An Empirical Assessment of the Relationship between Agricultural Sector Productivity and Economic Growth in Nigeria, 1986-2021

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Abstract
The study examines the relationship between agricultural productivity and economic growth in Nigeria using 1986-2021 data derived from Central Bank of Nigeria statistical bulletin. Key variables in underscoring agricultural productivity include labour and capital productivity as well as interest rate which were the explanatory variables. The data were analyzed using co integration and error correction model. The study finds a long run relationship between agriculture productivity and economic growth in Nigeria. In the long run, agriculture productivity exerted significant negative impact on growth as against capital productivity whose impact is significantly positive. However in the short run, the impact of agriculture value added and labour productivity on economic growth in Nigeria is positive whilst capital productivity is negative. Thus, it is recommended that government should consider a broad-based reform in the agriculture sector that will involve provision of farm inputs like tractors and fertilizer including granting of interest free loans to farmers in order to boost output. Also, government should consider increase in capital investment with a view to addressing severe infrastructural deficits like poor road networks and power supply in the country.

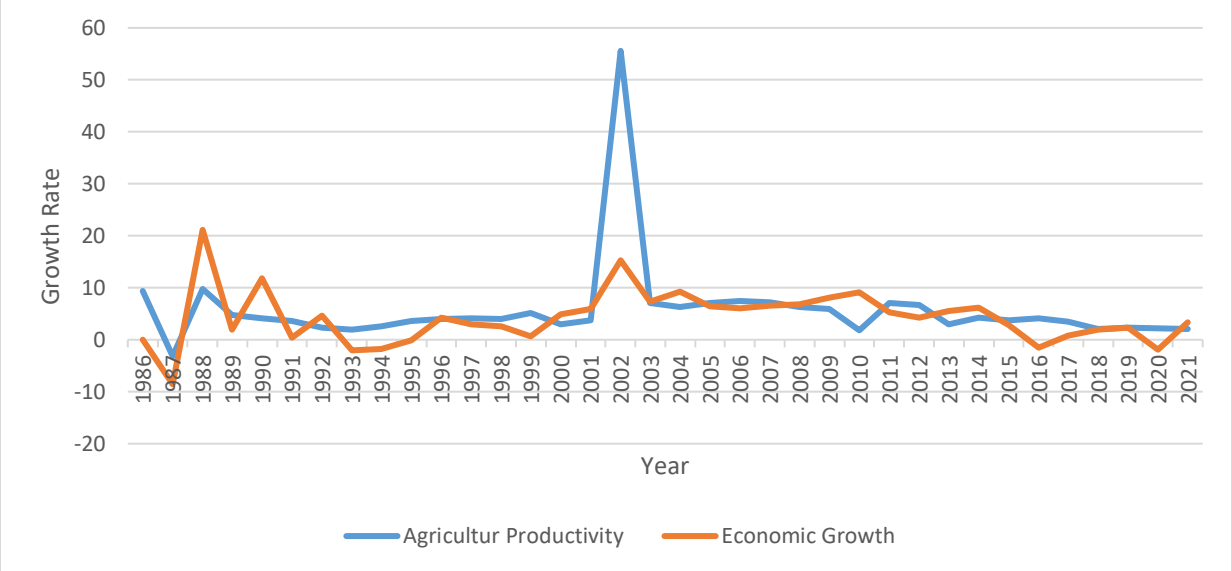
Keywords: Economic Growth, Agricultural Productivity, ECM, Nigeria
JEL CLASSIFICATION: O41, Q11, C13.

1. INTRODUCTION
Poor agricultural yields due to low level of mechanized agricultural methods is a major challenge in Africa especially in Nigeria. Over 60% of the Nigerian labour force is employed by the agriculture sector but the sector has failed to achieve food sufficiency as well as unable to contribute substantially to the GDP and export earnings even though it has been argued in the literature that the agriculture sector plays a leading role in the growth of any economy (Emam, 2021). The agriculture sector in most developing countries most especially Sub-Sahara Africa (SSA) is finding it increasingly difficult to produce sufficient food that can feed the teeming population due largely to high cost of farm implements occasioned by rising inflation, fewer arable land, lack of farmers access to credit as well as rural-urban migration among other factors (Osabohien, Adeleye & De-Alwis, 2020). According to Osabohien, Akinpelumi, Matthew, Okafor, Iku, Olawande and Okorie (2019), the growth of the agriculture sector is further constrained by low prices of agriculture products, unfavourable balance of payments occasioned by disparities in terms of trade caused by export price volatility. The authors augured that the revenue generated from agricultural productivity in Nigeria has been unusually low leading to decline in further productivity and the result is that country has no choice than to rely on food

importation. This, according to Lyndon, Topman and Adaka (2021) has dire consequences for the overall wellbeing of emerging economies including Nigeria with the result that exports from agriculture has not performed very well in promoting economic growth in Nigeria. Thus, broad based growth arising from agricultural income has tended to affect the Nigeria economy in that agriculture accounts for a large portion of overall employment. This is coupled with the fact that over 70% of the poor and food insecure live in rural areas who majorly depend on agriculture for their livelihoods (Kenny, 2019; Osuagwu, 2020).

Although, Nigeria is endowed with substantial natural and human resources, the performance of agricultural sector has been less than satisfactory which has recorded low productivity that has been basically stagnant. In most rural areas in Nigeria, it is difficult if not impossible to create employment opportunities that will reduce income disparities with a view to reducing poverty to achieve one of the key Goals of Sustainable Development Goals (SDGs) (Adesoye et al, 2018; Akpan et al, 2021). Observably, the performance of the agriculture sector has been less than satisfactory even though the rural areas rely heavily on it (Gbaiye, Ogundipe, Osabuohien, Olugbire, Adeniran, Bolaji-Olatunji, Awodele & Aduraola, 2013). For instance, available statistics from CBN (2021) showed that in 1986, the value of agricultural productivity stood at ₦2986.8 billion representing 9.4% increase over the preceding year which declined to 3.9% in 1996. Although, there was an improved performance in 2002 with a growth rate of 55.6%, it later declined to 7.4% in 2006. In 2016, agriculture sector witnessed further decline by recording 4.1% growth and continued thereafter reaching all-time low of 2.1% in 2021 (CBN, 2021). The continued decline in the performance of the sector may not be unconnected with the fact that the country entered a recession in 2016 (Osabohien *et al*, 2020). The Nigerian economy was yet to fully recover from the recession which it exited in 2018 before the advent of the deadly covid-19 pandemic that almost crippled the global economy for which Nigeria was not an exception (Ohwofasa & Magini, 2021).

