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Agricultural Production and Economic Growth in Nigeria: A VAR Approach

Ojonye, S.M. Nuga, K.A.
Federal School of Statistics, (National Bureau of Statistics), Manchok. P.M.B. 2043, Kaduna-Nigeria

Omotola, A.A. Philips, S.A. Esho, O.
Federal School of Statistics, (National Bureau of Statistics), Ibadan- Nigeria

Abstract
Prior to the discovery of crude oil in commercial quantities in 1952, Nigeria relied almost exclusively on agriculture for its sustenance. The sector contributed more than 80 percent of total government revenue and generated over 75 percent of total employment. However, this contribution was truncated in the late 1970s as the country shifted focus in favor of oil exploration and exportation. What is the extent of agriculture's contribution to economic growth in recent times had remained a theoretical puzzle. This study is undertaking with the objective of investigating the impact of agriculture on economic growth in Nigeria and offers a theoretical framework for understanding the co-evolution of the structural and institutional factors that contributed to several sectorial interactions among the core determinants of agricultural productivity and long-term economic growth in the country for the period 1980-2017. Adopting a vector autoregressive (VAR) model as a technique of analysis, the study found positive and significant impact of agricultural output on economic growth for the period of investigation. The study also explored the contributions of the various components of agricultural productivity and found that crop production contributes more significantly to agricultural development than the other sub sectors of the agricultural economy. The study conclude with some recommendations such as putting in place agricultural growth promotion plans that could guarantee the practice of agriculture as a business, investing in agricultural infrastructure development to encourage all-year farming to ensure food security and sustainability, subsidizing agricultural inputs to farmers as well as strengthening the linkages between agriculture and other sectors of the economy for rapid industrialization among others.
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1. Introduction

The clamour for increasing agricultural productivity to cater for the rising world population alongside the provision of raw materials for industrial inputs has been a long-standing one. Recent report by the United States Agency for International Development (USAID, 2014) that more than 800 million people across the globe go to bed hungry every night led to the resurgence of interest on agriculture as a means of sustenance cannot be over emphasized. As the world population is projected to hit 9 billion people by 2050, agriculture is the key to fighting any real or imagined food insecurity across the globe.

Prior to independence in 1960, the agricultural sector used to be the main stay of the Nigerian economy, employing over 80 percent of the population and contributing more than 75 percent of total government revenue. By the 1960s, Nigeria was the world's largest exporter of groundnut; the second largest exporter of cocoa and palm product as well as an important exporter of rubber and cotton. As CIA (2013) remarked, more recently, agriculture employs about two-thirds of Nigeria's labour force, and contributes significantly to the GDP and provides a large population of non-oil earnings. It is the oldest and the largest sector in the economy whose development is at the top the development agenda of the present administration. . It embraces all the subsectors of primary industry such as farming, fishing, livestock production and forestry.

Apart from its traditional role of providing food and animal for human consumption and trade, it creates jobs, draws the majority of the population into the economic and social mainstream and continuously reduces mass poverty and guarantee inclusive growth.

Following this introduction, the rest of the paper is divided as follows: section two presents a review of the literature; section three gives the theoretical framework and model specification; section four presents the estimation of the data while conclusion and recommendations are presented in section five.

2. Literature Review

The term "agriculture" has been variously defined by different authors over the years even though, its history predates to more than 10,000 years ago. The word "agriculture" emanated from the late Middle English adaptation of a Latin word "agricultura" coined from "ager", meaning "field" and "cultura", meaning "cultivation" or "growing". It is the act and science of growing plants and other crops and the raising of animals for food needed

by man or other economic grains. According to Rimando (2004), agriculture is the systematic raising of useful plants and livestock under the management of man. Hence, the "economics" of agriculture is at play because it dwelt more on the usefulness and necessity of man engaging in agriculture. As a result, not all planting of crops and raising of animals can be termed "agriculture". More concisely, Rubenstein (2003) defined agriculture as the deliberate effort to modify a portion of earth's surface through the cultivation of crops and the raising of livestock for sustenance or economic gain.

The relationship between agriculture and economic growth has been extensively discussed. Early Classical thinking by Ricardo (1877), was that diminishing returns in agriculture is crucial because limitations on the growth of agricultural output sets the upper limit to the growth of the non-agricultural sector and to capital formation for economic expansion. As a result, Lewis (1954) proposed a dual economy model that distinguishes between a traditional and modern (industrial) sector. In this view, labour productivity is typically lower in the agricultural sector than in the industrial sector and as such, developments require the movement of agricultural labour into non-agricultural sector.

