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# An Empirical Investigation of the Contribution of Agriculture, Petroleum and Development of Human Capital to the Economic Growth in Nigeria, 1970-2012

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## Authors' contributions

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## ABSTRACT

An empirical investigation of the contribution of agriculture, petroleum, human capital to the economic growth in Nigeria were carried out in this paper by employing cointegration test, Granger causality test and ordinary least square techniques, using the data of annual time series for the period 1970-2012. The findings reveal the existence of 3 cointegrating vectors which show a long-run relationship among the variables in the series used. The Granger causality test shows that there is a bi-directional causality among the variables. The OLS results show that agriculture and petroleum contribute to output growth positively and significantly, while human capital contributes to output growth negatively but insignificantly. Thus, if a policy aims at sustaining a high rate of economic growth in Nigeria, the priority should be given to the development of human capital in the budgetary and development policies. An effective coordination of these variables and a good policy mix to avoid lopsidedness will ensure a high and sustainable economic growth since there is a bi-directional causality between these variables.

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## 1. INTRODUCTION

### 1.1 Background of the Study

The contribution of the agricultural sector to the economy cannot be over emphasized when its role in building grounds for development, its employment potentials and financial impacts on the economy are considered. Apart from laying solid foundation for the economy, it also serves as an import substituting sector, providing a ready market for raw materials and intermediate goods [1]. It has been noted that problems of the Nigerian economy include downturn of the global oil market of the early 1980s, sharp decline in foreign exchange earnings, excessive dependence on imports for consumption and capital goods, dysfunctional social and economic infrastructure, unprecedented fall in the rate of capacity utilization in industry, neglect of the agricultural sector and the global financial crisis that rocked the world economies by creating "ripple effect". These have resulted in fallen incomes and devalued standard of living among Nigerians. Agriculture was the leading sector in the pre-oil boom era, contributing 63 and 54 percents to GDP in the 1950s and 1960s respectively [2]. The sector's share in gross domestic product fell in the post-oil boom period and later maintained a gradual increase. For instance, the share of agriculture in real gross domestic product (RGDP) in Nigeria averaged 29.2% between 1970 and 1980; it was 33.3% between 1980 and 2000 and 41.2% between 2001 and 2009 (Computed from the CBN Statistical Bulletin 2010). Agriculture also employs a majority of the Nigerian labour force which is 65% [3]. Agricultural sector contributes to the development of an economy in four major ways that are contribution to product, factor, market as well as foreign exchange [4-6]. It is estimated to be the largest contributor to non-oil foreign exchange earnings in Nigeria. This means that agriculture holds abundant potential for enhancing and sustaining the country's foreign exchange [7].

The structure of the Nigerian export composition changed with the entrance (entrant) of oil in 1970s. The petroleum sector brought about fundamental changes in the Nigerian economy. Increased dependency on the oil sector brought mixed feelings to the Nigerian government when it became the life line of the economy so that all sectors of the economy suffered the shock

waves. The prevalent opinion of "... governmental economic policies seemed to be dominated by the mentality that money was not our problem" [8] had brought crises to the Nigerian economy over the past 46 years due to continuous dependence on petroleum. For instance, the crisis in 1985 brought economic emergency measures that culminated to the structural adjustment programme in 1986 while a drastic fall in the oil price in 2009 brought more adjustments.

The economic slowdown brought by the global financial crisis reduced the growth of petroleum demand, resulting in a fall in oil price. These trends in the oil sector have plagued all sectors of the Nigerian economy.

The hope for reviewing Nigerian economy seems to lie on good policies aimed at diversifying the economy. The good policies can only be made by well-trained people. Therefore, the development of human capital is central to achieve the economic growth and sustainable development in any nation. It has been found that there is a strong positive relationship between the development of human capital and economic growth in Nigeria [9]. However, the illiteracy rate in Nigeria is still high and many workers are still unskilled. There is a large number of unemployed graduates and this situation leads to a low productivity in the economy. The development of Nigerian human capital and capacity utilization are besieged with many problems, such as the content of the training programme, paper qualification criteria and federal character principles in employment and attitude to work.

