ANALYSIS OF TRENDS IN PRODUCTION, CONSUMPTION AND TRADE IN THE AFRICAN ONIONS MARKET

Antia-Obong, Essien Akpan[1]
Akpaeti, Aniekan Jim2
Atairet, Elizabeth Atairet3
Marcus, Samuel Raymond4
123 and 4Department of Agricultural Economics and Extension, Akwa Ibom State University, Obio Akpa Campus Nigeria

[1]E-mail: essienantiaobong@aksu.edu.ng

ABSTRACT

Onions are a crucial agricultural commodity in Africa contributing significantly to both domestic consumption and international trade. It requires attention due to the African Continental Free Trade Agreement that encourages regional integration on the continent. The onion industry dynamics in Africa is a complex interplay of factors such as climatic conditions, farming practices, pricing and consumer dynamics and market access that shapes production volumes, quality, trade and ultimately the livelihoods of millions engaged in onion farming and trade. The study for the first time investigates trends in onion production, consumption and trade among the five regions in Africa, comprising North Africa, West Africa, Central Africa, East Africa and Southern Africa. By so doing, provides insights on the performance of the onion sector from the lens of production, consumption and trade. Data for the study was drawn from the database of the Food and Agricultural Organization of the United Nations and cover 1961-2022 (62 years), broken down into three periods to ease comparison (1961 - 1980), (1981 - 2000) and (2001 - 2022). The specific objectives of the study were to: 1. analyze the growth rates in onion production, consumption and trade across different regions of Africa. 2. estimate the doubling time in onion production, consumption and trade across different regions of Africa. 3. evaluate the contribution of area and yield to the growth of onion production across different regions in Africa. The findings from the study show that yield has not kept up with expansion in areas across Africa, despite both increased growth in consumption and trade. The study recommends investment in modern high yielding production technology and training across Africa, especially in West Africa in order to increase growth in onions yield.

KEYWORDS: Growth rate, doubling time, decomposition analysis, East Africa, West Africa, Middle Africa, North Africa, Southern Africa

ABSTRAKT

Zwiebeln sind ein wichtiges landwirtschaftliches Erzeugnis in Afrika, das sowohl für den Inlandsverbrauch als auch für den internationalen Handel von großer Bedeutung ist. Das afrikanische kontinentale Freihandelsabkommen, das die regionale Integration auf dem Kontinent fördert, erfordert besondere Aufmerksamkeit. Die Dynamik der Zwiebelindustrie in Afrika ist ein komplexes Zusammenspiel von Faktoren wie klimatische Bedingungen, Anbaupraktiken, Preisgestaltung, Verbraucherdynamik und Marktzugang, die Produktionsmengen, Qualität, Handel und letztlich die Lebensgrundlage von Millionen von Menschen, die im Zwiebelanbau und -handel tätig sind, beeinflussen. In der Studie werden zum ersten

Mal die Trends bei der Zwiebelproduktion, dem Verbrauch und dem Handel in den fünf Regionen Afrikas untersucht, die Nordafrika, Westafrika, Zentralafrika, Ostafrika und das südliche Afrika umfassen.

STICHWORTE: Wachstumsrate, Verdopplungszeit, Dekompositionsanalyse, Ostafrika, Westafrika, Mittleres Afrika, Nordafrika, Südliches Afrika.

RÉSUMÉ

Les oignons sont un produit agricole essentiel en Afrique, qui contribue de manière significative à la fois à la consommation intérieure et au commerce international. L'accord de libre-échange continental africain, qui encourage l'intégration régionale sur le continent, mérite que l'on s'y attarde. La dynamique de l'industrie de l'oignon en Afrique est une interaction complexe de facteurs tels que les conditions climatiques, les pratiques agricoles, la dynamique des prix et des consommateurs et l'accès au marché qui façonne les volumes de production, la qualité, le commerce et, en fin de compte, les moyens de subsistance de millions de personnes engagées dans la culture et le commerce de l'oignon. L'étude examine pour la première fois les tendances de la production, de la consommation et du commerce d'oignons dans les cinq régions d'Afrique, à savoir l'Afrique du Nord, l'Afrique de l'Ouest, l'Afrique centrale, l'Afrique de l'Est et l'Afrique australe.

