Review of Cassava Production in Nigeria: Trends and Decomposition Analysis Approach

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Abstract

This study analyzed the growth rate, the instability in the growth trend, and examined the contributions of yield and area to cassava production output in Nigeria. Using time-series of the selected variables which spanned through 1961-2018, the compound annual growth rate (CAGR) was estimated for the harvested area, production, and yield of cassava. The study adopted Coppock's instability index (CPII) to measure instability in cassava production. Between the period, TE1963-2018, cassava yield oscillated between 9.1 tonnes/ha (TE2018) and 11.9 tonnes/ha (TE2010) while the output fluctuated between 7.8 million tonnes (TE1963) and 59.5 million tonnes (TE2018). In this same period, the CAGR for yield (0.1%), area (9.7%) and production (9.9%) were positive and statistically significant at 1% except for yield. The decomposition analysis for the period revealed that the increase in output was largely due to an increase in area harvested during the period (110.4%). In view of these and other findings, the study recommends intensive planting of improved cassava varieties under well mapped out sustainable strategies to optimize production.

Keywords: Cassava production, Trends, Exponential growth rate, Instability, Decomposition analysis

Nijerya'da Kasava Üretiminin Gözden Geçirilmesi: Trendler ve Ayrıştırma Analizi Yaklaşımı

Öz

Bu çalışmada, büyüme oranı ve büyüme trendindeki istikrarsızlık analiz edilmiş olup verim ve alanın Nijerya'daki kasava üretimine katkıları incelenmiştir. Seçilmiş değişkenlerin 1961-2018'e yayılan zaman serileri kullanılarak, kasava hasadı, üretimi ve verimi için bileşik yıllık büyüme oranı (CAGR) tahmin edilmiştir. Çalışmada kasava üretiminde istikrarsızlığı ölçmek için Coppock'un kararsızlık endeksi (CPII) kullanılmıştır. TE1963-2018 dönemi arasında kasava verimi 9.1 ton/ha (TE2018) ile 11.9 ton/ha (TE2010) arasında salınırken, üretim 7.8 milyon ton (TE1963) ile 59.5 milyon ton (TE2018) arasında dalgalanmıştır. Aynı dönemde verim (%0.1), alan (%9.7) ve üretim (%9.9) için YBBO pozitif ve verim hariç %1 ile istatistiksel olarak anlamlı bulunmuştur. Döneme ilişkin ayrıştırma analizi, üretimdeki artışın büyük ölçüde dönem boyunca hasat edilen alandaki artıştan (%110.4) kaynaklandığını ortaya koymuştur. Bu ve diğer bulgular ışığında, çalışma, üretimi optimize etmek için iyi haritalanmış sürdürülebilir stratejiler altında gelişmiş kasava çeşitlerinin yoğun bir şekilde ekilmesini önermektedir.

Anahtar Kelimeler: Kasava üretimi, Trendler, Üstel büyüme oranı, İstikrarsızlık, Ayrışma analizi
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1. Introduction

The increase in demand by fast expanding feed and starch markets as well as other cassava based industries across the globe and rising prices of close substitutes like rice and maize are rapidly re-ordering the dynamics of cassava market in the tropics [Africa, Asia and Latin America] (Market Research Future, 2020; Ikuemonisan et al., 2020). A highly tolerant cassava crop known for its wide ecological adaptability will always perform relatively well where other crops may not be able to produce reasonable yield (Otekunrin and Sawicka, 2019). This attribute confers on cassava a reliable food security for farming households in the tropics (Ikuemonisan et al., 2020) in addition to providing dietary energy for close to a billion people and livelihood for millions of farmers/processors traders worldwide (FAO, 2018; Ikuemonisan et al., 2020). In Nigeria, cassava foodstuffs are integral part of household food basket and the emerging market dynamics may disrupt availability of the foodstuffs to consumers and this is of concern to policymakers and researchers.