This paper aims at finding out the contribution of agriculture, petroleum and development of human capital to the economic growth in Nigeria empirically. The finding will be important to policy makers both in analysing and determining the best policy mix in these three sectors of the economy.

This paper is organized into five sections: Section one comprises the introductory background of the study. Section two covers the theoretical framework and literature review. Section three gives information about the research methodology while section four deals with presentation, interpretation and discussion of results. Section five covers the summary of findings, policy implications and policy recommendations.

## 2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

### 2.1 Theoretical Framework

Agriculture involves the cultivation of land, the raising and rearing of animals for the purpose of food production (production of food) for man, feed for animals and raw materials for industries. In its broadest sense, agriculture comprises the entire range of technologies associated with the production of useful products from plants and animals, including the cultivation of soil, the management of crop and livestock and the activities of processing and marketing. The role of agriculture in reforming both the social and economic framework of an economy cannot be over-emphasized. It is a source of food and raw materials for the industrial sector. It is also essential for the expansion of employment opportunity, for reduction of poverty and improvement of income contribution, for speeding up industrialization and easing the pressure on balance of payments [10]. According to [11], agricultural development can promote economic development of the underdeveloped countries in four different ways (i) by witnessing the supply of food available for domestic consumption and referring the labour needed for industrial development, (ii) by enlarging the size of domestic market for the manufacturing sector, (iii) by increasing the supply of domestic savings and (iv) by providing the foreign exchange earned by agricultural exports.

Nigerian economy can reasonably be described as an agricultural economy because agriculture served as the engine of growth of the overall economy during the first decades after independence [12]. Nigeria was the world's second largest producer of cocoa, largest exporter of palm kernel and largest producer and exporter of palm oil during this period. Nigeria was also a leading exporter of other major commodities such as cotton, groundnut, rubber and animal hides [12]. The agricultural sector contributes to over 60% of the GDP in the 1960s. Despite the fact that Nigerian peasant farmers relied on traditional farm implements and indigenous farming methods, they produced 70% of Nigeria's exports and 95% of its food needs [12]. However, the agricultural sector now accounts for less than 5% of Nigeria's GDP [12]. The neglect of the agricultural sector and the dependence on a mono-cultural crude oil-based economy has not augured well for the well-being of the Nigerian economy. Development

economists have focused on how agriculture can best contribute to overall economic growth and modernization. A group of physiocrats believes that the fate of the economy is regulated by the productivity in agriculture and its surplus is diffused throughout the system in a network of transactions. According to another study, the underdeveloped economies consist of two sectors which are the traditional, agricultural sector and the modern, industrial sector [13]. If development is to take place and become self-sustaining, it will have to include the rural area in general and the agricultural sector in particular. It becomes pertinent to examine the contribution of agricultural sector vis-a-vis petroleum sector as well as the development of human capital so that a good policy mix for Nigeria to achieve the vision of becoming one of the 20 industrialized nations of the world in 2020 is ensured. To realize this vision, priorities have to be placed on these, three vital sectors of the economy.

Petroleum sector became the major contributor to GDP after the discovery of oil at Oloibiri in Niger Delta in commercial quantity in 1950s. The Federal Government of Nigeria issued ten oil prospecting licenses on the continental shelf to five companies in 1961. Each license covered an area of 2, 560 square kilometers and was subject to the payment of ₦1m. Full-scale on-shore and off-shore oil exploration began with these generous concessions [14]. Since then, the mining sector and especially petroleum became the mainstay of the Nigerian economy. The petroleum sector contributed almost 40% to GDP on average. It contributed to 37.46% in 1990, to 48.19% in 2000 but its contribution decreased to 29.62% in 2009. The decline can be attributed to many factors, such as the emphasis given to agriculture with the current global food crisis and the need to diversify Nigeria's export base. A good policy mix is essential to avoid undue emphasis to one sector.