MOTS-CLÉS: taux de croissance, temps de doublement, analyse de décomposition, Afrique de l'Est, Afrique de l'Ouest, Afrique centrale, Afrique du Nord, Afrique australe.

INTRODUCTION

Onions play a vital role on the African continent by contributing immensely in production, consumption and international trade (Zegeye, et al., 2024). The Onion vegetable belongs to the genus allium which is closely related to other vegetables such as garlic, shallots, and leeks (Braun, 2022). On average, a person consumes roughly 10 kilogram of onions per year and can be eaten raw, cooked, pickled, or powdered (Cattivelli, et al., 2021). Onions contain compounds that help protect the heart, reduce the risk of certain cancers and ease the process of the body to make insulin (Galavi, Hosseinzadeh, & Razavi, 2021).

Furthermore, Onions provide a veritable source of quercetin, and scientists have linked onions to many possible health benefits, for instance, the antioxidant properties in onions help prevent cell damage in the body by fighting inflammation and boosting the immune system. Onions are also a good source of vitamins and minerals as well as adding flavour to boost any breakfast, lunch, or dinner dish (Nemeth, Takacsova, & Piskula, 2003; Tawfeeq, Shallal, Abdulwahid, & Aldahham, 2023).

The cultivation of onions is widespread throughout Africa, with farmers producing the crop across diverse agroecological zones and climatic conditions (Emmanuel, Sulaiman, & Abu, 2024). The geographic distribution of onion production is influenced by soil fertility, water availability, temperature and market demand, leading to disparities in production levels and quality standards across different regions (Ochar & Kim, 2023). Despite facing numerous challenges, such as limited access to inputs, inadequate infrastructure, pests, diseases, and climate variability (Atairet & Umoh, 2022; Atairet, Umoh, & Atairet, 2024). Onion production remains a vital source of income and livelihood for millions of smallholder farmers across Africa (Zegeye et al., 2024). The resilience and adaptability of farmers play a critical role in mitigating these challenges and ensuring a steady supply of onions to meet both domestic and international demand (Jung, et al., 2024)

Egypt, Algeria, Sudan, and Nigeria lead onion production in Africa, making use of both irrigated and rain-fed agricultural systems to optimize output (Africa view facts, 2024). These nations meet substantial domestic demand while also contributing to regional onion trade, which bolsters economic ties within the African continent.

Accordingly, one of Africa's most significant policy decisions is the establishment of the Africa Continental Free Trade Agreement (AfCFTA) in 2018. AfCFTA aims to create a single market for goods and services across the continent, promoting economic integration and growth. A primary challenge for agriculture under the AfCFTA is the existence of trade barriers (Simola, et al, 2022). These barriers can take the form of tariffs, quotas, and non-tariff measures that restrict the flow of agricultural products between member states (Nugroho, et al., 2024). In addition, infrastructure plays a crucial role in the agricultural sector, affecting everything from production to distribution (Abiri, Rizan, et al, 2023). Many African countries suffer from inadequate transportation networks, poor storage facilities, and limited access to markets (Khan, Nouman, Negrut, Abban, Cismas, & Siddiqi, 2024).

Agriculture in Africa is particularly vulnerable to the impacts of climate change, which can exacerbate existing challenges such as droughts, floods and pests (Onyeaka, et al., 2024). The Africa Continental Free Trade Agreement holds great potential for transforming the agricultural landscape across the continent. However, addressing the various challenges faced by the agricultural sector is crucial for its success. Therefore, understanding the underlying trends in onion production, consumption, and trade in Africa is essential for informing evidence-based policy decisions and interventions aimed at addressing the growth performance of this important crop.

Accordingly, this study explores the trends in regional onion production, consumption and trade in Africa by investigating production, consumption and trade growth rates, doubling time and sources of production growth and drawing policy implications based on the findings that can guide policymakers, researchers, development practitioners and other stakeholders in designing effective interventions and strategies to promote sustainable onion production, improve market opportunities and enhance livelihoods for smallholder farmers across Africa.

This study is essential due to its significant contributions to the continent's agricultural economy, food security and trade competitiveness and holds significant importance for various stakeholders. The trend analysis provides insights into improving agricultural productivity, enhancing food security, and promoting trade competitiveness across the continent.

