, policies need to be mutually supportive and consistent if they are to be effective. Highlighting the significance of policy complementarity, Macedo, Martins and Rocha (2010) argued that structural reforms are mutually interdependent as a system. And if implemented in a disjointed manner the anticipated benefits are not likely to materialize, especially when sets of individual reform policies are complementary.

### **Monetary and Fiscal Policies Interaction in Nigeria**

Both monetary and fiscal policies aim to influence the aggregate demand in order to achieve economic growth, full employment and price stability among others. However, they use different tools, whereas fiscal policy uses government expenditure and tax, monetary policy uses money supply and interest rate. Therefore, there is tendency of these policy tools being used by the monetary and fiscal authorities at cross-purposes. For instance, the fiscal authorities may pursue expansionary fiscal policy by increasing government spending, in order to drive the economy out of recession. This will lead to budget deficit that is usually financed through domestic borrowing, which may lead to crowding out effect, by raising interest rate. On the other hand, the Central Bank might employ contractionary monetary policy to tame inflationary pressure or accommodative monetary policy, by working towards reducing cost of capital in order to stimulate investment and engender economic growth (Samuel, 2016). This scenario will lead to policy divergence and conflict of goals.

A major problem in monetary and fiscal policy complementarity as noted by Goshit and Landi (2014) is when the policy making process is dominated by one authority, whose goal dominate and dictate that of the other authority. In this regard, Laurens and de la Piedra (1998) argued that in many countries, fiscal policy dominates monetary policy; where central banks are involved in financing budget deficits and other fiscal activities, which often leads to inflationary pressure. This scenario is evident in Nigeria, where the federal government involve the CBN in delivering some of its policy goals, which are largely outside the core mandates of the apex bank. For instance, the CBN is involved in providing various financing schemes to the economy; meanwhile its core mandates of price and domestic currency stability are not being achieved. Moreover, as noted by Tule, Onipede and Ebuh (2020) fiscal policy in Nigeria is usually expansionary; so the monetary measures by the CBN are majorly geared towards offsetting the effects of the fiscal policy. Hence, there is more of divergence than complementarity between the two policies, which leads to macroeconomic imbalances.

### **Literature Review**

The issue of policy complementarities as a source of economic growth was popularise by Gallego and Loayza (2002) who found that credit policy complementarities are important not only in Chile but also for countries like Korea, Ireland, Thailand and the Netherlands, which record high performances. Examining the issue from the theoretical perspective, Amable and Gatti (2004) developed a model of dynamic efficiency wages and monopolistic completion. The model shows that even when enhancing competition in the product market is the suitable policy recommendation; it should be coupled with policies that promote job security. In related development, Roldán-Peña, Sámano and Torres (2014) presented a model that shows the interaction and complementarity between monetary and macroprudential policies. The findings indicate that when monetary and macroprudential policies are coordinated with each other, their complementarity improves policy outcomes.

Calderon and Fuentes (2006) explored the role of complementarities in economic policies in Chile and some other countries over the period 1970 to 2000. The findings reveal that policy complementarities are important for comprehending the heterogeneous response of growth to both trade and financial openness. Broadly, Macedo, Martins and Rocha (2010) investigate the impact of reforms and their complementarity on growth. They qualitatively justify the existence of pair-wise complementarities between six policy areas. On the other hand, the study empirically found reforms to have positive

relationships among themselves and their dispersion has negative effect on growth, which is stronger in developing countries. Plagerson and Stuart (2018) examine the complementarity of social, economic and environmental policy in South Africa, using the mining sector as a case study. They found inter-sectoral policy connections to be a necessary but not sufficient condition for the achievement of optimal redistributive outcomes.

The financial sector of every economy is the most regulated and often undergoes reform policies due to its sensitivity to the performance of the real sector of the economy. Recognising this reality, Njikam (2017) examines whether the effect of financial liberalization on economic growth is hinged on reform complementarities among 45 Sub-Saharan Africa (SSA) countries. The results reveal that financial liberalization has higher effect on economic growth if some complimentary policy reforms are implemented; such include macroeconomic and external stability reforms, and governance reforms among others.

However, monetary and fiscal policies are the two major policies that are employed in economic management; hence the debate on policy complementarity will not be complete without examining these two policies. In this respect, Scott (2011) examines the relative effectiveness of monetary and fiscal policies in Nigeria. The study used quarterly data covering the period 1981 to 2009 and employed residual-based cointegration approach. The results indicated that significant positive relationship between real GDP and government expenditure and lagged value of money supply. Moreover, the study found that monetary policy has more significant effect on economic activities than fiscal policy in Nigeria. Overall, the two policies were found to be complementary in managing the economy. Using a more robust cointegration approach, Ogege and Shiro (2012) investigated the dynamics of Nigeria's monetary and fiscal policies, focusing specifically on their effects on the growth of Nigerian economy. They employed the Engle-Granger and Johansen and Juselius co-integration approaches. The empirical results demonstrated that there exist a long-run linear relationship between the dependent variable and the explanatory variables, meaning that both monetary and fiscal policy contributed to the growth of Nigerian economy.

In another dimension, Tule, Onipede and Ebuh (2020) assess the level of coordination between monetary and fiscal policy and how it leads to macroeconomic stability in Nigeria. They utilised monthly data covering 2003 to 2017 and employed structural vector autoregressive model. The results revealed that whereas expansionary monetary policy has positive



contemporaneous effect on the economy, expansionary fiscal policy does not lead to economic growth. Using the Autoregressive Distributed Lag (ARDL) model, Adegboyo, Keji and Fasina (2021) examine the impact of monetary, fiscal and trade policies on the economic growth of Nigeria, over the period 1985 to 2020. The findings indicated that while fiscal policy measures stimulate economic growth, trade policies do not. Moreover, the study found that money supply deters economic growth in Nigeria. In a comparative study, Alege, Ayobami & Ejemeyovwi (2021) investigate and compare how monetary and fiscal policy affect unemployment level in Nigeria, they employed the ARDL approach to cointegration and the findings revealed that government capital expenditure reduces unemployment in the long run, while currency in circulation and the real GDP reduce unemployment in both the short and the long runs. The study recommends a policy mix, comprising of judicious government expenditure concurrently regulating the money supply, in order to overcome the problems of unemployment and inflation.

From the literature review, majority of the studies examined policy complementarity by focusing on financial, trade and environmental policies among others. Despite the overarching significance of monetary and fiscal policies in economic management, they receive little attention. The few studies that focus on monetary and fiscal policies, especially in Nigeria e.g. Scott (2011); Ogege and Shiro (2012) and Tule, Onipede and Ebu (2020) suffer from methodological limitations. They employed residual-Based (Engle and Granger) and/or system-based (Johansen and Juselius) cointegration approaches. These approaches impose restriction on the integration and lag order of the variables. Even though Alege, Ayobami and Ejemeyovwi (2021) and Adegboyo, Keji and Fasina (2021) adopted the ARDL approach, which overcomes these limitations; but they only compare how monetary and fiscal policies impact on unemployment. This has not captured the complementarity of the two policies. Therefore, this study seeks to overcome these literature gaps, by adopting the ARDL approach to cointegration to examine the contemporaneous as well as combined effects of monetary and fiscal policies on economic growth and inflation.

### **Methodology**

The study employs the quantitative research strategy and ex-post facto research design; as it relies on historical or after-the-fact data. It employs secondary time series data to examine the effect of monetary and fiscal policy variables (money supply and government expenditure as independent variables) on macroeconomic goals (price stability and economic growth as dependent

variables). Data on all the variables is sourced from the World Development Indicators (WDI) Databank of the World Bank. The data spans the period 1981 to 2020 based on availability.

The study employs the Keynesian theory of income, output and employment and the Fisher's quantity theory of money. The Keynesian theory emphasises the role of government expenditure in influencing aggregate demand and hence economic or output growth. On the other hand, the Fisher's quantity theory of money stresses the role of money supply in triggering price increase or inflation, especially when not accompanied by corresponding output growth. Drawing from these theories and augmenting them with capital formation and exchange rate as control variables, the baseline models for inflation and economic growth are specified below:

$$INF_t = \alpha_0 + \alpha_1 MS_t + \alpha_2 GE_t + \alpha_3 EXR \quad (1)$$

$$EG_t = \alpha_0 + \alpha_1 MS_t + \alpha_2 GE_t + \alpha_3 CF \quad (2)$$

Where INF is inflation measured by the consumer price index; MS is money supply measured by broad money in current local currency; GE is government expenditure measured by general government final consumption expenditure measured in current local currency; EXR is exchange rate measured by the official exchange rate; EG is economic growth measured by gross domestic product in current local currency and CF is capital formation measured by gross fixed capital formation in current local currency. The inclusion of exchange rate in the inflation model is based on the fact that, Nigeria heavily relies on import of capital and consumer goods; hence, domestic currency depreciation leads to imported inflation. Meanwhile, physical capital formation is included in the economic growth model given the infrastructural deficit in Nigeria, which affects economic growth.

### **Estimation Technique**

This study adopts the Autoregressive Distributed Lag (ARDL) model, which is bounds testing approach to cointegration developed by Pesaran, Shin, and Smith (2001). The ARDL has many advantages over other cointegration approaches such as the Engle and Granger (1987) and Johansen and Juselius (1990). These include that the ARDL does not impose restriction on the integration order of the variables being all integrated of order one i.e.  $I(1)$ . Thus, it can be applied in spite of whether the variables are all  $I(0)$ ,  $I(1)$  or mutually cointegrated (Pesaran et al., 2001). Even in the presence of endogenous regressors, the ARDL approach tackle the problem associated with omitted variables and autocorrelations; it also provides unbiased and efficient

estimates, as well as valid t-statistics (Narayan, 2004; Odhiambo, 2010). The ARDL approach involves the estimation of a restricted error correction (EC) version of the ARDL model. For this research, the models for inflation and economic growth are presented in Equations (3 and 4) respectively.

$$\begin{aligned} \Delta LINF_t = & \beta_0 + \sum_{i=1}^n \beta_{1i} \Delta LINF_{t-i} + \sum_{i=0}^n \beta_{2i} \Delta LMS_{t-i} + \sum_{i=0}^n \beta_{3i} \Delta LGE_{t-i} + \sum_{i=0}^n \beta_{4i} \Delta LEXR_{t-i} \\ & + \pi_1 LINF_{t-1} + \pi_2 LMS_{t-1} + \pi_3 \ln LGE_{t-1} + \pi_4 LEXR_{t-1} + \varepsilon_t \end{aligned} \quad (3)$$

$$\begin{aligned} \Delta LEG_t = & \beta_0 + \sum_{i=1}^n \beta_{1i} \Delta LEG_{t-i} + \sum_{i=0}^n \beta_{2i} \Delta LMS_{t-i} + \sum_{i=0}^n \beta_{3i} \Delta LGE_{t-i} + \sum_{i=0}^n \beta_{4i} \Delta LCF_{t-i} \\ & + \pi_1 LEG_{t-1} + \pi_2 LMS_{t-1} + \pi_3 \ln LGE_{t-1} + \pi_4 LCF_{t-1} + \varepsilon_t \end{aligned} \quad (4)$$

The variables are as defined above, while  $n$  is the optimal lag length and  $\varepsilon_t$  is the error term. All the variables are in natural logarithm. F-test is conducted to detect if the variables are cointegrated that is if they have long-run relationship. The null hypothesis is  $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ , which is tested against the alternative hypothesis  $H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$ . Accordingly, the decision rule is as follows. If the computed F-statistic is less than the lower critical bound, then the null hypothesis cannot be rejected, thus there is no cointegration. But when the F-statistic is greater than the upper critical bound, the null hypothesis is rejected; hence cointegration exists among the variables. Nevertheless, when the F-statistic value falls within the two critical bounds, then the result is inconclusive. In order to get the short-run coefficients and the adjustment parameters, an error correction model (ECM) is estimated. The ARDL specification of the ECM for inflation and economic growth are represented in Equations (5 and 6) respectively.

$$\begin{aligned} \Delta LINF_{t-i} = & \beta_0 + \sum_{i=1}^n \beta_{1i} \Delta LINF_{t-i} + \sum_{i=0}^n \beta_{2i} \Delta LMS_{t-i} + \sum_{i=0}^n \beta_{3i} \Delta LGE_{t-i} + \sum_{i=0}^n \beta_{4i} \Delta LEXR_{t-i} + \\ & + \lambda ECM_{t-1} + \varepsilon_i \end{aligned} \quad (5)$$

$$\begin{aligned} \Delta LEG_{t-i} = & \beta_0 + \sum_{i=1}^n \beta_{1i} \Delta LEG_{t-i} + \sum_{i=0}^n \beta_{2i} \Delta LMS_{t-i} + \sum_{i=0}^n \beta_{3i} \Delta LGE_{t-i} + \sum_{i=0}^n \beta_{4i} \Delta LCF_{t-i} + \\ & + \lambda ECM_{t-1} + \varepsilon_i \end{aligned} \quad (6)$$

Equations (3 to 6) represent the contemporaneous effect of money supply and government expenditure on price stability and economic growth. For the combined effect of money supply and government expenditure, which capture the complementarity of monetary and fiscal policies; another set of equations are estimated. In those equations, LMS and LGE are interacted to produce an interactive variable MPI. The dependent variables LINF and LGE are regressed against MPI together with the control variables LEXR and LCF in the models involving inflation and economic growth respectively.

### Presentation of Results and Discussion of Findings

The presentation of results commences with preliminary statistics, starting with the descriptive statistics presented in Table 1. It reveals that all the variables are stable as their mean values are within their maximum and minimum values and their standard deviations are below the mean values. Moreover, all the variables are normally distributed as indicated by the Jarque-Bera normality tests.

In the second segment of Table 1, the pair-wise correlation coefficient results are presented. It shows the pairs of the variables have strongly linear correlation, which means they co-move together and the potential of them being cointegrated, i.e. having long run relationship is high. In order to avoid spurious regression problem, unit roots tests were conducted using the Augmented Dickey-Fuller and Phillips-Perron tests and the results are presented in Table 2.

**Table 1 Descriptive statistics and correlation matrix**

Variables	<i>LEG</i>	<i>LINF</i>	<i>LMS</i>	<i>LGE</i>	<i>LCF</i>	<i>LEXR</i>
Mean	29.437	2.948	27.567	25.888	28.270	3.537
Median	29.663	3.474	27.784	25.659	28.523	4.667
Maximum	32.670	5.589	31.285	30.229	31.242	5.883
Minimum	25.660	-0.715	23.447	21.629	25.191	-0.482
Std. Dev.	2.408	2.057	2.680	3.023	1.922	1.996
Skewness	-0.252	-0.498	-0.126	-0.005	-0.260	-0.795
Kurtosis	1.626	1.842	1.604	1.419	1.707	2.347
Jarque Bera	3.573	3.885	3.355	4.164	3.236	4.929
Probability	0.168	0.143	0.187	0.125	0.198	0.085
Observations	40	40	40	40	40	40
LEG	1.000					
LINF	0.992***	1.000				
LMS	0.997***	0.982***	1.000			
LGE	0.984***	0.957***	0.990***	1.000		
LCF	0.996***	0.991***	0.989***	0.975***	1.000	
LEXR	0.955***	0.972***	0.944***	0.913***	0.953***	1.000

Note: \*\*\*, denotes statistical significance at 1% level

The unit root tests results contained in Table 2 reveal that all the variables have unit roots at their levels, hence are not stationary at levels. However, after taking the first difference, the unit root disappears and all the variables become stationary. Therefore, it is established that all the variables are integrated of order one.

**Table 2. Results of ADF and PP Unit Root Tests**

Variables	Level		First Difference		Order of Integration
	ADF	PP	ADF	PP	
LEG	0.181	-0.66	-3.523*	-3.442*	I(1)
LINF	-0.584	-0.641	-3.966**	-2.89	I(1)
LMS	-1.644	-1.155	-3.516*	-1.631*	I(1)
LGE	-1.896	-2.034	-6.137***	-6.137***	I(1)
LCF	-1.633	-2.095	-4.005**	-3.896**	I(1)
LEXR	-1.339	-1.34	-5.68***	-5.828***	I(1)

Notes: Lag length in the ADF test is automatically selected using the Schwarz Information criterion (SIC)

\*\*\*, \*\* and \* indicate statistical significance at 1%, 5% and 10%

The results of the ARDL bounds cointegration tests are presented in Table 3. The results show that all the four models involving contemporaneous and combined effects of monetary and fiscal policies on price stability and economic growth are cointegrated, which means long run equilibrium relationship exists among the variables in the models.

**Table 3: ARDL Bounds Test for Cointegration**

Bounds test for cointegration				Diagnostic tests	
Models	F Statistics	ARDL Model	K	R <sup>2</sup>	DW test
INF=F(MS, GE, EXR)	6.326***	4,0,0,1	3	0.759	2.109
EG=F(MS, GE, CF)	5.818***	2,0,0,0	3	0.541	1.893
INF=F(MPI, EXR)	5.719***	4,0,1	2	0.712	2.043
EG=F(MPI, CF)	5.122**	2,0,0	2	0.459	1.833
Critical value					
Significance level	Lower bound (0)		Upper bound (1)		
1% level	4.31		5.544		
5% level	3.1		4.088		
10% level	2.592		3.454		

Note: (\*\*\*), (\*\*), (\*) denotes Significant at 1%, 5% and 10% respectively.

Having established the equilibrium relationship among the variables, the long run parameter estimates were obtained and presented in Table 4. The results reveal that monetary policy represented by money supply plays significant role in the long run in influencing both price stability and economic growth. This is consistent with the findings of Tule, Onipede and Ebuh (2020), who found that expansionary monetary policy has positive contemporaneous effect on the economy in Nigeria. In the context of our study, a 1 per cent increase in money supply, leads to 0.649 per cent increase in inflation and 0.423 per cent increase in economic growth in Nigeria respectively.

On the other hand, fiscal policy represented by government expenditure plays no significant role in influencing price stability and economic growth in Nigeria, since all its coefficients are statistically not significant. Also the findings of Tule, Onipede and Ebu (2020) that expansionary fiscal policy does not lead to economic growth in Nigeria, lend credence to this finding. This finding implies that monetary policy plays greater role in achieving the macroeconomic goals of price stability and economic growth in Nigeria. This is consistent with the finding of Scott (2011) who found that monetary policy has more significant effect on economic activities than fiscal policy in Nigeria.

The role of money supply in influencing price stability and economic growth in Nigeria can be attributed to the fact that broad money which is used as the proxy for money supply, largely involve money in circulation outside the financial system. This is due to huge informal economic activities, which derive the economy of Nigeria and upon which the CBN has less control. Therefore, for monetary policy to be more effective, the CBN needs to evolve policies to include more people into the financial system. On the other hand, the insignificant role of government expenditure in influencing price stability and economic growth is not unconnected with the fact that a substantial portion (sometimes up to 80 per cent) of the government expenditure is made up of recurrent expenditure, which will have no long run effect.

**Table 4. ARDL Long Run Coefficients Estimates**

Model	INF=F(MS, GE, EXR)	EG=F(MS, GE, CF)	INF=F(MPI, EXR)	EG=F(MPI, CF)
Lag Structure	4,0,0,1	2,0,0,0	4,0,1	2,0,0
Regressor	Coefficient	Coefficient	Coefficient	Coefficient
LMS	0.649** [0.004]	0.423** [0.005]		
LGE	0.216 [0.183]	0.038 [0.634]		
LEXR	0.435*** [0.001]		0.647*** [0.000]	
LCF		0.583*** [0.000]		0.841*** [0.000]
MPI			0.004** [0.028]	0.005** [0.021]
C	-10.783*** [0.000]	0.376 [0.736]	-2.271* [0.071]	
Diagnostic Tests Statistics				
Serial Correlation	0.455 [0.640]	0.051 [0.950]	0.102 [0.903]	0.002 [0.998]
Normality	6.114 [0.047]	0.904 [0.636]	4.219 [0.121]	1.760 [0.415]
Heteroscedasticity	2.297 [0.051]	3.726 [0.009]	2.405 [0.046]	3.121 [0.028]

Note: (\*\*\*), (\*\*), (\*) denotes Significant at 1%, 5% and 10% respectively. P-value are in [ ]

Moreover, as indicated in Table 4, the combination of monetary and fiscal policy represented by their interactive term (MPI) has positive and statistically significant coefficients in both the inflation and economic growth models. This implies that monetary and fiscal policies are complimentary in

achieving the macroeconomic goals of price stability and economic growth in Nigeria. This is supported by the findings of Scott (2011), who found that overall monetary and fiscal policies are complementary in managing the Nigerian economy.

The short run dynamics of the equilibrium models for inflation and economic growth are presented in Table 5. It shows that in the short run, both inflation and economic growth are largely affected by their fast values. This means that monetary and fiscal policy efforts have no short run effects. However, there is evidence of adjustment to long run, when shocks are experienced in the short run. The rate of adjustment varies from 17 per cent to 43 per cent for the inflation and economic growth models respectively.

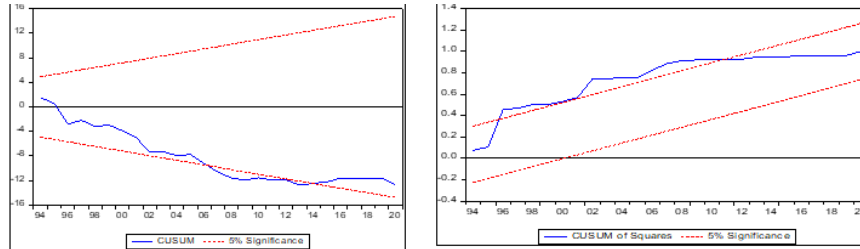
**Table 5. ARDL Short Run Coefficients Estimates**

Model	INF=F(MS, GE, EXR)	EG=F(MS, GE, CF)	INF=F(MPI, EXR)	EG=F(MPI, CF)
Lag Structure	4,0,0,1	2,0,0,0	4,0,1	2,0,0
Regressor	Coefficient	Coefficient	Coefficient	Coefficient
D(LINF(-1))	0.828*** [0.000]		0.830*** [0.000]	
D(LINF(-2))	-0.592** [0.002]		-0.541** [0.006]	
D(LINF(-3))	0.520*** [0.000]		0.467** [0.002]	
D(LEXR)	-0.048 [0.273]		-0.020 [0.668]	
D(LEG(-1))		0.426*** [0.000]		0.435*** [0.001]
ECM(-1)	-0.233*** [0.000]	-0.425*** [0.000]	-0.174*** [0.000]	-0.283*** [0.000]
Joint Significance and Diagnostic Tests Statistics				
R-Square	0.759	0.541	0.712	0.459
Adj. R-square	0.728	0.528	0.675	0.444
SE Regression	0.072	0.079	0.078	0.086
DW-Statistic	2.108	1.893	2.043	1.833

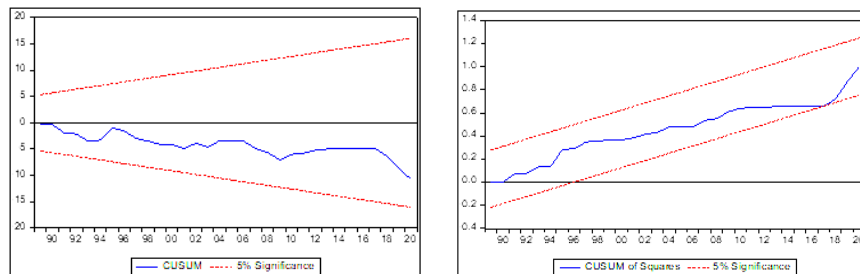
Note: (\*\*\*), (\*\*), (\*) denotes Significant at 1%, 5% and 10% respectively. P-values are in [ ]

Moreover, as indicated in Tables 4 and 5, all the models pass most of the diagnostic and stability tests, which include the Breusch-Godfrey Serial Correlation LM Test; Jarque-Bera normality test; Heteroskedasticity Test; Breusch-Pagan-Godfrey and the Cumulative Sum of Recursive Residuals (CUSUM) and the Cumulative Sum of Recursive Residuals Squares (CUSUMSQ) as depicted in Figures 1 to 4.

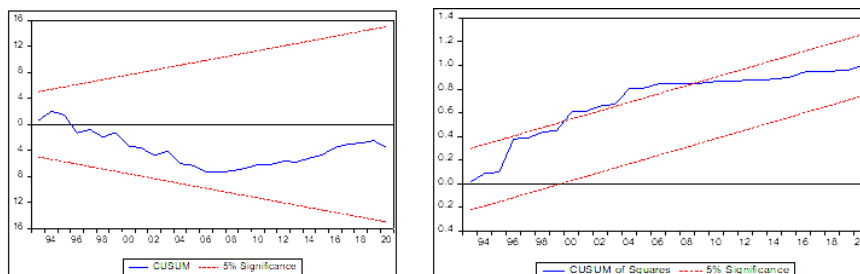
**Figure 1** CUSUM and CUSUMSQ for Contemporaneous Inflation Model



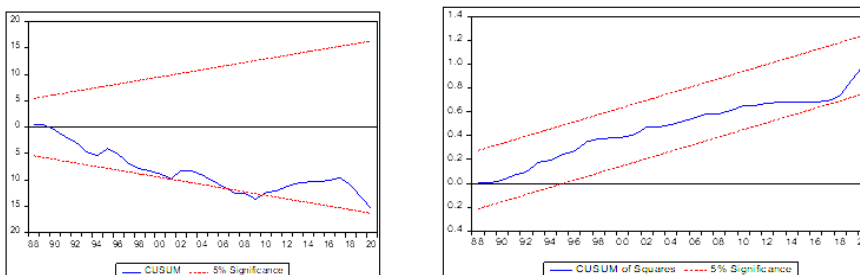
**Figure 2** CUSUM and CUSUMSQ for Contemporaneous Economic Growth Model



**Figure 3** CUSUM and CUSUMSQ for Combined Inflation Model



**Figure 4** CUSUM and CUSUMSQ for Combined Economic Growth Model





## Conclusion

This study examines both the contemporaneous and combined effects of monetary and fiscal policies in achieving the macroeconomic goals of price stability and economic growth in Nigeria. The study employed secondary data over 1981 to 2020 periods and utilised the ARDL approach to cointegration. The empirical results revealed that monetary policy plays greater role in influencing price stability and economic growth in Nigeria, than fiscal policy; whose role is insignificant. Moreover the study finds that monetary and fiscal policies are complementary in affecting price stability and economic growth, which means, both will be more effective if coordinated appropriately. For the control variables, the study found that both exchange rate and capital formation play significant role in influencing price stability and economic growth respectively. This further strengthens the case for policy complementarity; meaning that weak exchange rate policy will hinder the effectiveness of monetary and fiscal policies in Nigeria, and infrastructural deficit will hinder economic growth efforts. On the back of these findings, the following policy recommendations are proffered.

