GROWTH AND VARIABILITY OF SELECTED AGRICULTURAL RAW MATERIALS: PANACEA FOR GROWTH IN NIGERIA AGRO-ALLIED INDUSTRIES

Salawu M.B[1]., Salman. K. K.[2], Ibrahim A.G.[1], Rufai, A.M.[2], Sodeeq A.E.[1] and Lamidi L.O.[1]
[1]Federal College of Animal Health and Production Technology, Ibadan Nigeria
[2]Agricultural Economics Department, University of Ibadan, Nigeria

*CORRESPONDING E-MAIL: salawumutiat@gmail.com Telephone: +2348056614263

ABSTRACT
Agriculture and agro-allied industries have been identified as lifeline of any economy. They are both dependent on each other with respect to demand and supply of raw materials therefore, both must grow simultaneously. This study aimed at assessing growth and variability of selected agricultural raw materials. The study utilized secondary data sourced from Food and Agricultural Organization Statistics database for the period of 1980-2012. Data were analyzed using descriptive statistics, exponential and quadratic equation in time trend analysis, Cuddy-Della Valle index and doubling time. The result revealed that the mean area planted for all the raw materials considered was 9.70 million hectares, mean production was 40.38 million tonnes while mean productivity of 388,720 tonnes/hectares was recorded. It was also found that the growth rate for majority of the selected raw material though significant with time has not reached the recommended threshold of an average of 6% as recommended by Comprehensive Africa Agriculture Development Programme (CAADP) benchmark. Coffee (-3.25) had negative growth in area planted while plantain (-0.40), tomato (-1.92) and wheat (-1.41) recorded negative growth in productivity. The result further revealed that majority of the raw materials is fluctuating in area, production and productivity except plantain production (8.89) and cassava productivity (8.62). The nature of growth was also found to be decelerating for area and stagnant for both production and productivity. The study thus recommended that efforts should be made to accelerate the growth rate of production and productivity of these raw materials to ensure sustainability of the agricultural sector.
KEYWORDS: Growth, variability, agriculture, raw materials, agro-allied industries.

INTRODUCTION
The increasing globalization and the task of feeding agrowing world population are major challengesand special responsibilities of any country. Almost one-sixth of the world population is hit by severe hunger and malnutrition. The problem of hunger and malnutrition are not evenly distributed around the globe and Africa is on top (FAO, 2015).This makes agriculture most important sector of the any economy.The role of agriculture in reforming both the social and economic framework of aneconomy cannot be over-emphasized.A strong and an efficient agricultural sector would not only enable a country to feed its growing population but also generate employment, earn foreign exchange and provide raw materials for industries (Ogen, 2007) thus agricultural sector has a multiplier effect on any nation's socio-economic and industrial fabric because of its multidimensional usefulness.
Agro-allied industries are kinds of industries that specialized on the processing of agricultural produce to finished goods which is ready for market and consumers. Agriculture and agro-allied industries have been identified as lifeline of any economy (Jibril *et al.*, 2014). They meet people's demand for food and raw materials for other industries people demand for goods such as clothes, houses, books etc. Both food and non-food items are essential for living of human beings as such both agriculture and industry are essential for any society because they are complementary as far as satisfaction of people's needs and wants are concerned. Industries such as agro-allied industry cannot progress without the progress in agricultural sector through provision of raw materials. They are both dependent on each other with respect to demand and supply therefore, both must grow simultaneously. As more industries are set up or existing ones are expanded, the demand for raw

materials increases and this increasing demand can be fulfilled only by increasing agricultural production. The growth of industrial sector is therefore linked with the growth of agricultural sector. Nigeria is a country whose economy depended mainly on agriculture in the 1960's contributing about 65% of the Gross Domestic Product (GDP) and over 80% of foreign earnings during the period (Muhammad-Lawal and Atte, 2006). Even though the sector is not the leading contributor of the economy at present, agriculture is still the dominant economic activity in terms of employment and linkages with the rest of the economy. Nigeria has witnessed a declined in the growth rate of food grain production which are also raw materials utilized in industries during the 1990's and this has been attributed to stagnation in area and productivity (Ahmad *et al.*, 2015).

Ukeje (2005) attributed lack of growth in Nigerian agricultural sector to unchanged structure and method of production. FAO (2011) opined that agriculturalproduction needs to increase by60 percent within a few years if the growingdemand for food, agricultural raw materialsand fuels, and feedstuffs for increasinganimal stocks are to be reasonably met thus an annual benchmark of 30-40 million tonnes increase in the productionof all types of cereals was set and this aimed at a50 percent increase in production in 2050. This could support a vibrant agricultural sector capable of ensuring the supply of raw materials for the industrial sector as well as providing gainful employment and potential to be the industrial and economic springboard from which a country'sdevelopment can take off.