Research Objective: The study therefore has the following specific objectives:

1. analyze the growth rates in onion production, consumption and trade across the five regions of Africa, i.e. West Africa, East Africa, Central Africa, Southern Africa, and North Africa from 1961-2022.
2. estimate the doubling time in onion production, consumption and trade across the five regions of Africa, i.e. West Africa, East Africa, Central Africa, Southern Africa, and North Africa from 1961-2022.
3. evaluate the contribution of the area and yield to the growth of onion production across the five regions of Africa, i.e. West Africa, East Africa, Central Africa, Southern Africa, and North Africa from 1961-2022.

Research methodology: The Study area is Africa, which comprises 54 countries (worldometers.info, 2024). Africa is the second largest continent in the world by land mass covering an area of approximately 30 million square kilometres, with an estimated population of 1.5 billion

(Rosenberg, 2024), and is roughly divided equally between males and females (countrymeters.info, 2024). According to the African Union (2024), Africa is made up of five regions, namely: West Africa, East Africa, North Africa, Central Africa and Southern Africa and each region is associated with an economic bloc. According to Gardiner & Smedley (2024), Agriculture is by far the single most important economic activity in Africa, employing a large number of the working population.

Data Source: Secondary data obtained from the Food and Agriculture Organization statistical database (FAOSTAT) was used in the study. Data used include area (ha), yield (kg/ha), production (tonnes), consumption (tonnes), export (tonnes), import (tonnes), export value ($) and import value ($) of onion for each region and Africa and cover 62 years from 1961-2022. The data is further broken into three periods, namely: 1961-1980, 1981-2000 and 2001- 2022, to ease comparison.

Modelling Growth Rates: The log-linear model is generally used to estimate growth rates, the regressand takes the logarithm form and the regressor is a time variable which can take values from one to infinity (Akpaeti, et al., 2013; Akpaeti, Bassey, & Okon, 2014b; Sharma et al., 2017; Akpaeti, et al., 2018a; Godara & Krishan 2020).

The log-linear model generally takes the mathematical form:

$$\mathrm{In}y_{t\,(1,2,3,4,5,6.7.8)} = b_0 + b_1 t + \mathrm{e}_t \qquad (1)$$

Where lnYt1 = Natural logarithm of Onion production measured in tonnes

Where lnYt2= Natural logarithm of Onion yield measured in kg per hectare

Where lnYt3= Natural logarithm of Onion area harvested measured in hectare

Where lnYt4= Natural logarithm of Onion export measured in tonnes

Where lnYt5= Natural logarithm of Onion export value measured in $

Where lnYt6= Natural logarithm of Onion import measured in tonnes

Where lnYt7= Natural logarithm of Onion import value measured in $

Where lnYt8= Natural logarithm of Onion consumption measured in tonnes

b0 = estimated constant regression line

b_1 = estimated growth coefficient

t = linear time trend for each period

e_t = error term

Compound Growth Rate: Compound growth rate is a nonlinear measure, in other words, the effect of compounding takes into account variability or volatility that has occurred over time (Jagannath et al., 2013; (Akpaeti, et al., 2014a; Akpaeti, et al., 2018b; Akpaeti, et al., 2019; Antia-Obong & Otung, 2019)., the compound growth rate is expressed as follows:

$$CGR = (antilog\ b_1 - 1) * 100 \qquad (2)$$

Otherwise expressed as:

$$CGR = \left(e^{b1} - 1\right) * 100 \qquad (3)$$

Where;

CGR = Compound Growth rate of coconut.

b1 = estimated growth coefficient or slope.

e= Euler's exponential constant, given a value of 2.71828

Doubling Time. To estimate doubling time, the rule of 72 (Moneychimp, 2019; Antia-Obong et al. 2019) is applied and is used for annual periodic compounded data using a constant of 8 per cent at a periodically determined compounded rate derived as follows:

$2P = P(1 + r)^Y$ (4)

$Y = \ln(2) / \ln(1 + r/100)$ (5)

To approximate to obtain a fraction,

$Y = K/r$ (6)

Where K is a number that enables approximation of a good fit for r,

$ln(2)/ln(1 + r/100) = K/r$ (7)

ln(2)/ln(l+0.08)= K/0.08 (8)

$K = [ln(2)/ln(1.08)] * 0.08$ (9)

$K = 0.721$ (10)

$K = 0.721 * 100$ (11)

$Y = {}^{72}/_{r}$ (12)