## Policy Recommendations

- 1- Balance the objectives and goals of both monetary and fiscal policies: while monetary authorities are excessively focused on inflation, the fiscal authorities tend to neglect inflation and focus more on economic growth. However, if both authorities strike a balance between the two goals through policy coordination, optimal results will be obtained.
- 2- The federal government should reduce its reliance on the CBN to finance budget deficits and fund the implementation of some specific fiscal and other intervention policies. This will allow the CBN to be more focus in controlling money supply and inflation. This can be achieved through inculcating fiscal discipline, exploring the money and capital markets for public borrowing to finance deficit and encourage the participation of private sector in the provision of infrastructural facilities.
- 3- Government should provide enabling environment for private sector involvement in capital formation: While government use fiscal policy to accelerate the rate of capital formation; involving and encouraging the private or public-private capital formation will yield optimal results and will not lead to inflationary pressure and debt over-hang.

This can be achieved by providing enabling legal and policy frameworks as well as incentives for Public-Private Partnerships (PPP).

- 4- The CBN should tinker with the dual exchange rate policy being operated in favour of a unified and predictable exchange rate policy. Given that exchange rate is found to accelerate inflation in Nigeria, unifying the exchange rate policy will bring about a more stable and predictable macroeconomic environment and better long term business decisions, thereby addressing incessant inflationary pressure.
- 5- The Central Bank of Nigeria should strengthen its financial inclusion policies; such that high volume of money in circulation outside the financial system (largely in the informal economy), can be mobilised into savings and investment. This has the potential to reduce inflation, while accelerating capital formation and economic growth.
- 6- The fiscal authorities should institutionalised stabilisation mechanisms in the form of effective tax and transfer schemes; such that incessant fiscal interventions to stabilise the economy in the face shocks are avoided. This will provide the monetary authority more space to rollout effective policy measures that will achieve the goals of price and exchange rate stability and economic growth.
- 7- The federal government should create and/or strengthen existing platforms to enable dialogue and stakeholders' engagement to ensure effective formulation and implementation of monetary, fiscal and other policies and programmes for optimal results and to avoid duplication and wastages. In this regard the Monetary and Fiscal Policy Coordinating Committee (MFPCC) should be reinvigorated and empowered to discharge its responsibilities.

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## **Data Envelopment Analysis (DEA) of Credit Access and Firm Level Technical Efficiency among Mixed Smallholder Farmers in Plateau State, Nigeria**

Sunday Baba\*

### **Abstract**

Even though credit constraints have been widely researched as a major problem among smallholder farmers, its efficient utilization and link to technical efficiency is less empirically interrogated. The question of whether agricultural credit can lead to enhanced technical efficiency, especially when farmers access the credit during favorable weather conditions, is under-investigated. We therefore interrogated the socio-demographic characteristics as well as the effect of credit accessibility on the technical efficiency of the small holder mixed farmers in Plateau state, Nigeria. Through a multi stage sampling method, we sampled 384 mixed smallholder farmers across the 17 regions of Plateau State, Nigeria which are agricultural concentrated and then used structured questionnaires to collect data. We then conducted Data Envelopment Analysis using “DEAP 2.1” version software to establish the technical efficiencies of the farmers, per category, credit constrained and credit unconstrained. Secondly, we adopted Tobit regression model, estimated using STATA version 13.0, to establish the relationship between credit access and technical efficiencies of the small holder farmers sampled. Our results indicated that the mixed smallholder farmers in Plateau State, Nigeria are operating at an average technical efficiency of 93.2%, 6.8% below their potential. The credit constrained farmers were even more technically inefficient operating at an average technical efficiency of 92.9% compared to 93.4% for the credit unconstrained farmers. This indicated that the mixed small holder farmers in the region can potentially increase their technical efficiency through credit access. It was also indicated that credit access was a positive and significant determinant of technical efficiency of the mixed smallholder farmers sampled in the study. From a policy perspective, we recommend a need for financial institutions to advance credit to smallholder farmers based on their need for it and their ability to efficiently utilize it to maximize agricultural production. Through that, it will be ensured that only the

farmers in need of credit get it and use it to improve their technical efficiency.

**Key Words:** Credit Access, Technical Efficiency, Small holder Farmers, Agriculture, Nigeria

## Introduction

Agriculture is fundamental to the economy of most countries, reducing poverty and providing food security (Lakhan *et al.* 2020), more so for the developing economies because their population heavily relies on it as a source of their livelihood (Assogba, 2017). Globally, approximately 450 Million households depend on agriculture as their main source of livelihood (International Finance Corporation, 2014). The IFC (2014) report further added that of the 75 percent of the world's poor from rural areas, more than 80 percent of them depend on agriculture for survival. In Nigerian context, agriculture plays a critical role in poverty reduction, contributing over 40 percent of the GDP and employing about 60 percent of the working population (Oyakhilomen & Zibah, 2014).

Despite their socio-economic importance, small holder farmers in Low Income Countries (LIC) face a number of hurdles related to their agricultural activities and it ranges from low technical efficiency, low productivity, market inaccessibility for their produce as well as credit constraints among others (IFC, 2014). While it remains, a vibrant sector boosting of an employment rate of up to 55 percent in Africa, only 1 percent and less of farmers in the agricultural sector can access bank loans (IFC, 2014). Odoemenem and Obinne (2010) agreed that even though agriculture is an important contributor to Nigeria's economy, through the small holder farmers who dominate its contribution, its growth is being hindered by credit constraints.

Credit insufficiency among small holder farmers has been demonstrated in empirical research, despite positive relationships being established between credit access and agricultural productivity (Adebayo & Adeola, 2008; Ololade & Olagunju, 2013). In addition, other empirical evidences suggest adverse effects of credit constraints on agricultural output (Carter & Olinto, 2003). In cases where farmers have access to credit, Ololade and Olagunju (2013) demonstrated the importance of efficient use of credit acknowledging that even though the credit is not enough, it can realize better productivity when used efficiently. In Tanzania, Girabi and Mwakaje (2013) similarly demonstrated that agricultural credit can enhance productivity. Other scholars such as Feijo (2001) from Brazil and Mahmood *et al.* (2013) from Pakistan have

argued that availability of agricultural credit is associated with increased productivity, albeit when efficiently used.

### Literature Review

Even though credit constraint has been widely researched, its efficient utilization and link to technical efficiency is less empirically focused on. The question of whether agricultural credit can lead to enhanced technical efficiency, especially when farmers access the credit during favorable weather conditions, is under-investigated. Most of the previous empirical evidence in Sub-Saharan Africa focus on determinants of credit accessibility by small holder farmers (Assogbaet *al.* 2017 in Benin; Kiplimoet *al.* 2015 in Kenya; Sebatta *et al.* 2014 in Zambia) as well as numerous studies in Nigerian context such as Obisesan (2013); Ojo and Baiyegunhi (2020) who have all agreed that credit constraints significantly exist. Other empirical studies have linked credit access to agricultural production and established that it enhances production (Osabohien *et al.* 2020; Diallo *et al.* 2020).

Most of the previous studies on technical efficiency among small holder farmers have simply described technical efficiency and its determinants without necessarily linking it to credit access. Mwangiet *al.* (2020) for instance indicated that the TE of small holder tomato farmers in Kirinyaga County, Kenya was 39.6%. In Ijesha Land of Osun State, Nigeria, Tijani (2006) recorded a higher TE among rice farmers at 86.6%. There however exist limited scope on whether credit leads to technical efficiency of the small holder farmers. TE, according to Fare and Lovell (1978) indicates the ability of farmers to efficiently utilize their inputs to obtain maximum output. In this study, the ability of the small holder farmers in Plateau state, Nigeria to obtain maximal agricultural output given a combination of various inputs, in this case, size of land, cost of labour and cost of inputs.

Some of the related studies have been conducted in different contexts. In Ghana, Abdallah (2016) established that despite receiving credit, small holder farmers still operated below the frontier whereby their technical efficiency was increased by only 3.8 percent by credit. On the contrary, Siaw *et al.* (2020) argued that farmers were able to raise their technical efficiency by a margin not exceeding 8% when they access credit in Ghana while Duy, Neuberger and Suwanaporn(2015) indicated that the technical efficiency of rice farmers improved to 93% after access to credit with a further possibility of improvement by 5% among rural households in the Mekong Delta. Even so, studies linking credit access to technical efficiency in the Nigerian Plateau state are limited. While policy papers, agricultural economists and scholars alike

continue to agitate for credit accessibility among small holder farmers in Nigeria, it is reasonable to find out whether such a move can increase the technical efficiency of the beneficiaries, or whether the utilization of credit doesn't add much to the technical efficiency of the beneficiaries. This can go a long way in shaping policies geared towards not only advancing credit to the small holder farmers, but also targeting the determinants of technical efficiency among the credit beneficiaries. Guided and motivated by these observations, the study sought to answer the following research question: Does credit accessibility help enhance the technical efficiency of the small holder mixed farmers in Plateau state Nigeria? This raises questions about the efficiency with which these funds are used especially in periods when aid is supplied to farmers under favorable weather conditions.

### **Objectives of the Study**

The objectives of the paper are to:

- i. Assess the socio-demographic characteristics of small holder mixed farmers in Plateau state, Nigeria
- ii. Investigate the effects of credit accessibility on the technical efficiency of the small holder mixed farmers in Plateau state, Nigeria

### **Materials and Methods**

#### **Description of the Study Area**

The study focused on Plateau State, Nigeria, which is one of the largest states at number 12. The state is located in the North-Central zone of Nigeria and borders Bauchi, Kaduna, Taraba and Nasarawa states. The state which has approximately 3.5 Million people, is divided into 6 regions. The state is on an altitude of 1,200 Metres above sea level and experiences temperatures averaging 13°C to 22 °C. The average rainfall experienced is 52 in which has supported the predominant agricultural activities in some parts across the 17 local government areas. Other economic activities in the area mining.

#### **Data Source and Sampling Procedures**

The study targeted mixed small holder farmers based in Plateau state, Nigeria. The household heads of the small holding households were targeted to respond to a structured questionnaire. A cross-sectional survey research design was adopted. According to National Survey (2016), there were a total of 10,200 registered smallholding households in Nigeria's Plateau state. To determine the sample size from this value, the following Fisher (1983) formula recommended



for a population above 10,000 (Mugenda & Mugenda, 2009) was adopted.

$$n = \frac{Z^2 pq}{d^2}$$

**Where:**

**n** = sample size

**p** = sample population containing the desirable population traits. This proportion was 50% as recommended by Smith (2015)

**q** = sample population containing the undesirable population traits. This proportion was 50% (1 - P)

**d** = error term (5%)

**Z** = Z score at 5% level of significance

Replacing the values in the formula gives a sample size of 384 as shown:

$$n = \frac{1.96^2 (0.5)(0.5)}{0.05^2} = 384 \dots\dots\dots(1)$$

A multistage stratified random sampling technique was adopted to determine the respondents. First, the state was stratified into the 17 local government areas. Secondly, those areas where small holding agriculture was mainly concentrated were purposively sampled and then the small holder households involved in mixed farming targeted. In selection of the small holder farmers, attention was kept on settling only on those with less than 4 Ha of land as is the definition of a small holder farmer by FAO (2014). The selection of the household heads was through simple random methods in order to give each household an equal chance of being selected (Smith, 2015).

### **Description of Data Analysis Procedures**

The study collected quantitative primary data, through structured questionnaires, which was analysed through Statistical Packages for Social Sciences (SPSS) version 24 to produce the descriptive analysis (frequencies, percentages, means and standard deviation) to describe the farmers characteristics. DEA, conducted through “DEAP 2.1” version software was used to establish the technical efficiencies of the farmers as discussed in the sub-sections that follow while a Tobit regression model, estimated using STATA version 13.0 was used to establish the relationship between credit access and

technical efficiencies of the small holder farmers sampled.

Previous studies such as Wasseja and Mwenda(2015) adopted DEA to analyze the efficiency of Life Assurance Companies in Kenya while Abatania, Hailu and Mugera (2012) used bootstrap DEA model to analyze the farm household technical efficiency in Northern Ghana. In addition, other studies such as Aktan and Samut (2013) conducted an analysis of the determinants of Turkey's technical efficiency of Agriculture Sector by Two-Stage Data Envelopment Analysis (DEA) where both DEA and Tobit models were used while Aye and Mungatana (2010) similarly recommended the use of both DEA and Tobit models to estimate the technical efficiency of traditional and hybrid maize farmers in Nigeria. The estimated TE scores obtained through DEA were used in the Tobit regression against credit.

#### **Analytical Framework of Variable Returns to Scale (VRS) Data Envelopment Analysis (DEA)**

Data Envelopment Analysis (DEA) is a model used in analysis of multi-factor productivity scenarios to capture the relative efficiencies given homogeneous sets of decision-making units (DMUs). The model was propounded by Farrell (1957) but later extended by Charnes, Cooper and Rhodes (1978). The calculation of the efficiency scores by DEA follows two assumptions on Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS). Based on an argument by Charnes *et al* (1978), the efficiency scores are defined as follows:

$$\max_{\theta_0} = \frac{\sum_{r=1}^s u_r Y_{ro}}{\sum_{i=1}^m v_i X_{io}} \dots \dots \dots (2)$$

Such that,

$$\frac{\sum_{r=1}^s u_r Y_{rj}}{\sum_{i=1}^m v_i X_{ij}} \leq 1: j = 1 \dots n \dots \dots \dots (3)$$

$$v_r, v_i \geq 0; r = 1, m \dots \dots \dots (4)$$

DEA obtains Technical Efficiency (TE) values ranging from 0 to 1 whereby, at a TE = 1, the DMU is producing at the production frontier and is said to be technically efficient. Two models can be established, input or output oriented model, based on the possibility to control the variables. Nevertheless, since the small holder farmer in this study could only control the inputs they use more than the outputs they get, we adopted the input-oriented DEA as recommended by Abatania, Hailu and Mugera (2012); Aktan and Samut (2013) as well as Aye and Mungatana (2010).

To establish the relative efficiency scores for all the DMUs, the problem is run  $n$  times and every time, a DMU selects inputs and output weights which maximize its efficiency score. A DMU is termed as efficient when it obtains a score of 1 and considered as inefficient, when it has a score less than 1. The following linear programming model, suggested by Banker, Charnes and Cooper (1984) can be solved to establish the input-oriented DEA efficiency estimator,<sup>8</sup>

$$\hat{\delta}_i = \max_{\delta_i, \lambda} \{ \delta_i > 0 | \hat{\delta}_i y_i \leq \sum_{i=1}^n y_i \lambda; x_i \geq \sum_{i=1}^n x_i \lambda; x_i \geq 0, i=1, \dots, n \text{ firms} \} \dots\dots\dots 5$$

Where:

$y_i$  is a vector of output for farmer  $i$  (Agricultural production)

$x_i$  is a vector of inputs by farmer  $i$  (Amount of labour and farm inputs)

$\lambda$  is a  $1 \times 1$  vector of constants.

The value of  $\hat{\delta}_i$  obtained is the technical efficiency score for the  $i^{\text{th}}$  farmer. A measure of  $\hat{\delta}_i = 1$  indicates that the farmer is technically efficient and otherwise inefficient. We conducted the analysis under the assumption of VRS which relaxes the assumption that all the farmers were operating at an optimal scale. It is common knowledge that the small holder farmers cannot operate at optimal scale because they experience various challenges as earlier established ranging from but not limited to low productivity, market inaccessibility for their produce, credit constraints (IFC, 2014) as well as various shocks such as climate change especially since they rely on rain fed agriculture (Aktan & Samut, 2013).

### Tobit Regression Model

In the second state of analysis, the technical efficiency scores calculated under the DEA VRS were regressed against credit accessed using two-limit Tobit model since the efficiency scores range between 0 and 1. We use a Tobit regression model as opposed to an Ordinary Least Square (OLS) Regression Model since the TE scores which are used as the dependent variables in the study, limited in the range 0 to 1, don't have a normal distribution, which can thus lead to biased results using an OLS (Aktan & Samut, 2013). The Tobit regression model, proposed by Tobit (1958) is expressed as below:

$$y_i^* = \beta_0 + \sum_{j=1}^k \beta_j x_{ij} + \mu_i$$

$$\mu_i \sim IN(0, \sigma^2) \dots\dots\dots (6)$$

Where:

$y_i^*$  is a latent variable that indicates the efficiency score of farmer  $i$

$x_{ij}$  is the explanatory variable of farmer  $i$

$\mu_i$  is the error term.

Additionally,  $y_i$  is defined as the observed dependent variable expressed as shown in equation 7.

$$y_i = 0 \text{ if } y_i^* \leq 0 \dots\dots\dots (7a)$$

$$y_i = y_i^*, \text{ if } 0 < y_i^* < 1 \dots\dots\dots (7b)$$

$$y_i = 1 \text{ if } y_i^* \geq 1 \dots\dots\dots (7c)$$

We were careful not to have TE values with high correlations based on the argument by Abatania, Hailu and Mugeru (2012) that since various DMUs are combined when calculating TE, there is a high correlation between the TE scores which recommends bootstrapping for further analysis using the scores in order to avoid multicollinearity problem. However, Barros (2006) documented that when the sources of the variables in the DEA model are independent from that in the Tobit regression model, then the problem of correlation is eliminated and hence its irrelevant to do the bootstrap procedure. Given that this study used different variables in calculation of TE in DEA as well as running the Tobit model, there was thus no need to conduct a bootstrap.

### Description of Variables

The output variable in the study was agricultural output measured as the value of all the agricultural production of a mixed small holder farmer in Plateau, Nigeria captured in monetary values (Naira) at the current prices of produce. The input variables were the cost of labour in Naira, the cost of inputs (seeds, fertilizer) in Naira and the Farm Size (Ha). The dependent variable in the Tobit regression model was Technical efficiency scores under VRS and the predictor variable was Credit accessed.

## Findings and Discussion

### Descriptive Summary of Data

Table 1 indicates the descriptive statistics (Frequency and percentages) of the categorical data (Gender, Age Bracket, Level of education and credit access). It was established that majority of the small holder farmers in Plateau State, Nigeria, 306 (79.7%) were male to imply that small holding in the region is male dominated. Related findings were also indicated by the report on National Survey and Segmentation of Smallholder Households in Nigeria by the FGN which established that nearly nine in 10 smallholder households (88 percent) in Nigerian North Central region, which also includes Plateau and other states, are headed by men and in cases where the HH heads were female, they were mostly widowers. Similarly, Yusuf et al. (2016) in a survey of small holding in Nigeria, established that up to 82.5% of the small holder farming households were male headed.

It was also established that majority of the small holders, 171 (44.5%), were aged above 50 years while those aged between 31 and 50 years were 138 (35.9%). This implies that majority of the small holders in the study area are old, aged above 50 years. In contrast, few younger people are engaged in small holding in Nigeria which can probably be as a result of migration to urban centers as well as being in school as argued by Dan-Azumi(2011). The findings are consistent with that of a World Bank (2017) National Survey and Segmentation of Smallholder Households in Nigeria report that demonstrated that the Nigerian smallholder population includes a robust older generation whereby over half of smallholder heads of household (55 percent) are aged above 49 years and just over a one-tenth of smallholder household heads under the age of 30.

In regard to the highest education level, the study findings demonstrated that a large proportion of the small holders, 150 (39.1%) had no formal level of education, 69 (18%) had primary level of education and 119(31%) had secondary level of education. These findings indicated that there was a high illiteracy level among the small holding households in Plateau State, Nigeria. These findings are consistent with that of a World Bank (2017) survey which demonstrated that 25% of the HH heads in Nigeria attended school but those who went beyond junior secondary were only 9%.

Additionally, it was demonstrated that of the sampled respondents, 194 (50.5%) of them had accessed one form of credit or the other from various sources to finance their agricultural activities. This shows that access to agricultural credit

was still low at 50.5% implying that up to 50.5% of the small holder farmers were credit constrained. Related findings were shown in a study by Obisesan (2013) who indicated that only 29% of the smallholder cassava farming households in South West, Nigeria were able to access agricultural credit. Correspondingly, a report by FAO (2015) on the profile of smallholding among selected countries across the world showed that in Kenya, about 33% of smallholder households have access to credit while in the United Republic of Tanzania (URT), a few smallholders (17 percent) were able to access credit for agricultural activities. The report further placed the rate of credit access among small holders to between 8% and 35% on average.

**Table 1: Descriptive Summary of Categorical Data**

Socio-Demographic Variables	Category	Frequency (Percent)
Gender	Male	306 (79.7%)
	Female	78 (20.3%)
Age Bracket	Below 30 Years	75 (19.5%)
	31 to 50 Years	138 (35.9%)
	Above 50 Years	171 (44.5%)
Level of Education	No Formal Education	150 (39.1%)
	Primary	69 (18%)
	Secondary	119 (31%)
	Tertiary	46 (12%)
Credit Access	No	190 (49.5%)
	Yes	194 (50.5%)
<b>Sample Size, n = 384</b>		

Table 2 presented the descriptive statistics for the continuous variables in the study. It was established that the average household size of smallholders in the study area was 4.96 members in accordance with Yusuf *et al.* (2016) who similarly noted that the HH size of a small holder farmer in Nigeria averaged 5 members. The National Agriculture and Food Security Strategy (NAFSS) (2010–2020) by the Federal Republic of Nigeria Ministry of Agriculture and Rural Development also indicated that on average the household size of small holders in Nigeria was 5.5. Similarly, statistics by the National Bureau of Statistics, Nigeria (2020) indicate that the national household size of a rural household in Nigeria is 5.1 and that of an urban household is 4.7 with a national average of 5.0.

The results also showed that the small holders have an average of 2.15 Ha of land which is within the definition of a small holder as defined by FAO. Comparing these findings to other regions, there is a small variation in the farm size of the small holder. A FAO (2015) report on the analysis of small holder farmers based

on data from 9 countries indicated that the average size of a smallholder farm in Asian countries is relatively smaller such as 0.24 Ha in Bangladesh and 0.32 Ha in Vietnam. However, in Africa, smallholder farms can be relatively larger, averaging 0.47 Ha in Kenya and 0.9 Ha in Ethiopia. In Latin American countries, smallholder farms often tend to be over 2 hectares, as in Nicaragua where the average small farm size is 5 hectares. In Nigeria, the land size of a small holder farmer range between 0.1 to 4.99 hectares (National Agriculture and Food Security Strategy (NAFSS) (2010–2020), Federal Republic of Nigeria).

It was also shown that the small holders used an average of 3.2 people to work on their farms translating to an average of 61,990.2833.189.32 Naira (USD. 162.70) in labour costs per household. In contrast, a FAO (2015) report on the demographic profile of small holding across selected countries correspondingly indicated that the main source of labour for smallholders is family. In Nigeria, a NAFSS (2010–2020) survey indicated the family labour averages 2 to 5 members per family. Additionally, the study established that the small holder farmers averaged 33.189.32 Naira (USD. 87.11) as the cost of their inputs in terms of Seeds and fertilizers. The average yield in Naira per household was averaged at 93,661.14 Naira (USD. 245.83) per small holder farmer. This implied that the average yield per hectare was 59.148.66 Naira (155.24 Ha).

**Table 2: Descriptive Summary of Continuous Data**

Variables	Mean	Std. Deviation
Household Size	4.96	0.85
Credit Accessed (Naira)	20,608.81	26,506.83
Farm Size (Ha)	2.15	1.24
Labour Cost (Naira)	61,990.28	15,567.18
Labour Size	3.20	1.12
Cost of Inputs (Fertilizers and Seeds)	33,189.32	9,097.68
Agricultural Output (Naira)	93,661.14	95,369.46
Yield (Output in Naira per Hectare)	59,148.66	50,305.48
<i>Sample Size, n = 384</i>		

### **Descriptive Analysis of Technical Efficiency Scores for the Sampled Smallholder Farmers**

The study results demonstrated that the technical efficiency of mixed small holder farmers in Plateau State, Nigeria given labour costs and cost of other inputs ranges between 91.97% to 94.70% with a mean efficiency of 93.2%. For the average efficient mixed small holder farmer in Plateau State, Nigeria to achieve the technical efficiency level of the most efficient farmers, it could only bring about an increase in production by 2%. For the case of the least efficient mixed small holder farmer in Plateau State, Nigeria to achieve the technical

efficiency level of the most efficient farmers, it could only bring about an increase in production by 3%. Majority of the farmers, 292 (76%) are producing at between 92% and 93.99% technical efficiency implying that they are producing 8% below their potential. Only 12 (3%) of the farmers were producing at above 94% technical efficiency, still at 6% below their production potential, while 23 (6%) were producing at less than 92% technical efficiency, at more than 8% below their production potential.

Related studies such as Ajibefun, Battese and Daramola (2002) established that Nigerian small holder farmers operated at an average technical efficiency level of 82%. Another study by Amos (2007) indicated that smallholder cocoa farmers in Nigeria operated at an average technical efficiency of 72%. More recently, Joseph (2014) established that small holder farmers in Kogi State, Nigeria operated at an average technical efficiency of 64%. Additionally, in Osun state, Kehinde and Olatidoye (2019) established that smallholder Cassava Farmers operated at an average technical efficiency value of 73.6%. Therefore, it can be argued that farmers did not operate at their potential.

**Table 3: Frequency Distribution of VRS Technical Efficiency Estimates**

Efficiency Range under VRS	Frequency (Percentage) of Small holder farmers
>94.00%	12 (3%)
93.00% - 94.99%	58 (15%)
92.00 -93.99%	292 (76%)
< 92.00%	23 (6%)
Total	384 (100%)
Mean Technical Efficiency	0.9316
Minimum	0.9197
Maximum	0.9470

### Analysis of Returns to Scale (RTS)

The value of the Returns to Scale (RTS) of the farmers was 1.08 implying that the small holder mixed farmers were operating at increasing returns to scale to mean that they are yet to experience their maximum level of inputs combination to produce maximum output at their potential. This may be because the mechanics they are using is traditional. Related results were established by Kehinde and Olatidoye (2019) among smallholder Cassava Farmers in Osun State, Nigeria.