According to production theory, a rational cassava producer targets the equilibrium (least cost of production) where the largest volume of cassava output can be achieved from a given factor-expenditure outlay on factors of production. It thus implies that these factors are combined in the most efficient way to achieve optimal production of output. In a more explicit form, a rational producer is expected to choose that level of output, where a given isocost line is tangential to the highest possible isoquant to achieve the producer's equilibrium. That is the point, where the marginal rate of technical substitution is equal to the price ratio of factors. The producer maximizes his profits by producing at a given level of output with least combination of factors. This level of cost combination of factors becomes the optimum point for production. Farmers who produce at a cost above the equilibrium would not be able to competitively participate in the market. The productivity level of Thailand, Indonesia and Vietnam are examples of countries deliberately working to minimize cost with a view to achieving maximum cassava output. They are known to achieve more output per hectare than Nigeria and other countries in SSA by deploying best agronomic practices, using improved varieties and enabling environment. China's audacity to offer ridiculous price for cassava has also endeared them to the cultivation of cassava with more sophisticated agronomic approaches in order to reduce the cost of production. Other parts of this paper are organized as follows: Section Two: Cassava Development in Nigeria; Section Three: Methodology and Analytical Techniques; Section Four: Results and Discussion; and Section Five: Summary, Conclusion and Recommendation.

2. Cassava Development in Nigeria

Cassava products are increasingly becoming popular in Nigerian food and agricultural markets. Thus, it provides a strong incentive for more economic agents to be involved in the cassava market. According to FAO (2018), cassava is a choice crop for rural development, poverty alleviation, economic growth and ultimately, food security. It is in view of the above that critical stakeholders have continued to contribute immensely to shaping the development of cassava sub-sector in Nigeria. Eke-Okoro and Njoku (2012) captured the phases in efforts to improve cassava production in Nigeria as the emergent stage that spread from 1940 to 1953; a primitive stage that stretched from 1970 to 1990 and the anticipatory stage that spanned from 1995 to date. Other phases of cassava development are also found in the literature.

2.1. Cassava production and its associated challenges in Nigeria.

One major factor that has pronounced effect on the yield performance is the slow transition from dis-adoption of local cassava variety to adoption of improved variety. International Institute of Tropical Agriculture (IITA) has release some improved varieties for cassava farmers to adopt but for various agronomic reasons in addition to

poor awareness and accessibility to improved cassava varieties often hinder the transition from dis-adoption of local cassava variety to adoption of improved variety. Elaborate investigation was carried out by Bentley et al. (2017) and evidence showed that farmers prefer early maturing and large root tubers.

Over the years, the strategy adopted in the formal seed production and distribution has been largely constrained by limited resources and capacity to multiply and distribute the planting material of improved varieties to farmers. On the other hand, the ineffectiveness of the informal sector (friends, relations, and neighbors) in carrying out their distribution has not yielded the desired results. Bentley et al. (2017) proposed that with strategic support, funding, and adequate oversight of the sector the situation could be remedied.

Weed is another factor that has constrained the poor cassava yield performance in Nigeria. According to Anikwe and Ikenganyia (2018), inadequately managed weeds are capable of reducing yield performance by 50% - 80%. Farmers are always encouraged to keep weeds out of cassava farm particularly during the canopy formation or tuberization with a view to achieving optimum yield.

Agricultural land in Nigeria is fast declining in quantity and quality. Since it is consistently under threat from the increasing demand for expanded infrastructure to cater for the rapidly growing population, relying on improved cassava production through expansion of cultivated area is definitely not sustainable. Nigeria, being an oil-dependent economy, has gone through some unfavorable cycles in the recent time as a result of instability in oil prices It is expected that government, in attempt to diversify the economy, is also be making efforts to encourage the development of cassava sub-sector. Global cassava market is an emerging market in the world and the future looks economically promising with a view to accrue some foreign earnings. Although the current statistics show that despite a huge cassava production in Nigeria, the value of exports is still significantly low (FAO, 2018). It simply indicates that despite huge level of cassava production; supply of cassava and its derivatives is not significantly meeting domestic demand in Nigeria. This makes it appealing to policymakers. It is therefore not surprising that cassava producers are part of the beneficiaries of Anchor Borrowers Programme (ABP) launched by the Central Bank of Nigeria (CBN) in 2015 to encourage the supply of products to the processing sector. However, recent statistics showed that the implementation of ABP made rice more lucrative to cultivate than cassava. This is expected to have some effects on the cassava output and even its yield.