Where;

Y = Time to double growth

r = Compound growth rate as in equation (3)

Contribution of Area and Yield to the Growth of Onion Production across Different Regions in Africa. Decomposition analysis is used to capture the contribution of area and yield to onion production growth, which measures the relative contribution of area and yield to the total change in production (Antia-Obong, Eno, & Obot, 2024; Ikuemonisan et al ., 2020; Antia-Obong & Bhattarai, 2012). The equation is expressed thus;

$$P = \underbrace{\frac{(A_{by} * \Delta Y)}{\Delta P}}_{\text{(yield effect)}} * 100 + \underbrace{\frac{(Y_{by} * \Delta A)}{\Delta P}}_{\text{(area effect)}} * 100 + \underbrace{\frac{(\Delta A * \Delta Y)}{\Delta P}}_{\text{(Interaction effect)}} * 100 \quad (13)$$

Where;

P = Production growth

ΔP (Change in Production) = (Pcy – Pby)

ΔY (Change in yield) = (Ycy - Yby)

ΔA (Change in area) = Acy – Aby

Aby, Yby and Pbyare the base year for area, yield and production of onions.

Acy, Ycy and Pcy are the current years for area, yield and production of onions.

Accordingly, the area effect, yield effect and interaction effect share percentage contribution towards production growth with each source contributing different percentage levels to production growth.

RESULTS AND DISCUSSION

ANALYZE THE GROWTH RATES IN ONION PRODUCTION, CONSUMPTION AND TRADE ACROSS THE DIFFERENT REGIONS OF AFRICA. Table 1 presents the growth rates in area, yield and production of onions for Africa and captures the five African regions. All five regions including Africa experienced significant positive growth rates at the 1% level for the four periods concerning area except for West Africa which experienced growth in area at the 5% level of significance. The results mean that the area under onion cultivation had been increasing across Africa and the regions. Similar studies on

growth rates such as (Antia-Obong, et al., 2024; Akpan, et al., 2025) also found that area of coconut and oil palm fruit experienced increased growth.

For yield, East Africa and Middle Africa experienced significant positive growth at the 1% level during the second, third and pooled periods. However, Middle Africa experienced significant negative growth in yield at the 1% level during the first period; while North Africa on the other hand experienced significant negative growth in yield at the 5% level during the second period. Southern Africa experienced significant positive growth in yield across all the periods except the second period.

The growth rate in yield for the first period in West Africa was positive and significant at the 10% level; on the contrary, yield in the second and pooled periods experienced significant negative growth at the 1% level. Africa reveals a dismal yield growth rate with the only significant positive growth occurring during the third period; while the other periods experienced negative growth. An interesting finding is that growth rates in onion production experienced significant positive growth at the 1% level across all periods.

Table 2 classifies growth rates in the regions into low, medium and high corresponding to <2%, 2% to 3% and >3% respectively. Accordingly, in the first period, high and medium growth rates in the area occurred in all the regions with East Africa, Middle Africa, West Africa and Africa experiencing high growth rates. Furthermore, all regions experienced low growth in yield; while high and medium growth also occurred in all regions concerning production with East Africa, Middle Africa, Southern Africa and West Africa experiencing high growth.

Table 1: Compound growth rate for area, yield and production of onion (%)

Regions	**Period I (1961-1980)**			**Period II (1981-2000)**			**Period III (2001-2022)**			**Pooled period (1961-2022)**		
	A	Y	P	A	Y	P	A	Y	P	A	Y	P
EA	5.23***	-0.4	4.81***	4.5***	1.11***	5.65***	3.87***	2.22***	6.18***	4.29***	1.31***	5.65***
MA	12.41***	-4.5***	7.47***	1.41***	2.12***	3.56***	5.87***	1.21**	7.14***	4.29***	1.11***	5.34***
NA	2.84***	-0.6	2.22***	3.36***	-0.4**	2.84***	3.87***	1.61***	5.44***	3.46***	0.9***	4.5***
SA	2.53***	1.61***	4.29***	4.71***	0.2	4.92***	3.46***	1.01***	4.39***	3.15***	1.11***	4.29***
WA	4.71***	0.9*	5.65***	31.65***	-13.32***	14.11***	1.71**	4.29***	6.08***	12.19***	-3.44***	8.33***
AF	4.08***	-1.09	2.94***	10.63***	-4.97***	5.13***	2.63***	2.94***	5.65***	5.76***	-0.6***	5.13***