### Independent Sample t-test of the Technical Efficiency Scores between Credit Constrained and Credit Unconstrained Small holder farmers

An independent sample t-test was further conducted to establish whether there was a significant difference in technical efficiency of the small holder farmers



who accessed credit against those who had not. The results in table 4 indicated that the small holder farmers who accessed credit had a mean technical efficiency score (93.4%), which is greater than those who did not access credit (92.9%). This implies that those who accessed credit were technically more efficient than those who did not. On whether difference was significant difference, the  $\Pr(T < t) = 0.000$ , which implies that the null hypothesis that the difference in technical efficiency between credit constrained farmers and those who accessed credit is not significant was rejected and hence, it can be concluded that there was a significant difference in technical efficiency of the small holder farmers who accessed credit against those who did not whereby those who accessed were significantly more technically efficient. This implies that credit constraints hindered the farmers from operating at their full potential. Related results were established by Komicha and Ohlmer (2007) who indicated that credit unconstrained small holder farmers in Southeastern Ethiopia were more technically efficient (by 12%) than the credit constrained ones.

**Table 4: Difference in Technical Efficiency Scores between Credit Constrained and Credit Unconstrained Small holder farmers**

Group	Observations	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]		Independent sample t-test
Credit Constrained Farmers (0)	193	0.9292	0.0002	0.0025	0.9288	0.9296	<b><i>H<sub>0</sub>: The difference in Technical efficiency between credit constrained farmers and those who accessed credit is not significant</i></b>  <b><math>\Pr(T &lt; t) = 0.000</math>, hence reject null hypothesis</b>
Credit Unconstrained Farmers (1)	191	0.9336	0.0004	0.0057	0.9329	0.9344	
Combined	384	0.9320	0.0003	0.0052	0.9314	0.9325	
Diff (0-1)		(0.0044)	0.0005		(0.0054)	(0.0034)	

### Tobit Regression Results

To find out the effect of credit accessibility on the technical efficiency of the small holder mixed farmers in Plateau state, Nigeria, a Tobit regression model (Table 5) was adopted. The Tobit regression model estimated was established to be a good fit ( $\text{Prob} > \chi^2 < 0.05$ ). This implies that the Tobit regression model adopted in the study was a good fit in predicting the effect of credit access to technical efficiency of farmers. It was established that the amount of credit accessed had a positive and significant effect on the technical efficiency score of

the farmers ( $t = 4.32 > 1.96$ ;  $P\text{-Value} < 0.05$ ). Specifically, credit accessed explained up to 21.74% of the variations in the technical efficiencies of the mixed small holder farmer in Plateau State, Nigeria.

The findings imply that access to credit enabled the small holder farmers to enhance their technical efficiency probably because of employing more mechanized methods, buying fertilizers, increasing the size of cultivated land, employing more labour and using better seeds among others. These findings are consistent with that of a study by Siaw *et al.* (2020) who argued that farmers were able to raise their technical efficiency when they access credit in Ghana. Similarly, Duy, Neuberger and Suwanaporn (2015) indicated that the technical efficiency of rice farmers improved to 93% after access to credit with a further possibility of improvement by 5% among rural households in the Mekong Delta. On the contrary, Anang *et al.* (2016) established that credit accessed did not necessarily improve the technical efficiency of smallholder rice farmers in Northern Ghana.

**Table 5: Tobit Regression Results**

					LR Chi <sup>2</sup>	17.90
					Prob > Chi <sup>2</sup>	0.000
					Pseudo R <sup>2</sup>	0.2174
Technical Efficiency	Coef.	Std. Err.	t	P> t	[95% Conf.Interval]	
Credit Accessed	7.24E-08	1.68E-08	4.32	0.000	3.93E-08	1.05E-07
Constant	0.93064	0.000778	1196.02	0.000	0.929107	0.932174
/sigma	0.005476	0.000261			0.004961	0.005991

### Conclusion and Policy Implications

This article established the socio-demographic characteristics as well as the effect of credit access on technical efficiency of mixed small holder farmers in Plateau state Nigeria using primary data collected across the 17 local government areas of the state where it was agriculture concentrated. Through a direct elimination method, the small holder farmers were categorized into credit constrained and credit unconstrained farmers and then their technical efficiency estimated through DEA. It was documented that the mixed small holder farmers in Plateau State, Nigeria, are operating at an average technical efficiency of 93.2%, 6.8% below their potential. The credit constrained farmers were even more technically inefficient operating at an average technical efficiency of 92.9% compared to 93.4% for the credit unconstrained farmers. This indicated that the mixed small holder farmers in the region can potentially increase their technical efficiency through credit access. It was also indicated that credit access was a positive and significant determinant of technical

efficiency of the mixed small holder farmers sampled in the study.

This led to the recommendation that since improved credit access among this group of small holder farmers may result to improved technical efficiency with increased agricultural output, there is a need for more social campaigns and efforts by both the state and federal government of Nigeria as well as the financial institutions to encourage the small holder farmers in the region access more credit for their agricultural activities. Financial institutions may need to increase their presence in the region by focusing on improving their geographical vicinity in order to reduce the distance to them which may also increase credit access by the small holder farmers. However, it is important to note that the mixed small holder farmers in study area have an average of 6.8% inefficiencies. Thus, a 'blind' credit supply to all the mixed small holder farmers in Plateau state, Nigeria without considering technical inefficiencies and credit demand would not necessarily guarantee increased agricultural production or reduce their credit constraints. More specifically, advancing credit to the credit constrained small holder farmers, who are also technically inefficient, would result to low output that hindering their ability to repay the loans, which in turn would affect the effectiveness of credit supply. Therefore, there is a need for careful consideration when advancing credit to them in that, for credit to result to technical efficiency, it needs to satisfy the credit demand of the small holder farmers adequately, otherwise, inefficiencies will be realized. Credit policies in the region should thus seek to improve efficiencies of the small holder farmers accordingly, more so, the credit constrained ones.

Given that the smallholder farmers who are not credit constrained are more technically efficient than those who are credit constrained, it implies that supplying credit which is responsive to effective credit demand of the small holder farmers would definitely result to increased agricultural output, which in turn enhances the ability of the farmers to repay the credit. In so doing, it increases the incentive of the lenders to advance agricultural credit to the farmers to meet their responsive demand. On the contrary, it would be economically unattractive to lend credit to unresponsive credit demands of the farmers, therefore, it is the responsibility of the lenders to identify responsive credit demands before lending to the small holder farmers given that credit demands are not homogeneous. This can be done through checking the default rates of the farmers which may imply that they are operating at inefficiencies which makes it difficult for them to repay the loans. Though, this is just a necessary but not a sufficient condition for credit repayment.

### Conflict of Interest

No potential conflict of interest was recorded by the authors.

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## Health Security: Issues and Challenges in Nigeria

Etim O. Frank\*

### Abstract

The study examined the meaning and the applicability of the concept of Health Security in Nigeria and upheld its desirability. It however noted, that the practice and the culture of the ruling class in Nigeria, relying on overseas medical tourism abroad, would be the greatest challenge that the concept would be confronted with the problem. The study was conducted using the descriptive design paradigm because the issue of Health Security is a recurrent one in Nigeria, with the Nigeria Medical Association, embarking on strike every now and then to demonstrate the inadequacy in the sector. It utilized mostly secondary data generated from the various discourse in the sector derived from the dominant information of the threats and notions of strikes by resident doctors in the sector. These threat are indications of the poor infrastructure in the health social sector in Nigeria. This approach revealed that in order to have health security, infrastructure must be provided adequately at three levels; the primary health centers, secondary and tertiary level respectively. These levels must support each other and services provided should be accessible, available and affordable. The study acknowledged that the concept of Health Security must remain in the front burner of public discourse for a while in order to form an agenda for public policy in the health sector. This is because it is unknown to the public policy drivers and the National Planning Commission who design the development plan of Nigeria. In the absence of a functional National Health Insurance Scheme, affordable Health Security, is the alternative. This is one major way in which the life-expectancy of Nigerians living in a country bereft of health infrastructures and surrounded by brutish living conditions can make life worth living.

## Introduction

A discourse on the concept of 'Health Security' is equivalent to a treatise on 'security' they both have theoretical linkages and empirical dimensions, because the concepts cuts across several disciplines and generates different perspectives. It is an emerging area of study in international relations and security studies, wherewith it simply implies that in the pursuit of national interest with another, health and security should be one of the composite interest pursued. Even if it is not a stand-alone item in the list of national interest sought, whatever is obtained from a sister nation into the domestic environment should not constitute health and security risk. Infectious diseases that spread as epidemic into pandemic decimating population of states as the Spanish Flu of 1918, 2003 SARS in China, HIV/AID and the Chinese Corona virus of 2019 has made 'Health Security' an item to be considered in the development policy and planning of states in this borderless global states.

A healthy nation is a wealthy nation. Only a nation with healthy workforce will have optimum productivity with less off-work days which means increase productivity in the various industries, as sick people can only spend to recover instead of spending to boost the economy. When children are not vaccinated, you are building a population that will be susceptible to pockets

This is because there is health security as would be analyzed herein, in diplomatic practices and international relations. It is there in development studies and in sustainable development study and planning. This account for the declaration of the perspective in which one is discussing at any one time. Consequent upon the variety of its characteristics, the United Nations Organization, approaches it through the World Health Organization, which in turn apply the United Nation Development Programme (UNDP) framework in the pursuit of 'Health Security'. The subject-matter however is a worthwhile venture, because, healthy citizenry makes great nations. Healthy citizenry is a function of meticulous planning and execution.

The 1994 UNDP Annual Human Development Report- 'New Dimension of Human Security' identified 7 categories of threats to human security viz; economic, food scarcity, health, environment, personal, community and political (UNDP 1994). The preamble of the 1946 Constitution of the World Health Organization (WHO) stated, ***happiness, harmonious relations and security of all peoples. The health of all peoples is fundamental to the attainment of peace and security.***

In order to be able to conceptualize it we looked at security as a phenomenon

and found it to refer in the most elementary form to 'a state of being free from danger or any threat thereof. It is freedom from, or resilience against potential harm (or other unwanted coercive change) caused by others. Security may be of persons and social groups, objects and institutions, ecosystems or any other entity or phenomenon vulnerable to unwanted change (<https://en.m.wikipedia.org>).

The Concept of Security: Every time the term is referred to, it invokes states capacity to defend their territories by '*de facto*' or '*de jure*' principles drawn from the Westphalia Treaty of 1948. Jean Jacques Rousseau had described the state as an organized force within its territory. It placed security duties on the state, to secure the citizens therein of threats, within the state security would imply compliance with the relevant orders from relevant security state's institutions.

Security according to Viotti (1994, p.3), in the broadest sense, goes well beyond military considerations. It can be understood as a defense against external (or internal) threats as well as the overall socio-economic wellbeing of a society and the individuals who compose it. National security centers on protection from threat or any situation that is capable of causing a change to occur. It denotes the ability of a state to address the threats to sovereignty (Yanet & Oisamoje, 2016, p.245). It has been described more broadly as 'all measures of design to safeguard and protect the citizenry and the resources of individual, groups, businesses and the nation against sabotage, or violent occurrences (Kinge & Nweke, 2019 p. 357). Anytime anyone is taking proactive action against the occurrence of events that would have unpalatable consequences, he/she is taking security measures.

The various conceptions of security revealed the followings;

- i) That it is the business of the state to plan, execute and maintain security of the citizens within the territory.
- ii) It was to achieve security of life and property that men moved from the state of nature into the state as the most consummate community to reside.
- iii) It involved consciously planned measures to prevent and protect the citizenry against an occurrence (disease, epidemic, or pandemic) which would have unpleasant consequences.
- iv) It involve protection from threat or any situation that may occur.
- v) Security covers socio-economic well-being of individuals-society.

Drawn from the above, Health Security, would involve a conscious proactive measures taken by the state to protect the citizens against known diseases and prospective health occurrences, by establishing adequate health infrastructure that cuts across the phases of medical health (primary, secondary and tertiary levels) respectively. These health infrastructures should be spatially distributed and supported with medical laboratories and drug manufacturing organizations and adequate personnel. The health infrastructures should be adequately staffed and the personnel regularly retrained to have the relevant capacity to confront any unforeseen disease outbreak. This is to ensure that citizens are humanly secure. This situation is however alien to African states and Nigerian government particularly, because the public officials would always seek medical security abroad-. An Online Media, Premium Times reported that 'Nigeria would have lost \$500 million to medical tourism-but for restrictions on foreign travels due to COVID 19, a Lawmaker has said' (Sept 9, 2020). Health security is indeed a new concept in Nigeria and in many African states.

- i) The general aim of this study is to point out that the concept of 'health security' was never part of Nigeria's health architecture.
- ii) To highlight the fact that 'health security' is a meta-policy and should be the second fundamental objectives and Directive Principles of state policy.
- iii) To indicate that it belongs to the realm of national development plan of states.
- iv) To show that 'health security' is novel in Nigeria hence it had not received attention in the past.
- v) To illustrate that in Nigeria, while 'security' is given prominence, 'health' is not, 'health receives low budgetary allocations always.

It is important that the statement of intent outlined above should be elaborated upon as the study would provide data on each of the aims to ascertain the objectives in measureable outcomes with the steps required to be taken to achieve them. This study considered 'health security' as a major component of 'fundamental objectives and Directive Principles of State policy in which all organs of government, and all authorities and persons, exercising legislative, executive or judicial powers, would conform to, observe and apply the provisions of health security at the local state and national government. At the same time, the analyses would highlight in false steps which had been taken in relations of 'health security' thereby making the pursuit of 'health security' an urgent imperative.

The WHO Constitution defines health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. It further states that the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being, that the achievement of any state in the promotion and protection of health is of value to all and that the health of all peoples is fundamental to the attainment of peace and security (WHO,2005).

The problematic is that 'Health security' was in the first place unknown, hence, no budgetary allocation was ever made in the sector towards it. The phenomenon consists of a comprehensive health policy made to ensure that the citizenry is free from diseases, epidemic and pandemic and many other health threats thereof.

It involves the conception and establishment of primary, secondary and tertiary health institutions, which are equipped, funded and staffed to prevent and treat when it occurs.

However, since 1960, there had been no health policy which could describe as 'Health security, because until 1985 when Professor Olikoye Ransome Kuti became the Health Minister with his PHC, there was no primary health strategy. 1986-1990, PHC was expanded to all local government areas, it achieved universal immunization/vaccination of over 80 per cent and devolved responsibility for PHC to local government areas-which are not being carried out today. In 1992 National Primary Health Care Development Agency (NPHCDA) was created to ensure that PHC is sustained. All these ended in 1993 with the change in the government. Today 20 per cent of the 30,000 PHC facilities across Nigeria is functioning. At this point is no health security at the primary level ***Maternal, Newborn and Child Health***

It is right to state that at the secondary Health Structure has been without any policy. Public health services all have the doctors diverting patients and drugs where available to private clinics. Secondary health institutions lack the capacity to provide adequate medical care, because of poor staffing, inadequate equipment, poor distribution of health facilities where available, lack of drugs etc.

The collapsed of health security at the primary level, made many turn to the secondary and tertiary facilities which are themselves decrepit, hence cannot serve as the alternative. Health security is preventive focused rather than curative. This imply that the infrastructure should be in place but they are never provided.

The cumulative effect of the absence of health security is the poor public health system in the country. The members of the ruling class seek health security abroad, and pay no further attention to the health sector, hence no patriotic commitment to the phenomenon of health security. Nigerians are therefore without Health security. Nigerians have been exposed to the emptiness of the health system by COVID 19.

One of the greatest component of the problem is that the health budget of government in Nigeria is often the lowest whether at the local, state and national government are all very low, yet protection of lives of the citizens is a cardinal function of the government.

The issues are; health Security include *preventive rather than curative medicine*. The latest WHO released Nigeria's doctor-to-patient ratio is 4:10,000 patients and patients often wait hours to be seen. The World Health Organization (WHO) recommended doctor-to-patient ratio is 1:1,000 the Golden Finishing line' or 1: 2,500 in Nigeria. This is inadequate input to ensure Health Security'.

Against the backdrop of all these, Nigeria has the lowest national expenditure on health than Angola, South Sudan, and Ethiopia-Nigeria has lowest health budget. The cumulative effect is; (i) Infant mortality rate measures the probability that a child will die between birth and their first birthday. It is the number of deaths per 1000 live births. It was 97 deaths per 1000 in 2011 and 70/1000 in 2016/17. (ii) Under -5 mortality rate stands at 120/1000 by 2016/17. (iii) Maternal mortality rate stood 545 per 100,000 live births for 2013. Adolescent birth rate correlates child marriages and maternal mortality. Nigeria currently has 13.5 million out-of-school-children. These constitute a huge health -security problem in Nigeria, failing to adequately provide the health services required at the Primary Health Care level through the secondary and the tertiary levels respectively. These problems are compounded by the lack of accessibility and affordability of the health security for all in Nigeria. In the first term of the current government in Nigeria, the amount of fiscal resources budgeted for the State-House Clinic was more than that for the seventeen (17) Federal Medical Centers in the entire country, yet Mr. President sought medical attention abroad. This is the nature of the problem of Health Security in Nigeria.

### **The Approach of the work**

The descriptive strategy was adopted in this study to obtain information concerning the situation analysis of Health security in the face of COVID 19 pandemic. It was adopted to determine the nature of the situation, this showed

that Nigeria has no health infrastructure capable of addressing COVID 19. We are to describe what exists with respect to Health security. It was meant to obtain information which would assist in decision-making pursuant to the creation of Health security. It consists in the main of case-studies, survey, trend analysis and documentary analyses. It specifies the nature of Health security and apply the approaches outlined herein (Ndiyo, 2005, p. 70).

It specifies the nature of the Phenomena-Health Security in a scientific manner. The picture of the situation or the characteristics of the population in the situation is made distinct. It involves establishing an accurate description of the population in the situation in order to aid policy decision in ameliorating the situation to obtain improvement. In order to obtain information about the situation, the survey component is applied to generate large body of data on the subject. Being a basic for all types of research, it shows trends in description and uses case-studies, observations (Osuala, 1982, p. 197).

It was adopted because it unveils the analytical picture of Health Security in Nigeria. The tenet of descriptive research should be outline and followed. Though it does not establish cause and effect relationship, it however reveals the trends of events from where hypotheses can be later developed for further studies. Descriptive study then laid the foundation for further break-through in most searches for knowledge. When there is scientifically obtained database on a subject such as health security, this procedure of study become imperative as applied herein.

This form of study procedure often reduces raw data obtained from survey, observation, case-studies, trend and documentary analyses into easy to understand format of 'frequency distribution, percentiles, averages and standard scores (Osuala, 1982, p. 202). Similarly, the data that would be presented, consequent upon the study procedure would take the form of graphs, and numerical measures such as percentages or proportions, average, measures of deviation or dispersion, coefficients of correlation (Ndiyo, 2005 p58).

The adopted perspective of analysis in this work is Human Security because health security is wrapped in it. Human security was created by the Human Security Network in 1999 in association with the academia and civil society organizations to influence the United Nations to bring it into the agenda of deliberation. This was achieved in 1994 through the UNDP Report of that year. There were three critical factors which led to the prominence of the paradigm, these were first, (i) the end of the cold war (which indicated that both ideologies

were laying claim to better than the other in securing human development than the other). (ii) The rapid pace of globalization (which has made the world a global hamlet-with human security in the hamlet as its aim)/ (iii) The continuous failure of the liberal state built on the principles of the 'Washington Consensus (which has shown that human security has worsened in all states that had followed these prescriptions). (iv) The reduced threat of nuclear warfare between the superpowers (high threat of trade war). (v) The exponential rise in the spread and consolidation of democratization and international human rights movement (the end of democratization is development which entails holistic human security). All these in the final analysis sought development and security of man in the society rule by the government to enable man enjoy peace and security.

The second factor which made humans security a much more urgent requirement arose after Mahbub UL Haq declared *'the world is entering a new era in which the very concept of security will change and change dramatically. Security will be interpreted as: security of people not just territory, security of individual's not just nations. Security through development, not through arms. Security of all the people everywhere...in their homes, in their jobs, in their streets, in their communities, in their environment* (Fukuda-Parr & Messino, 2012, p.21). He then espoused in the executive summary of the United Nations Development Programme 1994-report, tagged more on Human Security with the intention that it would be the agenda for then forthcoming '1995 World Summit in Copenhagen'. Human Security according to the report included seven (7) dimensions viz; economic, food and health security. The other components are environmental, personal, community and political security (UNDP 1994). Barry Buzan on his part, identified five (5) proportions of human security to include military, political, economic, social and environmental security (1990:7). The differences in the components of human security between the two scholars is in 'military, social, food, health personal and community security.

The third factor which accounted for the rise of human security as an explanatory paradigm was the adoption by the United Nations General Assembly (UNGA) resolution No 66/290 of 2012. It stands for a broader concept of security. Its focus is the 'individual. The assembly's resolution upheld that human security is not the absence of war nor violence but embraced freedom from fear (security from violence), freedom from want (adequate food, accommodation and health care) and freedom to live in dignity (promotion and protection of human right). In the 2005, World Summit, the heads of state and



Governments then agreed that all individuals, in particular vulnerable people, are entitled to freedom from fear and freedom from wants. These then defined human security with health security assuming a central position within it.

These components are integrated and germane to human security and all come from the processes of planning, providing the resources and infrastructure for the benefit of the citizens. It however, stated that 'health security' is aimed at guaranteeing minimum protection from infectious and parasitic diseases, as well as circulatory diseases, all of which arises from insufficient access to health services and poor environmental control. In all of these, it is the poor and excluded people are the majority of the population which are most of the victims.

It is instructive to note that traditional security involves a state's ability to defend itself against external and internal threats, pursuant to these, it provides a standby military, police and subsidiary para-military institutions in anticipation of any occurrence from these angles of threats.

'Health security' drawn from the above would entails generating the ability to defend the citizens against infectious and parasitic diseases by providing the necessary infrastructures, training and obtaining the right quality of medical personnel to anticipate and manage disease outbreak at the epidemic and pandemic levels respectively. This is a function of careful planning, resource allocation to the health sector and conscious research and development of community medicine.

The concept of Human security is more appropriate in conflict and post-conflict arena, where the citizens remain vulnerable to different forms of security challenges, except the ruling class in every African state. All African state faces one form of security trials or the other. All Africans state have internal insurgency, those that do not have militias fighting, have internal contradictions, protests on the streets or hunger threat or threat from poor governance. Others are challenges of desertification, hunger and poor health infrastructure. These are some of the ranges of security challenges Africans are faced with which impinges on their health, making the adoption of this framework a categorical imperative for this work.

We shall however evaluate the budgetary allocation to the health sector for 2013-2020 to understand the trend of allocation to the sector in order to validate or repudiate one of the objectives of this chapter that Nigeria had never contemplated nor pursued health security in the past or in the present. The concept of health security is alien to the Nigerian ruling class because it is meant

to secure all against health insecurity. This has never been the policy.

### Health Data obtained 2013-2020

The application of the study procedure led to the study of the Budget, which at any time is an indication of what the priority of the government is at any one time, hence we want to decipher if at any time, the government had gone close to pursuing 'health security'. In the search for data we elected to survey and conduct documentary analysis budgetary allocations to the health sector for the period 2013 -2020 to obtain the trend analysis of the budgetary allocations to the sector to authenticate one of the objectives of this study that 'Health Security' have been unknown in the governance processes in Nigeria. The application of survey, case-studies observation and documentary analyses yielded the following data for the analysis that followed.

**Table 1** Budgetary Allocation to the Health Sector 2000-2020

Year	Amount #	Details	Others	Remark
2013	279			
2014	264 * 175m	Recurrent 214.94 Capital 49.52	4% assigned to NHIS which covers less than 4% of the population	*Allocated to <i>National Arbovirus &amp; Vector Research Institute</i> (nobody knows where these institutes with budgetary allocation are located).
2015	259	Capital 237 Capital 22		
2016	249	Recurrent 221 Capital 28		
2017	307	Recurrent 252 Capital 55		
2018	355	Recurrent 269 Capital 86	Total Budget # 9.1 Tn.	
2019	372	Recurrent 315 Capital 57	Total Budget #8.9 Tn.	
2020	440	Recurrent 381 Capital 59		

**Sources:** Nigeria Health Watch Dec. 24, 2013 by Chikwe Ihekweazu & [www.yourBudget.com](http://www.yourBudget.com) 2020

### Analyses

The perceptual framework of this study had revealed the significance of 'human security' to the overall wellbeing of the human person in the state. The analysis would illustrate the centrality of 'health security' to the attainment of human security in any development programme as indicated in the 1994 UNDP report.

In table 1 above, budget on health indicates two major trends; (i) 2014-2016 indicate decrease in budgetary allocation to the health sector in an era of expansionist budgeting (ii) 2017-2020 conversely indicated slide increase to the sector which is considered low in comparison to other sectors that are not considered as important as the health sector. This indicate the government

elites do not know the importance of healthy people to the economy. (iii) The decrease nor increase in budgetary allocation did not in any way indicate physical increase in either the primary, secondary and tertiary health infrastructure. The paltry amount allotted to 'capital development' could not turn around the infrastructure deficit.

Health security is at the center of Human security. When the health security is attained first by the government in place which consider the health and the wellbeing of the majority of the citizens a major priority, then all other things are likely to follow. In this case, (i) health would receive a considerable percentage of the budgetary allocation. (ii) The budget would be divided into Primary Health Care, Secondary and Tertiary health sectors respectively. (iii) The medical personnel development including medical laboratory scientists'/capacity trainings. (iv) Research and Development in the various sector of health services. (v) Standardize health architecture-citing of medical institutions in a three-tier structure in all states/zones. (vi) The fifth step above would conduce to accessibility of these medical institutions and their services by the citizens.

In the second place, when Health Security is pursued and incrementally attained, it would inadvertently generate *economic security*. The value-chain pursuant to health security would create enormous security in respect of employment, production of inputs to drugs manufacturing, construction etc.

Health and economic security would produce *food security* because it would empower people with basic means of livelihood in the value-chain, to have purchasing – power –parity which give access to health services. Health, Economic and Food security would in turn impact on the Environment positively because when these are being attain, the environment would not be over exploited but dealt with in a sustainable manner in order to provide for the current generation without jeopardizing the interest of generation yet unborn. When the environment is properly managed, it would not be left to have ponds or stagnant waters to become the habitat of mosquitoes and many water borne diseases. All these conduce to *personal security* of the individual, for the individual well-being is equivalent to community well-being. This is because the community is individual-writ-large. Political *security* and good governance along this tepid approach would guarantee the health security as contemplated herein.