Human capital refers to the abilities and skills of human resources and the development of human capital refers to the process of acquiring and increasing the number of people who have the skills, education and experience which are critical for the economic growth of the country [15]. As a country, Nigeria is immensely endowed both in natural and human resources. The primary focus of Nigeria has been to find a way to accelerate the growth rate of national income and to engage in structural transformation of her subsistence and resource based economy to a production and consumption based economy in order to

break the cycle of poverty and low productivity. This can only be achieved through adequate development of human capital headed towards the right sizing both in quality and quantity since the agriculture and petroleum sectors, which are the mainstay of the Nigerian economy, need human capital.

## 2.2 Empirical Literature

A study conducted by [16] on the agricultural production in Nigeria revealed that the coefficient of the value of food imports was negative (-0.17). This situation is interpreted as the increases in food imports decrease the domestic agricultural production since food importation exposes the local farmers to unfair competition by foreign producers who usually take advantage of economies of scale in production due to their access to better production technology. Most studies reveal that agricultural sector contributes to the growth of GDP but the trend of growth has been fluctuating over the years [17-19]. The contribution of agriculture to GDP which was 63% in 1960 declined to 34% in 1988 as a result of neglect of agricultural sector [20]. Equally, another study analysing the contribution of both agriculture and petroleum to the growth and development of Nigerian economy reveals that the contribution of the agricultural sector is higher than that of the petroleum sector though both sectors have a positive impact on the economic growth and development [14]. However, agricultural sector suffered neglect during the hey-days of the oil boom in the 1970s [21]. The agricultural sector accounted for less than 5% of Nigeria's GDP in 2004 [22]. In modelling life expectancy against agricultural output and agricultural expenditure among other variables, it is found in a study that agricultural output has a negative and significant impact on life expectancy in Nigeria. Even though agriculture may matter for economic development, reliance on the sector alone without corresponding and simultaneous development of other crucial sectors, such as education, health and industry will not yield positive fruits for economic development in Nigeria [23]. Moreover, there are similar studies on the same issue. For instance, another study, which uses the GDP as a proxy for economic growth, total government expenditure on education & health and the enrolment pattern of tertiary, secondary and primary schools as a proxy for human capital, puts forward a strong relationship between the development of human capital and economic growth. Due to the fact that equipment and technology are products of

human mind and can only be made productive by people, the success of any productivity programme depends on the innovative ideas and creativity of humans [9].

## 3. DATA AND METHOD OF ANALYSIS

### 3.1 Data

The data used for this study are the time series covering 1970-2012 period and are obtained from the Statistical Bulletin of Central Bank of Nigeria (CBN).

### 3.2 Method of Analysis

This paper made use of econometric procedure in estimating the relationship between the variables. The Ordinary Least Square (OLS) technique was employed in obtaining the numerical estimates of the coefficients of the equation. The Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) tests were used to test the stationary of the variables. Equally, Johanson co-integration procedure was used to test the existence of long-run equilibrium (stationary) relationship among the economic variables. We also employed the Granger causality test to establish the causal relationship of the variables.

The OLS method was chosen because it has some optimal properties; its computational procedure is fairly simple and it is also an essential component of most of other estimation techniques. In demonstrating the application of Ordinary Least Square method, the multiple linear regression analysis was used where the GDP, agriculture, petroleum and development of human capital were the relevant variables. The GDP was used as the dependent variable while the agricultural output, petroleum output and Federal Government expenditure on the development of human capital were the independent variables. The selection of this method was justified because the data were a time series and all time series data exhibit a random walk.

### 3.3 Model Specification

This paper employed a multiple linear regression function of the form.

$$GDP = f(AGO, HCD, PET) \text{ ----- (1)}$$

Where;

GDP = Gross domestic product  
AGO = Agricultural output

HCD = Development of human capital as a proxy for Federal Government recurrent and capital expenditures on education and health  
 PET = Petroleum output

Note: All variables are measured in Nigeria Naira values at 2004 constant price.