Fig 1: Trend of GDP and Agriculture Productivity in Nigeria



Source: CBN (2021) Statistical Bulletin

The fact that the agricultural sector which is a major non-oil sector had a fluctuating performance in the period under review no doubt affected the performance of the economy (Ogebe, Ali & Olagunju, 2020). Thus in 1986, real GDP stood at ₦17007.7 billion or a growth rate of 0.1% over the preceding period but further declined to ₦15552.1 billion representing -8.6% negative growth in 1987. In 1996 the economy recorded positive growth of 4.2% that continued on a positive trajectory of 6.1% in 2006 (CBN, 2021). The fluctuations in the price of crude oil at the international market in 2015 weakened the Nigerian economy such that the country's growth rate had become embarrassing recording -1.6% in 2016. The outbreak of the corona virus disease in December, 2019 exacerbated the deterioration in the growth of the economy which stood at -1.9% in 2020 but recorded marginal increase in 2021 with the growth rate oscillating to 3.4% (CBN, 2021). According to available statistics, at independence in 1960 agriculture was the backbone of Nigeria's economy such that between 1960 and 1969, the sector accounts for an average of 57.0% of GDP and also generated 64.5% of export earnings (Pwc, 2019). However, the sector's contribution to GDP witnessed steady decline between 1970 and late 2000s occasioned by the country shift to petroleum exploration. Observably, between, 2015-2019, the agricultural sector contributions to GDP averaged 23.5%. This explains why the sector which was hitherto the major employer of labour at independence is today left for the sick and the elderly (Pwc, 2019). For instance, unemployment rate which stood at 11.9% in 2005 declined to 10.4% in 2015 but rose to 18.8% in 2018 and over 25% in 2021.

Accordingly, a number of development indicators in the rural areas performed poorly when compared to those for urban areas. For instance, there is high infant mortality rate, lower incomes even as life expectancy are shorter coupled with widespread illiteracy rate. Likewise, a large proportion of the population does not have access to clean and drinkable water as well as improved sanitation services (Ogebe *et al*, 2020). Essentially, the role of agricultural sector is critical to poverty reduction as it contributes over 45% of GDP and employs about 60% of the working population (Akpan, Udoka & Patrick, 2021). Although, the sector may have contributed significantly to the growth of the Nigerian economy in the past, its actual contribution appears to have fallen short of expectations since the sector currently records the highest poverty incidence, all of which have deleterious impact on growth. As should be expected, a number of SSA countries including Nigeria now face the risk of external debt crises which is aggravated by the advent of Covid-19 pandemic. This resulted in a serious transformation deficit for Nigeria ranging from agriculture to manufacturing and trade thereby leading to low level of investment. In the United States for instance, agriculture and its affiliated industries such as food sales contributed over $1.05 trillion to GDP, amounting to about 6% of the overall US economy (Akpan *et al*, 2021). In Nigeria, export basket has remained largely undiversified and continues to be dominated by crude oil and gas-related products with agricultural output taking the back sit.

A number of empirical studies in the literature have documented mix findings on the relationship between economic growth and agriculture productivity. The studies that reported positive findings include Ismail and Kabuga (2016), Oguwuike (2018), Adesoye, Adelowokan, Maku and Salau (2018), Osabohien *et al* (2019), Akpan *et al* (2021) and Lyndon *et al* (2021). On the other hand, there were studies that have documented negative relationship and they include Ezeonwuka

(2014), Ewetan, Fakile, Urhie and Oduntan (2017) and Kenny (2019). It was observed from the literature that most of the empirical studies employed explanatory variables which in addition to agricultural output include inflation, manufacturing output, petroleum product output and exchange rate among others. Whereas, labour and capital which constitute significant inputs in agricultural productivity are missing in many of these studies, this has constituted a lacuna which this study seek to fill.

Hence, this paper assessed the impact of agricultural productivity on economic growth in Nigeria for the period of thirty six years, 1986-2021 using labour productivity, capital productivity, interest rate and value added as the proxies of agricultural productivity. The rest of the paper is organized as follows: Whilst section two presents a brief review of relevant literature, section three contains the methodology. In section four, the result and findings is discussed while conclusion and recommendations were presented in section five.

2.0 LITERATURE REVIEW

This section reviews relevant literature on agricultural sector productivity and economic growth with a view to identify gaps which the paper aimed to fill. The section begins with conceptual review followed by theoretical and empirical issues.

2.1 Concept of Agricultural Productivity

The concept of agricultural productivity refers to the ratio of agricultural outputs to inputs as against individual products which are usually measured by weight and is simply referred to as crop yield (Ogebe *et al*, 2020). The measurement of overall agricultural output can sometime be difficult as a result of varying products. Also, agricultural productivity can be defined as a measure of efficiency in an agricultural production system which employs land, labour, capital and other related resources (Olufemi, 2019). Agricultural productivity is influenced by a host of factors which include population pressure on agriculture, the role of non-farm services, rural environment, and pattern of land tenure as well as size of land holdings. Agricultural productivity will involve massive transformation of the sector for increase productivity through changes in a country's farming practices. It engenders the overhauling of a country's rural economy (Osabohien *et al*, 2019). For instance, land ownership or tenure may be reformed to enable an all-inclusive agricultural transformation as a way of influencing farmers' investment and productivity.

2.2 Concept of Economic Growth

Economic growth encompasses a process that permits increases over time in a nation's wealth. Although, the term is often used in discussions of short-term economic performance, in the context of economic theory it generally refers to an increase in wealth over an extended period. In the 1950s, Solow (1956) and Swan (1956) were the brain behind the emergence of the main model used in growth economics which assumes diminishing returns to labour and capital. The Solow–Swan model also referred to as exogenous growth model is an economic model that tries to explain long-run economic growth by looking at growth rate of the population, capital accumulation as well as technological progress which largely account for increases in productivity. Economic growth therefore is the increase in the value of goods and services

produced by the economy thereby creating more profit for businesses prompting a rise in stock prices. In the process, firms have more capital for investment purposes, more jobs are created and more employees are hired leading to a rise in incomes (Osabohien *et al*, 2020). The job opportunities created lead to stronger demand for labour which is a very critical condition for increasing employment necessary in delivering higher growth. Basically, there are four main factors of economic growth which include land, labour, capital, and enterprise. Economic growth can also be viewed from the perspective of economic transformation which connotes a move away from low-productivity to high-productivity growth (Oguwuike, 2018). A policy aimed at promoting economic transformation amidst shocks is one strategy for developing economies to build resilience to further shocks. For resource dependent economies, this is mostly noticeable in that they are more exposed to shocks. Several of the developing economies struggle to survive the fallout occasioned by a number of economic shocks most especially the continue fall of the commodity prices. According to Oxford Advanced Learner's Dictionary, transformation is a total change in the structure of something especially for the better. To achieve this, a total revolution is inevitable thereby resulting in a better results.