2014 had part of the allocation assigned to a health institute that was and is yet to be heard of in the sector. The outcome of the poor financial allocation resulted

in according to the WHO, Nigeria is a country where nearly 20% of global maternal deaths happen. Between 2005 -2015, about 600,000 maternal deaths and about 900,000 maternal near miss cases occurred in Nigeria. The maternal mortality rate (MMR) is approximately 800 per 1000 live births and 58,000 maternal deaths occurred in 2015. Only 61% pregnant women can access antenatal services (Healthcare for Women Inter & Relief web & Trading Economics) births attended to by skilled health staff in 2014 at 35%. Nigeria Malaria Factsheet-300000 malaria deaths per year with 100million cases. Malaria contributes to 11% mortality rate in Nigeria. (Online premiumtimesng.com).

### **Human and Health Security in Africa: The Discourse**

In this section of the chapter we are concern with how to bring Human security into the agenda of governance in Africa and particularly in Nigeria which has very poor health statistics in the continent. It would be recalled that the persistent false start towards development in the third world led to the creation of Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), to provide a trajectory to be followed and the timeline for the third world pursuant to development. It is the view of this treatise that to direct African states particularly Nigeria, to put health security into the national development agenda, an external push from the United Nations Organization is required. The alienation and the class nature of government in African states between 'we' and 'them' has made this submission imperative. The estimate of the government which gives priority of place to the health of the citizens in Africa would tentatively be put at -5 per cent. This means no government have devoted about 10 per cent of the annual budget to the health sector. This is because has we had stated earlier, the concept is not only new, but also because African governments hardly situate the welfare of the people in the center of their government.

The wave of democratization in Africa mean that political parties are the platform of participation. The political parties must include in their programme 'Health Security' and ensure that adequate funds are allotted to the sector and design strategies to manage it through the phases of primary, secondary and tertiary health system. It is instructive to note that there is no ruling party in African states in which robust health programme which could be termed health security was ever in their manifesto. They all allocate funds to the existing MDAs on health with much of the funds arrested by corruption. Consequently, there is no state in which health security had been implemented hence it is a new concept to be pursued.

Health security require a National Development Plan, where there would be a careful programming and integration of both Busan and Mahbub Ul Haq's dimensions of human security. These are hardly possible in a free-market economy based on the principles of the 'Washington Consensus' which is prevalent and practiced in African states. The pursuit of Health Security cannot be attained through health policy focused on profit-making which is the motivation for private sector investors. It is therefore hardly achievable in a liberal-free market economy. It is required state investment at the primary, secondary and tertiary levels of the health system. African states are yet to come to this realization, this is why they far away from achieving the SDGs.

It would certainly require an international protocol or development platform such as the MDGs, and the SDGs to redirect the attention of African government towards the pursuit of health security as an objective of development in the various states in the continent.

#### **Agriculture-Nutrition and Health Security**

In this section of the discourse, we conjecture that health security can be approach not just from the provision of primary, secondary and tertiary health infrastructure but also from ensuring that the citizens have access to adequate food and balanced diet. Food and nutrition could serve as health security when all people at all times have physical, social and economic access to and consume food in sufficient quantity and quality to meet dietary needs, complemented by a good source of drinking water and clean environment. Put differently, when citizens of any nation and specifically Nigeria grow enough food, and possesses purchasing power capability to access the foods and eat the right quality and quantity of balanced diet, they would have obtained security against ill-health.

Nigeria currently is state in crises, adequate food cannot be cultivated in the Boko Haram territory of the north-east, farmers in southern Kaduna state cannot expect harvest, herders have continued to plunder farmland in the middle belt and other places. The feasibility of attaining health security through agriculture, nutrition and food security is desirable yet difficult at this period of considerable insecurity in Nigeria. Nigeria recently borrowed grains from other Economic Community of West African States (ECOWAS) countries to augment food shortage in the country.

#### **Health Security: Failure of Preventive Module**

One aspect of Health Security is its preventive component. Health Security is a new concept of development which imply that there should always be 'health related research institutions', where investigations are carried out to

understand the natures of diseases and develop appropriate curative medicine for it. However, where such institutions exist in Nigeria, they are often underfunded. The outcomes have been (i) poor prevention of childhood illness. The wild-polio virus had been eradicated all over the world, but it persisted in Nigeria until 2020 when Nigeria was just certificated as being free from the virus. This was because of cultural and religious differences in the country.

ii) River blindness had been eradicated in most of the world communities but it remained a public health challenge in Nigeria along with Guinea-worm control. (iii) Malaria have remained endemic in Nigeria with no hope of its eradication. The scourged\ of Aids since 1981 has continued to devastate the nation without any national policy thrust. This the same for the novel COVID 19. In all the mentioned ailments, there have been no strategic medical output from the research institutions. Where there have been, the Government see no rationale to fund such researches.

### **Issues and Challenges**

The issues and challenges of Health Security is essentially that there is no strong public health leadership. The local government chairman does not know that Primary Health Care is under the purview of his administration. This sector hardly has budgetary allocation at that level. They assume that it is the State's business. The State on the other hand through the Local Government Commission engages and post nurses to the Local Government without request from the latter. In the final analysis services are not rendered. At the secondary level where general hospitals belong, drugs are not readily available where the hospital facility exist, while the appropriate personnel are not available. The Tertiary institutions are characterized by strikes and constant struggles. All these create room for medical tourism for the ruling class. Health Security as a concept is alien to the Government operators. It requires planning and synergy of the levels of health services and knowledgeable managers of the system. This is a challenge which considerable public education to mainstream it into the development agenda in Nigeria.

### **Health Security: Policy Options**

A public policy is a set of actions and decisions that governments intend to take to solve a raging problem. The problem to be resolve in this instance 'Health Security' must first enter into the public policy agenda discourse with its expedencies vastly canvass to earn public buy-in. Consequently, it would become the accepted pathway to deploy public resources in order to achieve expected outcomes as a distributive type of public policy. It is also important to

state that public policies are no law to be followed, but laws are public policy to be complied with the provisions. Accordingly, the enunciation of public policy on Health Security is not likely to be followed either at the national nor at the sub-national levels given the multi-party system and type of federalism operational in Nigeria. The party controlling the central government could evolve Health Security policy, but the other political parties ruling the States may not willingly support the programmes, as Nigeria witnessed in the second Republic 1979-83, policies such as the 'Green Revolution' and 'Presidential Liaison Officers' respectively had challenges of buy-in by the States.

In order to establish Health Security, the option is a federal statute or an Act of Parliament enunciating it and specifying; (i) that Mr. President, Governors and all public officials must not seek medical treatment abroad- this would compel them to allocate enough fiscal resources to the sector and ensure effective implementation. (ii) The Primary Health Centers (PHC) must be created in all Local Government, staffed by qualified personnel with strategic drug supply arrangement covering the range of ailments indigenous to the areas. (iii) Each State must have secondary health facility (General Hospital) in all local government headquarters staffed and supplied with drugs. (iv) Each State should have a teaching and specialist hospital to which cases above the capacity of the general hospitals would be referred for specialist attention. (v) All employers of labor with 50 – 100 employees should establish functional medical facilities for its employees. Above all, National Health Insurance scheme should be reviewed and made more functional with wider coverage. (vi) Appropriate sanctions that are enforceable should be prescribed for all entities who fail to provide functional health Security for its employees. (vii) The health facilities should be inspected at regular interval (Regulatory Public Policy), by specialist body to ensure compliance and maintenance of standard.

The outcome of the Health Security policy practiced as discussed herein, are numerous, these consists of; (i) it would create a healthy workforce for all sectors of the economy and this would inadvertently enhance productivity in the economy. (ii) Truancy which is endemic in the public and private sector in Nigeria, most of which excuses are on health ground would decrease and also aid the rise in productivity. (iii) The large quantum of financial resources currently being expended on medical tourism would at least be retained in the country. (iv) Jobs would be created for medical doctors and allied staff in the country. (v) Pharmacist would be encouraged to engage in researches to manufacture drugs in the country using herbs which had been used in traditional medical practices.

## Conclusion

Health Security is a new concept of development which is yet to find meaning and a place in the development focus of development planners in Nigeria and political parties seeking political power to rule the country. It presupposes a linkage between Primary Health Centers (PHC), which ought to be the first point of health facility located in each political ward. It is intended to provide first line health treatment, maternity and other auxiliary health services to the citizens and dissuade prospective mothers from patronizing Traditional Birth Attendant (TBAs). This health level has the challenge of personnel and inputs.

The second level in the link is the Secondary Health Centers- which include the General Hospitals, where health cases which are above the primary health centers are referred for treatment and management. Health challenges which are above the capacity of the secondary health centers herein known as 'General Hospitals' are then referred to the teaching and specialist hospitals where specialists in all aspects of human health are supposed to be found but are never there. This is the tertiary health centers. These structural linkages are hardly planned in Nigeria because the policy makers depend on overseas medical facilities. The tertiary of health security is hardly effective. It would be recall that the Nigeria Medical Association like their University counterpart, spend most time on strikes trying to call the attention of the Government to the parlous situation in the teaching hospitals.

We had raised issues of Agriculture and nutrition and accessibility of food as a means of achieving health security. This is because affordable of balance diet would generate adequate antibodies in men/women to fight disease. However agricultural and food security this is not the case in Nigeria, given that the pervasive insecurity arising from Boko Haram, kidnapping, rape have all scared farmers away from their farms. The outcome is food inadequacy hence Nigeria had to borrow 5000 metric tons of food recently from ECOWAS states.

The Nigeria government need to be sincere and patriotic in its responses to Non-state actors perpetrating insecurity in Nigeria in order to provide for agricultural cultivation and the production of adequate food to provide adequate nutrition to serve as health security.

Health security would take a long time as concept to be drum into the consciousness of the development planners in Nigeria and the ruling political party. This is a huge task which is possible to institute but would take time to do so. Concerted effort is required from all to bring this to be in Nigeria.



Health Security would come to stay in Nigeria only through federal statute as the current system is of advantage to select few against the preference of the majority of the population. The latest new World Poverty statistics reveals that about 105 million Nigerians are now extremely poor. This means they cannot afford food, talk less of health services. The state should redistribute health services through health security policy. It is only a healthy population that make a health nation-state.

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## **Harnessing Open Access Initiatives for the Promotion of Health Communication in Medical Training Institutions in Nigeria**

Osime Samuel\*

### **Abstract**

Communication is central to public health delivery, and advances in digital media and communication technology, including use of open access platforms, hold significant prospects for addressing major public health and development issues confronting Nigeria. This paper, therefore, calls for the adoption of open access principles to drive health communication in the country, with particular emphasis on medical training institutions. The paper adopts a bibliometric methodology, and shows that while the open access initiative has gained significant momentum in health communication globally, the level of its use by scholars in the medical sciences in Nigeria is abysmally low. For instance, open access articles account for less than ten per cent of journal articles on health communication on the SCImago Journal Rank indicator. Also, only one medical training institution in the country has a specialized open access repository devoted to health communication in the country, that is, the African Digital Health Library, hosted by the College of Medicine, University of Ibadan. Factors responsible for this poor adoption of open access were traced to lack of appreciation of the advantages of open access for the promotion of health communication, inadequate information and communication technology infrastructure, inadequate and epileptic power supply; inadequate funding of medical training institutions, and fear of copyright violation. Among other recommendations, the study proposes the institutionalisation of open access publishing in Nigeria's medical training institutions as a strategy to improve the dissemination of research output emanating from these institutions and ensure greater accessibility, visibility, impact and utility of these research output.

**Key Words:** Open Access, Health Communication, Medical Training

## Introduction

The aim of this study is to explore how open access initiatives can be harnessed for the promotion of health communication in Nigeria's medical training institutions. This is in recognition of the fact that restricted access to relevant new knowledge can pose a significant challenge to the development of medical trainees and subsequently the delivery of top-quality healthcare services in the country.

Health communication is the art and technique of informing, influencing and motivating individuals or larger audiences about important health issues based on scientific and ethical considerations. It includes the study and use of communication strategies to inform and influence individual and community decisions that enhance health (The Open University, 2019).

Health communication contributes to better health outcomes for individuals and for the whole community. It raises awareness of health risks and solutions, and provides the motivation and skills needed to reduce these risks. It can affect or reinforce good health practices and attitudes, giving people the information they need to make complex choices, such as selecting health plans, care providers and treatments. Health communication also encourages social norms that benefit health and improve quality of life. Indeed, according to Essien (2014), if Nigeria health care delivery system is to gain its rightful place in this era of globalization, concerted efforts to improve connectivity in communication system must be given recognition.

Among other benefits, according to The Open University (2019), health communication:

- Increases knowledge and awareness of a health issue, problem, or its solution
- Influences perceptions, beliefs, attitudes and social norms about health
- Generates effective action
- Demonstrates or illustrates health related skills
- Shows the benefit of behaviour change
- Increases appropriate use and demand for health services
- Reinforces knowledge, attitudes and behaviour
- Refutes myths and misconceptions
- Advocates for a health issue or a population group.

Health Communication is an aspect of scholarly communication which can benefit from the adoption of open access principles, however, available evidence suggests that the adoption of open access in health communication is still relatively low, particularly in Nigeria's medical training institutions.

### **About Open Access**

The open access movement emerged in response to increasing legal and economic barriers by commercial scholarly publishers which made access to research output and information difficult especially to people in developing countries of the world. Thus the movement seeks to promote open access to research output devoid of any permission barriers and unnecessary legal restraints.

Open Access literature has been defined as scholarly communication that is “digital, online, free of charge and free of most copyright and licencing restrictions” (Suber, 2004). The term "open access" was first formulated in three public statements in the 2000s: the Budapest Open Access Initiative in February 2002, the Bethesda Statement on Open Access Publishing in June 2003, and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities in October 2003. One important legacy of the Berlin Conference is that, for the first time, research in the humanities and social sciences, was included in the scope of research covered by the open access mandate.

According to the statement that emerged from the Budapest Open Access Initiative (2002), open access research literature is defined by:

its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited.

Following from the above definition, the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (2003) stated that open access contributions must satisfy two conditions:

1. The author(s) and right holder(s) of such contributions grant(s) to all users a free, irrevocable, worldwide, right of access to, and a license to copy, use, distribute, transmit and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship (community standards, will continue to provide the mechanism for enforcement of proper attribution and responsible use of the published work, as they do now), as well as the right to make small numbers of printed copies for their personal use.
2. A complete version of the work and all supplemental materials, including a copy of the permission as stated above, in an appropriate standard electronic format is deposited (and thus published) in at least one online repository using suitable technical standards (such as the Open Archive definitions) that is supported and maintained by an academic institution, scholarly society, government agency, or other well-established organization that seeks to enable open access, unrestricted distribution, inter-operability, and long-term archiving.

Common to all these definitions is the need to remove price and permission barriers to scholarly communication. Open Access removes price barriers (subscriptions, licensing fees, pay-per-view fees) and permission barriers (most copyright and licensing restrictions). We may therefore see open access as a publishing model for scholarly communication that makes research information available to readers at no cost, as opposed to traditional subscription models in which readers sometimes have to pay exorbitant fees to access research literature.

One question that may arise with respect to open access is the issue of copyright. However, as Suber (2012) explains, “the legal basis of open access is the consent of the copyright holder (for newer literature) or the expiration of copyright (for older literature). Therefore, because open access uses copyright-holder consent or the expiration of copyright, it does not require the reform, abolition, or infringement of copyright law.”

### **Channels of Open Access**

There are two main channels of open access publications: The Gold Road and the Green Road.

#### ***Open Access Journals***

Open access journals also referred to as “Gold Road” to open access, are peer-

reviewed journals made available free of charge to the public through the Internet (Harnad, 2005a). Unlike the business publishing model, in open access publishing the end user is not charged to access journal articles. Instead, various funding strategies such as direct author fees, institutional membership to sponsor all or part of author fees, funding agency payment of author fees, grants to open access publishers and institutional subsidies are used to cover the costs for publication and distribution of OA content for free access by the end user. Some of the open access journal avenues for direct access include: the Directory of Open Access Journals (DOAJs).

### ***Self-archiving***

Self-archiving also referred to as “Green Road” to open access is making articles freely available in digital form on the Internet by authors (Budapest Open Access Initiative, 2002; Harnad, 2005a). There are three most common ways of self-archiving: authors' personal websites, disciplinary (subject-specific) repositories, and institutional repositories of individual universities/research institutions. The Registry of Open Access Repositories (ROAR) and the Directory of Open Access Repositories (DOAR) provide the list of open access compliant archives from disciplinary and institutional archives worldwide.

### **Models of Open Access**

Open access has two different versions—***gratis and libre***. Gratis open access is simply making research available for others to read without having to pay for it. However, it does not grant the user the right to make copies, distribute, or modify the work in any way beyond fair use. Libre open access is gratis, meaning the research is available free of charge, but it goes further by granting users additional rights, so that people are free to reuse the research.

While the Open Access Movement has continued to grow and become increasingly popular as an alternative model of scholarly communication, its adoption in Nigeria has been somewhat slow (Nwagwu, 2013). There is, however, no doubt that adoption of open access principles hold significant prospects for the development of medical education in Nigeria.

### **Problem Statement and Justification**

Available statistics from the Medical and Dental Council of Nigeria, as at October 2021, indicate that there are 37 fully accredited medical schools in Nigeria and 7 partially accredited medical schools in the country. However, none of these medical training institutions is listed among the global top

universities in the The QS World Ranking of medical schools based upon academic reputation, employer reputation and research impact. Also, data obtained from EduRank indicate that College of Medicine, University of Ibadan, which is the highest ranking medical training institution in Nigeria is not among the top-ten in Africa, and occupies 605<sup>th</sup> position in the world. One reason that may be adduced for this is the poor visibility and impact of research works from these institutions, due to non-prioritization of open access. The study therefore makes a case for the institutionalisation of open access in Nigeria's medical training institutions as a strategy to promote health communication in the country.

### **Literature Review**

A lot of empirical studies have been carried out on the development of open access scholarly communication in Nigeria. Oyedipe, et al (2017) did a study on “Awareness and Usage of Open Access Among University Lecturers in Nigeria”. The study examined the level of awareness and usage of Open Access among lecturers in the Faculties of Arts and Education, Olabisi Onabanjo University, Nigeria. The authors explored the important role of open access in the development of a viable knowledge economy, particularly in Nigeria.

The authors noted that despite the “benefits of Open Access to individuals in the university community, lecturers are still reluctant to the use of this initiative services and products. This is because many lecturers are still unaware of the services and opportunities that abound in the use of Open Access”. In their findings, the researchers noted that “lecturer's awareness about Open Access as a means of conducting research, updating general knowledge, updating/seeking knowledge in respective disciplines and forming lectures notes for students was high but low as a means of communicating research findings. It was further found that lecturers' awareness about Open Access impacted on usage of the information content.”

Ola, (2015) conducted a study on “Scholarly Publication in Nigeria: Implications of Open Access”. The article discussed the entrance of open access to the Nigerian system. It looked at scholarly publishing in Nigeria and identified several initiatives that have been introduced for the purpose of granting access to developing countries. It highlighted the progress made so far towards enabling open access in Nigeria and discussed the implications of open access to Nigeria and other developing countries. While emphasising the imperative of open access, the author noted most works published in Nigeria suffer low global and local visibility. By contrast, works published in foreign journals are globally



visible, but most often inaccessible to Africans as well as to others in developing countries due to the high subscription costs and pay-per-view fees.

Ivewighrehweta, O. & Onoriode, (2012) examined “Open Access and Scholarly Publishing: Opportunities and Challenges to Nigerian Researchers”. The study investigated the extent of researchers' appreciation of open access scholarly publishing, using the University of Benin as case study. The study found that the level of usage of open access articles was high. It was also found that the major benefit derived from using open access journals is that it provides free online access to the literature necessary for research. Again, it was found that unavailability of Internet facilities is a major constraint to the use of open access scholarly publications. Finally, on strategies to enhance open access, the study found that a strategy to enhance open access publications is to improve internet connectivity.

There have also been some studies on health communication. Fayoyin (2016) explored the important role social media can play in health communication in Africa. The study recommends strategies for effective deployment of social media in health communication including applying a theory of change model, creative integration of multimedia platforms and meaningful participation of all actors to generate a new development narrative. Implications for health communication's theory, practice, policy, research and training are also addressed.

Odorume (2015) assessed the role of the mass media in health communication in Nigeria. The author noted that the mass media should be seen as an integral part of governance in matters concerning health. He therefore advocated that civil societies, the private sectors, parliaments, external agencies etc should render supports to the media in the area of health communication. Also, the author called on media practitioners to endeavour to inject health communication or message in their programs as this will make for a greater reach.

### **Methodology of the Study**

This study adopted the descriptive bibliometric approach to determine the quantum of peer-reviewed articles on health communication in leading medical journals, and also determine how many of these publications are open access. Bibliometric analysis is a quantitative method used to analyze the bibliometric publications data such as peer-reviewed journal articles, books, conference proceedings, periodicals, reviews, reports, and related documents. Historically, bibliometric methods have been used to trace relationships amongst academic

journal citations. it is an effectual way to measure the influence and impact of publications in the scientific community.

For this study, data was extracted from the Registry of Open Access Repositories (ROAR), Directory of Open Access Repository (DOAR) and the Directory of Open Access Journals (DOAJ). Additional data was also obtained from Scimago as well as African Journals Online (AJOL). Finally, the study analysed publications on health communication in the African Digital Health Library, to unveil the nature and pattern of open access health communication in the country. The bibliometric analysis is presented in graphs, charts and figures to provide a clear representation of the nature and status of open access health communication in the country.

### Discussion of Findings

#### Use of Open Access Repositories for Health Communication in Nigeria's Medical Training Institutions

As earlier indicated, available statistics from the Medical and Dental Council of Nigeria show that there are 37 fully accredited medical schools in Nigeria and 7 partially accredited medical schools in the country (see Table 1).

**Table 1: Status of Accredited and Non-accredited Medical Schools in MEDICAL SCHOOLS ACCREDITED BY MDCN**

#### A. FULLY ACCREDITED MEDICAL SCHOOLS

S/N	Name of Institution	Quota
1	College of Health Sciences, Abia State University Uturu, Abia State.	120
2	College of Health Sciences, University of Uyo, Akwa Ibom.	50
3	College of Health Sciences, Nnamdi Azikiwe University Nnewi, Anambra State.	100
4	College of Medical Sciences, University of Maiduguri, Borno State.	150
5	College of Medical Sciences, University of Calabar, Cross - Rivers State.	100
6	College of Health Sciences, Delta State University, Abraka, Delta State.	50
7	College of Health Sciences, Ebonyi State University Abakaliki, Ebonyi State.	100
8	College of Medical Sciences, University of Benin, Benin-City, Edo State.	150
9	College of Health Sciences, Igbiniedion University Okada, Edo State.	75
10	College of Medicine, Ambrose Alli University Ekpoma, Edo State.	50
11	College of Medicine, University of Nigeria Enugu Campus, Enugu State.	180
12	College of Medicine, Enugu State University of Science & Technology, Enugu, Enugu State.	50
13	College of Medicine, Imo State University Owerri, Imo State.	50
14	College of Medicine, Ahmadu Bello University Zaria, Kaduna State.	180
15	Faculty of Medicine, Bayero University Kano, Kano State.	150

16	College of Medicine, University of Ilorin, Kwara State.	150
17	College of Medicine, University of Lagos, Idi-Araba, Lagos State.	150
18	College of Medicine, Lagos State University Ikeja, Lagos State.	100
19	Obafemi Awolowo College of Health Sciences, Olabisi Onabanjo University Ago Iwoye, Ogun State.	75
20	College of Health Sciences, Obafemi Awolowo University Ile-Ife, Osun State.	100
21	College of Medicine, University of Ibadan, Oyo State.	180
22	College of Medical Sciences, University of Jos, Plateau State.	150
23	College of Health Sciences, Madonna University Elele, Rivers State.	50
24	College of Health Sciences, University of Port-Harcourt, Rivers State.	150
25	College of Health Sciences, Usmanu Danfodio University Sokoto, Sokoto State.	150
26	College of Health Sciences, Ladoke Akintola University of Technology, Ogbomosho, Osun State.	75
27	College of Health Sciences, Niger Delta University, Wilberforce Island, Bayelsa State.	50
28	College of Health Sciences, Bingham University Karu, Nasarawa State.	50
29	College of Health Sciences, Benue State University, Makurdi, Benue State.	75
30	College of Health Sciences, Odumegwu Ojukwu University, Uli Anambra State.	50
31	College of Health Sciences, Bowen University, Iwo, Osun State	50
32	College of Health Sciences, Babcock University, Ilisham-Remo, Ogun State	50
33	College of Health Sciences, University of Abuja.	50
34	College of Health Sciences, Afe Babalola University Ado-Ekiti, Ekiti State	100
35	College of Medicine, Ekiti State University, Ado-Ekiti	50
36	College of Health Sciences, Gombe State University	60
37	College of Medicine, Kaduna State University, Kaduna State	60
<b>B. PARTIALLY ACCREDITED MEDICAL SCHOOLS</b>		
S/N	NAME	Quota
1	College of Medical Sciences, Abubakar Tafawa Balewa University, Bauchi.	60
2	College of Medicine, Edo University, Iyamho, Edo State.	50
3	University of Medical Sciences, Ondo, Ondo State	50
4	College of Medicine & Health Sciences, Gregory University, Uturu, Abia State	50
5	College of Health Sciences, Nile University, Abuja	50
6	University of Medical Sciences, PAMO Port Harcourt	100
7	College of Medicine Rivers State University Port Harcourt	100

**Source:** Medical and Dental Council of Nigeria, October, 2021

Table 1 above shows all the accredited and non-accredited medical training institutions in Nigeria. However, out of these 44 institutions, only one medical training institution in the country has a specialized open access repository devoted to health communication in the country, that is, the African Digital Health Library, hosted by the College of Medicine, University of Ibadan. The

African Digital Health Library (ADHL) is a collaborative initiative of medical libraries in six African universities, including: University of Science, Techniques and Technology of Bamako, Mali, Kenya Methodist University, University of Ibadan, University of Zimbabwe, University of Zambia and the University of Nairobi, Kenya.