Although, studies such as Rahji *et al.*(2005); Mairiga (2014), Ahmad *et al.*(2015), Samuel *et al.*(2013) for the case of cereal crops; Ali and Jabbar*et al.*(2015) for the case of fruits crops; Maikasuwa (2013) for sorghum and Salawu *et al.* (2013) for cocoa have examined the trend and variability of different crops/crop groups. This study is however different as it considered different crop groups together and links growth in the selected raw materials to growth in industries.

Objectives of the study

The main objective of the study is to assess the trend and variability of the selected raw materials. The specific objectives are to:

(i) Estimate the mean area planted, production and productivity of the selected raw materials.
(ii) Estimate the growth rate and instability index of selected raw materials.
(iii) Determine how long it will take to double the growth rate the selected raw materials.
(iv) Assess the nature of growth experienced by the selected raw materials.

METHODOLOGY

The study used secondary data sourced from Food and Agricultural Organization Statistics database (FAOSTAT). The data covers the period of 1980-2012. Data on area harvested, production and productivity of the selected raw materials were utilized. Analytical techniques such as descriptive statistics, exponential and quadratic equation in time trend analysis, Cuddy-Della Valle index and doubling time were used for the study.

The descriptive statistics employed in the study are mean, standard deviation and coefficient of variation (CV) which is given as:

$$CV = \frac{Standard\ deviation}{Mean} X\ 100 \qquad (1)$$

The CV has an easy interpretation in measuring an overall variation in a data not showing trend. This study employed the exponential trend in modeling time trend as used by authors like Samuel *et al.*(2013), Ahmad *et al.* (2015), Ali and Jabaar (2015).

The exponential trend equation is specified as

$$\ln Y_t = \ln \beta_0 + t \ln \beta_1 + \mu_t \qquad (2)$$

Taking the natural log of both sides to make it amendable to OLS we have

$$\ln Y_t = \beta_0 + \beta_1 t_1 + \mu_t \qquad (3)$$

Where Y= Area, Production or Productivity, t= Time trend variable,

β_0 = Intercept of trend equation, β_1 = trend coefficient, μ_t = error term.

The compound growth rate was computed using the formulae

$$r = \left(e^{\beta_1} - 1\right) * 100 \qquad (4)$$

Where r = compound growth rate, β_1 = estimated coefficient from trend equation,
e= Euler's exponential constant (e= 2.71828).
In measuring the instability index of the raw materials, the study Cuddy-Della Valle (1978) called Cuddy- Della Valle index which is given as:

$$CD = CV * \left(1 - R^2\right)^{\frac{1}{2}} \qquad (5)$$

Where CD= Cuddy- Della Valle index, CV= Coefficient of Variation,
R^2 = Coefficient of determination from time trend equation.
Doubling time is the time it will take to double the rate of growth and it is computed as

$$DT = \frac{69}{r} \qquad (6)$$

Where DT= doubling time, r = compound growth rate.
The quadratic trend equation is used to estimate the pattern of growth which can be decelerating, stagnant or accelerating. The equation is given as

$$\ln Y_t = \beta_0 + \beta_1 t_1 + \beta_2 t_1^{\,2} + \mu_t \qquad (7)$$

The coefficient of $t_1^{\,2}$ which is β_2 is important when determining the pattern of growth. According to Samuel *et al* (2013), $\beta_2 > 0$ and statistically significant implies acceleration in growth, $\beta_2 < 0$ and statistically significant implies deceleration in growth while β_2 positive or negative but not statistically significant implies stagnation in growth.

RESULT AND DISCUSSIONS

Area Planted, Production and Productivity of Selected Agricultural Raw Materials

The mean area planted for all the raw materials considered in the study is 9.70 million hectares with maize having the largest area planted of 3.52million hectares and coffee has the lowest area planted which is about 3,977.45 hectares. However, the mean production for all the raw materials is 40.38 million tonnes with cassava recording the highest mean production of 29.0 million tonnes and coffee recorded the lowest mean production of 3,356.36 tonnes. This may be attributed to the low area planted to coffee. The mean productivity of the selected agricultural raw materials considered is 388,720 tonnes/hectares with cassava recording the highest mean productivity of 108,410tonnes/hectares and the lowest mean productivity was recorded by cocoa 3,273.88tonnes/hectares. This implies that the area planted, production and productivity of the selected raw materials vary from crop to crop and this may be attributed to different requirements entails in the production of different crops.