*** indicates a 1% level of significance, ** indicates a 5% level of significance, *indicates a 10% level of significance

EA= East Africa, MA= Middle Africa, NA= North Africa, SA= Southern Africa, WA= West Africa, AF= Africa

A= area, Y= yield and P= Production

During the second period, only Middle Africa experienced low growth while the other regions all experienced high growth rates concerning the area. The reverse occurred for yield, in this case; Middle Africa experienced medium growth; while the other regions all experienced low growth rates. Furthermore, a high growth rate was experienced in all the regions except for North Africa which experienced medium growth in production.

The third period witnessed a high growth rate in the area in East Africa, Middle Africa, North Africa and Southern Africa; while low and medium growth rates in the area were experienced in West Africa and Africa respectively.

Yield on the other hand witnessed low and medium growth rates across the regions; on the contrary, production experienced high growth rates across all regions.

Table 2: Classification of regions based on growth rates of Onions

Periods	Elements	Low (<2%)	Medium (2% to 3%)	High (>3%)
Period I	Area		NA, SA	EA, MA, WA, AF
(1961-1980)	Yield	EA, MA, NA,		
20 years		SA, WA, AF		
	Production		NA, AF	EA, MA, SA, WA
Period II	Area	MA		EA, NA, SA, WA,
(1981-2000)				AF
20 years	Yield	EA, NA, SA,	MA	
		WA, AF		
	Production		NA	EA, MA, SA, WA,
				AF
Period III	Area	WA	AF	EA, MA, NA, SA
(2001-2022)	Yield	MA, NA, SA	EA, WA, AF	
22 years	Production			EA, MA, NA, SA,
				WA, AF
Pooled	Area			EA, MA, NA, SA,
(1961-2022)				WA,AF
62 years	Yield	EA, MA, NA,		
		SA, WA, AF		
	Production			EA, MA, NA, SA,
				WA,AF

EA= East Africa, MA= Middle Africa, NA= North Africa, SA= Southern Africa, WA= West Africa, AF= Africa

The pooled period provided an interesting finding, because area and production in all the regions experienced a high growth rate; while yield on the other hand experienced a low growth rate in all the regions. On the other hand, growth rates occurred at the extremes i.e. either low growth rate or high growth rate.

Table 3 presents the growth rates in onion consumption, the most striking finding was that all regions in the four periods witnessed positive and significant growth rates at the 1% level. This finding is consistent with Yeshiwas, Alemayehu, & Adgo (2023) wherein onion was acknowledged as increasingly being consumed in Africa.

Table 3: Compound growth rate for domestic consumption of onions (%)

Regions	**Period I (1961-1980)**	**Period II (1981-2000)**	**Period III (2001-2022)**	**Pooled period (1961-2022)**
	Consumption	Consumption	Consumption	Consumption
EA	4.08***	5.55***	6.93***	5.55***
MA	5.34***	4.71***	9.75***	6.29***
NA	3.25***	2.22***	6.18***	4.81***
SA	5.13***	5.02***	3.67***	4.29***
WA	1.92***	3.98***	6.18***	4.07***
AF	3.05***	3.46***	6.18***	4.6***

***indicate 1% level of significance

EA= East Africa, MA= Middle Africa, NA= North Africa, SA= Southern Africa, WA= West Africa, AF= Africa

Table 4 shows the classification of growth rate in onion consumption, during the first period, only West Africa witnessed low consumption growth; while the other regions experienced high consumption growth rates.

In the second period, only North Africa witnessed medium consumption growth, while the other regions experienced high consumption growth.

The third and pooled periods all experienced high consumption growth which further confirms that onion consumption increased across Africa.

Table 4: Classification of regions based on consumption growth rates of Onions

Periods	**Element**	**Low (<2%)**	**Medium (2% to 3%)**	**High (>3%)**
Period I (1961-1980) 20 years	Consumption	WA		EA, MA, NA, SA, AF
Period II (1981-2000) 20 years	Consumption		NA	EA, MA, SA, WA, AF
Period III (2001-2022) 22 years	Consumption			EA, MA, NA, SA, WA,AF
Pooled (1961-2022) 62 years	Consumption			EA, MA, NA, SA, WA,AF

EA= East Africa, MA= Middle Africa, NA= North Africa, SA= Southern Africa, WA= West Africa, AF= Africa

Table 5 shows the growth rate in the export and import of onions, while export and import generally experienced significant negative growth at the 1% level during the first period the remaining periods experienced significant positive growth at the 1% level. This negative trade growth rate implies that onion exports and imports mostly declined during the first period, while the positive trade growth rate suggests that onion exports and imports increased after the first period.