In the Neoclassical version, the need for agricultural growth during early stages of development was examined within the context of equilibrium wage being predicted to equate the value of the marginal product. With minor qualifications, any observed difference in wages is attributed to differences in labour quality which leads to differences in marginal product. Differential labour quality according to Mincer (1958) may be due to personal ability or endowment of human capita, built up primarily through schooling. Hence, Yang and Zhu (2004) use growth theory to capture the inter -temporal dynamics of the development process in which without the agricultural productivity, a traditional economy cannot overcome the fixed supply of natural resources and thus, cannot generate sustainable economic growth. Irrespective of how fast the non-agricultural sector can grow, stagnation of agricultural productivity during the early stage of development may prevent the structural transformation from a traditional sector to a modern economy.

While the development of a productive agricultural sector is both a necessary and sufficient condition for economic growth of nations, there exist in the literature, two conflicting views about the economic contribution of agriculture to national economic growth. In the first view, Lewis (1954) opined that industrialization depends upon agricultural growth and productivity with both industrial and agrarian revolutions always occurring simultaneously. In the same vein, Mellor (1979) postulated that agriculture has a major role in the process of industrialization and modernization of a domestic economy due to the interrelationships and the multiplier effect between food supply, rural purchasing power, as well as labour and capital. This implies that agriculture is a demand-led industrialization in which growth in agricultural output can fuel growth in the non-agricultural economy through a variety of mechanisms – direct and indirect. As such, there was a concentration of argument on market-based inter-sectoral linkages as the source of agriculture's contribution to economic growth.

According to Johnson and Mellor (1961), there are five inter-sectoral linkages, namely: supply of surplus labour to firms in the industrial sector; supply of food for domestic consumption; provision of markets for industrial output; supply of domestic savings for industrial investment; and supply of foreign exchange from agricultural export earnings to finance import of intermediate and capital goods.

In the second argument, Cuong (2009), opined that a country which relies on agricultural export can be adversely affected by global economic shocks. This was supported by Pauw and Thurlow (2011) who argued that while sub-Saharan Africa countries experienced unprecedented economic growth in recent decades, this did not translate into less poverty or improved nutrition. There was a similar view by Nwafor, Ebor, Chukwu and Amuka (2011) who argued that it does not always lead to rapid poverty reduction due to differences in poverty outcome of growth which may result from the sources of growth in different scenarios.

In empirical term, several studies have focused on understanding the relationship between agriculture and economic growth. Awokuse (2009) argued that there exist, disagreement on the causal dynamics between agriculture and economic growth which Timmer (2005) opined that part of the controversy of the role of agriculture to economic growth stems from the fact that structural transformation of an economy is a general equilibrium process that cannot be explained by looking at agriculture alone. Hence, the relationship between the agricultural sector and economic growth should not be a matter of competition, but viewed as inter dependent where supply and demand can be accommodated through a system of linkages.

Thus, Irz, Lin, Thirtle and Wiggins (2001), posited that the most direct contribution of agriculture to economic growth is increase in incomes of farmers and their purchasing power. Therefore, agriculture contributes to economic growth by increasing the incomes of the majority of the population thereby strengthening their saving capacity. Also, Diao, Xinshen, Hazell, Peter and Thurlow (2009) in a study of six low-income countries of Africa, examined the effect of other channels of growth on the decrease in poverty and overall economic growth rate. They found that industrial growth is less effective in reducing poverty than the agricultural growth because a major percentage of the population live in rural areas. They stated further that even though the industrial sector is important for boosting the economy, it fails to create sufficient employment opportunities for the poor and unskilled workers. They concluded that there was little evidence to show that African countries could launch a

successive economic transformation without going through agricultural revolution on a country-wide basis.

