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Empirical Analysis of Government Agricultural Spending and Agricultural Output in Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study examined the relationship between government agricultural spending and agricultural output in Nigeria using annual time series data from 1981 to 2019. This study used descriptive and analytical techniques such as descriptive statistics, Augmented Dickey-Fuller test, VEC Granger Causality/Block Exogeneity Wald test, Johansen co-integration test, vector error correction test, impulse response, and variance decomposition. The study found that all variables were not stationary at level but became stationary at first difference. The study also revealed that there is a positive effect of government agricultural spending on agricultural output in Nigeria, though, significant in the long-run only. The study also showed that there is a bidirectional relationship between government agricultural spending and agricultural output in Nigeria at 10% level of significance and that agricultural output would respond positively to shocks in government agricultural spending in Nigeria during the forecast period. Therefore, the study recommends that government expenditure on agriculture should be improved upon the funds allocated to the sector and should be made available to real farmers through the provision of fertilizers, improved seedlings and grant aiding to farmers through farmers cooperatives while farmers in Nigeria should form farmers' cooperatives to be able to easily access credit facilities from banks as well as

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enhancing their easy access to farm inputs provided by the government. More so, the Nigerian government should also increase the budgetary allocation to the agricultural sector to boost food production, alleviate poverty as well as meet up with the international standard.

Keywords: Agricultural output; Agricultural labour force; government agricultural spending and Interest rate.

JEL Classification: Q11, Q14, Q18

1. INTRODUCTION

The development impact of an effective and desirable agricultural sector for any economy is hard to over-emphasize. Agriculture is of great importance for people in many developing countries. This is because it has an unswerving effect on poverty alleviation, eradication of extreme hunger and reduction of unemployment rates as the majority of the population in developing countries are directly engaged in agriculture. The indirect effects are equally significant. For instance, empirical studies have indicated that the multiplier effect of growth in agriculture is higher than in other sectors [1,2]. According to Mozumdar [3], the livelihood of a major proportion of the population in the developing nations is directly or indirectly connected with agriculture. Evaluation Corporation Group-ECG [4] also asserts that about 75% of all world poor people live in rural areas and 86% of them work in the agricultural sector for their livelihood. Therefore, agriculture is critical to achieving global poverty reduction targets and it is still the single most important productive sector in most low-income countries, often in terms of its share of Gross Domestic Product and the number of people it employs [5]. Therefore, it can be seen as the economic mainstay of most of the households in Nigeria and one of the important sectors in the Nigerian economy. Besides, without substantial growth in the agriculture sector, a fundamental step in the process of economic transformation and growth in many countries would be missed.

One of the major determining factors of agricultural sector growth is infrastructure and financing that have remarkable contributions towards the effective performance of the sector by reducing transaction costs in input and improving output. Agricultural financing is seen as the backbone of sustainable development in the agricultural sector. The financial sector has been perceived as a catalyst to the sustainability of agricultural sector performance. For instance, Onoja and Adione (2019) [6] noted that to accomplish the Sustainable Development Goals (SDGs) of ending hunger, achieving food security, improved nutrition, and promoting sustainable agriculture by 2030, agriculture requires a greater level of investment and finance to drive higher output to match an increasing global population. Given the above, the Nigerian government has been increasing its spending on the sector especially in the wake of diversification policy.

Over the years, the Nigerian government has maintained increased financing of the agricultural sector. The total government spending on the sector increased from 0.28 billion in 1981 to 216.12 billion in 2019 with much financing in 1999 and 2008 (Central Bank of Nigeria (CBN) [7]. More so, the Nigerian government has instituted several schemes and policies to revive the sector. Among them are: the Agricultural Credit Guarantee Scheme Fund (ACGSF) that was established by Decree No. 20 of 1977 and started operations in 1978 to guarantee credit facilities to farmers; Agricultural Credit Support Scheme (ACSS) which was an initiative of the Federal Government and the Central Bank of Nigeria with the active support and participation of the Bankers' Committee to enable farmers exploit the untapped potentials of Nigeria's agricultural sector, reduce inflation, lower the cost of agricultural production (that is, food items), generate surplus for export, increase Nigeria's foreign earnings as well as diversify its revenue base; and Commercial Agriculture Credit Scheme (CACS) that was established by the Central Bank of Nigeria (CBN) in collaboration with the Federal Ministry of Agriculture and Water Resources (FMA&WR) in 2009 to provide finance for the country's agricultural value chain (production, processing, storage and marketing) and fast-track the development of the agricultural sector of the Nigerian economy by providing credit facilities to large-scale commercial farmers at a single digit interest rate [8]. The Nigerian government has also made several other efforts in the financing of the agricultural sector to improve its contribution

to annual income in the economy. Some of the recent schemes include the Anchor Borrowers' Programme and the establishment of The Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL). Several state governments have also deployed funding strategies to unlock growth in the agricultural products of their comparative advantage. Despite these huge sums of money allocated to the sector over the years, the contribution of agriculture in Nigeria remains doubtful.

Agricultural output has recorded an improvement in output of 17.05 billion from 1981 to 1341.04 billion in 1998 accounting for 29.22 percent contribution of the sector to GDP. The percentage contribution exhibited an upward trend during this period. Between 1999 and 2001, the output from the sector further improved from 1426.97 billion to 2015.42 billion but the percentage contribution of the sector to GDP declined to 21.87% and 24.78% in 2000 and 2001. Even though the output from the agricultural sector has improved over the years to 31904.14 billion in 2019, the percentage contribution of the sector to GDP declined to 22.12% in 2019 [7]. The fluctuations in the percentage contribution of the agricultural output to GDP with declining episodes have become worrisome. This has failed to keep pace with the needs of a rapidly growing Nigerian population and the increasing agricultural spending by the government, thus, resulting in a progressive increase in import bills for food and industrial raw materials [9].

This has called for the need for empirical investigation of the relationship between government agricultural spending and agricultural output in Nigeria spanning 1981 to 2019. The study, therefore, examines the nature of causation between government agricultural spending and agricultural output in Nigeria and the extent to which government agricultural spending affects agricultural output in Nigeria.

The rest of this paper is structured as follows; section 2 discusses the literature review. The methodology is presented in section 3 while section 4 presents results and discussion of findings. Section 5 offers conclusion and policy recommendations.