Likewise, economic growth can also be referred to as a sustained increase in per capita income. This increase in income may emanate from very few sectors of the economy like crude oil as in the case of Nigeria. As for economic development, it involves economic growth plus qualitative changes in all or majority of sectors in the economy (Ezeonwuka, 2014). In the latter case, there should be advances in economic goods, institutions, incentives, wants, productivity and knowledge. There can be economic growth without economic development as absence or near absence of technological and structural changes may permit the presence of inequalities, poverty and unemployment. On the other hand, there can be no economic development without economic growth as is the case in western economies. Thus, an economy may grow, develop, retard, shrink or fail (Ezeonwuka, 2014).

2.3 Theoretical Issue

2.3.1 Input-Output Theory

The idea of this theory is the examination of relationship between input and output used by firms and industry. The input-output theory explains the interrelationship existing between industries within the economy where input in one industry serves as an output in another industry and for this reason the focus of the theory is mainly on measurement of the existing relationship among the major sectors of the economy. Developed by Leontief (1980), the theory looks on how changes in one sector of the economy can trigger changes in other sectors. The input-output model evaluates the quantitative relationship that exist using the output levels within the various sectors of the economy. It is therefore a tool for planning and national accounting. According to the theory, no one sector of the economy is independent as the output generated by one industry constitutes an input for another industry within the economy. For instance, maize which is an output produced from the agriculture sector is a critical input in the manufacturing sector required for the production of starch, cornflakes and flour. In line with the input-output model therefore, the growth of an economy will be enhanced if the role interdependence played by different sectors are recognized and adequately harnessed.

2.3.2 Endogenous Growth Theory

This growth theory developed by Lucas (1988) and Romer (1990) drops two central assumptions of Solow earlier model, namely, that technological change is exogenous, and that the same technological opportunities are available in all countries. New growth models treat technology and knowledge as economic goods in an attempt to understand the determinants of long term growth based on learning-by-doing or investment in human capital and new technologies. Contrary to the standard neoclassical models, there are invention costs in the creation of new technology, and there are adoption costs associated in particular with creating the human capital required to use a new technology. Adoption costs have a direct component in the form of investment outlays for schooling and on-the-job training, among others, as well as an indirect components in the form of foregone output.

The new growth models differ as to what mechanism is employed to indigenize the impact of technical progress on growth. The mechanisms in early models (Lucas, 1988; Romer, 1990) are dynamic externalities at the aggregate level, i.e. technology is endogenously provided as a side-effect of private investment decisions. Romer (1990) assumes that the stock of knowledge of a firm increases in proportion to the firm's expenditure on research and development, while spillovers from these private investments increase public knowledge. In the absence of an effective patent market, the stock of knowledge is like a public good. In Romer's model, technological change is endogenized, since in his view long-term growth is driven primarily by the creation of new knowledge by forward-looking, profit-maximizing, private agents. Given the knowledge spillovers due, for example, to the inadequacy of patent protection, the production of goods from new knowledge exhibits increasing returns. Since new knowledge is produced from investment with diminishing returns, each profit-maximizing private agent who invests in knowledge creation – and hence incurs invention costs - faces an optimal upper limit to his investment.

2.3.3 Harrod-Domar Growth Model

This model was developed by Harrod and Domar in (1948) popularly known as Harrod-Domar (H-D) model which assumes that capital bears a fixed relation to output why investment has been seen as interest inelastic. The H-D model combines three growth paths encompassing the rates of growth of capacity, demand and labour force. The rate of growth of capacity also known as the "warranted rate of growth" is the rate of growth of income that ensures overtime a succession levels of investment that equals desired savings. The theory assumes that savings is proportional to income, S=sY and since investment relates capital to output, the belief is that the capital output ratio is fixed, k/y=v. This implies that the warranted rate of growth can only be attained if planned saving equals planned investment given the accelerator (v). Thus, $gw = \in Y/Y = s/v$.

On the contrary, the rate of growth of demand refers to investment demand which sometimes is affected by expectations, profits, income or sales levels, among others so that planned saving could differ from planned investment which could deviate the economy from its equilibrium growth path (Umaru & Zubairu, 2012). Finally, the rate of growth of the labour force or the natural rate measures the rate of growth over which the government has little control. This is the growth rate of labour force adjusted for technical change and is known as efficiency labour force. In the

H-D model, production requires fixed units in both the capital-output and capital-labour ratios so that the maximum possible increase in output is given by the increase in the labour force (Oguwuike, 2018). For a full equilibrium, there should be the equality of the warranted rate of growth, the actual rate of growth and the natural rate of growth (Osuagwu, 2020). The model tells us how the economy can grow such that the growth in the capacity of the economy to produce is matched by the demand for the economy's output.

2.4 Empirical Review

The literature is saddled with copious studies on the impact of agricultural productivity on economic growth and mixed findings were uncovered. Thus, Suleiman and Aminu (2010) averred that the role of agriculture in economic development in Nigeria must be given ultimate priority. They scrutinized the impact of agriculture, petroleum and manufacture outputs on economic growth in Nigeria using data for the period 1990-2008. The ordinary least square (OLS) methodology was employed. Their findings indicated that the contribution of the agricultural sector to the nation's economic growth exceeded that of petroleum and manufacturing sectors. Ascertaining the extent at which agriculture and petroleum sectors contributed to economic development in Nigeria, Umaru and Zabairu (2012)'s study using data of 1960–2010, and employing the OLS technique indicated that agriculture and petroleum sectors had significant positive impact on economic growth with the latter responding more to changes in agricultural output growth. Gbaiye *et al* (2013) assessed the role of agricultural exports on economic growth in Nigeria using a data period, 1980-2010. Employing a co-integration test and OLS regression method, the study found a long-run equilibrium relationship existing between agricultural exports and economic growth. Obansa and Maduekwe (2013) in their study used causality approach to explore the response of economic growth to changes in agriculture growth for the period, 1986-2000. The study found a bidirectional causality running from agriculture growth to economic growth.