Similarly, the CBN also reviewed the Commercial Agricultural Credit Scheme (CACS) in 2018 with a view to increasing access to credit for farmers. However, experts have argued that these efforts should not replace the quest to develop high yield performing cassava.

2.2. Justification for the study

The performance of cassava sub-sector is largely dictated by the low output per hectare that characterize agriculture in Nigeria and other countries in SSA (Fakayode et al., 2012). Inadequate adoption of contemporary innovations and technology have constrained cassava productive efficiency to less than 60% in most countries in sub-Saharan Africa including Nigeria (Ajibefun, 2015; Federal Department of Agriculture [FDA], 1995). The call to address this seemingly difficult challenge has again come to the fore as the demand for cassava is increasingly gaining momentum among various consumers. Besides, in the last two decades, government agricultural policies have been favorable to the production of cassava with a view to using it as one of the pods to drive the country's economic growth. Some of these policies mandated bakers to include 10% cassava in their flour mix for bread production and flour mills to pre-mix cassava flour with wheat flour before supplying same to bakeries and confectioneries (Technical for Agricultural and Rural Cooperation [CTA], 2005). However, there are concerns that cassava production is not

immured to production instability. An increasing number of authors have argued that production instability often exposes the economy to food price fluctuations that are capable of distorting consumption habit and compromising consumers' welfare (Moledina at al., 2004; Krohner, 2014; Sulewski and Kłoczko-Gajewska, 2014; Sehkar et al., 2017; Ikuemonisan and Akinbola, 2019). The literature seems to be silent on cassava production instability in Nigeria.

There is no doubt that cassava output has increased tremendously from 7.4 million tonnes in 1961 to 59.5 million tonnes in 2017 making Nigeria the highest producer of cassava in the world (FAO 2018). However, the literature seems scarce on the trend of cassava production in Nigeria with clear calibration for the trends in cassava production indicators and contributions of harvested area and yield in the increasing cassava production in Nigeria. Therefore, this study questions the propelling factors for cassava production with the intention to ascertain factors that substantially influence growth in the sub-sector. The import of this question becomes real as the associated challenges with expanding development infrastructure and increasing industrial drive pose a serious threat against achieving agricultural growth only through the expansion of cultivated/harvested instead of high yield cassava stems. The land is fixed and agricultural land is even under threat as infrastructure expands to cater for the rapidly increasing population. Besides, the fact that most cassava producers are smallholders who cannot afford machines for intensive cultivation sets snags on the path of cassava revolution in Nigeria. To put it more pithily, expanding cultivation area to increase cassava output may not be sustainable in the long run because as the industry grows, there will be a higher demand for labour and land by the industrial sector expected to come from those working in the agricultural sector and agricultural land respectively.

In view of the above, this paper attempts to: (i) analyze the trend and growth in the area, production and yield of cassava; (ii) review the instability in the growth of area, yield and production of cassava; and (iii) contributions of area and yield to the growth of cassava production in Nigeria.

3. Material and Method

3.1. Data

The paper relied strongly on secondary (time series) data obtained on area, production, and yield of cassava in Nigeria for the period 1961-2018 from FAOSTAT. However, the analysis spanned across three periods: Period I (TE1961-TE1995); Period II (TE1996-TE2010) and period III [the pool – a combination of the two distinct periods] (TE1961-TE2018).

The triennium ending [TE] figures for area, yield and production of cassava in Nigeria were determined from data obtained from FAOSTAT and presented on Figure I. The TE is to even out inter-year fluctuations.

3.2. Analysis of data

3.2.1. Compound growth rate

The compound growth rate (CAGR) was preferred to the linear growth rate (LGR) in analyzing the growth rate in the area, production and yield of cassava because according to (Dandekar, 1980), the LGR is not convenient for comparing two periods. After exploring the four functional forms of linear model to capture the linear trend of the series, the exponential model best fits the trend. Therefore, the compound annual growth function was specified as exponential model according to the specification of Sadiq et al. (2017) and Rambabu et al. (2014) as follows:

$$lnY = a + tlnb + e \quad (1)$$

Y = area (ha)/production (1000 tonnes) /yield (kg/ha)

a = Intercept

t = Year

b = 1 + r (The slope coefficient 'b' measures the instantaneous relative change in Y for a given absolute change in the value of

explanatory variable 't') – instantaneous growth rate.