2. REVIEW OF RELATED LITERATURE

Recently, Edeh, Ogbodo, and Onyekwelu [10] assessed the impact of government expenditure on agriculture on agricultural sector output in Nigeria from 1981 to 2018 using annual time series data. Utilizing the ARDL Bounds test cointegration approach, the study found a long-run relationship and that capital expenditure positively influences agricultural output while recurrent expenditure has a negative and insignificant influence on agricultural output in Nigeria. The study has disaggregated the effect of capital and recurrent expenditure on agricultural output, unlike this study that has aggregated the expenditure by the government to the agricultural sector. The novelty in this current study is that it has considered the model in a system to take account of endogeneity that may exist among the explanatory variables. In a closely related study, Uremadu, Ariwa and Uremadu [11] also examined the effect of government agricultural expenditure on agricultural output in Nigeria using annual time series data from 1981 to 2014. Johansen co-integration test was employed in a bid to capture the effect of government agricultural expenditure on agricultural output within a system of equations. The result revealed that a long-run relationship existed between agricultural output and government agricultural expenditure while the vector error correction model showed that agricultural output adjusted rapidly to changes in total government agricultural expenditure, real exchange rate, banking system credit to agriculture, average annual rainfall, and population growth rate. However, the study calibrated the model from no theoretical model and has adopted a linear model from a relationship that seems non-linear function without any form of transformation which has cast doubts about the reliability of the estimates thereof.

Most of the studies have assessed the influence of government agricultural spending on agricultural output in Nigeria using the Ordinary Least Squares (OLS) approach that has a limitation in assessing the relationship between government agricultural expenditure on agricultural output within a system of equations. Hence, the effect of endogeneity on the estimates. For instance, Aina and Omojola [12] examined the effect of government expenditure on agricultural sector performance in Nigeria between 1980 and 2013 using annual time series data. The study employed the econometrics method of Ordinary Least Square and Error Correlation Mechanism (ECM) methods and found that government spending contributes positively to the agricultural sector performance in Nigeria. Using a similar methodology, Ewubare

and Eyitope [13] examined the effects of government spending on the agricultural sector in Nigeria from 1980 to 2013. The study used annual time series data and found that government spending on the agricultural sector was positive and statistically significant at influencing agricultural output in Nigeria. Wangusi and Muturi [14] also examined the impact of agricultural public spending on agricultural productivity in Kenya using annual time series data from 1973 to 2012. The study used ordinary least squares technique and found that there is a positive and significant relationship between agricultural productivity and public spending in the agricultural sector. Idoko, Sunday, and Sheri [15] also examined the impact of government agricultural expenditure on agricultural output in Nigeria spanning from 1975 to 2010. Ordinary Least Squares econometric technique was used to estimate a multiple regression. The relationship that existed between government expenditure on agriculture and Nigerian agricultural sector output was found to be significant and positive. These studies a found significant positive influence of government agricultural expenditure on agricultural output.

Other studies have used the Autoregressive approach in assessing the effect of government agricultural expenditure on agricultural sector output in Nigeria and found varying results. For instance, Udoh [16] examined the relationship between public expenditure, private investment, and agricultural output growth in Nigeria using annual time series data from 1970 to 2008. The bounds test Autoregressive distributed lag (ARDL) modelling approach was used and the study found that public expenditure has a significant positive influence on the growth of agricultural output. More so, Ndubuaku, Okoro, Bello, and Alozie [17] investigated the impact of agricultural financing on agricultural sector contribution to GDP in Nigeria from 1981 to 2016. The Auto Regressive Distributed Lagged regression model (ARDL) was used to estimate the annual time series data. The study found that government funding to agriculture and agricultural credit guarantee scheme fund had a non-significant impact on agricultural contribution to GDP in Nigeria. This finding shed the importance of the technique employed for the analysis.

Adopting the system of equations to avert the effect of endogeneity, Iganiga and Unemhilin [18] also examined the impact of federal government agricultural expenditure on agricultural output in Nigeria. The study utilized annual time series data from 1970 to 2008 employing the ECM technique for the data analysis. The study found that federal government capital expenditure was positively related to agricultural output. However, the study showed that the impact of government expenditure on agriculture is not instantaneous. Though the study observed that the investment in the agricultural sector is imperative and that it should be complemented with monitored credit facilities, and food importation should be banned to encourage local producers. This called for the application of methodologies that accounts for instantaneous effects and long-run effects while utilizing the current wave of diversification of the Nigerian government to the agricultural sector. Obi and Obayori [19] also examined the dynamic effect of government spending on agricultural output in Nigeria from 1980 to 2013 using annual time series data. A Vector error correction test was used and the study found that government capital and recurrent expenditure on agriculture were positively related to agricultural output in Nigeria.

On contrary, Mathew and Mordecai [20] investigated the impact of public agricultural expenditure on agricultural output in Nigeria for the period 1981 to 2014 with annual time series data. The Johansen Cointegration test, Error Correction Method (ECM) and Granger Causality test were employed as analytical tools. The Johansen Cointegration test revealed that there exists a long-run relationship among agricultural output, public agricultural expenditure, commercial bank loans to the agricultural sector and interest rates in Nigeria. The study further showed that public agricultural expenditure has a significant negative impact on agricultural output while commercial bank loans to the agricultural sector and interest rate have no significant impact on agricultural output in Nigeria. The study inferred that the negative impact of public agricultural expenditure on agricultural output may have resulted due to discrepancies that existed between the amount allocated to the agricultural sector and the amount spent on the sector in the country. Similarly, De and Dkhar [21] also examined the short-run and long-run relationship between government expenditure on agriculture and its allied sector and agricultural output of Meghalaya. The study used annual time series data from 1984 to 2014 while utilizing the ARDL approach to cointegration and an error correction representation of the ARDL model. The study found the presence of a long-run relationship among the variables in the study and

that in the long run, the effect of public agricultural expenditure on agricultural output is significantly negative. The findings also revealed that judicious use of government spending has significant potential to accelerate agricultural development and improve its efficiency.