The ADHL in Nigeria is managed by E. Latunde Odeku Medical Library, College of Medicine, University of Ibadan. It is a repository of theses and dissertations from the College of Medicine, University of Ibadan, Nigeria funded by the Office of Global AIDS/U.S. Department of State and the U.S. National Library of Medicine / National Institutes of Health.

This specialised disciplinary repository contains 51 Volumes of the *African Journal of Medicine and Medical Sciences* (Volume 2, 1971 to Volume 52, 2021). African Journal of Medicine and Medical Sciences is owned and published by the College of Medicine, University of Ibadan, Ibadan, and University College Hospital, Ibadan, Nigeria. The Journal is published quarterly and features in *Index Medicus*.

In addition to this open access journal, ADHL repository contains scholarly works and theses from scholars in the following Faculties and Departments of College of Medicine, University of Ibadan:

1. **Faculty of Basic Medical Sciences**

- Department of Anatomy
- Department of Biochemistry
- Department of Chemical Pathology
- Department of Medical Microbiology and Parasitology
- Department of Pathology
- Department of pharmacology and Therapeutics
- Department of Physiology
- Department of Virology

2. **Faculty of Clinical Sciences**

- Department of Anaesthesia
- Department of Medicine
- Department of Nursing

- Department of Obstetrics and Gynaecology
  - Department of Ophthalmology
  - Department of Otorhinolaryngology
  - Department of Paediatrics
  - Department of Physiotherapy
  - Department of Pyschiatry
  - Department of Radiology
  - Department of Surgery
3. **Faculty of Dentistry**
- Department of Child Oral Health
  - Department of Oral Maxillofacial Surgery
  - Department of Oral Pathology and Medicine
  - Department of Preventive Dentistry
  - Department of Restorative Dentistry
4. **Faculty of Public Health**
- Department of Epidemiology and Medical Statistics
  - Department of Health Promotion and Education
  - Department of Human Nutrition
  - Department of Health Policy and Management
  - Department of Environmental Health Sciences
  - Department of Preventive Medicine and Primary Care
  - Institute of Child Health (ICH).

Without doubt, the ADHL initiative represents a significant step in open access health communication that has made College of Medicine, University of Ibadan the leading medical training institutions in Nigeria according to 2021 data obtained from <https://edurank.org/medicine/ng/> which ranks medical training institutions ranked based on their research performance.

It should be noted that while some of the medical training institutions in the country also use their host university's institutional repository for open access

dissemination of theses and scholarly works, the volume of such publications is rather small compared to what we have on the ADHL which is dedicated specifically to health communication. Moreover, out of about 170 universities in the country, only 20 of them have functional institutional repositories, according to data obtained from the Registry of Open Access Repositories and the Directory of Open Access Repositories.

Evidently, therefore, dissemination of health communication through open access repositories in the country is quite limited.

### **Use of Open Access Journals for Health Communication in Nigeria**





According to the Scimago Journal Rank (SJR) indicator which is a measure of the scientific influence of scholarly journals, there are 11 Medical journals among the 20 leading journals in Nigeria (See Figure 1). These include:

- African Journal of Reproductive Health
- African Journal of Infectious Diseases
- Nigerian Journal of Clinical Practice
- Pan African Medical Journal
- Nigerian Postgraduate Medical Journal,
- Tropical Journal of Pharmaceutical Research
- Nigerian Journal of Physiological Sciences
- African Journal Biomedical Research
- Journal of Medicine and Biomedical Research
- Nigerian Journal of Parasitology, and
- West African Journal of Medicine

However, only 3 of these journals are open access (See Figure 2). The three open access health communication journals are:

- Tropical Journal of Pharmaceutical Research
- Pan African Medical Journal
- African Journal of Infectious Diseases

What this indicates is that the use of open access journals for health communication is still relatively poor in the country.

	Title	Type	↓ SJR	H index	Total Docs. (2020)	Total Docs. (3years)	Total Refs. (2020)	Total Cites (3years)	Citable Docs. (3years)	Cites / Doc. (2years)	Ref. / Doc. (2020)	
1	<a href="#">African journal of reproductive health</a>	journal	0.455 Q3	41	93	165	3007	178	143	0.88	32.33	■ ■
2	<a href="#">African Journal of Infectious Diseases</a> 	journal	0.386 Q3	11	14	65	401	93	65	1.47	28.64	■ ■
3	<a href="#">Nigerian Journal of Clinical Practice</a>	journal	0.294 Q3	27	279	842	6745	756	835	0.90	24.18	■ ■
4	<a href="#">Pan African Medical Journal</a> 	journal	0.287 Q3	30	1129	2505	16556	1542	2213	0.52	14.66	■ ■
5	<a href="#">Filosofia Theoretica</a>	journal	0.269 Q1	7	7	67	232	33	62	0.53	33.14	■ ■
6	<a href="#">Nigerian postgraduate medical journal, The</a>	journal	0.261 Q3	19	62	134	0	113	134	0.67	0.00	■ ■
7	<a href="#">Tropical Journal of Pharmaceutical Research</a> 	journal	0.209 Q3	36	358	1041	8244	735	1041	0.57	23.03	■ ■
8	<a href="#">International Journal of Veterinary Science</a>	journal	0.203 Q3	5	110	149	3477	123	149	0.93	31.61	■ ■
9	<a href="#">Nigerian Journal of Physiological Sciences</a>	journal	0.180 Q4	17	36	94	1055	46	93	0.37	29.31	■ ■
10	<a href="#">Journal of Agricultural Extension</a>	journal	0.169 Q4	4	57	156	1173	65	156	0.45	20.58	■ ■
11	<a href="#">African Journal of Library Archives and Information Science</a>	journal	0.166 Q3	8	7	32	338	20	30	0.75	48.29	■ ■
12	<a href="#">African Journal of Drug and Alcohol Studies</a>	journal	0.145 Q4	9	5	36	177	14	36	0.32	35.40	■ ■
13	<a href="#">African Journal Biomedical Research</a>	journal	0.134 Q4	17	93	141	2652	36	136	0.20	28.52	■ ■
14	<a href="#">Journal of Medicine and Biomedical Research</a>	journal	0.130 Q4	4	0	7	0	2	7	0.00	0.00	■ ■
15	<a href="#">Tropical Journal of Natural Product Research</a> 	journal	0.127 Q4	4	189	204	7188	65	197	0.32	38.03	■ ■
16	<a href="#">Nigerian Journal of Parasitology</a>	journal	0.119 Q4	4	0	122	0	13	122	0.08	0.00	■ ■
17	<a href="#">Nigerian Journal of Economic and Social Studies</a>	journal	0.105 Q4	1	12	5	546	0	5	0.00	45.50	■ ■
18	<a href="#">Journal of Home Economics Research</a>	journal	0.101 Q4	2	34	37	830	2	37	0.05	24.41	■ ■
19	<a href="#">Nigerian Journal of Nutritional Sciences</a>	journal	0.101 Q4	1	0	40	0	2	40	0.05	0.00	■ ■
20	<a href="#">West African Journal of Medicine</a>	journal		30	101	0	0	0	0	0.00	0.00	■ ■

**Figure 1: Overview of leading Journals in Nigeria**

**Source:** Scimago Journal and Country Ranking. Metrics based on Scopus® data, April 2021

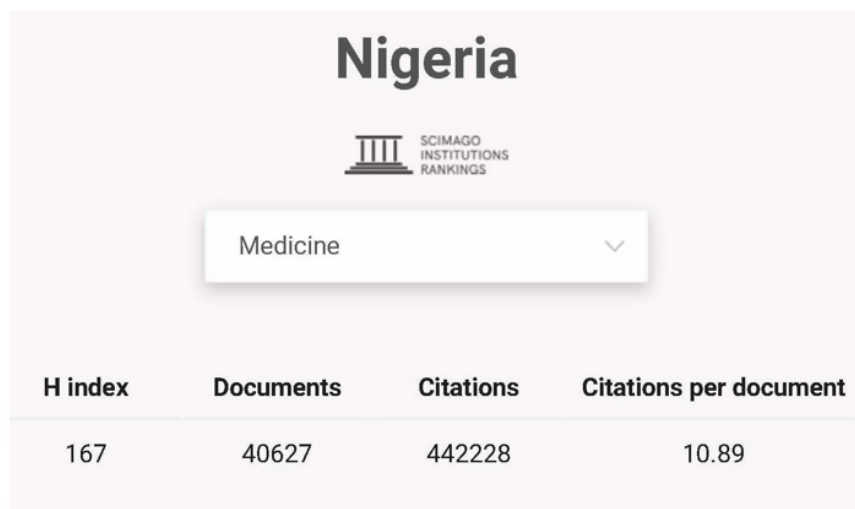
	Title	Type	↑ SJR	H index	Total Docs. (2020)	Total Docs. (3years)	Total Refs. (2020)	Total Cites (3years)	Citable Docs. (3years)	Cites / Doc. (2years)	Ref. / Doc. (2020)	
4	<a href="#">Tropical Journal of Natural Product Research</a>	journal	0.127 Q4	4	189	204	7188	65	197	0.32	38.03	■■■
3	<a href="#">Tropical Journal of Pharmaceutical Research</a>	journal	0.209 Q3	36	358	1041	8244	735	1041	0.57	23.03	■■■
2	<a href="#">Pan African Medical Journal</a>	journal	0.287 Q3	30	1129	2505	16556	1542	2213	0.52	14.66	■■■
1	<a href="#">African Journal of Infectious Diseases</a>	journal	0.386 Q3	11	14	65	401	93	65	1.47	28.64	■■■

**Figure 2: Overview of leading Open Access Journals in Nigeria**

**Source:** Scimago Journal and Country Ranking. Metrics based on Scopus® data, April 2021

### Summary of Findings

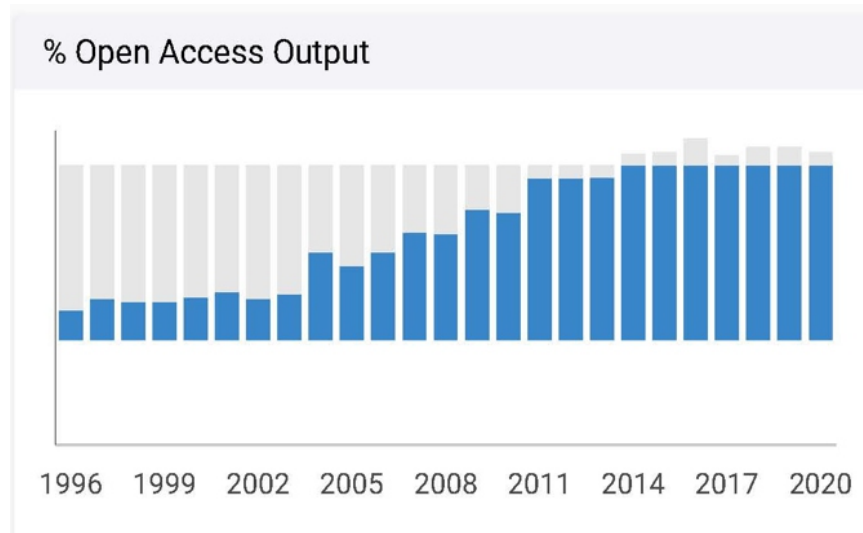
As at 2020, Out of 40,627 health communication documents in 47 subject areas of the medical sciences, only 4460 (representing a mere 9 per cent) are open access documents (Scopus data, April 2021). Figure 3 below provides an overview of the total number of published articles in leading medical journals, while Figure 4 provides a graphic representation of the number of open access articles published in the country between 1996 and 2020.



**Figure 3: Open Access Output on Health Communication in Nigeria, 1996-2020**

**Source:** Scimago Journal and Country Ranking. Metrics based on Scopus® data, April 2021





**Figure 4:** Open Access Output on Health Communication in Nigeria, 1996-2020

**Source:** Scimago Journal and Country Ranking. Metrics based on Scopus® data, April 2021

### Conclusion and Recommendations

The specific objectives of medical and dental education in Nigeria, as listed in the handbook of the Medical and Dental Council of Nigeria are:

1. To provide a sound scientific and professional basis for the training of medical and dental practitioners capable of working anywhere in Nigeria with other health workers.
2. To provide such training as would equip these health personnel to render Primary Health Care (PHC). Teaching of primary health care should be multi-disciplinary, involving all clinical departments.
3. To produce medical and dental practitioners who are conversant with Nigeria's National health policies and global health issues.
4. To produce medical and dental practitioners whose training is community based. In keeping with the concept of social responsibility all health training institutions should make a definite commitment to provide community service.
5. To produce medical and dental practitioners who would satisfy

internationally recognized standards, and who could undertake further training towards specialization anywhere in the world.

6. To produce medical and dental practitioners with sufficient managerial ability to play a leadership role in health care delivery.

This paper contends that adoption of open access will not only advance the realization of these objectives but also promote the use of health communication in addressing major public health and development issues confronting Nigeria.

The Advantages of Open Access are numerous. According to African Journals Online (2021):

- Open Access brings greater visibility and impact
- OA moves research along faster
- OA enables better management and assessment of research
- OA provides the material on which the new semantic web tools for data-mining and text-mining can work, generating new knowledge from existing findings
- OA provides access to the world's research output, free of financial and other restrictions – a level playing field
- OA incorporates local research into interoperable network of global knowledge;
- OA increases impact of local research, providing new contacts and research partnerships for authors; removes professional isolation, and
- OA can strengthen economies through the development of a strong and independent national and international science base.

From this study, it is evident that Nigeria's medical training institutions have not fully embraced the benefits of open access. As Ola (2015) stated “Open access has the potential to increase the accessibility, visibility, impact and utility of an author's work. The potential for these four impacts is possible considering that once an author is able to upload his or her work through self-archiving or is able to publish it via an open access journal, the work will become freely available on the Internet and to anyone with Internet connectivity”.

Poor visibility and impact of research works from these institutions, due to non-prioritization of open access is perhaps one of the reasons why none of these

medical training institutions is listed among top universities in the The QS World Ranking of medical schools based upon academic reputation, employer reputation and research impact. Also, data obtained from EduRank indicate that College of Medicine, University of Ibadan, which is the highest ranking medical training institution in Nigeria is not among the top-ten in Africa, and occupies 605<sup>th</sup> position in the world. (<https://edurank.org/medicine/ng/>).

In view of this situation, and as a strategy to ensure greater accessibility, visibility, impact and utility of scholarly communication from Nigeria's medical training institutions, the following recommendations are proffered:

1. Medical training Institutions in Nigeria should be encouraged to institutionalise an open access policy. This will certainly help to position the medical training institutions for increased relevance in the global knowledge society.
2. Establishment of institutional repositories will help to promote open access in Nigeria's medical training institutions. As earlier indicated, only one medical training institution in the country, College of Medicine, University of Ibadan, has a devoted repository for health communication. Although about 20 universities in the country have institutional repositories which includes publications relating to health communication, the example of the African Digital Health Library of the University of Ibadan can be adopted as a model for the promotion of health communication in the country.
3. Faculty members in Nigeria's medical training institutions should be sensitised regularly on the advantages of open access. This can be done by organizing capacity building workshops to educate and train stakeholders in academic and research institutions in Nigeria. In this way their knowledge of open access will be enriched and they will be in a better position to advocate for change in policies within their institution and at national level. This will create a conducive environment that will nurture the development and growth of open access in Nigeria.

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## **Impact of Health Expenditure on Maternal and Child Mortality Rates in Nigeria**

Dickson Vonke Juliana\*

### **Introduction**

It is the desire of every government in every country of the world to have a healthy population that will contribute to economic growth and development of their countries. The most fundamental of this ambition is maternal and child health. It is in recognition of this fact that governments across the globe provide funding to purge or reduce maternal and child mortality rates in various countries. Empirical literature has consented to the existence of a relationship between health expenditure and health status as expenditure on health is expected to improve health status such as maternal and child mortality. Nigeria's maternal and child mortality rates are regarded among the world's worst. Maternal mortality rate in Nigeria was 1200 per 100,000 live births in the year 2000. It dropped to 951 in 2013 and further to 917, and 814 in 2017 and 2019 respectively. Child mortality or under-five mortality rate in year 2000 was 183 per 1000 births, it dropped to 129 in 2013, and further to 122 and 117 in 2017 and 2019 respectively (World Bank, 2019; 2021).

The state of maternal, new-born and child health are important indicators of a nation's health status and economic development. A woman's chance of dying from pregnancy and childbirth in Nigeria is 1 in 13 compared to 1 in 35 in Ghana and 1 in 4900 in developed countries (Health Reform Foundation of Nigeria, HERFON, 2006; Sule, et al, 2021). Less than 20% of health facilities offer emergency obstetric care and only 40% of deliveries are attended to by skilled birth attendants in Nigeria (UNICEF, 2014). This means that over 80% of the country's health facilities do not offer emergency obstetric care and about 60% of deliveries are either unattended, or attended to by unskilled or semi-skilled attendants. Onyeji (2020) added that only a third of

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Dickson Vonke Juliana, Department of Economics, Faculty of Social Sciences, University of Jos Plateau State, Nigeria,  
[vonkemarcus@yahoo.com](mailto:vonkemarcus@yahoo.com) 08037007143

every Nigerian births are attended to by skilled attendants and that the worst side of the issue according to him is that maternal death in Nigeria is actually under-reported and unexplained.

Maternal and child deaths are caused by many factors. The indirect causes are poverty, early marriages, illiteracy, long queues in wait for scarce health facilities and manpower, insecurity, inadequate primary healthcare centres as well as poor management of same. The National Health Policy of 1988 which identified primary health care as vital to the improvement of Nigeria's health status was the first most comprehensive health policy in Nigeria. Two of the key elements of the policy were maternal and child health as well as immunization. In 1999 the desire to pursue health sector reform agenda led the democratic regime of President Obasanjo to review the National Health Policy, which still maintained the role of primary healthcare (PHC). Yet in 2021, PHCs, which are supposed to be the nearest to the masses, are still not being regarded as adequate facilities that control maternal and child deaths. Nigeria is ranked the second largest contributor to maternal and child mortality rates in the world (UNICEF, 2014). About half of the under-five deaths worldwide occur in only five countries out of which India and Nigeria together account for more than a third of all under-five deaths (WHO, 2014). While Nigeria alone accounts for about 20% of global maternal deaths, Nigeria and India combined, account for about 34% (Sule, 2021). Obviously, Nigeria and India are competing for the worst positions.

Huge health expenditure and expertise, have been injected over the years so as to enable Nigeria overcome its position as the second largest contributor of maternal mortality globally, yet statistics suggest that it is rather competing for the first position, because despite occupying the highest position in Africa, many Nigeria's maternal deaths are under-reported and unexplained. If the cases were properly reported, given the insecurity challenges and the worsening poverty level, Nigeria's position may be different from its current position in the world; perhaps the global worst. Despite government expenditure, coupled with bilateral and multilateral assistance, Nigeria is not numbered among the best or fair, but among the worst countries, yet the efforts made and the funds expended on health is expected to improve health status.

This paper therefore, investigates the impact of health expenditure specifically: aggregate government (local, state and federal) health expenditure, out-of-pocket health expenditure and external health funds on child and maternal mortality rates in Nigeria between the year 2000 and 2019. The paper comprises five sections, and the foregoing is the introductory section one.



Section two clarifies relevant concepts and reviews related empirical literature from which gap were identified. Section three describes the methodology of the paper, specifies the model and states the *a priori* expectation. Section four presents the result and discusses the findings of the paper. Section five concludes with policy recommendations.

### **Conceptual Issues and Empirical Review**

The Maternal and Neonatal Programme Effort Index (MNPI, 2010) viewed maternal mortality as the deaths caused by complications due to pregnancy or childbirth, these complications may be experienced during pregnancy, delivery itself, or 42 days following childbirth. For each maternal death, many more suffer injuries, infection and disabilities brought about by pregnancy or childbirth complications. WHO (2016) stated that maternal mortality is the death of a woman while pregnant, or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to, or aggravated by the pregnancy or its management, but not from accidental or incidental causes. This study defines maternal mortality rate as the number of maternal deaths per 100 000 live births (WHO, 2014); and also maternal mortality as deaths related to pregnancy or childbirth.

Child mortality is also referred to as under-five mortality; it is the probability of dying between birth and exactly five years of age (UNICEF, 2010). It is the probability of a child born in a specified year dying before reaching the age of five subject to current age-specific mortality rates (UN, 2014). It is the probability of dying between birth and the fifth birthday (Sullivan & Tureeva, 2012). This paper describes child mortality rate as the number of child (from birth to age 5) deaths per 1000 live births (WHO, 2014); and child mortality is also defined as death of children from birth to age five.

Health expenditure is the sum of expenditure on activities such as the application of medical, paramedical and nursing knowledge and technology with the goal of promoting health status as defined by the Organisation for Economic Cooperation and Development (OECD, 2015). Health expenditure is divided into private and public health expenditure. While out-of-pocket health expenditure is a component of private health expenditure, government health expenditure and external health funds are components of public health expenditure. Out-of-pocket health expenditure refers to direct outlays of households made to practitioners and to suppliers of pharmaceuticals, therapeutic appliances and other goods and services (WHO, 2006). It comprises cost sharing, self-medication and other expenditure paid directly by private

households (OECD, 2015). According to the OECD, aggregate government health expenditure refers to expenditure on health incurred by central, state and local government authorities. External health funds include all grants and loans whether passing through governments or private entities for health goods and services (WHO, 2006). External health funds comprise non-resident units providing health care for the final use by resident units (OECD, 2015).

The following empirical studies reviewed, were on the effect, or impact of health expenditure, or healthcare expenditure on health status. OECD (1995) studied the directions in health care policy among some OECD countries and reported that health spending per capita is positively correlated with life expectancy (LE) at birth, at age 60 and at age 80, and negatively correlated with potential years of life lost, infant mortality and prenatal mortality. This implies that health expenditure per capita improved health status by increasing life expectancy and reducing infant mortality within the OECD countries.

Nixon and Ulmann (2006) investigated the relationship between health care expenditure and health outcomes using fixed effects model on a panel data for the former 15 members of European Union. Nixon and Ulmann reported marginal but positive effect of health expenditure on the examined health status for the European Union, more so for infant mortality than life expectancy. Their work implied that health expenditure had more effect on infant mortality than life expectancy. The above studies are similar to this but they were conducted using data from developed countries.

Rajkumar, and Swaroop (2007) studied the nexus between public health spending, governance and outcomes amongst developed and developing economies. They found that public health spending lowers child mortality rates more in countries with good governance than those without. Examining the impact of health expenditure on health outcomes in the Middle East and North Africa, Akinci, Hamidi, Suvankulov and Akhmedjonov (2013) used panel data to estimate the impact of government and private health care expenditures on infant, under-five and maternal mortality rates. Pooled Ordinary Least Regression, Random Effects and Hausman-Taylor Instrumental Variable models were used for the estimation. Their result revealed that both private and government health expenditures significantly improved infant, under-five and maternal mortality in the region. The regions covered by the study did not include Nigeria.

Using panel data for 47 African countries from 1999-2004, Anyanwu and Erhijakpor (2017) adopted Robust Ordinary Least Squares (ROLS) and

Robust Two-Stage Least Squares (R2SLS) to examine the effects of health expenditure, proxied by per capita total health expenditure and per capita government health expenditure, on health status proxied by under-five and infant mortality rates. That is, health expenditure was used as independent variable, while health status was the dependent variable. They found out that total health expenditures as well as the public component are important contributors to health outcomes. That is, health expenditures have a statistically significant effect on infant mortality and under-five mortality.

Similarly, Novignon, Olakojo and Nonvignon (2012) used panel data spanning 1995-2010 from 44 sub-Saharan African countries, employed fixed and random effects panel data regression models. They found that health care expenditure significantly influences health status through increasing life expectancy at birth and reducing death and infant mortality rates. That is both the private and the public healthcare expenditures strongly improved health status, but the public component had more impact. This result is similar to that of Anyanwu and Ehrijakpor (2007) but differs from Berger and Messer (2002) who found that increases in the public component of health expenditure increases mortality rate.

Muftaudeen and Bello (2014) investigated the effect of public health care expenditure and the quality of institutions on health outcome in Nigeria using Autoregressive Distributed Lag (ARDL) and Vector Error Correction Model (VECM). They found the existence of a long-run and short-run relationship among the variables. The long-run and short-run estimated elasticity coefficients of government health care expenditure and institutions are negative and insignificant. That is, government healthcare expenditure and institutions insignificantly lowered infant and under-five mortality in Nigeria. Their study used public health expenditure and its component is narrowed to only federal government health expenditure, which may largely explain the insignificant impact on reduction of mortality.

In line with the work of Rajkumar and Swaroop (2007), who used data from selected developed and developing countries, Yaqub, Ojapinwa and Yussuff (2012) were interested in investigating how the effectiveness of public health expenditure is affected by governance in Nigeria. Using OLS and 2SLS, they regressed public health expenditure and governance, captured by corruption perception index on infant mortality, under-five mortality and life expectancy. They found that public health expenditure worsens infant mortality, under-five mortality and life expectancy when the governance indicators are included. Their result is similar to the result of Rajkumar and

Swaroop (2007), corruption renders public health expenditure ineffective. Their study is very interesting and important because they captured the effect of governance, but they like others, only made use of government health spending, particularly federal government as a component of public health spending.

Nwanosike, Orji and Okafor (2015) used ordinary least square (OLS) estimation technique based on the model of health production to investigate the implication of malaria spending (proxied by health spending) on health outcome in Nigeria from 1970 to 2013. They found that health spending is not significant on under-5 mortality (which is their proxy for malaria cases). Their study and this are similar in the sense that both used health production model, health outcome as dependent variable and health spending as independent variable. However, their proxy for health outcome was under-5 or child mortality rate in this study, maternal mortality is added. They also used only government expenditure as public health expenditure.

From the foregoing, the empirical studies conducted in Nigeria, revealed that public health expenditure worsens infant mortality, under-five mortality as well as life expectancy when there is no good governance (Yaqub, Ojapinwa&Yussuff 2012), or rather has no significant effect on under-five mortality, or child mortality (Nwanosike, Orji &Okafor, 2015). On the other hand, Muftaudeen and Bello (2014) found that public health expenditure reduces infant mortality and under-five mortality, although not significantly. These results call for more research in this area to clear the haze.

### **Gaps Identified in Literature**

The following gaps were identified from the empirical review:

- i. Studies reviewed on Nigeria, focused more on public health expenditure specifically federal government health expenditure as their explanatory variable. This study used aggregate government health expenditure which comprises local, state and federal government health expenditures and further included external health funds and out-of-pocket health expenditure, as components of both public and private health expenditure.
- ii. Most of the studies reviewed focused on infant or child mortality, less attention is given to maternal mortality.