r = Growth rate

However, when the relative change in Y is multiplied by 100, the percentage change or growth rate in Y for an absolute change in variable 't' is obtained while the slope coefficient 'b' measures the instantaneous rate of growth. Therefore, the compound growth rate is then estimated using the following equation:

CAGR = [antilog b – 1] * 100 (2)

Equation (1) was estimated using Ordinary Least Square (OLS) method hence the t- test was applied to test the significance of 'b'. The underlining assumption in this estimation is that a change in cassava output in a given year would depend upon the output in the preceding year (Deosthali and Chandrehekhar, 2004). Since analyzing the growth rate in the area, production and yield of cassava does not account for the relative contributions of the area and yield towards the total output change, this paper adapted component/decomposition analysis model to achieve same. The literature is replete with evidence of how this model has been used to estimate relative growth performance of individual output in agricultural production (Shadmehri, 2010; Rehman et al., 2011; Devi et al., 2017).

3.2.2. Instability in cassava production

Production instability signals unpredictable phenomenon which effects can be hurtful to people whose livelihood depend on this line of production. Put more succinctly, it connotes inefficiency and undermines the sustainability of production growth. When this affects food production and distribution in developing or low-income countries, the effects on the preponderance of the low- income farmers can be devastating. In Nigeria, the huge population of participants in cassava market is evidence of its importance as a source of income and food for almost all. Therefore, experts have deployed different methods to estimate instability (Coppock's instability index) in agricultural production. Ahmed and Joshi (2013) used the trend free measure of variability, which is a close approximation of the average year-to-year percentage variation adjusted by trend. Besides, modified coefficient of variation has also been used to estimate production instability (Singh et al., 2014). Several other studies have also measured the magnitude of instability by an index developed by experts (Parthasarathy, 1984; Paltasingh, 2013). Another index that has been used to measure production instability is Cuddy Della Valle Index (Cuddy and Della Valle, 1978). Although in the literature, standard deviation and coefficient of variation have been prominently used to measure risk and instability in agricultural production however, they have been widely criticized because it overestimates instability. Thus, this study deployed Coppock's instability index (PII) to measure instability in cassava production in Nigeria simply because of its advantages as highlighted above. The indexes of Coppock's instability measures (PII) are compared to those obtained from the coefficient of variation (CoV).

Following the approach of Sandeep et al. (2016) and Boyal et al. (2015), the CoV is estimated as follows:

$$\text{CoV} = \frac{Standard\ Deviation}{Mean} * 100 \quad (3)$$

According to Coppock (1962) and Rai et al. (1989), Coppock's Instability Index is estimated as follows:

$$\text{Coppock's instability Index (CPII)} = \left(antilog\ \sqrt{Vlog} - 1\right) * 100 \quad (4)$$

$$Vlog = \frac{1}{N-1}\sum[logX_{t+1} - logX_t - M]^2 \quad (5)$$

$$M = \frac{1}{N-1}\sum[logX_{t+1} - logX_t] \quad (6)$$

Where X is the time series variable under consideration (production/area/yield)

3.2.3. Decomposition analysis

The decomposition analysis was performed using the equation below:

$$\Delta P = A_b * \Delta Y + Y_b * \Delta A + \Delta A * \Delta Y \quad (7)$$

ΔP = Change in production

$A_b * \Delta Y$ = Yield effect
$Y_b * \Delta A$ = Area Effect
$\Delta A * \Delta Y$ = Interaction effect

Where, $\Delta P = P_C - P_B$

$\Delta Y = Y_C - Y_B$
$\Delta A = A_C - A_B$

A_B,P_B and Y_B are the area, production and yield of cassava respectively for the base year.

A_C, P_C and Y_C are the area, production and yield of cassava for the current year.

The analysis is done for 3 periods i.e. 1970-1995, 1996-2017 and 1970-2017.

Thus, the total change in cassava production is attributed to area and yield using a model that decomposes production output into three effects viz; yield, area and interaction effects.