On their part, Ismail and Kabuga (2016) employed the autoregressive distributed lag (ARDL) model to study how economic growth responded to variation in agricultural output in Nigeria. The study which covered 1986-2015 found that agricultural output is a key determinant of economic growth in Nigeria both in the short and long runs. Amire (2016) noted that agricultural activities have the potential to reduce poverty and also promote equity and social justice thereby guaranteeing sustained economic growth. His study appraised the impact of agriculture productivity on economic growth in Nigeria for the period 2000-2014. The study found that agricultural output, gross expenditure on agriculture and loans/credit to agriculture had statistical significant relationship to economic growth in Nigeria in the period reviewed. The study employs the OLS and the Pearson correlation co-efficient for the analysis. Ikenwa, Sulaimon and Kuye (2017) found that the Nigerian economy can be lunched into the world economy from its current backwater state by transforming the agriculture sector into an agribusiness model. The study which used data on GDP, agriculture, manufacturing, oil and gas as well as service sectors in Nigeria spanned the period 2005-2014. Utilizing the OLS and ANOVA techniques, the study found statistical significant response in GDP to changes in agricultural output growth. The study by Ewetan *et al* (2017) assessed the long run effect of agricultural output on economic growth in Nigeria using a data covering the period 1981-2014. Accordingly, the study found evidence of

long run relationship between the variables and a causality running from agricultural output to economic growth. The study utilized Johansen co-integration approach, vector error correction model and granger causality test for the analysis.

In a related study, Adesoye *et al* (2018) used data covering 1981-2015 to examine the contribution of agricultural value chain on economic diversification in Nigeria. The study developed two models in which agricultural productivity was made as a function of agriculture recurrent expenditure, agricultural raw materials, agricultural machinery, agricultural land, commercial bank credit as well as interest rate. In another model economic growth was modeled as a function of agricultural productivity. The study employed the ARDL model to assess the contemporaneous dynamics among the variables. Accordingly, the study found that long run relationship existed between the dependent and the explanatory variables. Specifically, the study further found that agricultural productivity had significant positive impact on economic growth both in the long run as well as in the short run. Oguwuike (2018) assessed the relationship between agricultural output and economic growth in Nigeria for the period 1981-2016. The study made economic growth as a function of crop production, livestock, fishery and forestry on the application of co-integration test, OLS and error correction mechanism techniques. The study found evidence of long run relationship between the dependent and the explanatory variables. Also, the study found that economic growth had positive and significant response to changes in crop production and livestock thereby giving supporting claim to the findings of Ewetan *et al* (2017).

Stressing the role of agricultural productivity in promoting industrialization, Kenny (2019) found that overtime agriculture is undoubtedly the bedrock through which any economy pass through to industrialization. His study assessed the performance of agricultural sector on economic growth in Nigeria. Using vector error correction model, the study found evidence of long run relationship between agricultural productivity and economic growth. Also, it was found that agricultural productivity had significant positive impact on growth in Nigeria. Osabohien *et al* (2019) averred that export promotes growth in an economy most especially developing countries. The authors utilized the ARDL model to explore the long and short run relationships between agricultural exports and economic growth in Nigeria. In addition to agriculture exports, labour force, inflation and foreign direct investment were used as independent variables for the study. A notable finding for the study is the evidence of significant positive impact that agricultural exports exerted on growth in the period under review. It was noted by the study that exports from agricultural products should be given utmost importance.

In a recent study by Osabohien *et al* (2020), which assessed how Nigeria could use agro-financing to ensure food production so as to meet the Sustainable Development Goals (SDGs) promote sustainable agriculture, achieve food security and end hunger leading to improvement in food nutrition. The study employed data from Central Bank of Nigeria statistical bulletin and World Development Indicators for the period 1981–2018. Using Johansen and the Canonical co-integration techniques, the study found that agro-financing had significant positive impact on food production in Nigeria. The study concluded that with robust funding of the agricultural sector at relatively low-interest rates, farmers are spurred into procuring high-yield seedlings, machinery and relevant farm implements that will increase total agricultural yield thereby increasing food

production. In a similar study, Osuagwu (2020) utilized Granger causality, co-integration and vector error correction model to examine the long-run relationship existing between agricultural productivity and output of manufacturing industry in Nigeria for the period 1982-2017. The study found the presence of bidirectional causality between manufacturing output and agriculture productivity. Also, the study found that agricultural productivity had significant positive impact on the out of manufacturing industry in Nigeria both in the short- and long-run periods. Ogebe *et al* (2020) attempted to ascertain the relationship existing between agricultural productivity and economic growth in Nigeria using data covering 1979-2019. The ARDL model was employed to scrutinize the short and long run relationships between economic growth and agricultural productivity. The study found evidence of long run relationship between agricultural productivity and economic growth in Nigeria. Specifically, the study further found that agricultural productivity has significant positive impact on economic growth both in the long run and short run in Nigeria. The study recommended increase investment in agriculture that will benefit the poor thereby alleviating rural poverty in Nigeria.

In a more recent study, Akpan *et al* (2021) scrutinized the impact of agricultural output on growth in Nigeria covering a data span of 1981-2019. The bound test approach to co-integration was employed by the study. The findings of the study indicated that output of agricultural sub sector significantly enhances economic growth in Nigeria whether in the short run or long-run. The study harped on the need to channel more resources into agricultural production as a means of sustainable economic growth in Nigeria. In their study, Lyndon *et al* (2021) tried to determine the likely contribution of agricultural productivity on economic growth in Nigeria with data covering 2000-2018. The study utilized the OLS method and findings indicated that agricultural productivity had significant positive impact on economic growth in Nigeria during the period of the review. The study advocated for the strengthening of the linkages between agricultural sub-sector and other sectors within the Nigerian economy. In Saudi Arabia, Emam *et al* (2021) assessed the impact of agricultural products comprising honey, dates, chicken, fish, and cattle on the growth of domestic product of the agriculture sector. The Johansen co-integration test and vector error correction model was employed to analyze the relationship between the variables which spanned the period 1985-2017. The findings indicated that long-run co-integration existed between the variables. Likewise, the study found that cattle, honey, and chicken had significant positive impact on agriculture output growth in the short run.

A cursory review of the empirical literature indicates that most of the studies employed agricultural productivity as the only relevant explanatory variable and add other control variables such as inflation, manufacturing output, petroleum product output, exchange rate and foreign direct investment and among others. The relationship between agriculture and most of these variables are indirect. Whereas, labour and capital and interest rate constitute major inputs in agricultural productivity, these variables were missing in a number of these studies. Also, most of these studies failed to conduct in-depth and rigorous diagnostic tests to ascertain the reliability of their models while quite a number of them did not conduct it at all. These cast doubt on the credibility of their models. Finally, this research would be among the few studies in the area that have employed the most recent data in Nigeria extending to 2021. Thus, the current study is undertaken to close the identified gaps.