The model is expressed in a mathematical equation as

$$GDP = b_0 + b_1 AGO_t + b_2 HCD_t + b_3 PET_t + U_t \quad (2)$$

## 4. EMPIRICAL RESULTS AND DISCUSSION

### 4.1 Unit Root Test

We first tested if the relevant variables in equation (2) were stationary as well as determining their orders of integration. We used both the Augmented Dickey-Fuller (ADF) and Philips-perron (PP) tests to find the existence of unit root in each of the time series. The result of both the ADF and PP tests are presented in Table 1.

Table 1 reveals that all the variables of time series are stationary at a second difference. On the basis of this fact, the null hypothesis of non-stationary is rejected and it is safe to conclude that the series are stationary. This also implies that the variables are integrated of order two, i.e, 1(2).

### 4.2 Cointegration Test Result

Having confirmed the stationarity of the variables at 1(2), we proceeded to examine the presence or non presence of cointegration among the variables. When a cointegration relationship is present, it means that gross domestic product (GDP), agricultural output (AGO), development of human capital (HCD) and petroleum output (PET) share a common trend and long-run equilibrium as suggested theoretically. We started the cointegration analysis by employing the Johansen and Juselius multivariate cointegration test.

Tables 2 and 3 show the results of the cointegration test. Both the trace statistic and

maximum Eigen value statistic indicate three (3) cointegrating equations at the five percent (5%) level of significance, suggesting that there is a cointegration or long-run relation among the variables tested in the tables.

The results in the Tables 2 and 3 were achieved after the sample was adjusted from 1970 to 1972-2012, i.e by including 41 observations with linear deterministic trend assumption and lags interval (in first differences) 1 to 1 in the series.

### 4.3 Granger Causality Test Result

According to the result obtained from the Granger causality test as shown in Table 4, there is bi-directional causality between agricultural outputs (AGO) and gross domestic product (GDP) and between petroleum output (PET) and gross domestic product. It suggests that the null hypotheses of "AGO does not Granger cause GDP" and "GDP does not Granger cause AGO" are rejected, which indicates that causality runs from either directions.

Equally, the result indicates that there is (are) bi-directional causality between HCD and AGO, between PET and AGO, no comma and between PET and HCD. These results are statistically significant for the data samples. On the other hand, the result also shows that causality runs from HCD to GDP but does not significantly run from GDP to HCD.

Based on these results, we can conclude that the budgetary policy of the government, which will increase the development of both the human capital and petroleum sector in addition to the improvement of agricultural output, should be pursued.

### 4.4 Ordinary Least Square Result

The multiple linear regression equation based on ordinary least square method shows the model as

$$GDP = 27321.01 + 2.65(AGO) - 64.64(HCD) + 0.11(PET)$$

S.E =	(113274.8)	(0.24)	(39.45)	(0.02)
t* =	0.24	10.85	-1.64	4.99
Prob.=	0.81	0.00	0.11	0.00
R2 =	0.9964			
DW =	1.17			

**Table 1. ADF and PP tests results**

Time series Variable	ADF (intercept and Trend)	PP (Intercept and Trend)	1% Level	5% Level	10% Level	Order of integration
GDP	-14.82244	.....	-3.605593	-2.936942	-2606857	1(2)
		-14.82244	-3.605592	-2.936942	-2606857	
AGO	-7.254904	.....	-3.610453	-2.938987	-2.607932	1(2)
		-15.57202	-3.605593	-2.936942	-2.606857	
HCD	-7.358813	.....	-3.605593	-2.936942	-2.606857	1(2)
		-8.945466	-3.605593	-2.936942	-2.606857	
PET	-6.922904	.....	-3.615588	-2.941145	-2.609066	1(2)
		-12.37523	-3.605593	-2.936942	-2.606857	

Note: Mackinnon (1996) one-sided P-values and critical value for rejection of hypothesis of unit root were applied. Source: Authors' estimation using E-views 7.0