In the Nigeria context, Iyoha and Oriakhi (2002) in their study of African economic growth performance using the growth accounting model identified the sources of economic growth and found that agriculture contributes more than expected to GDP growth. Also, Anyanwu, Ibekwe and Adesope (2010) examined the share of gross domestic product and its implications for rural development for the period 1990 and 2001. They adopted a correlation matrix and found that production of major staples in Nigeria contribute significantly to GDP growth with the exception of wheat. In another study, Olajide, Akinlabi and Tijani (2012) examined the role of agricultural resources and economic growth using Ordinary Least Squares Regression and found a positive causal relationship between GDP and agricultural output in Nigeria for the period of 1970 and 2010. Relatedly, Onunze (2012) investigated the impact of agricultural development on the Nigeria's economic growth for the period 1980 – 2010. The result of the Ordinary Least Squares regression method showed that agricultural development, productivity impacted positively on economic growth in Nigeria. In an earlier study, Oji-Okoro (2011) investigated the relationship between agriculture and economic growth in Nigeria for the period 1980 – 2010 and found that agriculture resources has been an important sector in the Nigerian economy in the past decades, and is still major sector despite the oil boom.

In a study on agricultural production and economic growth in Nigeria for the period 1981 – 2012, Oyakhilomen and Zibah (2014) used an Autoregressive Distributed Lag (ARGL) model and found that agricultural production was significant in influencing a favourable trend of economic growth in Nigeria. Also, Amire and Arigbede (2016) in their study on the effect of agricultural productivity on economic growth in Nigeria for the period 2000 – 2014 applied an Ordinary Least Squares method and found that there is a long-run relationship between agricultural productivity on economic growth.

Other valuable contributions to the relationship between agriculture and economic growth can be found in the work done by Ogen (2007) in his paper entitled "agricultural sector and Nigeria's development" believed that the agricultural sector has a multiplier effect on socio-economic and industrial fabric of any nation because of the multifunctional nature of the agricultural sector.

3. Theoretical Framework and Model Specification

The relationship between economic growth and the sources of growth across nations can be understood within the context of the Neo-classical growth accounting framework of Solow (1957). There are three advantages of using the Solow's growth accounting framework. First, it presents a theoretical framework for understanding the sources of economic growth and the consequences of long-run growth of changes in economic environment and in economic policy. Second, it allows one to break down growth into components that can be attributed to the observable factors and to a residual factor-often called the Solow residual-which is a portion of growth that is left unexplained by increases in the standard factors of production. Third, it is a social accounting or input-output matrix which helps in the calculation of the impact multipliers from a model based on economic theory.

The Neoclassical growth accounting framework measures the aggregate output of an economy (Y_t) at any given time as a function of the economy's stock of capital at that particular time (K_t), its labour force (L_t) and the economy's total factor productivity (A_t); which is technically represented as $Y_t = A_t \,.\, (K_t)^{\alpha} L_t)^{1-\alpha}$. This is based on the assumption that $0<\alpha<1$ and $\mu>0$; so that the level of output at any given time is defined by; $Y_t - Y_t - A_t^{\mu} f(K_t^{\alpha}, L_t^{1-\alpha})$. This Cobb-Douglas-type production function states that output changes due to the economy's capital stock, the labour force and changes in its level of total factor productivity.

The level of changes in output with respect to capital stock from its current value has its effects defined by $K_t + \Delta K$, so that increase in capital stock is in proportion to an amount $\Delta K/K$. Here, K is raised to α for a proportional growth rate of a quantity of output raised to a power to discover that the proportional increase in output from this change in capital stock is $\Delta Y/Y_t = \alpha \,.\, \Delta K/K_t$. This effect of output change to a change in labour force from its current value, L_t to a value $L_t + \Delta L$ imply that an increase in capital stock by a proportional amount $\Delta L/L$ is such that the labour force, L_t is raised by a power $(1 - \alpha)$ to raise the output growth by the same power on the discovery that the proportional increase in amount of output is from $\Delta Y/Y_t = (1 - \alpha)\Delta L/L_t$. For a given change in total factor productivity A, an effect of this change on output will result in a proportional increase in total factor productivity which provides the same proportional increase in output as $\Delta Y/Y_t = \Delta A/A_t$. Given a real-world situation, the proportional growth rate of output in an economy is defined by $\Delta Y/Y_t = \alpha \,.\, \Delta K/K_t + (1 - \alpha)\Delta L/L_t + \Delta A/A_t$. The first term $\alpha(\Delta K/K_t)$ gives the contribution of

capital to the growth of output; the second term $(1-\alpha)^{\Delta L}/_{L_t}$ gives the contribution of labour to growth of output, and the third term $(^{\Delta A}/_{A_t})$ gives the contribution of the total factor productivity to the growth of output. These terms are essential in understanding the sources of economic growth in an economy. If the diminishing-returns-to-scale parameter (α) in the production function is known, then, the growth accounting equation can be used to calculate the rate of growth of total factor productivity A_t, and to decompose the growth of total output Y_t into three distinct variables: the contribution from increase in capital stock; the contribution from increase in labour force; and the contribution from higher total factor productivity.