Other studies have assessed the influence of agricultural financing on agricultural output while using the various schemes established by the Nigerian government. For instance, Egwu [22] also examined the impact of agricultural financing on agricultural output, economic growth and poverty alleviation in Nigeria from 1980 to 2010. The ordinary least square regression technique and cointegration test were used in the analysis of the annual time series data. The study found that commercial bank credit to the agricultural sector and agricultural credit guarantee scheme fund loan to Nigeria's agricultural sector was significant to agricultural sector output percentage to gross domestic product. But Shuaib, Igbinosun and Ahmed [23] examined the impact of government agricultural expenditure on the growth of the Nigerian economy from 1960 to 2012 using annual time series data. The results revealed that government agricultural expenditure has a significant direct relationship with economic growth. From above, it is pertinent to re-examine the relationship between government agricultural spending and agricultural output in Nigeria using recent data and employing a Vector Autoregressive methodology that could address the endogeneity issues that may exist among the explanatory variables. The study also employed the Granger causality/Block Exogeneity Wald test to assess whether the inclusion of the lagged value of a variable is important in explaining dynamics of other variables in the multivariate framework in addition to the explanatory power of lag of these variables. Thus, this study is set to fill this empirical gap in the literature.

3. THEORETICAL FRAMEWORK

The Cobb-Douglas production function is widely used to represent the relationship between output and two inputs. The Cobb-Douglas (CD) production function was developed and tested against statistical evidence by Cobb and Douglas [24]. The production function is denoted by $\Delta Q = f(L,K)$ then the partial derivative $\Delta Q/\Delta L$ is the rate at which production changes with respect to the amount of labour and is called the marginal productivity of labour. On the other hand, $\Delta Q/\Delta K$ is the rate of change of production with respect to capital and is called the marginal productivity of capital. The non-linear form of the production function can be expressed as:

$$Q = AK^{\alpha}L^{\beta} \quad (1)$$

Where Q is output, K is capital, L is labour, α and β are coefficients of capital and labour, and A is the productivity.

The theory of government intervention was propounded by John Maynard Keynes in 1936 [25]. He favored government intervention to correct market failures. He criticized the classical insistence on long-term equilibrium and rather attached greater importance to short-term equilibrium. Keynes believed that "we are all dead in the long run" [26]. Keynes believed government intervention as a short term cure to depression and that increasing savings will not help but spending. Increasing government spending gives individuals purchasing power and producers turn to produce more, creating more employment. This is the multiplier effect that shows causality from public expenditure to national income. Keynes believed the role of the government to be crucial as it can avoid depression by increasing aggregate demand and thus, switching on the economy again by the multiplier effect. It is a tool that brings stability in the short run but this needs to be done cautiously as too much public expenditure leads to inflationary situations while too little of it leads to unemployment [25].

4. RESEARCH METHODOLOGY

4.1 Data

This study used annual time series data. These were collected from CBN Statistical Bulletin, World Bank Development Statistics and United Nations Conference on Trade and Development. The data include agricultural output, agricultural land, government agricultural spending, interest rate on bank credit to the sector, value of loans guaranteed by ACGF to agricultural sector, commercial bank loans to agricultural sector and agricultural labour force. The data on agricultural output, government agricultural spending, value of loans guaranteed by ACGFS to agricultural sector and commercial bank loans to agricultural sector were sourced from Central Bank of Nigeria, data on agricultural land and interest rate on bank credit to the sector were sourced

from World Bank while data on agricultural labour force were sourced from United Nations Conference on Trade and Development.

4.2 Model Specification

To capture the effect of government agricultural spending on agricultural output in Nigeria, the study adopts the Cobb-Douglas production function with modifications. Thus, decomposing capital into government agricultural spending, government agricultural spending, value of loans guaranteed by ACGFS to agricultural sector and commercial bank loans to agricultural sector, the interest charged on loans to the sector and agricultural labour force, the functional form of the model can be stated as:

$$AOT_t = f(GASP_t, CBLA_t, ACGF_t, INT_t, ALF_t) \quad (2)$$

Expressing equation (2) in stochastic form and taking natural logarithm (ln), the model can be stated as:

$$\ln AOT_t = \beta_0 + \beta_1 \ln GASP_t + \beta_2 \ln CBLA_t + \beta_3 \ln ACGF_t + \beta_4 INT_t + \beta_5 \ln ALF_t + u_t \quad (3)$$

β_0 =Constant Intercept, $\beta_1 - \beta_5$ =Slope of Coefficients of the explanatory variables that are captured in the model and u_t =Stochastic disturbance term.

The study used VEC to account for the endogeneity that could exist. This is because in the case of endogeneity among explanatory variables, it avoids simultaneous equation bias. Applying a VECM specification of equation (3) since the variables or series were stationary at the first difference and co-integrated, the models can be specified as:

$$\Delta \ln AOT_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta \ln AOT_{t-i} + \sum_{i=1}^{p} \beta_{2i} \Delta \ln GASP_{t-i} + \sum_{i=1}^{p} \beta_{3i} \Delta \ln CBLA_{t-i} + \sum_{i=1}^{p} \beta_{4i} \Delta \ln ACGF_{t-i} + \sum_{i=1}^{p} \beta_{5i} \Delta INT_{t-i} + \sum_{i=1}^{p} \beta_{6i} \Delta \ln ALF_{t-i} + \Omega_1 ECM_{t-1} + \mu_{1t} \quad (4)$$

$$\Delta \ln GASP_t = \theta_0 + \sum_{i=1}^{p} \theta_{1i} \Delta \ln AOT_{t-i} + \sum_{i=1}^{p} \theta_{2i} \Delta \ln GASP_{t-i} + \sum_{i=1}^{p} \theta_{3i} \Delta \ln CBLA_{t-i} + \sum_{i=1}^{p} \theta_{4i} \Delta \ln ACGF_{t-i} + \sum_{i=1}^{p} \theta_{5i} \Delta INT_{t-i} + \sum_{i=1}^{p} \theta_{6i} \Delta \ln ALF_{t-i} + \Omega_2 ECM_{t-1} + \mu_{2t} \quad (5)$$

$$\Delta \ln CBLA_t = \varphi_0 + \sum_{i=1}^{p} \varphi_{1i} \Delta \ln AOT_{t-i} + \sum_{i=1}^{p} \varphi_{2i} \Delta \ln GASP_{t-i} + \sum_{i=1}^{p} \varphi_{3i} \Delta \ln CBLA_{t-i} + \sum_{i=1}^{p} \varphi_{4i} \Delta \ln ACGF_{t-i} + \sum_{i=1}^{p} \varphi_{5i} \Delta INT_{t-i} + \sum_{i=1}^{p} \varphi_{6i} \Delta \ln ALF_{t-i} + \Omega_3 ECM_{t-1} + \mu_{3t} \quad (6)$$