4. Results and Discussion

4.1. Trend in area, yield and production of cassava in Nigeria

Between the period TE1963-TE1986, cassava output increased from 7. 6 million tonnes to 12.1 million tonnes (59%). In the 60s, although Nigeria just gained her independence, there was deliberate effort to develop agriculture because of the dominant role it was playing in the economy. However, the civil war between 1967-1969 stiffened cassava production. Cassava production witnessed some marginal growth in the 70s. Despite this fairly increased production, there was a sharp drop in cassava yield between the period, 1980-1984 (10.3 tonnes/ha to 9.3tonnes/ha). The decline in output per hectare coincided with the period when cassava in Nigeria was prevalently infested with violent cassava bacterial blight (CBB), cassava mosaic virus disease (CMD), cassava anthracnose disease (CAD), cassava mealybug (CMB) and cassava green mite. This necessitated the marked collaboration between national and international institutions for the development of cassava in Nigeria, which led to the development of some improved cassava varieties in the 80s. The International Institute of Tropical Agriculture (IITA) continued to champion the development of cassava in Nigeria. Beginning from 1985, there was a tremendous improvement in production as output rose from 11.3 million tonnes to 30.9 million tonnes in 1995. However, there was seemingly flat growth between 1995 and 1999 (5%) with a marginal increase in the yield from 10.6 tonnes/ha to 10.7 tonnes/ha at this period. This performance was discouraging in view of the policy strategies put in place to improve cassava production per hectare. It would be recalled that in 1996, the National Co-ordinated Research Programme (NCRP) was approved. Hence, the collaboration between IITA, Ibadan and National Root Crops Research Institute, (NRCRI), Umudike resulted in some high yielding and low cyanide cassava varieties.

At this period, farmers had challenges tackling various diseases affecting their cassava farms. However, respite came when IITA, Ibadan in collaboration with NRCRI, Umudike released new cassava varieties to check these diseases. These efforts manifested in the increase in yield from 9.73 tonnes/ha to 11.3 tonnes/ha between the period, TE 2002-2006 and it rose to 11.73 tonnes/ha in TE 2011. After this period, there was a sharp decline to 7.90 tonnes/ha in TE 2014. Between the period, 2012-2018, there was a marked increase in output (49.6 million tonnes-59.5 million tonnes) was hinged on the expansion of area cultivated during this period. The poor yield performance caused the government to launch the Anchor Borrower Programme (ABP) in 2015. Consequently, there was a sharp increase in cassava yield from 7.9 tonnes/ha in 2014 to 9.3 tonnes/ha in 2017. However, the yield declined to 9.1 tonnes/ha in 2018. The trend in yield performance calls for concern.

Figure 2 reveals the bar chart showing the decile distribution of Area, Production and Yield of Cassava in Nigeria (1961-2018). This study views the dynamics in the trend of the concerned variables using a range of 10 years. The figure reveals a steady increase in the yield from the first decade (9.7 tonnes/ha) up to the fifth decade (11.1 tonnes/ha). This could be as a result of various interventions and policy strategies

directed towards optimal production of cassava yield with minimal use of land. Surprisingly, there was a sharp decline to 8.9 tonnes/ha during the period, 2011-2018 but the period witnessed the highest cassava production output (54.6 million tonnes) of the six decades. Experts have submitted that increasing production by expanding cultivated area is not sustainable (Spencer et al., 2017).