Table 5: Compound growth rate for export and import quantities of onions (%)

Regions	Period I (1961-1980)		Period II (1981-2000)		Period III (2001-2022)		Pooled period (1961-2022)	
	Export	Import	Export	Import	Export	Import	Export	Import
EA	-10.95***	-8.7***	7.04***	9.42***	10.08***	14.45***	5.76***	6.18***
MA	6.29	-2.54***	6.5	3.25**	31.39***	7.68***	4.19***	5.44***
NA	-7.6***	-24.87***	13.66***	11.4	5.34***	18.18***	3.25***	3.05
SA	-2.57*	29.05***	7.68***	18.18***	10.41***	5.02***	4.5***	14.68***
WA	6.18**	2.33***	6.61*	4.81***	3.56***	7.79***	7.47***	6.72***
AF	-6.67***	-1.88***	11.18***	5.65***	5.87***	8.98***	3.67***	6.18***

EA= East Africa, MA= Middle Africa, NA= North Africa, SA= Southern Africa, WA= West Africa, AF= Africa
*** indicates a 1% level of significance, ** indicates a 5% level of significance, *indicates a 10% level of significance

Table 6 shows the classification of growth rates into low, medium and high. The most obvious finding to emerge from the classification is that export and import for the second, third and pooled periods all experienced high growth rates.

Table 6: Classification of regions based on growth rate of export and import quantities of Onions

Periods	Elements	Low (<2%)	Medium (2% to 3%)	High (>3%)
Period I (1961-1980) 20 years	Export quantity	EA, NA, SA, AF		MA, WA
	Import quantity	EA, MA, NA, AF	WA	SA
Period II (1981-2000) 20 years	Export quantity			EA, MA, NA, SA, WA,AF
	Import quantity			EA, MA, NA, SA, WA,AF
Period III (2001-2022) 22 years	Export quantity			EA, MA, NA, SA, WA,AF
	Import quantity			EA, MA, NA, SA, WA,AF
Pooled (1961-2022) 62 years	Export quantity			EA, MA, NA, SA, WA,AF
	Import quantity			EA, MA, NA, SA, WA,AF

EA= East Africa, MA= Middle Africa, NA= North Africa, SA= Southern Africa, WA= West Africa, AF= Africa

Table 7 shows the growth rate in the value of exports and imports measured in United States dollars. What can be seen is that import value in the first period was the only period with a significant negative growth rate at the 1% level for North Africa. In other words, the value of imports and exports was generally positive and significant at the 1% level during the other periods.

Table 7: Compound growth rate for export and import value of Onions (%)

Regions	**Period I (1961-1980)**		**Period II (1981-2000)**		**Period III (2001-2022)**		**Pooled period (1961-2022)**	
	Export ($)	Import ($)	Export ($)	Import ($)	Export ($)	Import ($)	Export ($)	Import ($)
EA	-2.27	-0.99	5.65***	8.11***	9.97***	14.22***	6.5***	7.68***
MA	7.25	5.34***	0.9	1.21	34.31***	8.55***	5.13***	6.93***
NA	0	-16.05***	6.18***	10.08	13.31***	19.96***	5.13***	4.39***
SA	5.13***	29.3***	7.14***	17.7***	11.85***	6.93***	6.29***	15.37***
WA	19.72***	8.33***	8.98*	4.08***	4.19**	10.08***	9.42***	7.47***
AF	1.41	5.13***	7.9***	4.29***	11.07***	10.63***	5.65***	7.25***

*** indicates a 1% level of significance, ** indicates a 5% level of significance, *indicates a 10% level of significance

EA= East Africa, MA= Middle Africa, NA= North Africa, SA= Southern Africa, WA= West Africa, AF= Africa

Table 8 shows that the export and import value of onions tilted towards a pattern of high growth rate during the third and pooled periods. Accordingly, the low growth rates witnessed in export and import value for East Africa, North Africa and Africa during the first period and Middle Africa during the second period transitioned to high growth rates during the third period. In other words, the value of onion trade increased over time implying that the international price of onions has over time experienced high growth which suggests that onion supply has not met with rising demand in Africa.