A production function summarises the relationship between inputs and outputs. Simply put, health production function views health status as an

output of a health production process involving various inputs, prominent among them is the healthcare expenditure which is viewed as a representative of the variable, healthcare. It is important to point here that the health production function forms the theoretical background upon which this research is anchored.

### Method and Data Sources

The paper used time series data obtained from secondary sources. The data is sourced from the World Bank. The paper has attempted to make an empirical analysis of the impact of health expenditure on maternal and child mortality rates in Nigeria (2000-2019). The dependent variables are maternal and child mortality rates, while, the major components of health expenditure: aggregate government health expenditure, external health funds and out-of-pocket health expenditure are the independent variables. Pre-estimation tests of unit root using the Augmented Dickey Fuller (ADF) and cointegration (bounds test) were conducted.

In line with the theoretical postulations therefore, the following linear multiple regression models were formulated, and health status has been hypothesised as a function of health expenditure:

$$HS=f(HEX) \dots \dots \dots (1)$$

Health expenditure has the following components: Aggregate Government Expenditure on Health, AGEH, External Health Funds, EHF and Out-of-Pocket Expenditure on Health, OPEH. Thus, model 1 is further expanded as:

$$HS=f(AGEH, EHF, OPEH) \dots \dots \dots (2)$$

Child Mortality Rate, CMR and Maternal Mortality Rate, MMR are some of the so many indicators of health status. Model 2 is therefore, decomposed into two as:

$$CMR_t = \alpha_0 + \alpha_1 AGEH_t + \alpha_2 EHF_t + \alpha_3 OPEH_t + \mu_{1t} \dots \dots \dots (3)$$

$$\text{A priori expectation} = \alpha_1 < 0; \alpha_2 < 0; \alpha_3 < 0$$

$$MMR_t = \beta_0 + \beta_1 AGEH_t + \beta_2 EHF_t + \beta_3 OPEH_t + \mu_{2t} \dots \dots (4)$$

$$\text{A priori expectation} = \beta_1 < 0; \beta_2 < 0; \beta_3 < 0$$

Where:

CMR = Child Mortality Rate

MMR = Maternal Mortality Rate

$\beta_0$  and  $\alpha_0$  = intercepts of the functions

$\beta_i$  and  $\alpha_i$  = various slopes of the functions

AGEH = Aggregate Government Expenditure on Health

EHF = External Health Funds

OPEH = Out-of-Pocket Expenditure on Health

U = error term

t = time period

The independent variables (AGEH, EHF and OPEH) were measured in percentages, while the dependent variables (CMR and MMR), in rates. In order to obtain the numerical values of the different variables, to smoothen the data set so as to prevent spurious regression, to raise precision level, as well as to reduce the effect of unit measurement in the data, the models are re-specified in semi-log linear form. That is, only the dependent variables were logged since the independent variables were measured in percentages.

$$\log \text{CMR}_t = \alpha_0 + \alpha_1 \text{AGEH}_t + \alpha_2 \text{EHF}_t + \alpha_3 \text{OPEH}_t + \mu_{t1} \dots \dots \dots (5)$$

$$\log \text{MMR}_t = \beta_0 + \beta_1 \text{AGEH}_t + \beta_2 \text{EHF}_t + \beta_3 \text{OPEH}_t + \mu_{t2} \dots \dots \dots (6)$$

Based on ARDL specifications, models 5 and 6 are further stated as:

$$\Delta \log \text{CMR}_t = \alpha_0 + \sum_{i=1}^p \alpha_i \Delta \log \text{CMR}_{t-i} + \sum_{i=0}^p \alpha_2 \Delta \text{AGEH}_{t-i} + \sum_{i=0}^p \alpha_3 \Delta \text{EHF}_{t-i} + \sum_{i=0}^p \alpha_4 \Delta \text{OPEH}_{t-i} + \eta_1 \log \text{CMR}_{t-1} + \eta_2 \text{AGEH}_{t-1} + \eta_3 \text{EHF}_{t-1} + \eta_4 \text{OPEH}_{t-1} + \mu_{t1} \dots \dots (7)$$

A priori expectation:  $\alpha_i < 0$ ;  $\eta_i < 0$

$$\Delta \log \text{MMR}_t = \beta_0 + \sum_{i=1}^p \beta_i \Delta \log \text{MMR}_{t-i} + \sum_{i=0}^p \beta_2 \Delta \text{AGEH}_{t-i} + \sum_{i=0}^p \beta_3 \Delta \text{EHF}_{t-i} + \sum_{i=0}^p \beta_4 \Delta \text{OPEH}_{t-i} + \theta_1 \log \text{MMR}_{t-1} + \theta_2 \text{AGEH}_{t-1} + \theta_3 \text{EHF}_{t-1} + \theta_4 \text{OPEH}_{t-1} + \mu_{t2} \dots \dots (8)$$

Where:

(7) = ARDL child mortality rate model

(8) = ARDL maternal mortality rate model

$\Delta$  = the first difference operator

log = natural logarithm

p = lag order selected

$\beta_i$ , and  $\alpha_i$  = short-run dynamic coefficients

$\Theta_i$  and  $\eta_i$  = long-run coefficients

$U_i$  = the error term

$t$  = current time period

$t-1$  = previous time period

other variables are as defined earlier

The Error Correction Model (ECM) representation of the ARDL models is as specified hereunder:

$$\Delta \log \text{CMR}_t = k_0 + \sum_{i=0}^p k_2 \Delta \text{AGEH}_{t-1} + \sum_{i=0}^p k_3 \Delta \text{EHF}_{t-1} + \sum_{i=0}^p k_4 \Delta \text{OPEH}_{t-1} + \lambda_2 \text{ECM}_{t-1} + \varepsilon_{t1} \dots \quad (9)$$

$$\Delta \log \text{MMR}_t = b_0 + \sum_{i=0}^p b_2 \Delta \text{AGEH}_{t-1} + \sum_{i=0}^p b_3 \Delta \text{EHF}_{t-1} + \sum_{i=0}^p b_4 \Delta \text{OPEH}_{t-1} + \lambda_2 \text{ECM}_{t-1} + \varepsilon_{t2} \dots \quad (10)$$

Where:

$\lambda_1$  = Coefficient of ECM, representing the speed of adjustment to long run equilibrium.

#### ***A Priori Expectation***

From models 3, 4, 5, 6, 7 and 8, it is expected that all the coefficients  $\alpha$ ,  $\beta$ ,  $\eta$  and  $\Theta$ , would be negative. When the coefficients of aggregate government expenditure on health, external health funds and out-of-pocket health expenditure are negative it means that they reduce the maternal and child mortality rates. It is expected *a priori* that child and maternal mortality would be a more representative and reliable health outcome because, reduction of risks associated with child birth and early years – the first year of an infant and the first five years of a child, are achieved by better health facilities and procedures (Nixon & Ulmann 2006). Therefore, maternal and child mortality rates are expected to respond inversely to increases in health expenditure which implies improvement in health facilities and procedures. The *a priori* expectation is stated symbolically as:

$$\beta_i < 0; \Theta_i < 0$$

The main technique of analysis used is the simple Autoregressive Distributed Lag (ARDL) regression model, proposed by Pesaran and Shin (1999); Pesaran, Shin and Smith (2001).

## Results and Discussion

The results for pre-estimation test of unit root and co-integration for both models are presented in Table 1. Note that a variable is stationary at a given level when the ADF value is greater than the critical value.

**Table 1: Augmented Dickey Fuller (Adf) Unit Root Test Result**

Variable	ADF	Critical Value			Order of
Integration		1%	5%	10%	
MMR	-3.647689*	-2.692358	-1.960171	-1.607051	I(0)
CMR	-4.916669*	-4.667883	-3.733200	-3.310348	I(0)
AGEH	3.791372-***	-4.532598	-3.673616	-3.277364	I(0)
EHF	-5.703095*	4.532598-	-3.673616	-3.277364	I(0)
OPEH	-4.747782*	-4.571559	-3.690814	-3.286909	I(1)

Source: Author's Computation Using EVIEWS 9

\* Indicates significance at 1%, \*\* at 5% and \*\*\* at 10% levels respectively.

Mackinnon (1996) Critical value for rejection

The ADF unit root test results in Table 1 shows that Maternal Mortality Rate (MMR), Child Mortality Rate (CMR), Aggregate Government Expenditure on Health (AGEH), and External Health Funds (EHF) were stationary at level I(0), while Out-of-Pocket Expenditure on health (OPEH) was stationary at first differencing I(1). The ADF results necessitated the choice of Autoregressive Distributed Lag (ARDL) method of estimation in this study, as argued by Arshed (2014), that ARDL cointegration technique is preferable when dealing with variables that are integrated of I(0) and I(1) combined and further argued by Nkoro and Uko (2016) that they could either be integrated of order I(0), I(1), or a combination of both. They both emphasised that none of the variables should be stationary at second differencing, I(2).

## ARDL Bounds Test Result for Child/Maternal Mortality Rate Models

Bounds test was conducted to test the existence of cointegration in the child and maternal mortality models. Table 2 presents the result of the cointegration test using the ARDL bounds test approach to cointegration.



**Table 2: Bounds Test Results for Child/Maternal Mortality Rate Models**

Test Statistic	Value	K
F-statistic	4.405639	3
	*17.63161	3
Critical Value Bounds by Pesaran (2001)		
Significance	I(0)	I(1)
5%	3.23	4.35
	*4.01	*5.07

Source: Author's Computation Using EViews 9

Table 2 reveals that the F-statistic value (4.405639) is greater than the upper bound (4.35) at 5% level of significance. Hence, there is the existence of a long run relationship between child mortality rate and health expenditure in Nigeria within the study period. Again, the values with asterisks as presented in Table 2 indicate that the F-statistic value (17.63161) is greater than the upper (5.07) bounds at 5% level of significance. It means that there is a long run relationship between maternal mortality rate and the explanatory variables within the study period. Based on the bounds test results, the cointegrating and long run forms of the models were also estimated.

### The Long-Run ARDL Result

The long run ARDL result for both child and maternal mortality models revealed that the values (see appendices 1 and 2) of the coefficient of the Error Correction Model (ECM) are negative (-0.1044 and -3.5023) and significant at 5% (probability values at 0.0365 and 0.0217 respectively) as expected. The ECM coefficients being significant and also negative, further confirm the existence of a long run relationship existing in the child and maternal mortality rate models. The fitted regression line of the long run estimated result in appendix 2, is therefore given as:

$$\text{LOGCMR} = 12.3040 - 0.0645\text{AGEH} - 0.0844\text{EHF} - 0.0771\text{OPEH}$$

$$t^* = \quad 9.4053 \quad -5.5952 \quad -4.8674 \quad -6.0455$$

$$\text{Prob.} = 0.0007 \quad 0.0050 \quad 0.0082 \quad 0.0038$$

The estimated coefficient for the Aggregate Government Expenditure on Health (AGEH) as well as the probability value stood at -0.0645 and 0.0050, respectively. It shows that AGEH had a significant, reversal impact on Child Mortality Rate (CMR); a unit increase in AGEH has led to about 6% decrease in child mortality rate in Nigeria. The probability value which is below 5% level of significance means that AGEH had a significant impact on child mortality rate in Nigeria within the period under review. The negative sign of the coefficient of AGEH is in line with the *a priori* expectation of the model.

The estimated value of the external health funds (EHF), -0.0844, revealed that a unit increase in external expenditure on health has led to about 8% decrease in child mortality in Nigeria. The sign of the coefficient is in line with the model's *a priori* expectation and it is significant at 5% level since its probability value is 0.0082. EHF had significant impact on child mortality rate in Nigeria.

Out-of-Pocket Expenditure on Health (OPEH), had an estimated value of -0.0771 that is, OPEH had a negative, reversal impact on child mortality rate. A unit increase in OPEH has led to about 8% decrease in child mortality rate in Nigeria within the period under consideration. The sign of the coefficient is in conformity with *a priori* expectation of the model. The probability value of this variable (0.0038) fell below the level of significance at 5%, indicating that out-of-pocket expenditure on health had significant impact on child mortality rate in Nigeria. The fitted regression line of the long run estimated result for the MMR Model (see appendix 3) is given as:

$$\text{LOGMMR} = 2.1203 - 0.044\text{AGEH} - 0.066\text{EHF} - 0.054\text{OPEH}$$

$t^* =$	0.905252	-2.216026	-2.296161	-2.090546
Prob. =	0.4609	0.1570	0.1485	0.1717

From the estimated regression line, the value (0.044) of the estimated coefficient for aggregate Government Expenditure on Health (AGEH), the estimated value of the coefficient of External Health Funds, EHF (0.066) as well as the coefficient of out-of-pocket expenditure on health, OPEH (0.054), have the probability values of 0.1570, 0.1485, 0.1717 respectively, which are all above the 5% level of significance which means that, AGEH, EHF and OPEH had no significant impact on maternal mortality rate within the period of study. The positive signs of the coefficients disagree with the *a priori* expectation of the model, and the signs suggest that health expenditure rather, worsens maternal mortality in Nigeria.

### Post Estimation Diagnostic Test Result

The Newey-West, or the Heteroscedasticity-and-Autocorrelation-Consistent (HAC) standard errors and covariance procedure was run during regression analysis of the two models (see appendices 2 and 3) to correct the problem of autocorrelation and heteroscedasticity. The application of the HAC technique in the E-VIEWS software calculates and takes care of the Newey-West standard error in the model (Gujarati and Porter, 2009). Post diagnostic tests of stability, normality and specification were conducted which means that the results obtained are reliable for prediction and policy. The residual test results are presented in Table 3

**Table 3: Post Estimation Test Results for Child/Maternal Mortality Rate Models**

	Tests	Coefficient	Probability
Normality	JarqueBera	0.05354*	0.9736*
		5.765919**	0.0559**
Ramsey RESET	F-stat.	4.1796*	0.1335*
		22.1498**	0.1333**

Source: Author's Computation Using EVIEWS 9

\*Indicates values for the CMR Model; \*\*Indicates values for the MMR Model

For the child mortality rate model, Table 3 shows 0.05354 value of the Jarque-Bera coefficient with corresponding probability value of 0.9736 which is above 5% level of significance. The Jarque-Bera test for normal distribution of error terms revealed normally distributed residuals. The 0.1335 p-value, which was found to be greater than 5% level of significance in the Ramsey Regression Specification Error Test (RESET) showed no evidence of specification error in the model.

Similarly, the maternal mortality rate model revealed in Table 3 that 0.9736 probability value of the Jarque-Bera test is above 5% level of significance, indicating that the residuals are normally distributed. Probability value of 0.1333 was found to be greater than 5% level of significance in the Ramsey Regression Specification Error Test (RESET), it showed that the model was mathematically specified. The stability test of Cumulative Sum of Squares (CUSUM of Squares) presented in figure 1 revealed that the CMR model is stable as the plot of the chart lies within the critical bounds at 5% level of significance.

Again, the CUSUM of Squares presented in figure 2 revealed that the MMR model is stable as the plot of the chart lies within the critical bounds at 5% level of significance.

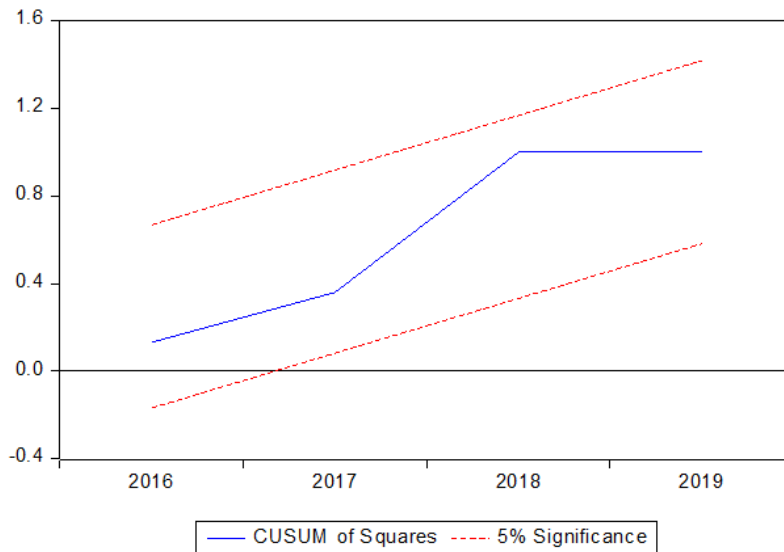


Figure 1: CUSUM of Squares Test Result of Stability for CMR Model



Figure 2: CUSUM of Squares Test Result of Stability for MMR Model

## Discussion of Findings

Result from the first model of this study, which is the Child Mortality Rate Model, indicated that aggregate government expenditure on health, external health funds and out-of-pocket expenditure on health had a significant reversal effects on child mortality in Nigeria. The negative signs of the coefficients are in tune with the *a priori* expectations of the model where aggregate government expenditure on health, external health funds and out-of-pocket expenditure on health individually led to a significant reduction in child mortality rate in Nigeria. The finding of the Child Mortality Rate model contradicts that of Nwanasoke, Orji and Okafor (2015) as well as Muftaudeen and Bello (2014) who found that public health expenditure has no significant effect on child mortality rate in Nigeria. The contradiction might be explained by the fact that the component of their health expenditure is narrowed down to federal government health expenditure only, as against the inclusion of aggregate government, out-of-pocket and external health expenditure.

From the Maternal Mortality Rate model, the estimates indicated that aggregate government expenditure on health, the external health funds (EHF), Out-of-pocket or household expenditure on health which largely represents the private health expenditure in Nigeria, did not yield significant reduction in maternal mortality rate in Nigeria within the period under review. The result showed that efforts of government, foreign health funders and the private individuals on the combat of maternal mortality did not significantly reduce the problem. Considering the outcome of the child mortality rate model and the maternal mortality rate model, the results suggest that the funders concentrate on child health more than maternal health issues, because the same funds injected into the sector has significant impact on child health but insignificant impact on maternal health.

Despite the fact that health expenditure is an effective tool for tackling the problem of child mortality in the country, the problem still persists. This brings to mind the statement by UNICEF (2014), that Nigeria is still regarded as the second largest contributor to maternal and child mortality in the world. Why the problem still persists is the fact that the sector is bedevilled with both medical and non-medical challenges, what others refer to as direct and indirect causes of maternal and child mortality. For example, in Nigeria, only less than 20% of the health facilities in the country offer emergency obstetric care (UNICEF, 2014), which signifies the presence of medical challenge or challenge within the health care sector. Also, only one out of every three Nigerian births are attended to by skilled attendants and maternal deaths in Nigeria is actually

under-reported and unexplained (Onyeji, 2020) which signifies a non-medical challenge or challenges outside the healthcare sector.

Medical challenges exist in the sector in the sense that when healthcare services do not respond to all maternal and child health problems as expected due to some problems such as power failure, inadequate or absence of some basic inputs, industrial actions and negligence by health workers, medical care may be unable to, or fail to treat all cases that approach it, especially emergency cases. Similarly, some non-medical challenges such as affordability and acceptability problems due to some economic, cultural and religious factors which deter some Nigerians from accessing healthcare services may create situations where some maternal cases are dealt with outside the healthcare system. Since health expenditure in Nigeria is largely made from out-of-pocket spending as seen in the raw data (see appendix 1), the significant reduction in the mortality, is only a reflection of a few rich, with a good number of the poor populace not included because they cannot afford, or do not accept the healthcare services. A good percentage of the Nigerian population does not access existing medical services (Alubo, 2012).

Therefore, even if Nigeria's health sector was operating as expected and increases in health expenditure lead to improvements in the country's health care, the country will still face maternal mortality problem if only 35% of maternal issues are taken care of by healthcare professionals which means that 65% of maternal problems are handled outside medical care, probably at homes. Many causes of maternal mortality in Nigeria such as unsafe abortion, where dangerous objects are inserted into the vagina or harmful drugs taken, high level of female illiteracy, high rate of poverty, cultural or religious practices that deter women from visiting health professionals especially male doctors, all reduce access to maternal health services. There are many causes of child mortality in Nigeria such as refusing to take vaccines on children for vaccine preventable diseases, and a lack of access to healthcare. Thus, some medical and non-medical factors, create problems such as poor access to healthcare due to, for example, affordability and acceptability problems, which render the child and especially the maternal mortality issues to still linger.

### **Conclusion and Policy Recommendations**

The study used quantitative tools to analyse the impact of health expenditure on maternal and child mortality rates in Nigeria. The empirical evidence established that the impact of total health expenditure (government, out-of-pocket and external) on child and maternal mortality rates in the

country during the period under review differ. While health expenditure has significant reversal impact on child mortality rate in Nigeria, its impact on maternal mortality is insignificant. That is, key players in the health sector, especially the government and foreign health funders concentrate more on child health than maternal health issues. Based on the findings of the paper, the following recommendations are hereby made:

1. In order to reap better results in the areas of maternal and child health, the government needs to: check wastages and corruption in the health sector; attain the minimum of 15% of budget allocation to the health sector; ensure effective primary healthcare (PHC) institutions through, restructuring Nigeria, which will enable states and local governments to do better in improving primary health care in terms of funding and management; check the level of emigration of health personnel, especially Doctors and Nurses.

*Implementation Strategies for Recommendation 1:*

- a) The President of the Federal Republic of Nigeria should initiate an Executive Bill for the Establishment of the National Maternal and Child Care Development Fund (NMCCDF) in the first quarter of 2022.
  - b) Governments at all levels to allocate at least 19 percent of their total budget to the Health Sector beginning from fiscal year 2022.
  - c) EFCC should, with immediate effect, beam its search light on health sector expenditure with a view to preventing wastages and curbing corruption in the sector.
2. External health funders should be encouraged by the public and private sectors in order to do more on maternal health improvement. A proper coordination of all external health funds by the Ministry of Health is needed so as to avoid leakages or diversion of funds, because without proper support, cooperation and collaboration from within Nigeria, external health resources no matter the quantum, cannot yield the expected result.

*Implementation Strategy for Recommendation 2:*

The Act establishing the NMCCDF should make provision for domiciling an External Health Fund Desk as a unit in the proposed Bill to cater for Health Support Funds, donations, foreign aid, etc.

3. Although out-of-pocket health expenditure significantly reduced child mortality in Nigeria within the period under review, available literature in this area revealed that out-of-pocket health expenditure discourages healthcare consumption of the poor, it creates affordability problem. Therefore, in order to properly tackle maternal and child mortality problems in Nigeria; a country with a lot of poor people, out-of-pocket health spending by individuals (especially the poor) should be greatly reduced through making NHIS more inclusive; and through making maternal and child health goods and services free in public health centres by group of rich private individuals, Charity Organisations and the Government in order to remove, or reduce price barrier.

*Implementation Strategy for Recommendation 3:*

Federal Government of Nigeria to declare Maternal and Child Care services free in all Primary Healthcare Centres (PHCs) across the country, and direct the NMCCDF (when established) to provide funding support to the PHCs by the second quarter of 2022.

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## **Boosting of Aquaculture and Marketability of Aquatic Products as A Pivot to Sustained Self-food Sufficiency and Employment Generation In Nigeria**

Adebambo Adesoji Adedapo Rasak\* Banjo Oluwale Sikiru

\*\* Banjo James Olanrewaju Sunday\*\*\* Awofodu Adebola Daniel\*\*\*\*

Oladipupo Oluwabusayo Adenike\*\*\*\*\*

Uthman Tajudeen Olusegun Oladipupo\*\*\*\*\*

### **Abstract**

Securing of natural water bodies within Nigeria, their uninterrupted availability, safe use, sustenance of their high quality and freedom from pollutants are critical factors for aquatic life. These factors are imperatively critical and inter-related for enhanced natural and artificial production of aquatic foods. By the global index of measurement, hunger still ravages on the population in Nigeria, despite the availability of its huge resources and vast area of water bodies within the total land mass of the country. Aquaculture is a term that encompasses many activities for the survival of aquatic life for use by humans, Aquatic foods are major and good sources of quality proteins needed for human growth and development. This article examines the massive aquatic food production, its marketability and some factors that may militate against the production and sustainability of food sufficiency (especially aquatic food) and the performance of vital roles which hinge on supervisory organs of the government to ensure safety of the water bodies as a natural endowment to the country which may be needed for production of aquatic foods, The potential productivity of the water bodies if optimally harnessed for the production of different aquatic animal species such as fish, crocodile, shrimps with employment of biotechnology will sufficiently feed the growing population, solve unemployment issue. In consequences lots of jobs will be created leading to increased gross domestic products. Huge investments in the production of algae will also reduce the massive dependence on hydro and fossils fuel for generation of power. This will catalyze industrial growth since Nigeria as a Country still struggles to overcome its epileptic power supply which has not been able to sustain the country's industrialization. There should be a declaration of state of emergency on aquatic food production, as this revolution

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\* Adebambo, A.A.R.; Department of Biological Sciences, Tai Solarin University of Education, Ijagun, Ogun State \*\*

Banjo,O.S; Department of Agricultural Science Education, Tai Solarin University of Education, Ijagun, Ogun State

\*\*\*.Banjo, J.O.S., Department of Agricultural Science Education, Tai Solarin University of Education, Ijagun, Ogun State

\*\*\*\*Awofodu, A.D, Department of Biological Sciences, Tai Solarin University of Education, Ijagun, Ogun State

\*\*\*\*\*Oladipupo, O.A, Department of Public health, Los Angeles Pacific University, USA. \*\*\*\*\*Uthman, T.O.O.,

Department of Biological Sciences, Tai Solarin University of Education, Ijagun, Ogun State. **Corresponding author E-mail**  
:adebamboar@tasued.edu.ng

on it will contribute to increased foreign exchange earnings of the country by the export of excess aquatic products, with a view to sustainably wiping out hunger by the year 2030. This will significantly decrease poverty level of citizens, create employment, stabilize the ecosystem and the natural resources, through unbiased investments and incentives to aquaculturists in the private and public sector of the economy.