The aggregate output (Y_t) is defined as the sum of contributions of each of the sectors of the economy. Consequently, aggregate output (Y_t) in this case comprises the sectoral outputs (from agriculture) as assumed to be outputs of its sub-sectors, and is specified as $Y_t - \sum_t^T Y_{it}$ and $Y_{it} - \sum_t^T Y_{ijt}$. Where ($Y_t$) is the aggregate output of an economy in period t, Y_{it} is the output of the sector (agriculture) in period t, and Y_{ijt} is the output of the sub-sectors (crops, livestock, fisheries and forestry) of agriculture in period t. Growth in each sector of the economy influences growth in the aggregate output, while growth in the sub-sectors can be sources of growth in that sector. This can be specified by stating that growth in aggregate output and growth in sectoral output are the first derivatives such that $\delta Y_t/_{Y_t} = \sum_t^T \delta Y_{it}/_{Y_{it}}$ and that $\delta Y_{it}/_{Y_{it}} = \sum_t^T \delta Y_{ijt}/_{Y_{ijt}}$. This yield the aggregate economic growth and those of the sectoral output to be expressed as $\delta Y_t/_{Y_t} = \sum_t^T \delta Y_{it}/_{Y_{it}} \cdot \delta Y_{it}/_{Y_{it}}$ and $\delta Y_{it}/_{Y_{it}} = \sum_t^T \delta Y_{ijt}/_{Y_{ijt}} \cdot \delta Y_{ijt}/_{Y_{ijt}}$. Here, the weighted growth of the sectors and the sub-sectors are expected to contribute positively to the growth in the aggregate output.

Disaggregating the total output of the economy into agricultural sector; A, and non-agricultural sector; N, the total output can be expressed, in line with Poonyth, Hassan, Kirsten, and Calcoterra (2012) as

$$Y = A + N \quad \text{---------- 1}$$

Where: $$A = f(K_A, L_A) \quad \text{---------- 2}$$

And $$N = f(K_N,\ L_N,\ A) \quad \text{---------- 3}$$

The Nigerian economic sectors according to Central Bank of Nigeria (CBN) and National Bureau of Statistics (NBS) are disaggregated into the agriculture, industry, trade and services. The agricultural sector is decomposed into crop production, livestock production, fisheries and forestry. The value-added by these sectors and sub-sectors are included in the modeling framework and estimated using the Ordinary least Squares (OLS) method as follows:

$$GDP = \beta_0 + \beta_1 AGRIC + \lambda X_{is}^1 + \mu_i \quad \text{---------- 4}$$

X_{is}^1 are vectors of instrumental variables and cofactors that may influence agricultural production in the country.

The growth equation was estimated as a system with equations for the determinants of economic growth; agricultural production and instrumental variables whose estimation in the context of classical regression analysis is straight forward. If the error distribution cannot be considered independent of the regressor's distributions, then instrumental variables is exploited using appropriate set of instruments. Hence, the equation relates the GDP to a number of variables whose relationship has been well established in the empirical literature on growth. The econometric model includes the following equations:

$$GDP_t = \alpha_0 + \alpha_1 AGRIC_t + \alpha_2 INDUST_t + \alpha_3 BUILDG_t + \alpha_4 TRADE + \alpha_5 SERVICES_t + \mu_{t1} \quad \text{---------- 5}$$

Where: GDP_t is gross domestic product in period t, as a proxy for economic growth; $AGRIC_t$ is output of agricultural sector in period t; $INDUST_t$ is output of industrial sector in period t; $BUILDG_t$ is the value of building and construction sector in period t; $TRADE_t$ is the value of wholesale and retail trade sectors in period t; and $SERVICES_t$ is the value of the services sector in period t.

The $\beta's$, α_{is} and λ are parameters (or vector of parameters) to be estimated while ε_i and μ_i are the random disturbance term in each equation.