Table 1: Mean Area, Production and Productivity of Selected Agricultural Raw materials in Nigeria
Source: Data Analysis, 2016

	Area Planted (ha)			Production (tons)			Productivity (ton/ha)		
Crops	Mean	Std deviation	CV	Mean	Std Deviation	CV	Mean	Std. Deviation	CV
Cassava	2,628,813	1,030,564.09	39.20	29,004,815	12940874	44.62	108,410	12004.9	11.07
Cocoa	891,171	233924.78	26.25	292,427.27	99089.26	33.89	3,273.88	817.6	24.97
Coffee	3,977.45	2041.34	51.32	3,356.36	1051.08	31.32	9,406.7	3254.71	34.60
Maize	3,522,810	1,523,239.62	43.24	5,119,526.7	2338907	45.69	14,451.3	2792.26	19.32
Pineapple	122,670	27765.9	22.63	862,092.06	213951	24.82	70,756	9234.98	13.05
Plantain	299,604	125424.1	41.86	1,808,622.1	661917.9	36.6	62,326.8	8009.05	12.85
Tomato	126,445	100008.12	79.09	922,969.64	623139.7	67.51	85,025.7	17486.4	20.57
Wheat	43,551.5	23463.27	53.87	66,163.64	35654.19	53.89	16,856.1	5362.29	31.81
Groundnut	1,563,987	764451.36	48.88	1,994,204.1	1112981	55.81	12,312.2	2600.7	21.12
Soybean	486,971	156495.21	32.14	308,953.03	193973.2	62.78	5,901.42	2970.17	50.33
Raw materials	9,689,999	3375798.94	34.84	40,383,130	17593853	43.57	388,720	22665.3	5.83

Growth Rate and Instability Index of AreaPlanted, Production and Productivity of Agricultural Raw Materials in Nigeria

The adjusted R^2 for individual crops considered with respect to area planted, production and productivity shows that time trend is an important variable that account for variation noticed in area, production and productivity of agricultural raw materials in Nigeria as individual crop with respect to its area planted, production and productivity are statistically significant with time except for coffee production. The consideration of all the crops as a whole shows that time trend is an important variable that accounted for variation in area planted and production but not productivity as adjusted R^2 of 0.771 and 0.905 for area and production implies that 77.1% and 90.5% of variation noticed in area and production of agricultural raw materials in Nigeria are as a result of the time trend. However the adjusted R^2 for productivity is 0.001 which implies that time trend account for only 0.1% variation in productivity.

All the crops witnessed positive growth rate in area planted during the period except coffee which witnessed a negative growth rate of -3.25. The highest positive growth was recorded in tomato (9.20%) and the lowest positive growth in pineapple (1.61%). A positive growth rate was also witnessed in the production of all the crops with the highest growth recorded by soybean (8.22%) and lowest in pineapple (2.12%).Majority of crops witnessed positive growth in productivity except plantain (-0.40%), tomato (-1.41%) and wheat (-1.41%) which witnessed negative growth rate. The highest positive growth in productivity was recorded by soybean (5.55%) while pineapple witnessed the lowest positive growth of 0.50%. Even though majority of the crops witnessed positive and significant growth rate in area, production and productivity.

These growths are however minimal to achieve sustainability in their production as Ali and Jabbar (2015) opined that higher growth in agricultural production coupled with low variability is desirable as higher variability in agricultural production makes the agricultural sector less sustainable and this could impact negatively on the growth of the agro-allied industries as the agro-allied industries depend on agriculture for its raw materials. The area planted, production and productivity of majority of the selected raw materials except for plantain production (8.89%) and cassava productivity (8.62%) were unstable during the period as their instability index is more than 10% with relatively low coefficient of variation. Authors like Alemu (2005) opined that production instability is more of increased yield than area instability but the combination of all raw materials in this study revealed instability in area (16.67%) and production (13.43%) of the crops not productivity/yield (5.83%).

Table 2: Compound growth rate of area, production and productivity of Agricultural raw materials in Nigeria

Source: Data Analysis, 2016. * denotes significant at 1%, ** denotes significant at 5%, *** denotes significant at 10%, NS denotes not significant, CGR denotes compound growth rate, IST denotes instability index, R-square denotes Coefficient of determination.