Table 8: Classification of regions based on the value of growth rate of export and import of Onions

Periods	**Elements**	**Low (<2%)**	**Medium (2% to 3%)**	**High (>3%)**
Period I	Export value	EA, NA, AF		MA, SA, WA
(1961-1980)	Import value	EA, NA		MA, SA, WA, AF
20 years				
Period II	Export value	MA		EA, NA, SA, WA, AF
(1981-2000)				
20 years	Import value	MA		EA, NA, SA, WA, AF
Period III	Export value			EA, MA, NA, SA, WA,AF
(2001-2022)				
22 years	Import value			EA, MA, NA, SA, WA,AF
Pooled	Export value			EA, MA, NA, SA, WA,AF
(1961-2022)				
62 years	Import value			EA, MA, NA, SA, WA,AF

EA= East Africa, MA= Middle Africa, NA= North Africa, SA= Southern Africa, WA= West Africa, AF= Africa

Estimate the doubling time in onion production, consumption and trade across different regions of Africa. Table 9 shows the doubling time in years for area, yield, production, consumption, export, import, export value and import value of onions in Africa.

Table 9: Doubling time in years for Area, yield, production, consumption, export quantity, import quantity, export value and import value of Onions in Africa

Pooled period (1961-2022)								
Regions	Area	Yield	Production	Consumption	Export	Import	Export Value	Import Value
EA	17	55	13	13	13	12	11	9
MA	17	65	13	11	17	13	14	10
NA	21	80	16	15	22	24	14	16
SA	23	65	17	17	16	5	11	5
WA	6	-21	9	18	10	11	8	10
AF	13	-120	14	16	20	12	13	10

EA= East Africa, MA= Middle Africa, NA= North Africa, SA= Southern Africa, WA= West Africa, AF= Africa

The results show that for the area, Southern Africa experienced the highest doubling time of 23 years, while West Africa witnessed the lowest with 6 years. This means that it will take 23 years for the area harvested under Southern Africa to double in size from the current size; while it will take just 6 years for the area to double in West Africa from the current size.

Concerning yield, the finding shows that it will take 21 years for onion yield to fall to half its current level. The opposite of doubling time is half-life and is referred to as negative doubling, which implies that West Africa had the shortest doubling time, furthermore, it will take Africa 120 years for onion yield to fall to half its current level. This finding is disturbing because the implication is that it will take 240 years for onion yield to double from current levels and it shows that onion yield in Africa is lacking in modern yield technology that can rapidly increase yields and shorten its doubling time.

For production, West Africa experienced the lowest doubling time of 9 years while Middle Africa witnessed the least doubling time of 11 years to consumption. Furthermore, North Africa experienced the highest doubling time for export and import as well as export and import values.

Evaluate the contribution of area and yield to the growth of onion production across different regions in Africa. Table 10 shows the sources of production growth, a cursory look reveals that area effect was the main

source of production growth across all periods. This means that expansion in area under onion cultivation was the main reason behind onion production across the regions in Africa. Akpan, Udoh, & Edet (2025) also found that area expansion was the main source of production growth for oil palm fruit in Nigeria. Furthermore, West Africa had the shortest doubling time of 10 years for export and export value, while Southern Africa experienced the shortest doubling time of 5 years for import and import value.

Table 10: Contribution of area and yield to Onion Production growth across Africa

Regions	Period I (1961-1980)				Period II (1981-2000)				Period III (2001-2022)				Pooled period (1961-2022)			
	YE%	AE%	IE%	Total %	YE%	AE%	IE%	Total %	YE%	AE%	IE%	Total %	YE%	AE%	IE%	Total %
EA	13.31	72.41	14.28	100	12.62	71.77	15.62	100	17.59	56.14	26.27	100	4.74	41.56	53.81	100
MA	-16.17	191.11	-74.94	100	60.6	21.85	17.55	100	4.89	85.19	9.92	100	0.32	91.07	8.6	100
NA	27.07	62.08	10.86	100	-12.69	126.48	-13.79	100	19.99	51.43	28.58	100	7.1	51.2	41.7	100
SA	30.1	51.75	17.87	100	-7.4	117.64	-10.24	100	28.04	54.76	17.2	100	6.59	56.87	36.87	100
WA	11.11	74	14.89	100	-19.99	946.16	-826.17	100	29.51	40.2	30.3	100	-1.12	339.69	-238.57	100
AF	8.33	85.57	6.11	100	-35.7	267.61	-131.91	100	24.44	46.47	29.09	100	-0.42	107.87	-7.45	100