**Keywords:** Security, Aquaculture, Hunger, Global index of measurement, Sustainable development goals

## **Introduction**

Security involves all activities by the government of a state or nation to protect the lives and properties of her citizens. According to United Nations (1994), human security is conceived as the summation of seven distinct dimensions of security namely, economic, food, health, environmental, personal, community and political and that if achieved will maintain more peaceful world. This paradigm is extended by the government to protect the territorial integrity of the country be it land, water and aerial confinements which falls within the environment. Security predisposes inhabitants of a country to peaceful co-existence amongst the citizens of a country. This hinges on some factors including, prevailing health situation, quality of educational standard and general level of illiteracy, state of nation's economy, political stability cum quality of governance, crime level and competence level of institution to combat crime, sustainability of the environment, degree of technological advancement, quality of life, calorie intake of the populace, level of social integration amongst contending ethnic, religious, gender and sectional dichotomies in the country, (Ogoh, 2008). This article examines the security of the water bodies, its availability, and food security especially aquatic foods as a vital component of protein supply, as it affects the well-being of the populace and employment generation. It may not be an understatement that a nourished and healthy individual makes a happier family leading to a secured society, and ultimately to a peaceful co-existing entity of a country.

Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food, which meets their dietary needs and food preference for an active and healthy life (World summit food, 1996). While Food sufficiency may not be problematic to some advanced countries in the Europe, America and Asia, rather food challenge in these countries may be consumption of wrong combination that contain excessive calories, but with little exercise leading to obesity, hyper-cholesterol levels, hypertension, heart

disease, cancer and type 2 diabetes (HHP, 2022). However food insecurity still ravages in some South American countries, affecting 41% of the population, which increased by 20.5% between 2014 and 2020 (PAHO and WHO, 2021). In Asia 512 million people are hungry representing 67% of the world hungrier (UNICEF, WHO and World Bank, 2012) and the estimate of hungry people is placed at 256.5 million in Africa and 59.7 million in Latin America and Caribbean. (FAO, 2021), while in Nigeria the number of people experiencing food insecurity is on the rise with the number increased from 10 million in 2010 to 14 million in 2020 according to Owoo (2021), with malnourishment as its index. This is due neglect in food production for about four decades due to oil production as major export product (Otaha, 2013)

Food and Agriculture organization of the United Nations (FAO 2018) stated that the prevalence of undernourishment had reached 920 million among people in the world, however as at 2016 and 2017 it was 804 million and 821 million respectively, with 795 million people in the world not having enough food to live healthy and active lives, which is such that one among nine people of the earth is hungry with vast hungry people living in developing countries. Furthermore hunger is ravaging in some parts of the industrialized world of South America, while the undernourishment in Asia is slowing down significantly

**Global Food Security:** The impact of food insecurity on everyone is important and should be a concern to everyone globally, while its index is a composite indicator aiming at monitoring progress towards food security at country level, The United States is leading an international efforts to address the need that people around the world have reliable source of quality food with the aid geared towards food security, to ensure that every nation has the potential to feed its population with adequate quantity of nutritional food in circulation., Some of the countries herein ( Table 1) have been secured in term of food availability as indicated according to global index of measurement which is a dynamic quantitative and qualitative scoring model from 28 unique indicators that measures the drivers of food security across both developing and developed countries with overall GFS score in the range of 77.8 and 80 points on the index , these are Ireland, Austria, United kingdom, Finland, Switzerland , Netherlands, Canada, Japan, France and United States of America, however, Burundi, Yemen, Mozambique, Sudan, Malawi, Ethiopia and Syria are among the worst performer (Clear IAS, 2022)

**Table 1: Ranking and trends: Performance of countries based on their 2021 food security score**

Global ranking	Country	Overall score	Affordability	Availability	Quality and Safety	Natural Resources and Resilience
1 <sup>st</sup>	Ireland	84.0	92.9	75.1	94.0	74.1
2 <sup>nd</sup>	Austria	81.3	90.5	75.2	91.2	65.7
3 <sup>rd</sup>	United Kingdom	81.0	91.1	72.7	89.6	69.0
4 <sup>th</sup>	Finland	80.9	91.7	66.2	93.8	75.1
5 <sup>th</sup>	Switzerland	80.4	89.0	76.9	86.4	65.1
6 <sup>th</sup>	Netherlands	79.9	89.7	73.7	92.2	61.2
7 <sup>th</sup>	Canada	79.8	87.6	77.7	94.5	54.4
8 <sup>th</sup>	Japan	79.3	90.0	75.7	83.4	61.9
=9th	France	79.1	90.3	67.0	92.1	67.5
=9th	United States	79.1	88.7	71.0	94.3	61.3
11th	Germany	78.7	90.1	69.3	87.8	66.0
12th	Israel	78.0	90.6	75.2	90.7	47.6
13th	Sweden	77.9	91.0	62.7	92.3	67.3
14th	Czech Republic	77.8	88.3	69.1	81.4	70.9
15th	Singapore	77.4	87.9	82.9	79.1	46.7
16th	New Zealand	76.8	90.9	63.2	82.0	70.8
17th	Denmark	76.5	93.1	61.4	93.5	56.9
18th	Italy	76.4	89.3	71.5	86.2	51.8
19th	Belgium	76.1	89.8	71.1	85.2	50.9
20th	Norway	76.0	83.3	60.6	90.7	76.1
21st	Portugal	75.2	88.8	67.1	88.3	52.3
22nd	Poland	74.9	87.0	65.0	80.5	65.0
23rd	Russia	74.8	86.9	64.9	85.8	59.9
=24th	Costa Rica	73.6	84.5	61.4	82.4	67.0
=24th	Qatar	73.6	83.8	74.4	83.5	43.4
=24th	Spain	73.6	88.4	61.2	84.4	58.2
27th	Greece	73.3	89.0	59.6	89.5	53.6
28th	Chile	73.2	82.4	66.8	84.2	57.1
29th	Romania	72.4	81.8	66.6	85.4	52.6
30th	Kuwait	72.2	80.1	72.3	86.4	43.0
31st	Hungary	72.1	83.5	66.9	77.4	55.4
=32nd	Australia	71.6	84.9	64.1	87.8	44.7
=32nd	South Korea	71.6	80.3	69.7	78.5	52.2
34th	China	71.3	77.4	78.4	71.4	47.2
35th	United Arab Emirates	71.0	75.9	71.3	88.8	43.6
=36th	Belarus	70.9	86.3	57.0	82.8	56.3
=36th	Panama	70.9	82.6	67.4	72.3	54.7
38th	Bulgaria	70.5	83.3	59.2	81.5	56.8
39th	Malaysia	70.1	85.6	64.0	76.3	46.6
40th	Oman	70.0	88.8	57.3	83.8	45.2
41st	Kazakhstan	69.2	83.0	58.5	81.0	51.9
42nd	Slovakia	68.7	89.6	48.8	72.9	62.7
43rd	Bahrain	68.5	79.2	67.5	79.9	39.1
44th	Saudi Arabia	68.1	75.0	67.8	79.8	44.3
45th	Uruguay	68.0	75.4	53.1	81.2	68.5
46th	Mexico	66.9	73.8	60.9	81.0	51.2
47th	Dominican Republic	65.4	74.6	62.0	69.5	50.3

48th	Turkey	65.1	67.6	61.6	75.8	56.4
=49th	Jordan	64.6	80.4	55.2	63.5	54.2
=49th	Peru	64.6	79.8	54.6	71.2	48.4
51st	Thailand	64.5	81.8	57.3	59.5	50.8
52nd	Colombia	64.4	70.4	57.2	72.3	58.4
53rd	Argentina	64.2	65.6	58.8	90.2	45.8
54th	Algeria	63.9	77.9	58.0	62.0	50.7
55th	Tunisia	62.7	74.4	54.0	72.1	47.6
56th	Azerbaijan	62.6	82.3	58.0	59.1	38.2
57th	Morocco	62.5	75.1	51.8	72.3	49.0
58th	Ukraine	62.0	73.9	51.8	71.9	49.3
59th	Paraguay	61.6	77.5	47.7	74.9	44.7
60th	Serbia	61.4	82.6	38.4	81.1	44.7
61st	Vietnam	61.1	68.9	60.4	64.3	44.9
62nd	Egypt	60.8	66.5	60.0	60.7	52.0
63rd	Brazil	60.6	68.7	46.4	90.0	42.4
64th	Philippines	60.0	74.3	53.9	61.5	43.6
65th	Bolivia	59.9	73.0	52.9	61.1	47.4
66th	Ecuador	59.6	71.0	50.5	70.8	44.1
67th	El Salvador	59.5	65.5	59.2	63.2	45.5
68th	Honduras	59.4	53.0	64.2	63.8	57.8
69th	Indonesia	59.2	74.9	63.7	48.5	33.0
70th	South Africa	57.8	63.1	49.4	72.1	49.4
71st	India	57.2	50.2	65.7	59.1	52.8
72nd	Myanmar	56.7	58.9	52.2	63.0	54.7
73rd	Nicaragua	56.0	66.1	48.3	57.7	49.8
74th	Botswana	55.5	69.6	47.5	59.6	40.0
75th	Pakistan	54.7	52.6	63.0	55.7	42.2
76th	Mali	54.5	43.7	64.5	61.1	49.4
77th	Sri Lanka	54.1	62.9	50.6	52.1	46.3
78th	Uzbekistan	53.8	49.3	51.3	65.1	55.4
79th	Nepal	53.7	48.3	64.5	53.7	44.0
80th	Guatemala	53.5	58.0	48.2	57.4	51.2
81st	Cambodia	53.0	68.8	48.7	44.3	40.7
82nd	Ghana	52.0	60.0	48.6	58.2	37.3
83rd	Tajikistan	51.6	53.1	51.1	55.7	45.9
84th	Bangladesh	49.1	48.8	58.1	45.5	36.8
85th	Burkina Faso	48.1	42.0	55.6	48.2	45.5
=86th	Côte d'Ivoire	48.0	45.5	53.6	42.3	48.2
=86th	Tanzania	48.0	39.7	57.4	50.6	43.5
88th	Niger	47.6	37.1	52.6	51.7	53.4
89th	Senegal	47.4	44.4	47.7	55.9	43.9
90th	Kenya	46.8	47.6	45.6	54.8	39.7
91st	Laos	46.4	47.7	46.1	49.2	42.0
92nd	Cameroon	45.5	45.5	42.4	51.6	45.3
93rd	Benin	45.2	42.1	50.7	48.2	37.8
94th	Togo	44.2	40.8	46.7	35.1	55.1
95th	Uganda	43.9	41.5	38.0	49.2	53.7
96th	Guinea	43.0	32.5	53.1	40.4	46.4
97th	Nigeria	41.3	33.4	45.3	48.6	41.3

98th	Angola	41.1	32.6	42.6	48.7	45.9
99th	Chad	40.6	37.8	42.0	42.3	41.6
100th	Madagascar	40.4	36.3	41.1	39.9	47.3
101st	Rwanda	40.3	25.8	45.9	52.1	44.8
102nd	Venezuela	39.4	37.3	27.1	64.3	41.1
103rd	Congo (Dem. Rep.)	39.1	38.0	41.6	36.0	39.9
104th	Sierra Leone	38.1	34.1	32.1	36.8	58.0
105th	Zambia	38.0	29.0	40.4	42.0	46.4
=106th	Harti	37.8	27.8	40.2	44.2	45.2
=106th	Syria	37.8	34.0	30.1	53.2	43.3
108th	Ethiopia	37.6	24.5	47.5	41.6	39.4
109th	Malawi	37.3	23.6	40.9	37.1	55.9
110th	Sudan	37.1	31.8	31.6	52.4	41.4
111th	Mozambique	35.9	42.9	30.4	33.8	35.2
112th	Yemen	35.7	39.3	27.6	37.4	42.1
113th	Burundi	34.7	24.0	33.7	45.7	44.8

Source: The Economist Group, (2022) Global food security index (GFSI)

It is however, pathetic, that Nigeria, with her affluence and variety of wealth sources, vast area of water and land masses and a nick name of giant of Africa occupies 97<sup>th</sup> position. The global index measurement of state of food security in the world is based on (a) Affordability (b) Availability (c) Quality and safety of the food. (d) Natural resources and resilience (The Economist group, 2022), this calls for attention and actions needed to accelerate food production towards the United Nations sustainable development goal of zero hunger by 2030 (Clear IAS,2022). Food security implies that people at all times have sufficient access to food, to meet their dietary needs for maintenance of good and healthy life. Factors here-in stated that may improve the food security include (a) good political, economic, social and behavioral factors (b) Provision of technical assistance and partners in the appropriate method and implementation for food security, as in the case of food and nutritional technical assistance (FANTA) Programme in collaboration with United State agency for international development (USAID) to improve the health and well- being of vulnerable group. (Clear IAS,2022)

### Food Security in Nigeria

Nigeria agricultural potential requires to be necessarily assessed for planning food sufficiency, employment creation, economic and industrial growth. Despite vast agricultural potentials, Nigeria is still a massive importer of food as a result of subsistence level of production. Also, there has been decline in agricultural potentials of Nigeria since the discovery of crude oil, On a global comparative scale, insecurity of food has existed in Nigeria, a result of poor investment to agriculture, corruption, policy summersault and lack of political



will, loss of cultural values, treatment of agriculture and agribusiness as non-viable investment, subsistence level of farming operations, communal conflicts, dependence on preference crop types, lack of will by the youths to engage in agriculture coupled with over ambition to make fortune without hard work. However natural causes such as weather, pests, diseases, flood, erosion also increase Nigeria's food security threat. Man-made exigencies such as oil theft through oil pipe vandalisation according to Sylvanus and Chukwuemeka, (2021), oil spill courtesy error from oil industries where 6,000 spills of oil had taken place leading to the loss of 1,820.410.50 barrels of oil in the 40 years oil exploration in Nigeria which has led to water bodies pollution and reduction in farm land quality,(DPR,1997). The oil spills has also caused exacerbating hunger and poverty in fishing communities (Chindah and Brade,2000), while open grazing by the nomadic herds men has caused mass kill of cattle, deforestation, water and environmental pollution, increased green-house effect, death of citizens, hospitalization and illegal acquisition of fire arms and often threatened the nation's security (Iloanya and Chukwuemeka,2020 )

Foods are substances that are taken into the body to provide nutrients and energy, it also makes us grow, repair worn out body tissues. There are six classes of food, namely: carbohydrate, proteins, fats and oil, mineral, vitamins and water, all herein mentioned except water are nutrients. However, the role of water in human's life cannot be quantified as nearly all physiological and biochemical processes of life takes place in aqueous environment. Each class of food has specific roles to play in the human physiological system. While Carbohydrates provide energy, protein makes human grow and replace worn out tissues of the body, fats and oil provide energy and insulate the body, Vitamins and minerals salts are essentials for the well- being of the body. In this regards, aquaculture products which include diverse fish types, crayfish, lobster, shrimps, bivalve, octopus (water snail) and crocodilian meat from water environment contain all classes of food except carbohydrate, most especially high amount of protein, and naturally a major source of protein outside the conventional livestock products

**Water Security:** Water security is defined as the capacity of a population to safeguard, sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being ,and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability (United Nations,2013). Water Security occur where water-related risks are managed and water-related opportunities are captured,

however with difficulty to provide a set of indicators to quantify the risks (Sadoff *et al.*, 2020)

Water security is critical among the agenda of the United Nations Sustainable Development Groups (SDGs) because most SDGs cannot be met without access to adequate and safe water. (Caretta *et al.*, 2022) The absence of water security is termed water insecurity, (UNICEF, 2021). And it is a growing threat to humanity. Factors contributing to water insecurity include water scarcity, water pollution, reduced water quality due to climate change impacts, poverty, destructive forces of water and others such as natural disaster, terrorism and armed conflict (Peter *et al.*, 2020). Water security is imperative to aquatic food existence, nourishment and sustenance for the continuous livelihood of humanity. Water security can be achieved by better management of water resources, which comprise the society's ability to sustain the hydrologic environment, the socio-economic environment and changes in the future environment (climate change) (Sadoff *et al.*, 2020), which is a key factor in achieving sustainable development and poverty reduction. (Grey and Sadoff, 2007). Water security risks need to be managed at different spatial scales ranges from within the household to community, town, city, basin and region as well as correct timing in order to build resilience to local climate variability and extreme events such as heavy precipitation or drought (REACH, 2021). Effect of climatic changes affecting the severity of water risks had been mentioned (Zhang *et al.*, 2019). Approaches for improving water security require natural resources, science, and engineering knowledge, political and legal tools, economic and financial tools, policy and governance strategies (Peter *et al.*, 2020)

Nigeria as a country should ensure to have a superb diplomatic relationships amongst countries that the major rivers in it would have traversed through, as well as ensuring proper border demarcation within states of it, else issue of water conflict is inevitable, which may bring in international, interstate and intrastate boundaries dispute hampering water security, security threats to lives and properties and the prevention of optimal usage of water for public and private lives. An instance is the case of Ethiopia if moved to fill its dam's reservoir could reduce Nile flows by as much as 25% and devastate Egyptian farmlands, (NPR, 2018). Water conflicts could occur through territorial disputes, a fight for resources, and strategic advantage (HIICR, 2007). Instances are the cases of Bakassi peninsula between Nigerian and Cameroonian governments which eventually led to litigation at the International court of justice, Hague, The Netherlands and where judgment favoured the

Cameroonian government, however there were skirmishes between the two countries as per the owner affecting the nationals of the two countries which had effects on their livelihood until resolved, while on the local scene, there have been agitation about water insecurity in the Niger Delta due to oil exploration by multinationals which has led to destruction of lives and properties and hampered aquatic food exploration

Water as a chemical substance, it is also referred to as universal solvent; it is used in all activities of living, such as agriculture, medicine, industrial production, construction, electricity production and human consumption. Water covers about 13,000 sq. km of total land mass of 923,768 sq km of Nigeria (CIA World Fact Book 2015). Water bodies are divided into marine, freshwater and estuarine environment, while marine water is that containing high concentration of dissolved salt (35%) and it consists of Atlantic ocean in the coastal area of the country stretching 853 kilometre from Lagos through the Niger Delta (Peter and Badejo, 2006., Croitoru *et al.*, 2020). Estuarine is the water body that possess characteristics of either freshwater and or marine, these are lagoon and such include Epe, Lagos and Badagry Lagoon in Southwest Nigeria. Freshwater has low concentration of salt (0.05%), and it covers 12.5mha of the land mass area of Nigeria (Ibeum 2006), and consists of many rivers, lakes, dams, swamps.

### **Water Resources**

Nigeria lies between longitude between 2° 49' E degrees and 14° 37' E and latitude between 4° 16' E and 13° 52' north of equator (Sowunmi, 2019) experiencing a tropical climate, which is characterized by high temperatures and humidity. The seasons comprise wet and dry period. Total rainfall decreases from the coast northwards. The annual rainfall ranges between 800 and 1,600 mm in Southwest, 1200 and 2500mm (South east), 2,000 and 3,000 (South south). North central had 700 and 1430mm, 600 and 1,000 (North west) and the North east between 500 and 800 mm. (Eruola *et al.*, 2021). Nigeria is blessed with a vast expanse of inland freshwater and brackish ecosystems (Kuruk, 2000). However their full capacity cannot be accurately stated as it varies with season and from year to year depending on amount of rainfall.

The Country has an extensive mangrove ecosystem found in nine out of the 36 states of which a great proportion lies within the Niger Delta as they include Rivers, Delta, Cross River, Akwa Ibom, Bayelsa, Edo, Imo, Abia and Ondo States (James *et al.*, 2013) while Lagos and Lekki lagoons fringed by mangrove ecosystem are found in the west (Arabomen *et al.*, 2016). They lie between

Latitudes 3° and 7° 6' North and are estimated to cover between 500,000 and 885,000 ha. Freshwaters start at the northern limit of the mangrove ecosystems and extend to the Sahelian region.. The major rivers, estimated at about 10,812,400 hectares, make up about 11.5% of the total surface area of Nigeria which is estimated to be approximately 94,185,000 hectares. The inland water system include 13 lakes and reservoirs of between 4000 to 550,000 hectares and a total surface area of 853,600 hectares (Kuruk, 2004), and represent about one percent of the total area of Nigeria. The water bodies herein listed (Table 2) are divided into saline deltas and estuaries, and freshwaters. Deltas and estuaries, with their saline wetlands have a total surface area of 858,000 ha, while freshwaters cover about 3,221,500 ha. Other water bodies, including small reservoirs, fish ponds and miscellaneous wetlands suitable for rice cultivation cover about 4,108,000 ha.

#### **Major Inland Water Resources of Nigeria and the Approximate Surface Area (ha)**

Types of water bodies

##### **A: Major Rivers**

- i) Anambra River 1,401,000
- ii) Benue River 129,000
- iii) Cross River 3,900,000
- iv) Imo River 910,000
- v) Kwa Iboe River 500,200
- vi) Niger River (less Kainji and Jebba lakes) 169,800
- vii) Ogun River 2,237,000
- viii) Oshun River 1,565,400

Sub-total 10,812,400 According to Ita *et. al.* 1985

##### **B: Major Lakes and Reservoirs**

- i) Lake Chad (natural) 550,000
- ii) Kainji Lake (man-made) 127,000
- iii) Jebba Lake (man-made) 35,000
- iv) Shiroro Lake (man-made) 31,200

- v) Goronyo Lake (man-made) 20,000
- vi) Tiga Lake (man-made) 17,800
- vii) Chalawa Gorge (man-made) 10,100
- viii) Dadin Kowa (man-made) 29,000
- ix) Kiri (man-made) 11,500
- x) Bakolori (man-made) 8,000
- xi) Lower Anambra (man-made) 5,000
- xii) Zobe (man-made) 5,000
- xiii) Oyan (man-made) 4,000
- Sub-total 853,600 According to Ita *et. al.* 1985

**Total A + B = 11,666,000**

A + B as % of total area of Nigeria

(94,185,000ha) 12.4%

### **Distribution and Extent of Nigerian Brackish and Freshwater bodies.**

Types of wetland and distribution, its approximate size (ha)

#### **1. Deltas and estuaries**

- i) Niger delta- 617,000., Scott (1966)
- ii) Cross River estuary- 95,000 (1)
- iii) Imo and Qua Iboe estuary- 36,000., ENPLAN (1974)
- iv) Others- 110,000

Sub-Total -858,000

#### **2. Freshwaters**

- i) Niger delta freshwater- 362,000., Scott (1966)
- ii) Apex of Delta to Lokoja- 635,000., Mutter (1973)
- iii) Niger/Sokoto Basin- 470,000
- iv) Niger Kaduna Basin- 150,000

- v) Lower Niger: Jebba to Lokoja- 385,500
- vi) Benue River floodplain- 312,000
- vii) Hadejia Komadugu Yobe 624,000 Hughes and Hughes (1991)
- viii) Ogun/Oshun floodplains (Not estimated)
- ix) Cross River floodplains 250,000 Moses (1981)
- x) Imo River floodplains 26,000 ENPLAN (1974a)
- xi) Kwa Iboe 7,000 Moses (1981)
- Sub-Total 3,221,500

### **3. Other freshwaters**

- i) Minor reservoirs 98,900 Ita *et. al.* (1985)
- ii) Fish ponds 5,500 Ita *et. al.* (1985)
- iii) Miscellaneous wetlands suitable for rice cultivation 4,108,100
- Sub-Total 4,212,500

Surface area of Nigeria 94,185,000

**(1).** As % of total area of Nigeria= 1.0% , **(2)** As % of total area of Nigeria =3.4%

The role of water sources is vital to the development and sustainability of a country's economy, water bodies have been used for hydro power generation, irrigation, municipal water supply, security control, recreation, while its ways have been used for logistics. Then how often, are these water bodies secured, in terms of the optimal benefits to be derived with reference to food sufficiency? Water can be referred to as conjoined twin with aquaculture according to Fafioye, (2009) since aquaculture is solely practiced in water environments. This presupposes that the water environment must be secured to produce aquatic food either naturally from the wild and improvised arrangement as built up cages, pens on the water bodies and ponds, where water can be channeled from the natural source to grow aquatic food within few radius of distance while the wild still act as the abundance source of varieties of aquatic food.

Secured water usage in Nigeria involve the surveillance of the water bodies of the Country by Nigerian Maritime Safety Agency (NIMASA) whose responsibilities include the enactment of the regulations related to shipping,

coastal water inspection, search and rescue operations while National inland Waterways Authority (NIWA) amongst other responsibilities is involved in the maintenance of water ways, transportation, clearing of waterweeds to improve its navigation, though the employment of some water weeds have been in the purification of water pollutants, however this seems not optimally used in Nigeria, while the roles of these agencies may go beyond this in line with global phenomenon. It is opined that securing the water environment contributes to protection of the fragile environment, improving the navigational prospects, provision of natural aquatic food and provision of healthy environment in the society.

### **Aquaculture Security**

This involve multidimensional approaches to securing the viability, sustainability, harvest and dependence on aquatic products, as lots of aquaculture products are reaped through these outlets and to secure the aquatic environment continually for the sufficient provision of food for teeming and growing population of Nigerians. To make bye-products available for related industrial growth, the water security attainment is inevitable, as this may bring the optimal utilization of aquatic products without wastage, to long term consumption during scarcity, a scourge which still disturbs the preservation and conversion of agriculture and aquaculture products during glut. Aquaculture products are very rich in protein, vitamins, minerals, good fatty acid and oil, thus it is imperative that all stakeholders comprising the government and citizens must have all hands on deck to securing vast production of aquatic food which is an integral part of food sufficiency, which should be accessible, affordable and nourishing to wipe off hunger to zero level by the year 2030, thus addressing goal 2 of the sustainable development goals (United Nations, 2022)

**Exploring Aquaculture:** These involve the farming to produce aquatic products such as Fish, Crayfish, Lobster, Shrimps Prawn, Squid, Bivalve, Octopus, Crocodile, and Algae.

**Fish Farming:** The production of fish varieties in Nigeria is facilitated by the availability of extensive in-land water system consisting of streams, rivers and lakes supporting a large numbers of species many of which are of economic importance. The world's largest aquaculture producer is China, followed by America where production rose for more than 400% between 1980 and 2000, according to Jhingnan, (2001). This mass production came up as a result of mechanization leading to increase productivity, labour efficiency and improved

quality products (Emmanuel *et al.*, 2014). However Africa has little aquaculture tradition as a result of number of problems such as low productivity, poor management of resources, economic stagnation, and lack of technical know-how, environmental damage and severe poverty (Emmanuel *et al.* 2014). Nigeria has expended 1.33 billion US dollars on the importation of fish, crustaceans, molluscs, and other aquatic invertebrates in 2020 to augment the under-production of fish locally according to the United Nations (2022)

Modern fish production in Nigeria started in early 1950 by the establishment of fish farms at Onikan, Lagos, Panyam, in Jos and Okigwe, in Imo state, (Wokoma, 1987). Nigeria has estimated 12.5mha of freshwater as lakes, pond, and rivers (Ibeum 2006). Fish production of 200,000 metric tonnes by 2020, had been projected by Adewunmi (2015), however about 1,027,058 tonnes had been achieved in 2017 according to National Bureau of Statistics (2017) and accounted for about 2% of national gross domestic products and 40% of the animal protein intake with a proportion of employment and principal livelihood of over three million people.