	Area Planted (ha)			Production (tons)			Productivity (tons/ha)		
Crops	**CGR**	**R-square**	**IST**	**CGR**	**R-square**	**IST**	**CGR**	**R-square**	**IST**
Cassava	4.60	0.827*	16.30	5.23	0.896*	14.39	0.70	0.394*	8.62
Cocoa	2.33	0.817*	11.23	3.56	0.780*	15.90	1.21	0.193*	22.43
Coffee	-3.25	0.525*	35.37	5.13	0.190NS	28.19	3.77	0.837*	13.97
Maize	4.81	0.417*	33.02	6.29	0.596*	28.97	1.31	0.460*	14.20
Pineapple	1.61	0.509*	15.86	2.12	0.811*	10.79	0.50	0.107***	12.33
Plantain	4.29	0.842*	16.64	3.87	0.941*	8.89	-0.40	0.095***	12.22
Tomato	9.20	0.897*	25.38	7.14	0.899*	21.46	-1.92	0.671*	11.80
Wheat	4.19	0.343*	43.66	2.74	0.241*	46.95	-1.41	0.169**	29.00
Groundnut	5.76	0.847*	19.12	7.14	0.894*	18.17	1.31	0.343*	17.12
Soybean	2.53	0.373*	25.45	8.22	0.805*	27.72	5.55	0.861*	18.76
Raw materials	4.08	0.771*	16.67	5.23	0.905*	13.43	0	0.001NS	5.83

Compound Growth Rates, Doubling Time and Nature of Growth for Area, Production and Productivity of Selected Agricultural Raw Materials in Nigeria

The growth rate of area and production for the selected raw material were minimal signifying a slow development in area and production of the selected raw material. This has a negative impact on agricultural sector as minimal growth rate indicates slow agricultural development hence low supply of agricultural raw material and low growth in the agro-allied industries which invariably lead to low contribution to the Gross Domestic Product (GDP). Mairiga, (2014) attributed low and fluctuating growth rate of cereals in Nigeria to its subsistence orientation and predominantly rain-fed nature of cereal production in the country. However, no growth was experienced in the productivity of the raw material as productivity is not significant with time trend. The computation of the doubling time for compound growth rate for area and production in years revealed a period of 17years and 13years for area and production respectively. Even though the doubling period is not too high, the area and production growth trend needs to be improved to reduce the doubling period. Ahmad *et al.* (2015) opined that growth trend of crops can be improved through creation of awareness to farmers on the adoption of new technologies and increasing their access to farm inputs such as hybrid seeds, fertilizers among others.

The quadratic equation in the time trend variable shows the nature of growth in area planted, production and productivity of selected raw materials. The growth can be accelerating, decelerating or stagnant. The quadratic term t^2 can be used to conclude whether growth is accelerating, decelerating or stagnant. The coefficient of $t^2$for area in table 3 is -10950.24. Though significant but negative which implies that the growth in area for the selected raw materials are decelerating. The value of coefficient of t^2 for production and productivity were -7030.58 and 22.46 respectively. The coefficients were not significant as such implies stagnation in growth of production and productivity. Stagnation in agriculture is the principal explanation for poor economic performance in Nigeria and for successful industrialization there must be increase in agricultural productivity.

Table 3: Compound Rates, Doubling Time and Nature of Growth for Area Planted, Production and Productivity of Selected Agricultural Raw Materials in Nigeria

Source: Data Analysis, 2016. *denotes 1% level of significance. NS denotes not significant.

Raw Materials	CRG	Doubling (years)	Year doubling would be achieved	Coefficient of t^2	t-ratio	Nature of growth
Area Planted	4.08	17	2033	-10950.24	-4.92*	Deceleration
Production	5.23	13	2029	-7030.58	-0.82^{NS}	Stagnation
Productivity	-	-	-	22.46	0.45^{NS}	Stagnation

CONCLUSION

Based on the findings of this study, the growth rate for majority of the selected raw material though significant with time has not reached the recommended threshold. It was also found that majority of the raw materials is fluctuating in area, production and productivity except plantain production and cassava productivity. The nature of growth was found to be decelerating for area and stagnant for both production and productivity. It was also revealed that the growth rate of production of the selected raw material was due to growth in area expansion not growth in productivity. The study thus recommended that government should encourage intensive system of production which is aimed at reduction in area cultivated and increase in yield/productivity. Efforts should be made to accelerate the growth rate of production and productivity of these raw materials to ensure sustainability of the agricultural sector asdeceleration and stagnation in the growth rate of raw materials will impact negatively on the growth of agro-allied industries in the country because agriculture and industries are interdependent.

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