On a priori, α_0, α_1, α_2, α_3, α_4, and $\alpha_5 > 0$ for equation (5) All the data were sourced from Statistical Bulletin

of the Central Bank of Nigeria (2017) and the Annual Abstract of Statistics from the National Bureau of Statistics (various issues).

4. Estimation

Before actual estimation, a unit root and stationarity tests are performed on the levels of the variables through the use of the Augmented Dickey-Fuller (ADF) test. The ADF test is used due to the drawback associated with the conventional Dickey-Fuller (DF) test. The following results were obtained:

Table 4.1: Result of Unit Root (Stationary) Test

Augmented Dickey-Fuller (ADF) Test			
Variables	**Critical Value**	**ADF Test Statistic**	**Status**
GDP	-2.9499	-4.033048	I(1)
AGRIC	-2.9499	-3.516212	I(1)
INDUSTRY	-2.9499	-5.214738	I(1)
SERVICES	-2.9527	-5.313766	I(2)
BUILDING	-2.9527	-5.870540	I(2)
TRADE	-2.9527	-6.092964	I(2)

E-view Version 7.0

Based on the unit root properties of the variables, the Augmented Dickey-Fuller (ADF) test showed that the dependent variable, the GDP do not have the same order of integration with the explanatory variables. This means that the variables contain unit root and as such did not achieve stationarity at levels. This indicates that the null hypothesis of no unit root among any of these variables cannot be rejected and hence, there is need to conduct a co-integration test between these variables and GDP. Hence, stationarity was achieved after first-order and second-order differencing. The linear combination of the variables were estimated at level form without recourse to the intercept and the residual, hence, subjected to co-integration test as shown on table below

Table 4.2 Tests of Co-integration

Table 4.2(a): Test of Co-integration with Trace Statistic

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	5 Per cent Critical Value	1 Per cent Critical Value
None **	0.806380	115.6094	68.52	76.07
At most 1 **	0.638720	58.14438	47.21	54.46
At most 2 *	0.336278	22.51078	29.68	35.65
At most 3	0.194090	8.164564	16.41	20.04
At most 4	0.017338	0.612163	3.76	6.65

1(*) denotes rejection of the hypothesis at the 5 per cent (1 per cent) level
Trace test indicates 2 Co-integrating equation(s) at the 1 per cent level

Table 4.2(b): Test of Co-integration with maximum Eigen Value Statistic

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Per cent Critical Value	1 Per cent Critical Value
None **	0.806380	57.46607	33.46	38.77
At most 1	0.638720	35.63359	27.07	32.24
At most 2	0.336278	14.34622	20.97	25.52
At most 3	0.194090	7.562401	14.07	18.63
At most 4	0.017338	0.612163	3.76	6.65

1(*) denotes rejection of the hypothesis at the 5 per cent (1 per cent) level
Max-Eigen value test Indicates 2 Co-integrating equation(s) at both 5 per cent and 1 Per cent levels.

The unit root test as contained in table 4.1 showed that economic growth and the key sectors are integrated of orders (1) and (2) hence, the need for co-integration test as contained in table 4.2. The co-integration test was done with the aid of a reduced rank procedure developed by Johansen (1991) and Johansen and Joselius (1990) to detect the number of co-integrating vectors in a non-stationary time series. The choice of Johansen and Johansen and Joselius techniques is due to their vector auto regression based which is characterized by better performance than single equation and alternative multivariate method. In particular, it allows for a test of null hypothesis in respect of the key elements of co-integration based on a leading matrix. The procedure is used to determine the long run relationship between the variables. The results showed that there exist, at most two (4) co-integrating equations at both 5 percent and 1 per cent levels to show the presence of long-run relationship between GDP and all the explanatory variables. Since the variables are confirmed not to be co-integrated, a Granger-Causality test is conducted as shown below:

4.3 Results Granger-Causality Test

Null Hypothesis	Observations	F-statistic	Probability
AGRIC does not Granger-Cause GDP	35	8.50080	0.00119
GDP does not Granger-Cause AGRIC		2.33777	0.11389

Source: Own Computation Using E-Views 7.0

The causality test as shown above shows that the hypothesis that agriculture (AGRIC) does not Granger-Cause Gross Domestic Product (RGDP) can be rejected with the conclusion that development in the agricultural sector can spur aggregate growth of the economy and as such, there is the need to give serious attention to agricultural sector development.