2.5 The Link between Agriculture and Economic Development Strategy

In the view of Ikenwa *et al* (2017), agricultural sector is mostly saddled with subsistence method of traditional farming, coupled with obsolete system of preservation and distribution, these notwithstanding, the sector accounts for over 70% employment in Nigeria. Accordingly, the government sees the agricultural sector as having the potential of providing stable revenue and foreign exchange as in the 1960s. The strategy of agricultural transformation agenda is intended in making agriculture work for the Nigeria populace most especially the poor rural farmers. In this regards, agriculture is not merely considered as a development programme but an income generating commercial activity (Adama & Ohwofasa, 2016). Notably, the vision in the transformation strategy is aimed at achieving a hunger-free Nigeria through an agricultural sector that is income driven, ensures achievement of food security as well as ensures that Nigeria is transformed into a leading player in global food markets posed to grow wealth for millions of people around the world. Unfortunately however, this dream has appeared a mirage as the country has not been able to feed her citizens nor does the agricultural sector generate adequate employment for the population.

In Africa in general and Nigeria in particular, the land is mostly cultivated by smallholder farmers using traditional rudimentary production techniques that can only result in low yields. As smallholder farmers, they are saddled with problems ranging from lack of modern farming implements such as tractors and irrigation equipment. Also, there is the problem associated with poor infrastructures most especially roads, little or no access to credit facility as well as land and environmental degradation (Adama & Ohwofasa, 2016). Nigeria becoming an oil economy helps in no small measure in diverting attention from the agricultural sector. The result was loss of interest in agriculture by the populace as the sector is being regarded as business for the less privileged and peasants in the rural. The result is continue decline in economic development.

3. THE MODEL

3.1 Research Hypothesis

Basically, the study tested four null hypotheses as follows:

Ho1: There is no relationship between agricultural productivity and economic growth in Nigeria.
Ho2: Labour productivity does not affect economic growth in Nigeria.
Ho3: Capital Productivity has no discernable impact on economic growth in Nigeria.
Ho4: Interest rate does not have significant effect on economic growth in Nigeria.

3.2 Theoretical Framework

The modified version of the endogenous growth model developed by Lucas (1988) and Romer (1990) was adopted for the study which considers how changes in the growth level of the economy is predicated on combination of technology and knowledge as well as human capital development. Using the Cobb-Douglas production function the endogenous growth model is specified as follows:

$$Y = AK^{\beta}L^{\alpha} \quad \text{.....(1)}$$

Where: Y = economic growth, L = employees' compensations (a proxy for labour productivity), K = capital input such as gross fixed capital formation (a proxy for capital productivity) and A =

total factor productivity while α and β refer to elasticities of production using capital and labour respectively. Cobb and Douglass (1928) stated that the level and availability of technology determined the output elasticities which normally are constant values. However, the interest in the C-D model is the inclusion of the total factor productivity (TFP) which permitted the modification of the model by excluding some variables and including other variables in the model for this study. Accordingly, A as included in the model is a key factor that influence the level of output in the economy. The A in the C-D model is disaggregated to include agriculture value added and interest rate.

3.3 Model Specification

A linear model in the context of parsimonious error correction methodology similar to Osabohien *et al* (2020), Akpan *et al* (2021) and Emam *et al* (2021) was adopted for the study. Thus, the model is specified using annual time series data from 1986-2021. All variables are measured in billions of naira with the exception of interest rate and the model specification is presented as follows using Eview 12. Accordingly, equation (2) can be transformed to long stochastic form as follows:

$$InGDP_t = \alpha_0 + \alpha_1 InLPD_t + \alpha_2 InCPD_t + \alpha_3 InAGV_t + \alpha_4 INT + \mu_t \quad \text{.....(3)}$$

Where:

GDP = gross domestic product at 2010 constant price, LPD = labour productivity, CPD = capital productivity, AGV = agricultural value added and INT = interest rate. Similarly, β_0, β_1-β_4 = constant and parameters to be estimated respectively, t refers to time trend and μ is the white noise error term. It is expected that increase in labour productivity, capital productivity as measure of agricultural productivity and agricultural value added should lead to increase in economic growth in Nigeria while an inverse relationship is expected in the case of interest rate. Accordingly, the error correction model (ECM) of equation (3) is estimated as follows:

$$\Delta InGDP_t = \sigma_0 + \sum_{i=1}^{K} \beta_1 i \Delta InGDP_{t-1} + \sum_{i-1}^{K} \beta_2 i \Delta InLPD_{t-1} + \sum_{i=1}^{K} \beta_3 i \Delta InCPD_{t-1} + \sum_{i=1}^{k} \beta_4 i \Delta InAGV_{t-1} +$$

$$\sum_{i=1}^{K} \beta_5 i \Delta InINT_{t-1} + \lambda ECT_t \quad \text{.....(.4)}$$

The ECT_{t-1} in equation 4 is the error correction term why λ signifies the speed of convergence to the equilibrium process used to ascertain the stability of the parameters through the cumulative sum of recursive residuals (CUSUM) or cumulative sum of square of recursive residuals (CUSUMSQ) whose equation was detail in Brown et al (1975). It is important to note here that equation 4 has two components namely, the short run and the long run components. Thus, the part of the model carrying Δ is the short run while λ which is primarily the speed of adjustment is also a long run component in that it is derived from the residual of the long run dynamic estimate.

3.4 Unit Root Test

The essence of this test is to to avoid a spurious regression and more so that all the variables are integration of order 1 in order to fulfil the critical conditions for the Johasen co-integration test of long run equilibrium relationship. Accordingly, the Augmented Dickey Fuller (ADF) test which is relevant for this purpose is estimated as follows:

$$\Delta Y_t = C_i + \omega Y_{t-1} + C_{2t} + \sum_{t=1}^{p} di\Delta Y_{t-1} + \varepsilon t \quad \text{.....(5)}$$

Where yt = relevant time series; Δ = first difference operator; t = a linear trend and εt = error term. The null hypothesis of the existence of a unit root is Ho: ω=0. Failure to reject the null hypothesis leads to conducting the test on further differences of the series until stationarity is reached and the null hypothesis is rejected.