$$\Delta \ln ACGF_t = \varpi_0 + \sum_{i=1}^{p} \varpi_{1i} \Delta \ln AOT_{t-i} + \sum_{i=1}^{p} \varpi_{2i} \Delta \ln GASP_{t-i} + \sum_{i=1}^{p} \varpi_{3i} \Delta \ln CBLA_{t-i} + \sum_{i=1}^{p} \varpi_{4i} \Delta \ln ACGF_{t-i} + \sum_{i=1}^{p} \varpi_{5i} \Delta INT_{t-i} + \sum_{i=1}^{p} \varpi_{6i} \Delta \ln ALF_{t-i} + \Omega_4 ECM_{t-1} + \mu_{4t} \quad (7)$$

$$\Delta \ln INT_t = \vartheta_0 + \sum_{i=1}^{p} \vartheta_{1i} \Delta \ln AOT_{t-i} + \sum_{i=1}^{p} \vartheta_{2i} \Delta \ln GASP_{t-i} + \sum_{i=1}^{p} \vartheta_{3i} \Delta \ln CBLA_{t-i} + \sum_{i=1}^{p} \vartheta_{4i} \Delta \ln ACGF_{t-i} + \sum_{i=1}^{p} \vartheta_{5i} \Delta INT_{t-i} + \sum_{i=1}^{p} \vartheta_{6i} \Delta \ln ALF_{t-i} + \Omega_5 ECM_{t-1} + \mu_{5t} \quad (8)$$

$$\Delta \ln ALF_t = \varsigma_0 + \sum_{i=1}^{p} \varsigma_{1i} \Delta \ln AOT_{t-i} + \sum_{i=1}^{p} \varsigma_{2i} \Delta \ln GASP_{t-i} + \sum_{i=1}^{p} \varsigma_{3i} \Delta \ln CBLA_{t-i} + \sum_{i=1}^{p} \varsigma_{4i} \Delta \ln ACGF_{t-i} + \sum_{i=1}^{p} \varsigma_{5i} \Delta INT_{t-i} + \sum_{i=1}^{p} \varsigma_{6i} \Delta \ln ALF_{t-i} + \Omega_6 ECM_{t-1} + \mu_{6t} \quad (9)$$

The variables, measurements and sources are presented in Table 1.

Table 1. Variables and measurements

Label	Variable name	Measurement	Source
AOT	Agricultural Output	Billions of Naira	Central Bank of Nigeria
GASP	Government Agricultural Spending	Billions of Naira	Central Bank of Nigeria
INT	Interest rates on bank credit to the sector	Percent	The World Bank
ACGF	Value of Loans Guaranteed by ACGFS to Agricultural sector	Millions of Naira	Central Bank of Nigeria
CBLA	Commercial Bank Loans to Agricultural Sector	Billions of Naira	Central Bank of Nigeria
ALF	Agricultural Labour Force	Thousands of People	United Nations Conference on Trade and Development

Source: Authors' Compilation

4.3 Methods of Analysis

Descriptive statistics, augmented Dickey-Fuller unit root test (stationary test) were used as pre-estimation tests while Granger causality test, Johansen and Juselius [27] Full Information Maximum Likelihood Test, Vector Error Correction Model and VEC Granger causality/Wald Exogeniety tests were employed as estimation techniques. The post-estimation techniques employed were correlation test and diagnostic tests such as: VEC Residual Normality Tests, VEC residual serial correlation LM Tests and VEC residual heteroskedasticity tests. Impulse response and variance decomposition tests were used for study forecast.

5. RESULTS AND DISCUSSION

The pre-estimation results are descriptive statistics and augmented Dickey-fuller test results. The summary results of descriptive statistics for the variables incorporated in the model are presented in Table 2.

An examination of 39 observations in Table 2 reveals the mean, median maximum and minimum value, standard deviation, skewness, kurtosis, Jarque-Berra and probability of the data for the variables incorporated in the model. It shows that between 1981 and 2019, loans guaranteed by agricultural credit guarantee scheme, agricultural labour force, agricultural output, commercial bank loans to agricultural sector, government agricultural spending and interest rate averaged about 3,126.097 million,12.466 million persons, 12,456.25 billion, 12,875 billion, 57.03758 billion, and 17.69% with the maximum value of 3,126.097 million, 12.875 million persons, 31,904.14 billion, 2,720.102 billion, 279.7376 billion, and 31.65% respectively. The study recorded the maximum values for agricultural labour force, agricultural output, commercial bank loans to agricultural sector, government agricultural spending are recorded in 2019 while loans guaranteed by agricultural credit guarantee scheme recorded its maximum value in 2014. Commercial bank loans to agricultural sector and government agricultural had its maximum recorded in 1999 and 1993 respectively. This implies that the distribution for

commercial bank loans to agricultural sector and government agricultural trended downward after the maximum periods of 1999 and 1993 respectively. The corresponding minimum values of loans guaranteed by agricultural credit guarantee scheme, agricultural labour force, agricultural output, commercial bank loans to agricultural sector, government agricultural spending and interest rate are 24.6 million, 12.3 million persons, 17.05 billion, 0.59 billion, 0.064 billion, and 8.92%. The minimum values of agricultural output, commercial bank loans to agricultural sector, and interest rate were recorded in 1981, loans guaranteed by agricultural credit guarantee scheme and government agricultural spending recorded in 1984 and agricultural labour force recorded its least value in 2006. The 1984 downward trend in loans guaranteed by the agricultural credit guarantee scheme and government agricultural spending was occasioned by the economic downturn of activities that called for a structural adjustment programme.

The test for normality of the variables (ACGF, ALF, AOT, CBLA and GASP) shows that all the variables have high Jarque-Bera value with high their respective low probability values except for Interest Rate (INT). The data indicated a positively skewed distribution for all the variables. These indicate that the distributions for the variables are skewed to the right implying that the data are tilted towards large values. The results of kurtosis which explains the peakedness and flatness of a normal curve also indicated values of more than 3 (that is more than excess Kurtosis) for agricultural labour force, commercial bank loans to agricultural sector, government agricultural spending and interest rate implying that the data for those variables have leptokurtic shape (that is, K>3). This means that the distribution has a very steep slope unlike loans guaranteed by agricultural credit guarantee scheme that is platykurtic shape implying that the data were spread far from the average value. But kurtosis for agricultural output reveals excess kurtosis of 3 implying that the data distribution exhibits mesokurtic shape. Natural logarithm was applied for all the data for the variables to harmonize or unify the data for robust estimation.

The test result of the Augmented Dickey-Fuller statistic for all the time series (variables) used in the estimation. The study determined whether variables should be estimated with constant and trend or with constant only. The results are presented in Table 3.