Interestingly, Nigeria has all it takes in achieving the projected production if properly harnessed. However; this is still at its infancy with majority of farmers operating at homestead level of concrete and earthen ponds. Nigeria has diversity of fishes comprising of 250 species in inland water and 101 species in Kainji Lake (Ita 1993), 86 in Lake Chad, 40 in Lake Ogunta (Hopson 1962), 21 species in Bakalori (Ita 1993), 32 species in Oyan Lake (Ikenweiwe 2005) 199 species in brackish and marine water (Tobor and Ajayi, 1978), 41 species in Asejire Dam, 13 species in Opi Lake (Oguntade *et al.*, 2014). Fish has remarkable impacts on lives of about 35 millions individuals and communities reference to its consumption as snacks, food or medication and as a commercial venture to raise a living standard by forming major source of income (FAO 1996). Fish farming types that can sustain the growing population of Nigeria is the mechanized and intensive type where necessary inputs such as improved fish seedlings stock, filtration which in this case can be achieved through mechanized sedimentation cum re-circulatory system or otherwise massive flush by huge voluminous water contents of the wild, feed necessary for fish growth are supplied by commercial and nutritive feed types, of which its production can be done locally as most raw materials such as maize, fish oil, groundnut cake and soya beans are cultivable in the country, while the vitamins and minerals sources can be obtained from food products, by commercial synthesis and production by related industries which may derive raw materials from agricultural products and if properly cohered can generate



employment to lots of Nigerians youth, strengthen and support research and development of some research institutes, as well as granting intellectual property on patency.

Some of the fish types that are farmable include *Tilapia* sp, *Clarias* sp, *Heterotis* sp, *Heterobranchus* sp, with methods like fish pen and floating cages employable on the various water bodies without coming inland to do fish farming or channeling water to do inland fish farming as the water availability may tend to reduce the production cost by 50 % with also concrete and earthen ponds inclusive.

### **Advantages of fish farming**

Fish contains affordable source of animal protein, lipids, vitamins and minerals to average Nigerian families (Haruna, 2006).

It is a source of good fatty oil like Omega 3- which is necessary for proper functioning of the brain, heart and immune system (Hohn, 1999).

According to Omoniyi *et al.*, (2012) fish production can earn foreign exchange to the country, create employment, allow optimal utilization of natural water resources, it is involve in recycling of organic waste of livestock, it is employed to produce new species and strengthening stocks of existing fish in natural and man-made systems, it is used in the production of fish oil, fish flour gelatin and while fish farming brings about fertilization of water bodies and maintenance of water quality.

### **Crocodile Farming**

This can be done on an intensive level with the great economic benefits because crocodile farming supports many industries. Its establishment and expansion can contribute to the production of animal feed and employment of labour, it can also bring many farmers together into cooperative societies to loan facilities, to improving their farm for optimal usage of the environment leading to huge production. Crocodile farming has been practiced in America, Australia, Indonesia, Zimbabwe. Crocodile farming is done under darkened condition at temperature of 34°C (Robmayer, 1998).

In the early 1970s, crocodile farming started in some countries when the demand of the skin is on the increase while the harvest from the wild cannot satisfy such demand (Charlie *et al.* 2000). However, *Crocodila* sp have been listed as endangered wild fauna according to CITES (2013). As at 1970s and 1980s, the numbers of crocodilian farms have increased greatly, while between

4,000 and 5,000 crocodilian farm now existed worldwide (Luxmoore, 1992) which could have been on the increase as at present, about 2,000 of crocodile farms existed in Nigeria. However, this must be accepted with caution as no data bank can justify this, because production optimization is doubtful since this is done informally and illegal to mainly produce skin which is sold through black market (farming plan, 2022), this could have made the impossibility for regulatory and conservative agencies in the country to do unbiased assessment of the market status of the products, an easy way to improving the crocodile production including having data base of the producers, with the government coming up with policies to rescue the production and make the venture a viable and legal type

It is reported that most crocodile farms operate on a closed cycle of captive breeding, while some may be ranching involving collection of wild eggs and juveniles and raising such in controlled conditions. These outlets have produced between 40-45% of crocodilian skin of *Crocodila niloticus*, *Crocodila porosus*, *Caiman latirostris*, *C. yacare*, and *Alligator mississippiensis* (Furstenburg, 2008). The ranching methods have played significant roles and becoming incentive-driven program operating in many countries according to Joanen *et al.*, (1997), Lutz, (2022). The Countries that are involved in Crocodilian farming are USA, China, Nicaragua, Columbia, Brazil, Venezuela, Argentina, Bolivia, Paraguay, Cuba, Australia, Zimbabwe, Kenya, Namibia, Madagascar, Tanzania, Mozambique, Botswana, Malawi, Zambia, Ethiopia, Swaziland, Egypt, Manutius, South Africa, Tunisia, Senegal, Singapore, Phillipines, Malaysia and Thailand. While crocodile farming started since 1963 in Zimbabwe under captive breeding, slaughtered and exported to other countries, In South Africa, Africa crocodile farming started in the late 1960s and had risen to 40 farms by twentieth century and 80 by 21<sup>st</sup> century (Louw, 2022), with a single South African crocodilian farm harvesting 20,000 individual crocodile per year with its meat exported to Europe and far East and sold at restaurant or used as unprocessed crocodile feed (Hoffman, 2000)

#### **Products obtainable from crocodile farming**

1. Crocodile have been the source of quality skin, meat, oil and claws (Stickney 2000), with the skin useful in the production of high quality fashion-accessories
2. Pelleted feed used for crocodile has ruminants blood as constituents, situation that have assisted in the conversion of waste to wealth
3. The farm sites of the wild caught alligators or crocodiles under

captivity have been tourist attraction centres (Stickney, 2000).

4. Crocodile meat is exported by countries like Zimbabwe and South Africa for consumption (Hoffman 2000), while alligator meat has been on demand, for high price in China as a result of its mystic medical value of been anti-cancer, but yet to be proved scientifically (Khan *et al* 2019). 400 tons of crocodile meat have been in circulation since 1990 with China and Hong Kong being main importer of crocodile meat
5. Crocodilian skin has been used in the production of brief case, belt, shoes, purse and so on.
6. The meat is of high medicinal by its contents of unsaturated fatty acid and low sodium contents, thus accepted as unique delicacy for tourist (Hoffman *et al* 2000), as the low sodium contents is a good diet in the prevention of hypertension
7. Blood, bones, fats, teeth, head, skull have been used in pharmaceuticals, traditional ailments treatment
8. It has generated high employment as the hatchlings of crocodiles are also supplied for farm purposes in large numbers, such instance is the supply of 268,000 hatchlings of Nile crocodile from Mozambique to Zimbabwe and South Africa and about 1.2 million of skin that entered international circulation which peaked to 1.8m in 2006 (Cadwell, 2010).

### **Algae**

Several times, leaders of the world have come together under various cooperation such as United Nation General Assembly, United nation Security Council, African Union, Economic Community of West African States, or other affiliations based on peculiar relationships, economic and bilateral gains, topmost on the agenda of discussion often times are the effect of climate change, global warming and renewable energy contents amongst other things. This is an indication of importance of the ecosystem to humanity, A major contribution to climate change is hinged on major dependence on fossil fuel by most countries of the world, however, most advanced countries are at the verge of abandoning its dependence on fossil fuel to a larger extent and make use of alternative sources of renewable fuels, which may be seen as non-importance to developing countries like Nigeria as it depend solely on fossils fuel to earn foreign exchange, however series of algae have been sources of food, feed and

pollutant transformer in water or air to usable materials which has led to commitments of huge resources in terms of research and development on use of algae by the advanced countries, however energy availability for industrial growth stands as advantage of its usage

Algae have been seen as alternative feed stock for biodiesel because of its capacity to produce oil under stresses, with the use of its waste product as nutrients (Sheehan *et al.*, 1998), it also has the competence of significant economic potential. Algae use as raw materials for bio-fuel has brought about technological advancement to produce sustainable and diversified algae products. Algae are large and diverse group of organisms, they are autotrophic, capable of producing catalytic lipids, protein. Algae may look plant like, but are of lower status, thus are called Thallophyta, the bodies are not differentiated into stem, root and leaves, however they photosynthesized. Algae have raised our awareness of its use for water treatment though it is with its own itches as in the case of eutrophication, a situation caused by certain inorganic substances such as ammonia, nitrate, phosphate which may get to the water environment by indiscriminate disposal leading to excessive growth of algae, creating navigational challenges, also producing obnoxious smell and toxic metabolites causing poor fish spawning, bad water quality leading to fish kill. However biotechnology has improved our hope and knowledge to overcome some of the inadequacies lined up in the value chain process of algae use.

### **Algae farming**

There are two forms of algae namely- microalgae which consist of microscopic phytoplankton, that grow rapidly at the availability of required nutrients and Macro algae which forms a multilayer perennial vegetation covering all available photons, they grow on rocky substances, the productivity is ten times higher than that of plankton (Carlsson and Bowles, 2007). About 200 species are used globally with 10 species being intensively cultivated (Luning and Pang 2003). Some of those cultivated include *Alaria*, *Corallina*, *Cytoseria*, *Ecklonia*, *Egria*, *Euchemia*, *Laminaria*, *Sargassum* (Carlsson and Bowles, 2007). Over 8,000 species of microalgae existed, which are group under blue-green algae, red algae, green-algae and all other types, while each other types contain hundreds of species with each species also having thousand genetically distinct strains

### **Commercial value of algae**

- Algae have been used in the production of seasoning, with food industries generating up to five billion dollar a year and 600 million

dollar from oil related industries, as annual sales of products of macroalgae such as *Carrageenan*, being 240 million dollar and alginate 213million dollars (Mc Horgh, 2003).

- The production of algae related products and the work market value of micro-algae had been estimated at 5-6.5billion dollar covering factories such as health, food, chemical and agriculture (Pulz and Gross 2004)
- Dried seaweed which is a product from algae are used as food product in salads, seasoning
- Hydrocolloids production have been possible from cell wall of macro-algae
- Agar, as a source of algae is a clan of vegetable jam derived from seaweeds, which is indigestible by most bacteria(Subba Rao *et al.*, 2018) thus used in growing microorganism in laboratory contributing to knowledge in micobiological application
- Agar is used as emulsifier, gelling agent, preserving agent, laxatives and form materials used in demisting
- Agarose which is derived from agar is employed in genetic engineering application
- Some speices, such as *Carragenan* and alginates are macroalgae derivatives used as gum, emulsifier and gel.
- Macro-algae and micro algae has also been used in the production of methane (Carlsson *et al.*,2007), and have been employed in production of energy by fermentation
- Algae has been useful commercially in the production of raw-material for co-firing to produce electricity, ligind fuel production via Pyrolysis and thermochemical liquefaction, it has been employed in the production of bio diesel (Gallaghar 2011) about 3,000 strains of algae have been collected in USA for such project Carlsson and Bowle (2007)
- Algae have been used in production of cosmetics, skin products, vitamins and fertilizer
- Algae have been used to remove, transform pollutant including excess heavy metal, nutrients and xenobiotics from waste water or Carbondioxide from exhaust (Munoz and Guieysse, 2006)

- Algae have been involved in sewage treatment (Noue *et al.*, 1992)
- Algae are useful in oxidation processes for waste radiation
- Useful in sedimentation, disinfection, removal of heavy metal and organic toxins
- Save cost of energy needed to produce oxygen in sewage pond
- Algae product known as *B*-Carotene is used as food coloring, providing yellow color to margarine, also as additive to enhance color of the flesh of fish and fertility of cattle (Borowitzka and Borowitzka (1990)
- Some algae products have been noted to be of paramount health issues to prevent cancer and controlling of cholesterol and reducing risk of heart disease. (Nishino *et al.*, 2008),
- Phycobiliproteins as algae derivatives have been used as fluorescent markers for genetic screening of cell analysis and immunocytochemistry (Pulz and Gross, 2004)
- Many microalgae have been reported to have high nutritional values e.g. *Spiroliina* sp, and has been used as feed for animals (FAO, 2010) while *Chlorella*, *Dunaliella*, *Nostoc* as feed nutrition supplement
- They are used as raw materials for extraction of antioxidant from freshwater algae as in the case of *Haematococcus pluvialis* (FAO, 2010)
- Algae is a source of products used in long-life therapeutic treatment to reduce cholesterol, fat levels, in the blood and cleaning of blood vessels (Patil *et al.*, 2018) and treatment and prevention of heart disease and coronary diseases
- Fucoxanthin which has as a major constituents of sea weeds and *Odontella auita* (marine diatom) possess antioxidant properties which is vital to human health (Song Xia *et al.*, 2013)
- Algae such as *Porphyridium cruetum* have been able to produce a derivative such as Carrageenan which are polysaccharide often used as viscosifiers a thickening agent, flocculating agents and lubricants, with the market value running to hundreds of millions of dollars- Fuentes *et al.*, (1999)
- Algae products of *Dunaliella salina* have been used as Osmoregulators

### **Crustacean Farming (Crayfish, Shrimp, Lobster, Prawn)**

They are arthropods and essentially aquatic, they have hard shell and several pairs of legs there are about 45,000 species existing (Segun, 1989), they contribute to the best cuisines all over the world. They are highly tasty, leaving a savoury experience when consumed. It has a high nutritional value. Nigeria has potential to optimally produce huge tonnage of some of the crustaceans if not all as a result of the coast line length of 853km (Croitoru *et al.*, 2020), while there is a long stretch of unutilized beach at the Niger delta area which could be optimally turned productive without tampering with the mangrove resources. The Niger delta is the second largest in the world spanning a coast line of about 450km and remains a wetland with robust capacity to guarantee aquaculture potentials and production of Nigeria, as the coast line is a source of living to 30 million people, (Anwan *et al.*, 2016). Looking beyond the sales of crude oil, there is need to diversify the country's natural and economic status to boost the production of aquaculture and its allies for local consumption as food products, with potentials for earning foreign exchange, and also providing raw materials for industrial revolution, creating employment for teeming Nigerians in the situation where same has become a national epidemics as well as earning of foreign exchange

The government needs to stabilize the political will to declare a state of emergency in the aquaculture sector considering the fact that huge foreign exchange is prodigally spent to import fish and its related products such as fish concentrates, oil, vitamins, and medications for aquatic and veterinary use as well as for human needs

There seems to be scarcity of production information on aquaculture of crustaceans in Nigeria by farmers either, only wild crustaceans are harvested along the coastline of Nigeria covering states like Bayelsa, Delta, Rivers, Akwa-Ibom, Cross rivers, as well as lagoon of Lagos, Epe, Lekki and Badagry

**Shrimp Farming** – The shrimp farming constitute a significant proportion of the aquaculture industries (Zabbey *et al.*, 2010), Shrimps industry represent a huge global sea food industry, It is among the leading priced and worthy food item worldwide (Zabbey, 2007), the modern shrimp farming started in the early 70's with 26,000 MT to over 100,000 MT in the 1980s and 700,000 by 1995 (Rosenberry, 1995). Farming is done in ponds, raceways and tanks. ISAN(2000), which got increasingly developed in the United States of America, Japan, western Europe, (Zabbey *et al.*, 2010). Over fifty countries have invested in the shrimp culture, as about four million tonnes amounting 18 billion US

dollar are produced annually with half of the global production traded on international basis from developing countries of the tropics (CII)..Vietnam has produced 922,000 tonnes from 737,000 hectares of shrimps pond worth over 4 billion US dollar (The fish site,2022) However, the United States trade representative (2005) have reported increase in global market of shrimp and prawn by 3% annually due to increase in consumption in US, Europe and Japan, however Nigeria is part of the tropical countries endowed with rich shrimp resources (Zabbey *et al.*, 2010),

Shrimp farming has been seen as the potentially most important foreign exchange earner in the agriculture, fisheries and forestry sectors in some countries of Asia and the Pacific (FAO, 1994) Nigeria has been involved in the shrimp business through wild –caught shrimps however, is yet to be fully integrated into the lucrative international trade. Presently there is dearth of commercial shrimp farms and no sustained blue print and institutional frame work for its development in Nigeria, though it is found in abundance at the mouths of Badagry, Lagos and Lekki lagoon (Zabbey *et al.*, 2010). Four shrimps industries existed in West Africa at estuary of river Gambia, Senegal, Cote di'vore and Guinea (OECD,2006). A consultant to the United States Agency for International Development (USAID) on agricultural development assistance in Nigeria, has reported employment from shrimp farming alone can be increased from 3,306 to 84,000 within 10 years and that Nigeria's share of the world shrimp market could be increased from \$56 million to \$384 million within the same time frame been a maritime country.

Co-operate organization such as Shell Petroleum Development Company, also a Sri-lanka consortium known as Sulalanka according to Business Day newspaper (2004) and Sogbesan *et al.*, (2004) respectively and indigenous fisheries professionals, as reported by This day newspaper, (2008) have all invested into shrimps farming in Nigeria, however limitations such as human right abuses, poor economic status of coastal communities inhabitants and probable environmental damages were not accommodated as prospective challenges (Zabbey *et al.*, 2010).

Investigators such as Ezenwa, (1991; Ezenwa *et al.*; (1992,) Dublin and Tobor, (1992; Hart *et al.*; (2003) have conducted researches into shrimp farming in Nigeria and recommended the propagation of shrimp stems to complement the production from capture fisheries, in order to meet the insufficiency from the wild and the ever-increasing demand and to prevent over exploitation and extinction of some wild species if water resources of Nigeria must be secured to be used optimally for shrimps harvest as the worth of shrimps exported from



Nigeria in 2000 was estimated at 46,495 US dollar (N5.58billion), while 43.35% of revenue generated on fish production was from shrimp and license to shrimp (FDF, 2003), though, there was a quick and sharp drop from natural and wild harvest leading to near collapse of the sub sector of fishery due to inability of trawlers to achieve the harvest target, however this short fall may not have been experienced if energy is dissipated in the area of artificial culturing to complement wild harvest.

### **Probable environmental challenges and remedies**

These range from oil spillage, chemical toxicity, wreckage and flood amongst others, however these could occur naturally or through man-made activities. No country in the world is totally devoid of environmental hazards it is only the magnitude and the response to solve the challenges that differs, Nigeria as a country has different agencies responsible for solving the challenges within various water bodies. These bodies include (a) Nigerian Maritime Administration and Safety Agency (NIMASA) whose responsibilities are regulations related to Nigerian shipping, coastal water, inspection, search and rescue operations, (b) National Environmental Standards and Regulations Enforcements Agency (NESREA) which replaced Federal Environmental Protection Agency (FEPA), whose responsibilities are for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources and environmental technology, (c) Nigerian Meteorological Agencies (NIMET), responsible for science prediction, forecast of weather for the safe operations of aircraft, ocean going vessels, it also collate, collect, process and disseminate all meteorological data information within and outside the country it observes and analysis the timely and accurate report of weather and climatic information for development and safety of lives and properties. It is worthy to say that proper systems are put in place to guide and guard optimal utilization of various water bodies within the country. What is necessary to be done is extensive collaboration among these relevant agencies and release of predictions earlier for water availability, which may help the optimal usage of coastal and river bank and upland for aquaculture during the season of the year with less flood disaster for extensive and massive production of aquatic food to cater for short falls at the period of high water flow

Insecurity of lives and properties, as well as militancy among the citizens could have contributed to drop in the productivity of the water bodies as often times may sometimes include fear of the unknown about kidnapping and loss of lives may prevent aquaculture farmers from embarking on wild capture of shrimps and peradventures if coastal farms are built, could also hinged productivity

### Discussion and Conclusion

Aquaculture development globally is on the increase while developing Country like Nigeria with increased awareness, is very gradual, as the country's production of both cultured and artisanal fishery still fall below the consumption level due to lots of factors which include somersaults of government policies, lack of political will, corruption, lack of equity, loss of the middle class, non- acquisition of good breeding stocks, in-proper fish culture management, lack of use of good, non-contaminated, nutritive feed, most importantly, poor management of parasites and pathogens which impaired the health status and ultimately infringed on the overall productivity of fishery products, this consequently reduces the impact the consumption of fish products would have had in solving problems of protein malnutrition.

The production and further enhancement of aquaculture will improved the socio –economic status of the citizens by generating additional income to be used for employment for unemployed, Going by the index measurement of food sufficiency and abundance, it is clearly known that hunger and food insufficiency is ravaging in Nigeria depicted by the protest of youth against the brutality of Nigerian Police which dove-tailed into looting of food items in storage of most states of Nigeria. However this is to be accepted with caution as countries with similar demonstration do not experience such loot and arson but the fact may still be that hunger ravages in Nigeria.

Nigeria as a country must have to experience a regime of national re-birth and re-shaping of mental magnitude of its citizens and re- orientation of the citizens against the total dependence of white collar jobs. Government at the three tiers level, should encourage pandemic or infectious agriculture and aquaculture practice as a results of the agrarian nature of the country, so that the unemployed class becomes militant towards food production and self-sufficiency rather than partaking in public disturbance, kidnapping, bunkering, oil pipe vandalisation, drug crimes and cybercrime. This if supported with sustainable policies may soon bring socio- economic transmutation to the economy of the country within the shortest possible time, with hunger disappearing faster

In the investigation of Nosiru *et al.* (2008) on catfish production in Ijebu ode, (70%) of the fish farmers were youths within age bracket of 30-49 years, which means the country has high hope and potential by this outcome, and if the youth are optimally involved in aquaculture practice it may give insight for a brighter future in fish production.

However expectation is feasible for improved production of other related cultivable fish species such as *Tilapia* sp, *Heterobranchus* sp, and other aquatic products such as algae, crustaceans, and crocodile. Presently, Morocco can export ready to eat canned fish for over sixty years; however Nigeria potentials could have been hampered by series of challenges such as poor rural and urban road network which has contributed to inefficient movement of aquaculture products within the country. Electricity which is regarded as vehicular input to industrialization had been very scarce as its supply to farms and industrial estates, its quality and stability fast disappearing causing some blueship companies to relocate to nearby countries that receive electricity from Nigeria electricity generation and distribution facilities despite the country's sixty years of independence, and its privatization policies of basic infrastructures, other factors militating against aquatic food sufficiency in Nigeria include the lack of genuine access to credit facilities to improve the production status, rather this seems available to fewer individual as nepotism, favoritism, political influence, inaccessible and extreme conditionality are factors in operative

How often Nigerians access the use of biotechnology in all spheres of life, is an area that needs to be explored. (Ene-Obong, 2007) opined the use of biotechnology to cause accelerated improvement and increase in production using updated knowledge of living organisms including the genetic code. Some of the techniques included genetic engineering, genetic modification and animal transformation. The use of biotechnology in food security and environmental sustainability has been captured in United Nations General Assembly in 2005 where biotechnology as a tool was agreed in strong terms as a concerted efforts among scientist, engineers and medical experts to identify and successfully strategized to implement effective progress, in the reduction of poverty and enhancement of millennium development goals. While this was agreed upon by 336 Heads of States and Government worldwide to bring down global poverty, hunger amongst other things, it is surprising why Nigeria has not been able to overcome the problem of food security, as it lags behind and yet to key into the biotechnology procedures optimally to improve aquaculture production like China, Canada, USA to improve aquaculture production rather. Nigeria is still ravaging in hunger, despite evidence that biotechnology can be employed to overcome the cryptic and known challenges to produce a fast growing and genetically modified stock that are of disease resistant, of quality flesh, and a high feed conversion efficiency

However, as vital as biotechnology procedures are, they cannot go without its restrictions which are the ethical concerns and fear of contaminants. The onus

lies on the biotechnology and food regulatory agencies to work closely such that the adopted and approved items are consumed but without allergic reactions. This, according to (Ene-obong, 2007) occur especially in animal husbandry, however some of the insinuation by the citizens may be myths and misconceptions

By the projection of Nigeria population and in line with sustainable development goals to reduce hunger, sustainable and systematic aquaculture production can be achieved by massive, industrialized, and purposeful practice supported by biotechnology seen as catalyst to support the conventional production which brings desired results

### **Recommendations**

Based on the above and in the bid to improve Nigeria's aquatic food sufficiency status to improve the quality of protein needs and employments generation, here are some recommendations to support agenda of the sustainable development goals

- (1) The Naval aspect of Military, the Marine Police and Marine Customs must be involved to protect the water bodies of the country to prevent pollution and overfishing. fishery unit should be created from the existing Veterinary Department to produce aquatic food both on our water ways and inland, thus becoming critical stakeholders in aquaculture production
- (2) Aquaculturists should be encouraged to organize themselves into large co-operative societies that will be able to access funds to improve fishery and other related production. However monitoring systems should be put in place to see that genuine farmers get the loan grants but do not divert same to other uses
- (3) Fisheries and other related products in excess of domestic consumption should be purchased from farmers by the relevant government agencies and deposited for storage to prevent wastage and glut but see how to process the harvested produce and converted to other fish related products such as fish meal, fish oil, fish confectionary amongst others. This should be done with extensive and enviable marketing to give appreciable price to the products and make fisheries lucrative
- (4) Processing industries should be located very close to the sources of the raw materials as complimentary roles to sustainable aquaculture production thus giving job opportunities to citizens and production of variants and diverse food components

- (5) Highly improved fish seedlings with fast growing properties, low feed conversion ratio and diseases resistance should be supplied to farmers which is achievable through adequate funding for research and development at various institutes in the area of aquaculture
- (6) Basic needs of life are imperative and be given to farmers most especially in the rural areas to reduce rural- urban drift, to develop the rural areas with consumerate mortgage and vehicles on credit facilities to be paid back over years as obtainable in mortgage acts with simple and digit interest. This is to make aquaculture interesting and fascinating to teeming youths
- (7) There is need to strengthen and invest in the mechanized planting of other agriculture needs sector, such as those that will provide raw materials to the sustainability of the aquaculture such include grains ,oil as well as machinery and equipment needed for technology transfer from developed countries
- (8) Proper information flows as it affects water security need to be improved and strengthened to ensure continuous good water quality management, attracting investments in infrastructure of water and sanitation

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