3.5 Co-integration Test

The study tested for co-integration to ascertain the long run relationship between the dependent and the explanatory variables using the Johasen and Juselius (1990) test. The test proposed the use of two likelihood ratio tests namely, the trace and the maximum eigenvalue tests. On the one hand, the trace statistic for the null hypothesis of co-integrating relations is consummated as follows:

$$\Gamma_{trace}(r) = -\tau \sum_{i=1}^{m} \log\left[1 - \lambda_t\right] \quad \text{.....(5}a\text{)}$$

On the other hand, maximum Eigen value static tests the null hypothesis of r co-integrating relation against r + 1 co-integrating relations and is computed as follows:

$$\Gamma_{\max}(r, r+1) = \iota \log(1 - \lambda r + 1) \quad \text{.....(5}b\text{)}$$

3.6 Sources of Data

Annual time series data of gross domestic product at 2010 constant price, agriculture value added, labour and capital productivity as well as interest rate were used for the study. All the five variables were culled from the various issues of the Central Bank Nigeria annual report and statement of accounts.

4.0 DISCUSSION OF FINDINGS

This section presents the results of findings beginning with a brief discussion of the behavioural trend of agricultural productivity and other variables. Thus, over the last three decade, the performance of the Nigerian economy from the perspective of agricultural sector is one which can be described as not too palatable. The performance of agricultural sector and economic growth is depicted in Table 1 whilst Fig 2 shows the trend representation of Table 1

.

Table 1: Agriculture Productivity and GDP Growth (%)

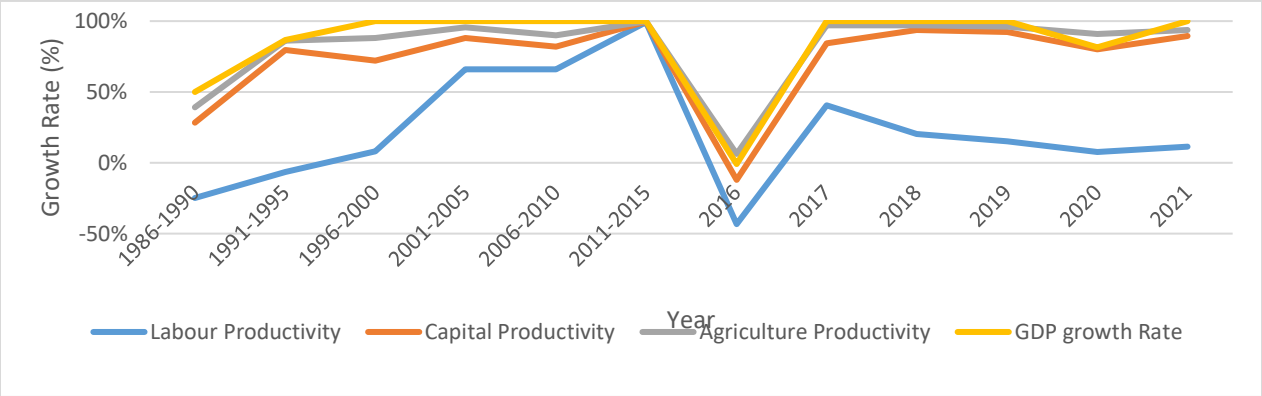
Year	Agriculture	Labour	Capital	GDP at 2010
1986-1990	5.0	-12.3	25.7	5.3
1991-1995	2.8	-2.7	35.3	0.2
1996-2000	4.0	2.0	16.1	3.0
2001-2005	16.0	138.7	46.4	8.8
2006-2010	5.7	47.3	11.6	7.3
2011-2015	4.9	2412.2	9.1	4.8
2016	4.1	-9.7	2.0	-1.6
2017	3.4	11.0	11.9	0.8
2018	2.1	12.4	45.2	1.9

2019	2.4	9.0	46.1	2.3
2020	2.2	1.6	15.0	-1.9
2021	2.1	6.1	41.3	3.4

Source: CBN Statistical Bulletin (2021)

Although, the sector recorded positive growth as indicated in Table 1, the period 1991-95 as well as 2017 to 2021 with growth rates of between 2.1 to 2.8% cannot be seen as good enough. In the case of labour productivity, its performance was unstable as the period 1986-1990 recorded average negative growth of -12.3% and oscillated to all-time high of 2412.2% in the period, 2011-2015. The rest of the period saw the growth of labour productivity rising and falling. On the other hand, the growth of capital productivity seemed to be relatively stable as it recorded double digit with the exception of 2011-2015 and 2016 with 9.1% and 2.0% respectively.

Fig 2: Trend of Agricultural Productivity



Source: CBN Statistical Bulletin (2021) and Annual Report and Statement of Account (various Issue)

With not too good a performance in the agricultural sector which is the largest employer of labour, the growth rate of the economy has been sluggish as it consistently remains less than double digit over the last three decades. The economy deteriorated during the 1991-1995 period with average growth of 0.2%. The situation become worse in 2016 and 2019 when the country entered a recession with growth rates of -1.6% and -1.9% respectively. For over two decades prior to the recession of 2016, a sustained annual growth rate was in the average of about of 5.2% in Nigeria. The worries then was that such growth was not sustainable and largely non inclusive as the economy was unable to generate new and good quality jobs. Analysts averred that the growth rates of the period were driven by imported goods facilitated by production of oil and gas thereby leading to increase in domestic consumptions.

4.1 Descriptive Statistics

Table 2 contains the summary of the basic statistics for the dependent variable namely the gross domestic product and the regressors which include agriculture value added, labour productivity, capital productivity as well as interest rate. The model contains 35 observations for the individual variables which represent data from 1986-2021. The Table indicates that the gross domestic

product in the period under review averaged ₦3956.2 billion which ranges from the minimum of ₦15552.1 billion to a maximum of ₦71387.8 billion with a standard deviation of ₦19697.1 billion.

Table 2: Data Description

	GDP	AGV	LPD	CPD	INT
Mean	3956.2	9026.5	39944.8	7554.7	13.1
Median	33004.8	8364.8	399.4	3078.8	13.0
Max	71387.8	18348.2	199201.3	41253.6	26.0
Min	15552.1	2891.7	70.4	108.9	7.9
Std Dev	19697.1	5419.8	74057.7	9780.7	3.7
Skewness	0.4	0.4	1.3	2.0	1.3
Kurtosis	1.6	1.6	2.8	6.8	5.9
Jarqe-Bera	4.0	3.6	10.5	44.7	22.1
Probability	0.1	0.2	0.0	0.1	0.0
Obs	35	35	35	35	35

Source: Author's computation using Eview 12.0

Also, the average agriculture value added stood at ₦9026.5 billion. It has a minimum value of ₦2891.7 billion and a maximum of ₦18348.2 billion with a standard deviation of ₦5419.8 billion. In the same vein, the productivity of labour within the agricultural sector averaged ₦39944.8 billion which varies from a minimum of ₦70.4 billion to a maximum of ₦199201.3 billion. It has a standard deviation of ₦74057.7 billion. Likewise, capital productivity has a mean of ₦7554.7 billion and ranges from ₦108.9 billion to a maximum of ₦41253.6 billion. Also, interest rate within the period of consideration averaged 13.1% with a minimum of 7.9% and a maximum of 26.0% and a standard deviation of 3.7%. Observably, Table 2 shows that the series are positively skewed around their mean. In the case of Kurtosis, capital productivity has a peaked distribution while other variables including the dependent variable had flat distributions.