The results show that trend and constant are significant for AGOUT, GAS, and CRAGS while only constant is significant for INT and ALF at 5% level of significance.

The results of the ADF unit test are presented in the Table 4.

The results of ADF unit root with constant and trend (for AGOUT, GAS, and CRAGS) and with constant only (for INT and ALF) in Table 4 show that all the variables are not stationary at level but became stationary after first difference (that is, integrated at the first difference-I(1)). This implies that all the variables were not having unit root problem after the first difference at 5% level of significance.

Table 2. Descriptive statistics of variables

Tools	ACGF (Million)	ALF (000'Persons)	AOT (Billion)	CBLA (Billion)	GASP (Billion)	INT (%)
Mean	3126.097	12466.08	6938.835	229.5879	57.03758	17.69615
Median	361.4490	12436.00	1508.409	41.02890	43.37514	17.55000
Maximum	12456.25	12875.00	31904.14	2720.102	279.7376	31.65000
Minimum	24.65490	12301.00	17.05218	0.590600	0.064340	8.920000
Std. Dev.	3973.085	139.2998	8910.723	554.0901	65.54157	4.793281
Skewness	0.917002	1.285900	1.211934	3.643894	1.505703	0.246071
Kurtosis	2.324992	4.244771	3.387683	15.60282	5.243331	3.753903
Jarque-Bera	6.206212	13.26586	9.791330	344.4074	22.91429	1.317183
Probability	0.044909	0.001316	0.007479	0.000000	0.000011	0.517580
Sum	121917.8	486177.0	270614.6	8953.928	2224.466	690.1500
Sum Sq. Dev.	6.00E+08	737368.8	3.02E+09	11666601	163236.5	873.0705
Observations	39	39	39	39	39	39

Source: Extraction from E-views 10 Output

Table 3. Determination of trended data

Variable	Variable specified	Coefficient	Std. Error	t-Statistic	Prob.
lnAOT	C	23.78572	0.145476	163.5023	0.0000
	@TREND	0.214211	0.006588	32.51705	0.0000
lnGASP	C	19.13262	0.39913	47.93579	0.0000
	@TREND	0.210082	0.018074	11.6235	0.0000
lnCBLA	C	20.48621	0.121298	168.8916	0.0000
	@TREND	0.195154	0.005493	35.52918	0.0000
lnACGF	C	16.9163	0.216969	77.96664	0.0000
	@TREND	0.177924	0.009825	18.10919	0.0000
INT	C	16.13558	1.496824	10.77988	0.0000
	@TREND	0.082136	0.067781	1.211776	0.2333
lnALF	C	16.3336	0.003409	4791.25	0.0000
	@TREND	0.000256	0.000154	1.658444	0.1057

Source: Extractions from E-views 10 Output; Note: AOT- agricultural output, GASP- government agricultural spending, CBLA- commercial bank loans to agricultural sector, ACGF- loans guaranteed by agricultural credit guarantee scheme, INT- interest rate, and ALF- agricultural labour force

Table 4. Result of unit root test (ADF)

Variables	At level	First difference	1%Critical level	5%Critical level	10%Critical level	Order of integration
lnAOT	-0.872222	-4.288148	-4.226815	-3.536601	-3.200320	I(1)
Prob	0.9486	0.0086***				
lnGASP	-1.761923	-7.394884	-4.226815	-3.536601	-3.200320	I(1)
Prob	0.7032	0.0000***				
lnCBLA	-2.487360	-6.993981	-4.226815	-3.536601	-3.200320	I(1)
Prob	0.3322	0.0000***				
lnACGF	-1.033215	-5.556284	-4.226815	-3.536601	-3.200320	I(1)
Prob	0.9270	0.0003***				
INT	-2.492832	-6.839611	-3.621023	-2.943427	-2.610263	I(1)
Prob	0.1251	0.0000***				
lnALF	-1.119433	-6.364945	-3.621023	-2.943427	-2.610263	I(1)
Prob	0.6978	0.0000***				

Source: Extractions from E-views 10 Output; Note: These critical values are computed from Mackinnon (1996) and if the probability value of a particular variable is less than 5% level of significance (that is, 0.05), the study rejects the null hypothesis of the variable having a unit root problem. This implies that the said variable is stationary at a specific level of concern. The asterisk (, **, ***) denotes rejection of the unit root hypothesis at 10%, 5% and 1% critical levels respectively*

Table 5. VAR Lag Order Selection Results

Lag	LogL	LR	FPE	AIC	SC	HQ
1	86.43141	NA	2.49e-09*	-2.801745*	-1.218226*	-2.249054*
2	117.7897	41.81107	3.71e-09	-2.54387	0.623165	-1.43849
3	154.6864	36.89673	5.44e-09	-2.59369	2.156866	-0.93562

*Source: Extractions from E-views 10 Output; * indicates lag order selected by the criterion. The criteria are: LR: sequential modified LR test statistic (each test at 5% level), FPE: Final Prediction Error, AIC: Akaike Information Criterion, SC: Schwarz Information Criterion and HQ: Hannan-Quinn information criterion*

The results presented in Table 5 show that lag one (1) has the least LR, FPE, AIC, SC and HQ relative to the other lags. This implies that the optimal lag for optimal performance of the model is lag one (1).

The Johansen Johansen and Juselius (1990) [27] co-integration approach was applied to determine the number of cointegrating vectors. It offers two tests, the Trace test and the Max-Eigen value test, to identify the number of co-

integrating relationships. The results are shown in Table 6 and Table 7.

Result from Table 6 reveals that there is cointegration among the variables. This is because the trace statistics of 119.5858 and 79.5859 are greater than the critical values of 95.75366 and 69.81889 at 5% level of significance respectively. The study, therefore, rejects the null hypothesis of at most one hypothesized number of co-integrating vectors. This means that there are 2 cointegrating equation(s) at the 5 percent level. This implies that there is a long-run relationship between the variables incorporated in the model.

Also, the Eigen value test rejects the null hypothesis if the Maximum-Eigen value test statistics exceeds the respective critical values. From Table 7, it reveals that there is cointegration among the variables. This is because the Eigen value statistics of 59.99994 and 38.23244 are greater than the critical values of 40.07757 and 33.87687 at 5% level of significance respectively. The study rejects the null hypothesis of at most one hypothesized number of co-integrating vectors. This means that there are 2 cointegrating equation(s) at the 5 percent level. Hence, Maximum-Eigen value statistic indicates two (2) co-integrating equations at 5 percent level of significance. Evidenced by the Trace and Max-Eigen test statistics, there is a long-run relationship between government agricultural spending and agricultural output in Nigeria.