**Table 2. Unrestricted cointegration rank test (Trace)**

Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 critical value	Prob.**
None	0.0832384	129.4259	47.85613	0.0000
At most 1*	0.530795	56.19663	29.79707	0.0000
At most 2	0.426530	25.17133	15.49471	0.0013
At most 3	0.056241	2.373281	3.841466	0.1234

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level, \* denotes rejection of the hypothesis at the 0.05 level  
\*\* Mackinnon-Haug-Michelis (1999) p-values, Source: Authors' Estimation using E-views 7.0

**Table 3. Unrestricted cointegration rank test (Maximum Eigenvalue)**

Hypothesized No. of CE (s)	Eigenvalue	Max-Eigen statistic	0.05 critical value	Prob.**
None	0.832384	73.22924	27.58434	0.0000
At most 1*	0.530795	31.02530	21.13162	0.0015
At most 2	0.426530	22.79805	14.26460	0.0018
At most 3	0.056241	2.373281	3.841466	0.1234

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level, \* denotes rejection of the hypothesis at the 0.05 level, \*\* Mackinnon-Haug-Michelis (1999) p-values, Sources: Authors' Estimation using E-views 7.0

**Table 4. Pairwise granger causality tests**

Null hypothesis	Obs	F-statistic	Prob.**
AGO does not Granger cause GDP	41	3.02958	0.0608
GDP does not Granger cause AGO		4.65671	0.0159
HCD does not Granger cause GDP	41	3.34674	0.0464
GDP does not Granger cause HCD		1.33898	0.2749
PET does not Granger cause GDP	41	11.7463	0.0001
GDP does not Granger cause PET		2.19005	0.1266
HCD does not Granger cause AGO	41	6.68060	0.0034
AGO does not Granger cause HCD		2.89282	0.0684
PET does not Granger cause AGO	41	14.1195	3. E- 05
AGO does not Granger cause PET		9.53971	0.0005
PET does not Granger cause HCD	41	2.08540	0.1390
HCD does not Granger cause PET		6.60303	0.0036

Source: Authors' Estimation using E-Views 7.0

From the results above, the regression coefficients of agricultural outputs (AGO), development of human capital (HCD) and petroleum output (PET) are 2.65, -64.64 and 0.11 respectively. The results shows that AGO and PET contribute to GDP positively and significantly with t-statistic values of 10.85 and 4.99 respectively. On the other hand, HCD contributes

to GDP negatively and insignificantly with -64.64 coefficient and -1.64 t-statistic value. The computed coefficient of determination ( $R^2=0.9964$ ) shows that 99.64% of the total variations in the dependent variable (GDP) are accounted for by the variations in the explanatory variables, namely AGO, HCD, PET while 0.35% of the total variation in the GDP is attributable to the influence of other factors not included in the regression model.

## 5. SUMMARY OF FINDINGS, POLICY IMPLICATIONS AND POLICY RECOMMENDATIONS

This paper has empirically attempted to investigate the contribution(s) of agriculture, petroleum and development of human capital to the economic growth in Nigeria by employing cointegration, Granger-causality test and Ordinary Least Square technique, using the data of annual time series for the period 1970-2012. The Johansen multivariate cointegration test indicates 3 cointegrating equations, showing a long-run relationship between agriculture, petroleum, human capital and output in Nigeria. The Granger causality test shows that there is bi-directional causality among the variables. The OLS results show that agriculture and petroleum contribute to output growth positively and significantly, while the contribution of human capital to output is negative but insignificant. This result supports the findings by Iganiga and Unemhilin.

## 6. CONCLUSION

The results suggest that output growth can be enhanced through agriculture and petroleum sectors and the development of human capital needs urgent attention for its impact to be positively felt on the economy.

Thus, if the objective of a policy is to sustain a high rate of economic growth in Nigeria, the priority should be given to the development of human capital in the budgetary and development policies. An effective coordination of these variables and a good policy mix to avoid lopsidedness will ensure high and sustainable economic growth.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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