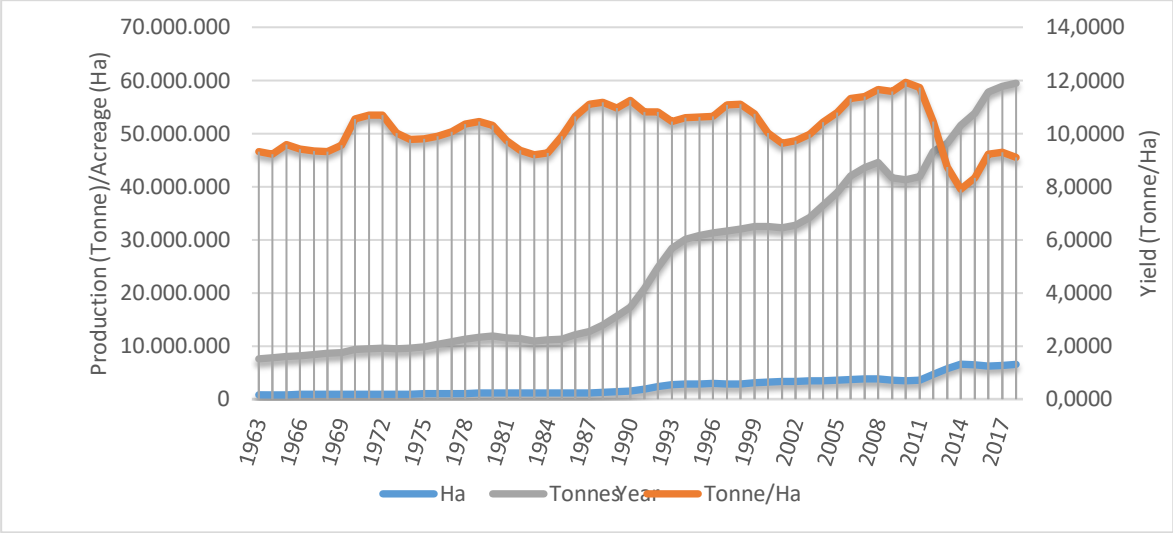

Figure 1. Trend in TE of area, production and yield of cassava in Nigeria (TE 1963 – 2018)
(Authors' computation adapted from FAOSTAT 2019)

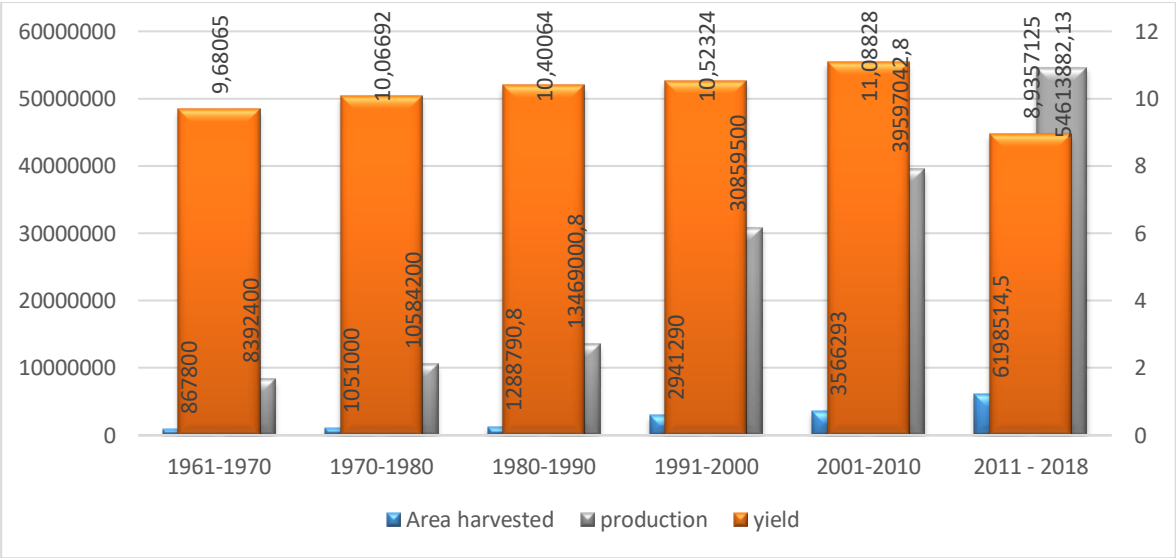

Figure 2. Decile distribution of area, production and yield of cassava in Nigeria (1961-2018)
(Authors' Computation adapted from FAOSTAT 2019).