5.1 Causal Relationship between Government Agricultural Spending and Agricultural Output in Nigeria

Given that the series are non-stationary and the need to account for the effect of lagged values of variables on the current values on others within a VAR framework, the study estimated the VEC Granger Causality/Block Exogeneity Wald test. The results of the granger causality test are presented in Table 8.

The result of VEC Granger Causality/Block Exogeneity Wald test in Table 8 bidirectional relationship or Granger causality between government agricultural spending and agricultural output at 10% level of significance. Thus, the causality runs from government agricultural spending to agricultural output and agricultural output to government agricultural spending in Nigeria.

The implication is that lagged values and current values of agricultural output have the capacity of influencing the current level of government agricultural spending in Nigeria while the lagged government agricultural spending and current government agricultural spending influence the current performance of the agricultural sector. There is also a unidirectional relationship running from agricultural credit guarantee scheme fund to commercial bank loans to agricultural in Nigeria at 1% level of significance. The implication is that the agricultural credit guarantee scheme loans are orchestrated through commercial banks, hence, the causal effect. The result also shows that government agricultural spending has Granger caused agricultural credit guarantee scheme funds at 10% level of significance. The implication is that the amount of past and current spending on the agricultural sector affect the current amount of agricultural credit guarantee scheme funds in Nigeria. More so, there is a unidirectional relationship running from agricultural output to agricultural labour force in Nigeria at 10% level of significance. This implies that output from agricultural sector has the capability of affecting agricultural labour force in Nigeria. These findings support the over 70% employment opportunities offered by the agricultural sector in Nigeria.

Table 6. Result of unrestricted co-integration rank test (Trace)

Null hypothesis	Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 Critical value	Prob.**
r = 0	None *	0.660771	119.5858	95.75366	0.0004
r ≤ 1	At most 1 *	0.644172	79.58590	69.81889	0.0068
r ≤ 2	At most 2	0.437922	41.35346	47.85613	0.1777
r ≤ 3	At most 3	0.344453	20.03723	29.79707	0.4204
r ≤ 4	At most 4	0.111329	4.412679	15.49471	0.8675
r ≤ 5	At most 5	0.001233	0.045651	3.841466	0.8308

*Source: Extractions from E-views 10 Output; Trace test indicates 2 cointegrating equation(s) at the 5 percent level. * denotes rejection of the hypothesis at the 0.05 level. **Mackinnon-Haug-Michelis (1999) p-values*

Table 7. Result of unrestricted co-integration rank test (Maximum-Eigen value)

Null hypothesis	Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
r = 0	None *	0.660771	59.99994	40.07757	0.0110
r ≤ 1	At most 1 *	0.644172	38.23244	33.87687	0.0142
r ≤ 2	At most 2	0.437922	21.31624	27.58434	0.2576
r ≤ 3	At most 3	0.344453	15.62455	21.13162	0.2475
r ≤ 4	At most 4	0.111329	4.367028	14.26460	0.8187
r ≤ 5	At most 5	0.001233	0.045651	3.841466	0.8308

Source: Extractions from E-views 10 Output; Max-Eigen value test indicates 2 cointegrating equation(s) at the 5 percent level
**denotes rejection of the hypothesis at the 0.05 level. **Mackinnon-Haug-Michelis (1999) p-values*

Table 8. Results of VEC Granger Causality/Block Exogeneity Wald test

Variables (Dependent)	Excluded	Probability	Chi-Square Value	Decision
D(lnAOT)	Variables			
	D(lnGASP)	0.0696*	3.288081	Significant at 10% critical level
	D(lnCBLA)	0.0516*	3.790040	Significant at 10% critical level
	D(lnACGF)	0.2797	1.168758	Not Significant
	D(INT)	0.3718	0.797543	Not Significant
	D(lnALF)	0.1271	2.327821	Not Significant
	Joint(All)	0.2182	7.032941	Not Significant
D(lnGASP)	Variables			
	D(lnAOT)	0.8786	0.023325	Not Significant
	D(lnCBLA)	0.7939	0.068257	Not Significant
	D(lnACGF)	0.9124	0.012096	Not Significant
	D(INT)	0.1874	1.737814	Not Significant
	D(lnALF)	0.1708	1.875500	Not Significant
	Joint(All)	0.5651	3.891443	Not Significant
D(lnCBLA)	Variables			
	D(lnAOT)	0.4721	0.517138	Not Significant
	D(lnGASP)	0.8864	0.020402	Not Significant
	D(lnACGF)	0.0035*	8.539806	Significant at 1% critical level
	D(INT)	0.5535	0.351058	Not Significant
	D(lnALF)	0.6653	0.187174	Not Significant
	Joint(All)	0.1069	9.054579	Not Significant
D(lnACGF)	Variables			
	D(lnAOT)	0.1114	2.534754	Not Significant
	D(lnGASP)	0.0698**	3.288067	Significant at 10% critical level
	D(lnCBLA)	0.7522	0.099674	Not Significant
	D(INT)	0.7525	0.099414	Not Significant
	D(lnALF)	0.9925	8.87E-05	Not Significant
	Joint(All)	0.4084	5.061346	Not Significant
D(INT)	Variables			
	D(lnAOT)	0.2505	1.320484	Not Significant
	D(lnGASP)	0.5146	0.424668	Not Significant
	D(lnCBLA)	0.4991	0.456781	Not Significant
	D(lnACGF)	0.3346	0.931105	Not Significant
	D(lnALF)	0.6974	0.151216	Not Significant
	Joint(All)	0.5377	4.081943	Not Significant
D(lnALF)	Variables			

Variables (Dependent)	Excluded	Probability	Chi-Square Value	Decision
	D(lnAOT)	0.0791*	3.084183	Significant at 10% critical level
	D(lnGASP)	0.1971	1.663374	Not Significant
	D(lnCBLA)	0.9627	0.002184	Not Significant
	D(lnACGF)	0.5284	0.397512	Not Significant
	D(INT)	0.4872	0.482626	Not Significant
	Joint(All)	0.5233	4.183550	Not Significant

Source: Extractions from E-views 10 Output; The asterisk (, **, ***) denotes rejection of the unit root hypothesis at 10%, 5% and 1% critical levels respectively*

5.2 Long-run Impact of Government Agricultural Spending on Agricultural Output in Nigeria

The long-run estimates from the Vector error correction test are presented as:

$$\ln AOT = 933.21 + 0.52\ln GASP + 0.32\ln CBLA + 0.87 ACGF - 0.06 INT + 57.4\ln ALF$$
$$(0.06) \quad (0.145) \quad (0.095) \quad (0.015) \quad (10.29)$$
$$[8.57] \quad [2.24] \quad [9.196] \quad [4.317] \quad [5.578]$$

Note: standard errors are in parenthesis () while t-statistics are in brackets [28].