4.2 Estimation Technique

The ADF and the PP statistics in Table 3 reveal that the series are non-stationary at level but at first differencing, stationary was achieved at 5% level of significance as the ADF and the PP statistics exceeded the 5% level of significance.

Table 3: Result of unit root test

ADF (Trend & Intercept)			Phillips-Peron (PP) (Trend & Intercept)	
Variable	Level	1st Diff	Level	1st Diff
LGDP	-3.25	-6.70	-1.56	-6.53
LAGV	-1.70	-5.54	-1.70	-5.54
LLPD	-2.11	-4.60	-2.07	-6.59
LCPD	-2.70	-5.85	-2.56	-7.60
LINT	-3.44	-7.07	-3.50	-7.35
Critical Value				
5%	-3.56	-3.55	-3.54	-3.55

Source: Authors' computation using Eview 12

In Table 4, the test to ascertain the extent of multicollinearity between the explanatory variables is conducted where a value less than 10 is an indication of absence of multicollinearity. Accordingly, the test revealed that multicollinearity is not a problem in the study.

Table 4: Variance Inflation Factor

Variable	Coefficient	VIF
Constant	0.13	NA
LAGV	0.00	9.42
LCPD	0.00	8.71
LLPD	3.44	3.00
LINT	0.00	1.19

Source: Extracted from Eview 12

Table 5 contains the results of co-integration test which revealed that there is at least one co-integrating equation in both the Trace and Max-Eigen statistics at 5% level. This therefore suggests that long run relationship exists between GDP and agricultural productivity variables going forward. In what follows, the second panel of Table 4 contains the results of the long run static regression normalized on GDP. The results reveal that GDP is significant and negatively responsive to changes in agricultural productivity. This implies that a 10% increase in agricultural productivity reduces economic growth by 1.6%. This is contrary to the findings of Kenny (2019), Akpan et al (2021) and Lyndon et al (2021).

Table 5: Co-integration results

Null Hypothesis	Alternative Hypothesis	Statistical Value	5%	Eigen Value	Prob
Trace Statistics					
r = 0	r > 0	70.23	69.82	0.65	0.04
r > 1	r > 1	35.81	47.86	0.41	0.40
Max Eigen value					
r =0	r = 1	34.42	33.88	0.65	0.04
r < 1	r = 2	17.53	27.58	0.41	0.53
Long Run Regression Estimates Normalized on GDP					
LGDP = 1.00 - 1.11LAGV + 0.01LLPD + 0.16LCPD + 0.23LINT (-10.1) (1.0) (4.0) (2.9) Log Likelihood = 82.5					

Source: Authors' computation using Eview 12

Meanwhile, capital productivity and interest rate had significant positive impact on economic growth and no evidence of significant relation could be found in the case of labour productivity in the long run. Accordingly, the over-parameterized error correction model is presented in Table 6. Although, the model looks fairly well estimated, it appears cumbersome to be interpreted in its present form. The number of lag in this model is an empirical issue.

Table 6: Over-parameterized error correction model
Method: Least Square
Dependent Variable: DLGDP

Variable	Coefficient	Std Error	t-statistic	Probability
C	0.03	0.03	0.86	0.41
ΔLGDP(-1)	0.31	0.22	1.40	1.18
ΔLGDP(-2)	0.44	0.15	2.89	0.01
ΔLAGV	0.26	0.08	3.32	0.01
ΔLAGV(-1)	-0.13	0.13	-1.00	0.33
ΔLAGV(-2)	-0.21	0.17	-0.23	0.83
ΔLLPD	0.01	0.01	1.40	0.18
ΔLLPD(-1)	0.06	0.02	3.00	0.00
ΔLLPD(-2)	-0.01	0.01	-0.67	0.52
ΔLCPD	-0.07	0.03	-2.33	0.04
ΔLCPD(-1)	-0.08	0.03	-2.67	0.02
ΔLCPD(-2)	0.03	0.12	0.29	0.78
ΔLINT	0.02	0.03	0.65	0.60
ΔLINT(-1)	-0.02	0.03	-0.62	0.54
ΔLINT(-2)	0.15	0.04	3.75	0.00
ECM(-1)	-0.37	0.17	-2.16	0.04
R^2 = 0.73; F-Stat = 2.99; DW = 1.96				

Source: Extracted from Eview 12

The lag length was set at 2 bearing in mind the possible problems of low degrees of freedom if higher order lags were used. Notably, the statistically insignificant variables are eliminated until parsimony is achieved. In Table 7 therefore, the parsimonious error-correction model is presented. Clearly, the interpretation of the dynamic process in this model is easy. The F-statistics of the diagnostics tests which checked for the validity of the model are presented alongside the p-values in parenthesis. For the alternative hypothesis to be rejected, the p-value must exceed the chosen level of significance which in this study is 5%. This means that our p-values must be greater than 0.05 for the null hypothesis to be accepted and conclude that the model is free from residual and stability problems. Observably, the model passes all the diagnostic tests conducted and is satisfactory as it indicated absence of multicollinearity, is serially uncorrelated, is homoscedastic (ARCH test) and is normally distributed even as there is no misspecification error as evidenced in Ramsey reset.

Table 7: Parsimonious error correction model
Method: Least Squares
Dependent Variable: DLGDP

Variable	Coefficient	Std Error	t-statistic	Probability
Constant	0.01	0.01	1.71	0.10
ΔLGDP(-2)	0.34	0.09	3.75	0.00
ΔLAGV	0.29	0.06	4.49	0.00

ΔLPD	0.12	0.04	3.00	0.00
ΔLCPD(-1)	-0.23	0.08	-2.87	0.02
ΔLINT(-1)	0.02	0.02	-0.99	0.33
ECM(-1)	-0.19	0.06	-3.17	0.01
Diagnostic Tests				
R^2	0.64			
DW	2.01			
F-Stat	9.17			
Serial Correlation LM F-Stat Test	5.08(0.12)			
ARCH LM F-Stat Test	1.06(0.41)			
Jarque-Bera (Normality) F-Stat Test	0.05(0.97)			
Ramsey Reset F-Stat Test	0.02(0.89)			

Source: Extracted from Eview 12

Likewise, the CUSUM and CUSUMsq plots (Fig 2 and 3) which lie between the two critical boundaries revealed parameter model stability. Similarly, Table 6 indicates that the fit of the model is relatively robust as the independent variables account for 64% variation in economic growth in Nigeria while the DW of 2.01 which support the diagnostic tests reveals absence of serial correlation. The F stat shows that the entire model is highly statistically significant.