4.2. Instability in area, yield and production of cassava

The instability index for the area, yield and production of cassava in Nigeria is presented in Table 2. The study adopted both the simple coefficient of variation (CoV) and Coppock's Instability Indexes (CPII) as measures for instability in cassava production. Measuring the instability in cassava production becomes imperative in view of widespread assertions in the literature that food production risk as well as food price volatility is high in the sub-region (Kornher and Kalkuhl, 2013; Sulewski and Kłoczko-Gajewska, 2014). More importantly, the welfare implications of these on the mass of poor farmers in the sub-region is depressing (Sassi, 2014; Sehkar et al., 2017; Ikuemonisan and Akinbola, 2019). Firstly, the difference

between the index of instability measured by CoV and CPII are too wide apart hence, confirming the submission that in most cases, standard deviation and coefficient of variation hypes the risk (instability, volatility) in time series. Therefore, this study interprets only the CPII. The results of the measures of instability show that in the instability of land put under the cultivation and yield of cassava are more pronounced in Period II [TE1996-2018] (12.2% and 11.4% respectively). However, instability in cassava output declined from 8.3% in Period 1 (TE1961-TE1995) to 7.8% in Period II (1996-2018). During Period III, which is the combination of the periods I & II, area allocated to the production of cassava (11.1%) is the most uncertain and closely followed by productivity (9.3%) and output (8.0%). Since instability/uncertainty is an indication of unpredictable future outcome (the area that can be allocated for cassava production, the yield of cassava and cassava output), it thus implies that future market and prices are also uncertain. This demand pressure can further be hyped with an increasing number of a high volume of cassava demanding ethanol (biofuel) and starch firms. There is evidence that both local and international markets for ethanol fuel and starch are expanding, and Nigeria is not excluded.

Table 2. Instability index for area, yield and production

		Area harvested (ha)	Yield (tonnes/ha)	Production (tonnes)
1961 - 1995	CoV	49.37	7.97	53.12
	CPII	10.54	7.87	8.29
1996 - 2018	CoV	33.66	13.58	23.12
	CPII	12.22	11.39	7.79
1961 - 2018	CoV	72.53	10.48	66.70
	CPII	11.14	9.30	8.04

Data Analysis 2019

4.3. Compound growth rate of area, yield and production of cassava in Nigeria

The CAGR of area, yield and production of cassava in Nigeria between 1961-2018 is presented in Table 3.

During the period I, TE1961-1995, CAGR for the area (8.0%), yield (1.0%) and production (9.0%) are positive and instantaneous growth rate is significant at 1% accordingly. Thus, it implies that changes in area yield and output per hectare are significantly influenced by time trend during this period.

During the period II, TE1996-2018, CAGR for the harvested area (10.0%) and production (7.6%) for cassava are positive and statistically significant accordingly at 1% apiece. In this period, CAGR for the yield performance is given as -2.1% and statistically significant at 5%. It means that time trend is significant in the growth of the harvested area, yield and production of cassava during period II (TE1996-2018).

The results from the analysis of the pooled data (TE1961-2018) show that CAGR and instantaneous growth rate for harvested area (9.8%), yield (0.1%) and production (9.9%) of cassava are positive and significant at 1% except for yield performance that is not statistically significant. When compared to the values of compound Growth Rate (CAGR) for yield and production of cassava in Ghana (5.1%; 14.8%), Benin (5.6%; 12.9%) and Vietnam (5.4%; 10.8%), Nigeria's rate of performance for yield and production (0.1%; 9.9%) within the period under review is ridiculously low while that of production comes after that of Vietnam. This paints a gloomy and relatively poor performance of cassava sub-sector in Nigeria especially in the face of a rapidly growing population and quest to diversify the economy. While Nigeria is still struggling to have an increased share in world cassava market, the growing output could be further jeopardized as agricultural land and farm labour decreases as a result of expanding industrial and other development infrastructure.

Table 3. Compound growth rate of area, yield and production of cassava in Nigeria (1961-2018)

		Area harvested (ha)	Yield (tonnes/ha)	Production (tonnes)
Period I 1961-1995	CAGR	7.9749	0.9614	9.0130
	R square	0.7622	0.2913	0.8104
	P value	0.0000	0.0008	0.0032
Period II 1996-2018	CAGR	9.9518	-2.0951	7.6481
	R square	0.7886	0.1915	0.9101
	P value	0.0000	0.0368	0.0000
Period III 1961-2018	CAGR	9.7824	0.0971	9.8890
	R square	0.9324	0.0044	0.9498
	P value	0.0000	0.6214	0.0000