The estimated coefficient of government agricultural spending is positive and theoretically plausible and statistically significant at 5% critical value. This implies that an increase in government agricultural spending leads to an increase in agricultural output in Nigeria. Similarly, the estimated coefficients of commercial bank loans to the agricultural sector and agricultural credit guarantee scheme fund are positive and theoretically plausible. They are statistically significant at 5% critical value. This implies that an increase in commercial bank loans to the agricultural sector and agricultural credit guarantee scheme fund lead to an increase in agricultural output in Nigeria. On the other hand, the estimated coefficient of interest rate is negative. The coefficient is also statistically significant at 5% critical value. This implies that an increase in interest rate leads to a decrease in agricultural output in Nigeria in the long run. Thus, there is a significant negative relationship between the interest rate and agricultural output in Nigeria in the long run. Furthermore, the estimated coefficient of the agricultural labour force is in line with the *a priori* expectation and statistically significant at 0.05 critical value. This indicates that an increase in the agricultural labour force leads to an increase in agricultural output in Nigeria in the long run. In this way, there is a significant positive relationship between the agricultural labour force and agricultural output in Nigeria.

5.3 Short-run Impact of Government Agricultural Spending on Agricultural Output in Nigeria

The results of the short-run estimates and the error correction mechanism that is used to eliminate the discrepancy that occurs in the short-run towards long-run equilibrium are summarized in Table 9:

The estimated coefficient of government agricultural spending in the short-run is positive and is theoretically plausible but it is not statistically significant. This implies that an increase in government agricultural spending does not significantly lead to an increase in agricultural output in Nigeria in the short-run. Similarly, the estimated coefficients of commercial bank loans to the agricultural sector, agricultural credit guarantee scheme fund, previous agricultural output and agricultural labour force are also positive in the short-run and theoretically plausible, but not statistically significant at 5% level of significance. This implies that an increase in commercial bank loans to the agricultural sector, agricultural credit guarantee scheme fund, previous agricultural output and agricultural labour force do not significantly lead to increase in agricultural output in Nigeria in the short-run. On the other hand, the estimated coefficient of interest rate is negative in the short-run, but not statistically significant implying that an increase in interest rate does not

significantly lead to a decrease in agricultural output in Nigeria in the short run at 5% level of significance. The estimated coefficient of the error correction term is significant with the expected sign and low magnitude (-0.10209). Its magnitude indicates that if there is any deviation the long-run equilibrium is adjusted slowly such that about 10% of the disequilibrium may be removed each period (that is each year).

The estimated coefficient of multiple determinations (R^2) explains that the independent variables were found to jointly explain 61.455% of the movement in the dependent variable with the R^2-adjusted ($\overline{R}^2$) of 54.9%. The overall significance of the model is explained by the F-statistic of 10.90114. Coefficients of the short-run dynamics show that government agricultural spending has insignificantly affected agricultural output of the Nigerian economy.

5.4 Model Checking (Diagnostics)

A diagnostic check is appropriate to establish whether the model is valid, in other words, a diagnostic check is applied to know if the model developed has a problem or not. Residual tests were conducted therefore to see whether estimates are reliable and can yield reliable statistical inferences. The result of Vector Error Correction VEC residual serial correlation Lagrange multiplier (LM) tests shows that there is no serial correlation at lag order 1. The multivariate normality test using Cholesky of variance was used for testing orthogonality. The study found that residuals are multivariate normal. The model used for the study was proven dynamically. This means that results or estimates produced are reliable and can stand statistical inferences. The overall significance of the model was good indicating that the results or estimates are not spurious but valid for statistical inference.

5.4.1 Impulse response of agricultural output to government agricultural spending in Nigeria

The results of the impulse responses of agricultural output in Nigeria to shocks are presented in Fig. 1.

The result of the ten years forecast shows that a positive shock of one-standard deviation to government agricultural spending in Nigeria would eventually have a positive impact on agricultural output in Nigeria throughout the forecast. This implies that the response of agricultural output to shocks in government agricultural spending has exhibited a weakly upward trending pattern. Similarly, one-standard-deviation shock to commercial bank loans to the agricultural sector and agricultural credit guarantee scheme fund would exert a positive on agricultural output throughout the forecast. This implies that one standard deviation shock to commercial bank loans to the agricultural sector and agricultural credit guarantee scheme fund would exact a positive response on agricultural output in Nigeria permanently. Also, a positive shock of one-standard-deviation to interest rate would have a positive impact on agricultural output in Nigeria in the short run and long run. On the other hand, one standard deviation shock to agricultural labour force would exert a negative influence on agricultural output in Nigeria throughout the forecast period. From above, it can be deduced that agricultural output in Nigeria would respond positively to one standard deviation shock to government agricultural spending, commercial bank loans to the agricultural sector, and commercial bank loans to the agricultural sector. Shocks to agricultural output (own shocks) are estimated to have a positive impact on agricultural output in Nigeria throughout the forecast period.

Table 9. Short-run estimates

Variables	Coefficient	Std. Error	t-Statistic	Prob.
CointEq1	-0.10209	0.08177	-1.24849	0.2135
D(LNAOT(-1))	0.340739	0.168944	2.016873	0.0452
D(LNGASP(-1))	0.02305	0.039255	0.587270	0.5578
D(LNCBLA(-1))	0.15727	0.080784	1.946803	0.0532
D(LNACGF(-1))	0.073944	0.068398	1.081091	0.2812
D(INT(-1))	-0.00795	0.008905	-0.89305	0.3731
D(LNALF(-1))	22.6089	14.81848	1.525720	0.1289
C	0.105537	0.044858	2.352692	0.0198

R^2 = 0.614551; $\overline{R}^2$ = 0.549098; F-statistic = 10.90114; Source: Extractions from E-views 10 Output