Fig 2: CUSUM plot of Model Stability

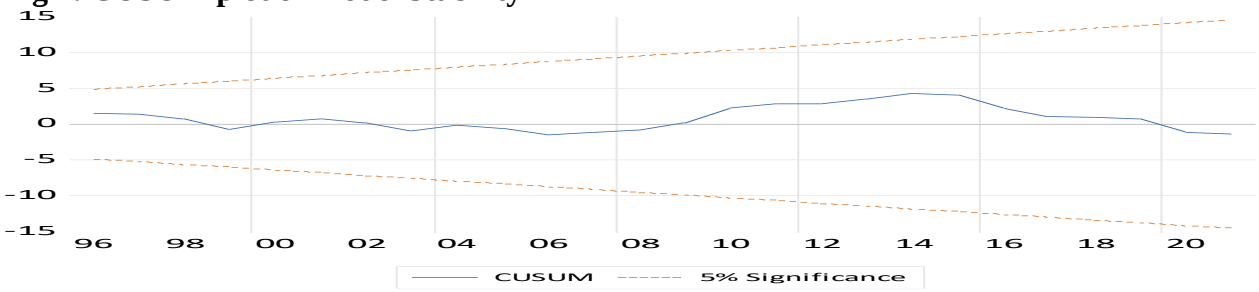
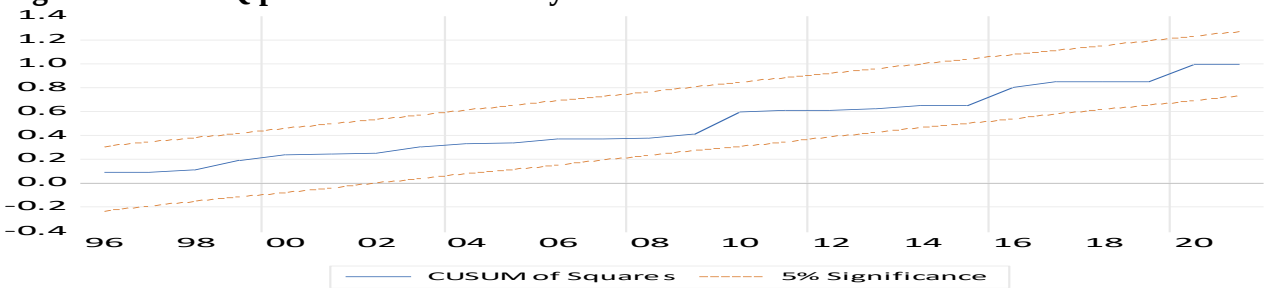


Fig 2: CUSUMSQ plot of Model Stability



Source: Extracted from Eview 12

Specifically, the results reveal that in the short run agricultural productivity, labour productivity, capital productivity as well as previous period GDP had significant impact on economic growth in Nigeria during the period under consideration. However, while agricultural productivity, labour

productivity and GDP lag 2 exerted positive impact on economic growth in Nigeria, the impact of capital productivity is negative. For instance, a unit increase in the past 2 periods GDP led to 0.34% increase in current GDP. Also, a 100% increase in agricultural productivity lead to increase in economic growth by 29% in the short run. The results give credence to the findings of Ikenwa et al (2017), Adesoye et al (2018), Kenny (2019), Osabohien et al (2020), Akpan et al (2021), Lyndon et al (2021) among others. On the contrary, a 1% increase in capital productivity resulted in 0.23% reduction in economic growth in the period of review. Meanwhile, the study could not established evidence of significant relationship between interest rate and economic growth in Nigeria.

Furthermore, the ECM is correctly signed and statistically significant which is what is expected if there is a co-integration between the dependent and the explanatory variables. Notably, the ECM reveals that any disequilibrium between the short and the long run models is corrected with a speed of about 19% within a year. The study therefore gives credence to a number of prior studies among which are Gbaiye et al. (2013), Oguwuike (2018), Osabohien et al (2019) and Ogebe et al (2020).

5. SUMMARY AND CONCLUSION

The study examined the relationship between agricultural productivity and economic growth in Nigeria. The study found that though agriculture provides bulk of employment generation in Nigeria, its contribution to economic growth has been very little. The study uses trend analysis and econometric approach on a data covering 1986-2021. Additionally, labour productivity and capital productivity as measures of agricultural productivity as well as interest rate were used as independent variables. The study found a long run relationship between agricultural productivity and economic growth in Nigeria. Thus, in the long run it was discovered that agricultural productivity exerted significant negative impact on growth. This findings is worrisome as it implies that the more productive the agricultural sector is, the lower will be economic growth in Nigeria in the long run. This could be as a result of the current structure of the sector. Most agricultural produce are exported in its crude form without much value added. On the other hand, capital productivity has significant positive impact on growth. However in the short run, the impact of agricultural productivity on economic growth in Nigeria is positive. The negative impact of agricultural productivity in the long run and capital productivity in the short run may not have come as a surprise because over the years, successive governments in Nigeria have abandoned the sector as a result of quick money from oil and gas sector.

Presently, most rural areas in Nigeria where agricultural activities are being undertaken do not have access road networks and the situation becomes very pathetic during the raining season when the already deteriorated roads may have carved in. likewise, epileptic power supply has reached a worrisome dimension even in the city centers. This made able bodied youths to abandon the rural areas for the already congested cities for non-existing white collar jobs. The result is a continued decline in agricultural output thereby exacerbating the already worsening food scarcity, unemployment and poverty. Thus, the agricultural sector could not play its vital role of providing food security as well as generate employment because it has been weakened by several years of poor and bad governance in Nigeria. It is recommended therefore that government should consider a broad-based reforms in the agricultural sector providing farm inputs like tractors and

fertilizer including granting loans at relatively low interest rate or outrightly interest free loans to farmers in order to boast output. Also, government should further consider increase in capital investment with a view to addressing severe infrastructural deficits like poor road networks and other infrastructural decays in the rural areas in the country.

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