Data Analysis 2019

.4. Decomposition of production of cassava in Nigeria

Table 4 shows the percentage decompositions of area, yield and their interaction towards increasing production of cassava production in Nigeria. Therefore, the results of the analysis of contributions of area and yield to the growth of cassava production in Nigeria. This is necessary because Figure 1 only presented the analysis of the trend in the growth of the area, yield and production of cassava and Table 3 shows the CAGR for same between TE1961-2018 but does not evaluate the contribution of area and yield to the production growth of cassava in Nigeria. To achieve the latter, contributive factors to cassava production output were divided into three effects: yield effect, yield effect and interaction effect. The decomposition analysis was done for disaggregated data as follows: period I; period II and period III.

Figure 1 clearly indicates a consistent increase in the output of cassava in Nigeria during the period under review. However, the decomposition analysis reveals that in the period, TE1961-1995, the area effect positively and dominantly contributes to the increase in cassava production at this period. The table reveals that the contribution of the harvested area effect is 85.3% while the contribution of yield effect and interaction effects are 3.9% and 10.8% respectively. The import of this is that increase in production of cassava over this period occurred mainly as a result of the expanded area of land cultivated. The scenario is significantly different during the period, TE1996-2018. At this period, the harvested area positively contributed 148.5% and compensated for the negative effects of both yield (-20.9%) and interaction (-27.7%) on the increase cassava production in Nigeria. Although this period coincided with the period when cassava multiplication programmes for optimum production and high yield in cassava in Nigeria dominated cassava input market (IFAD, 2010), it was surprising that these efforts only produced one-off result in the yield performance between TE2006-2011. The value of the yield fell drastically between TE2012-2015 (Fig 1A&B). The intervention of the Anchor Borrower Programme (ABP) could only contribute marginally to increase in yield between TE2016-2017. However, in the period III, TE1961-2018, the contribution of area effect was positive and very high (110.4%). During this period, the harvested area also compensated for the negative effects of the yield (-1.2%) and interaction between yield and area effects (-9.2%).

Table 4. Percentage decompositions of area, yield and their interaction towards increasing production of cassava production in Nigeria

Effect/Period	1961-1995	1996-2018	1961–2018
Yield Effect	3.90	-20.85	-1.18
Area Effect	85.29	148.50	110.36
Interaction Effect	10.81	-27.65	-9.18

Data Analysis 2019

5. Conclusion

The study analyzed the trend and the decomposition of cassava output growth in Nigeria between the period, TE1961-2018. The study reveals consistent growth both in harvested area and cassava production (output) in Nigeria but yield performance looks inconsistent throughout the period under review. For the Compound Annual Growth Rate (CAGR) of area, yield and production of cassava, the study found that there was a significant and positive relationship between time trend and changes in harvested area (9.8%) and production (9.9%) at 1% between TE1963-TE2018 while CAGR for yield was given 0.1% but not statistically significant. However, the study found that CAGR for yield during the periods is TE1961-TE1995 (1.0%) and it is TE1996-TE2018 (-2.1%) with both statistically significant at 1% and 5% respectively. It can be concluded that, the trend in both production and harvested area increased relatively than the unpredictable movement observed in the yield performance. Besides, changes in cassava production during the period under consideration was largely influenced by harvested area with yield having declining effect. Evidence from this study shows that yield (production per hectare) remains a source of concern for policymakers in the efforts to sustain increase in cassava production in Nigeria. This concern is heightened by the fact that agricultural lands are increasingly having competing need for other uses as the population increases. Therefore, going forward, there is compelling need for improved yield performance via land productivity.

Consequent on the findings of the study, the following recommendations are made: (i) there should be deliberate efforts to raise awareness on improved yield performance; (ii) intensive advocacy for research institutes to make improved cassava and disease resistant cassava varieties available and accessible to farmers; and (iii) Since the opportunities in world cassava market are high, it is essential that cutting edge scientific methods are courted to achieve optimization and precision in cassava production so that local farmers can directly and indirectly benefit from the growing global cassava market.

This study also suggests the need to explore the value chain analysis of cassava in Nigeria. Besides, making a near precise forecast of the future demand and supply of cassava in Nigeria in the context of emerging cassava dependent industry will be an area of interest.

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