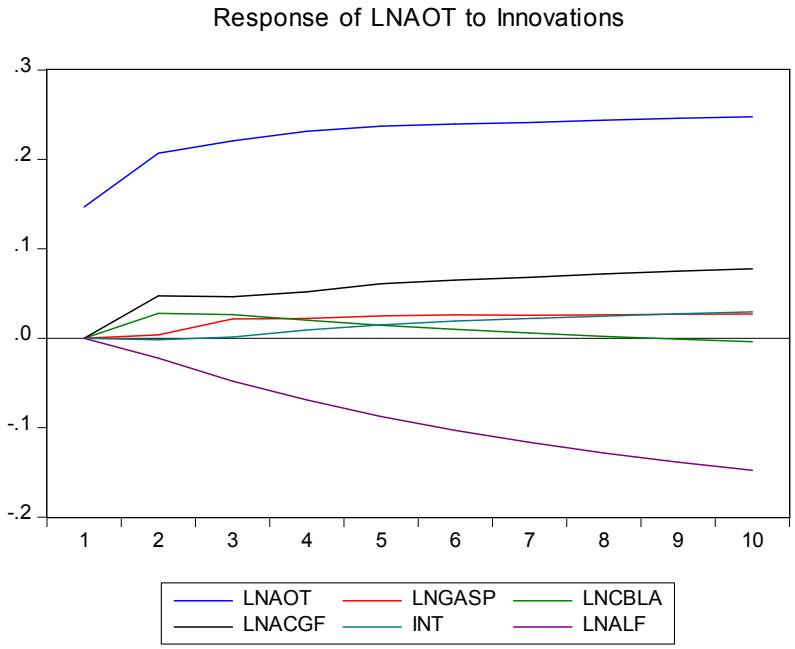

Fig. 1. Results of impulse response of the variables

Table 10. Variance decomposition of agricultural output

Period	S.E.	LNAOT	LNGASP	LNCBLA	LNACGF	INT	LNALF
Shortrun	0.349561	92.50680	0.390815	1.203116	3.597673	0.003781	2.297815
Longterm	0.814637	78.29135	0.765379	0.338010	5.499065	0.515332	14.59087
Decision		Decreasing	Increasing	Decreasing	Increasing	Increasing	Increasing

Source: Extractions from E-views 10 Output

5.4.2 The accumulated forecast error variance of agricultural output to government agricultural spending in Nigeria

The results of the accumulated forecast error variance of agricultural output to shocks in Nigeria is presented in Table 10.

The results in Table 10 suggest that a positive shock in government agricultural spending accounts for about 39.08% and 76.53% of the variations in agricultural output in Nigeria in the short-run (third year) and long-run (tenth year) respectively. Similarly, a unitary shock in commercial bank loans to the agricultural sector accounts for 1.203% and 0.338% of the accumulated forecast error variance of agricultural output in the third year (short-run) and tenth year (long run) respectively. More so, shock or innovation in agricultural credit guarantee scheme fund accounts for 3.59% and 5.499% of the accumulated forecast error variance of agricultural output in the third year (short-run) and tenth year (long run) respectively. Also, the variations in agricultural output due to a unit shock in interest rate are 0.003% and 0.515% in the short run and long run respectively. Agricultural labour force would account for about 2.29% and 14.59% of the variations in agricultural output in Nigeria in the short-run and long-run respectively. The agricultural output would account for 92.5% and 78.29% of the variations in agricultural output in the third year and tenth year respectively. This implies that the accumulated forecast error variance of agricultural output to shocks in all the variables would exhibit an increasing trend throughout the forecast period except the own shocks and shocks in commercial bank loans to the agricultural sector.

Deducing from above, the study found that there is a positive influence of government agricultural spending on agricultural output in Nigeria in the long-run. The finding is consistent with that of Uremadu, Ariwa and Uremadu [11] and Iganiga and Unemhilin [18] that found a positive influence

of government spending on the growth of agricultural output. However, it is at variance with that of De and Dkhar [21] who found that the effect of public agricultural expenditure on agricultural output is significantly negative. But in the short-run, the relationship is not statistically significant at 5% level of significance. This implies that government agricultural spending has no instant effect on agricultural output in Nigeria. This finding is similar to that of Iganiga and Unemhilin [18] who found that the impact of government expenditure on agriculture is not instantaneous. The study also found that the agricultural credit guarantee scheme fund has a strong positive influence on agricultural output in Nigeria unlike the findings of Ndubuaku, Okoro, Bello, and Alozie [17] and Mathew and Mordecai [20] who found no significant influence of agricultural credit guarantee scheme fund on agricultural output in Nigeria.

The study also found that the forecasted variations in agricultural output in Nigeria are accounted for by changes in government agricultural spending and that any positive shock to government agricultural spending exerts a permanent positive effect on agricultural output in Nigeria. This implies that improvement in government agricultural spending would improve the output from the agricultural sector in Nigeria.

6. CONCLUSION AND RECOMMENDATIONS

The study concludes that there is a bidirectional relationship between government agricultural spending and agricultural output in Nigeria and that government agricultural spending has a positive impact on agricultural output in Nigeria. Based on the findings of this study, the following recommendations are made:

i. Government expenditure on agriculture should be improved upon the funds allocated to the sector and should be made available to real farmers through the provision of fertilizers, improved seedlings, and grant aiding to farmers through farmers cooperatives.
ii. Farmers in Nigeria should form farmers' cooperatives to be able to easily access credit facilities from banks as well as enhancing their easy access to farm inputs provided by the government.
iii. There is a need to increase the budgetary allocation to the agricultural sector from the present less than 5% of the total government annual budget to over 10% to boost food production, to alleviate poverty as well as meet up the international standard in the country.
iv. There is also the need to judiciously utilize the resources allocated to the Agricultural Sector as the increase in the percentage of budgetary allocation to the sector does not automatically increase the sector's performance if the resources are mismanaged. Consistently in government policies/programmes is also needed to boost the performance of the sector.
v. The effects of economic reforms on the agricultural sector cannot be said to be satisfactory given its minimal contributions to the sector. Both the government and the private sector, which should drive the agricultural sector through consistent policies, robust funding, and infrastructural development, have failed to accord agricultural development the priority it deserves.
vi. Moreover, the anticipated benefits from agricultural development have been minimal in Nigeria. Thus, there is an urgent need to revamp the sector through adequate budgetary allocation, consistent policies and judicious use of allocated resources and above all a genuine democracy and good governance in Nigeria to achieve poverty reduction, sustainable livelihood, food security and above all, a corresponding output/performance of the sector in Nigeria.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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