4.4 Results of Linear Regression

Variables	Coefficient	Std. Error	t-Statistic	Prob.
AGRIC	0.115422	0.029643	3.893674	0.0005
INDUSTRY	0.375069	0.039943	9.389735	0.0000
$SERVICES_t$	0.212836	0.064673	3.290957	0.0026
$SERVICEt_{-1}$	0.033320	0.069280	0.480949	0.6240
$TRADE_t$	0.307626	0.057404	5.358967	0.0000
$TRADE_{t-1}$	0.039614	0.072722	0.453360	0.5909
C	0.564640	0.206453	2.699608	0.0113
R-squared	0.999210	Mean dependent var		7.480000
Adjusted R-squared	0.999052	S.D. dependent var		0.214683
S.E. of regression	0.006610	Akaike info criterion		-7.031935
Sum squared resid	0.001311	Schwarz criterion		-6.727166
Log likelihood	137.0908	F-statistic		6324.938
Durbin-Watson stat	1.520003	Prob(F-statistic)		0.000000

Source: Own Computation Using E-Views 7.0

The regression results as presented in table 4.4 are done at 5 percent level of significance to show the impact of agricultural production on economic growth in Nigeria. The regression analysis are quite plausible in that the estimated t-statistics that corresponds to each of the parameter estimates are statistically high and significance while the R^2 which measures the goodness of fit of the model explains over 99 percent (0.999210) of the total variations in the real gross domestic products are explained for by the regressors of the model. The F-statistic is equally statistically significant high while the value of the Durbin-Watson (D-W) statistic reveals that autocorrelation is not a problem in the model.

The results showed that GDP would rise by over 11 percent, for every one unit change in agricultural production, holding all other variables constant. This is consistent with literature that there exist a positive and significant relationship between agricultural output and economic growth. This contribution to economic growth by the agricultural sector is influenced by other variables of the model. Although, the effects and impacts of agricultural production on economic growth in Nigeria remains the focus of this study, the study incorporated other sectors of the economy into the modeling framework to allow for inter-sectoral comparisons that could warrant analysis for proper evaluation of the agricultural sector.

5. Conclusion and Recommendations

This study has successfully established the contributions of agricultural sector to economic growth in Nigeria for the period 1981 and 2017. The study was able to establish the fact that economic growth in Nigeria has largely been accounted for by the resilient agricultural growth associated with the performance of the other sectors such as industry, services and trade. Consistent with the literature, this study found that agriculture; industry, trade, and services all have positive contributors to economic growth in Nigeria with industry having the largest contributions, followed by the current values of trade and services. This was due to the rebasing exercise carried out by the National Bureau of Statistics (NBS) in 2012 which brought to the fore, the contributions of several "enclave: economies" in the process of economic growth in Nigeria.

This study established that agriculture production was positively and significantly related to economic growth for the period of study. Despite its neglect over the years, there was a clear evidence that agriculture has the propensity to spur economic growth through industrialization as well as facilitating trade, guarantee service delivery and improves the living standards of an average Nigerians if the sector can be adequately invested upon and given all the necessary attentions it deserves.

Based on the findings of this study, the following recommendations are made:

1. There is the need to adopt a proactive agricultural growth promotion plan that involves conducting agricultural survey across the country to identify areas of specific cropping needs and establishing small holder farming schemes for both crop and livestock farming as may be desirable and appropriate.

2. There is the need to invest in the building of infrastructures such as irrigation schemes, establishment of community farm centres and increasing the effectiveness of fish farming and forestry practices to ensure enhancement of aggregate agricultural productivity across zones in Nigeria.
3. There is the need to grant subsidies to domestic farmers to add a boost to agriculture production since the majority of farmers are poor and peasant who farm only to achieve subsistence and a little for commercial agriculture. This entails making agriculture a business from which incomes can be generated to ensure employment generation and poverty reduction for sustainable development. This can be achieved by inculcating a capitalistic mindset on all farmers to ensure an enhanced interest in agriculture through government intervention by way of subsidies.
4. There is also the need to strengthen the linkages between agricultural sector and other sectors of the economy such as industry, trade and services to ensure that agricultural growth is translated to the growth of other sectors, since agriculture will provide the needed inputs to the rest of economy, thus, serving as a leading sector of the economy.

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