EA= East Africa, MA= Middle Africa, NA= North Africa, SA= Southern Africa, WA= West Africa, AF= Africa
YE = Yield effect, AE= Area effect, IE= Interaction effect

RECOMMENDATIONS

The following recommendations are drawn from the findings of the study:

1. There is a need to invest in modern scientific technology to boost onion yields on the African continent, particularly in West Africa. This approach is likely to reverse the negative growth rate in yields and shorten the time required for yields to double.

2. There is a need to invest in the land, to improve on land productivity and management, and to slow down on land expansion for onion production. This will involve adopting good agricultural practices such as intercropping, to maximize land use as a finite resource.

3. Adequate training and capacity development are required for stakeholders in the African onion value chain on best agronomic practices and climate-smart techniques that can boost yields.

REFERENCES

Abiri, R., Rizan, N., Balasundram, S. K., Shahbazi, A. B., & Abdul-Hamid, H. (2023). Application of digital technologies for ensuring agricultural productivity. Heliyon, 9(12), e22601.

Africa view facts. (2024, July 6). Top Onion Producer. Retrieved February 19, 2025, from Africa View Facts: https://africaviewfacts.com/stats/top-onion-producers-in-africa/

African Union. (2024). Retrieved August 8, 2024, from Regional Economic Communities: https://au.int/en/recs

Akpaeti, A. J., Bassey, N. E., Okoro, U. S., & Nkeme, K. K. (2014a). Trends and Drivers of Agricultural Investments and Growth in Nigeria: The Pre and Financial Sector Reforms Experience. Asian Journal of Economic Modelling, 115-127.

Akpaeti, A. J., Nwosu, A. C., Nwaru, J. C., & Ebong, I. O. (2013). Economic Assessment of Trends in Loanable Funds in Nigeria. The Journal of Economcs Photon, 113, 157-162.

Akpaeti, A. J.; Agom, D. I.; Frank, N. N. (2018b). Analysis of the Effects of Inflation on Farmers' Income in Nigeria (1970-2017). AKSU Journal of Agricultural Economics, Extension and Rural Development, 1(1), 110-120.

Akpaeti, A. J.; Agom, D. I.; Michael, U. S.;. (2019). Insulating Young Agricultural Entrepreneurs against Inflation in Nigeria: An Econometric Method. Faman Journal, 19(1), 36-50.

Akpaeti, A. J.; Bassey, N. E.; Okon, U. E. (2014). Trend Evaluation of Agricultural Export Crops in Nigeria. International Journal of Food and Agricultural Economics, 2(1), 165-175.

Akpaeti, A. J.; Frank, N. F.; Luke, U. H.;. (2018a). Petrol Pump Prices Fluctuation and Agricultural Productivity in Nigeria (1970-2016): A Vector Error Correction Approach. London Journal of Research in Science, Natural and Formal, 18(2), 1-18.

Akpaeti, A. J.; Ibok, O. W.; William, K. U.; Archibong, M. N.;. (2024). Is Naira Depreciation Having Any Effect on Agricultural Productivity in Nigeria? AKSU Journal of Agriculture and Food Science, 8(1), 1-13.

Akpan, S., Udoh, E., & Edet, G. (2025). Analysis of trend, growth, and Instability in output, harvested area, and yield of oil palm fruit in Nigeria. Journal of Agriculture and Nature, 28(1), 219-231.

Antia-Obong, E A; Udoh, E S; Eduno, E B; Okon, I M;. (2019). Analysis of Beer of Barley production and Trade Growth rates, Patterns of Growth and Doubling time in Nigeria. Journal of Economic Studies, 16(01), 39-52.

Antia-Obong, E. A. (2019). Trends in Export and Import of Beer of Barley in Nigeria: 1961-2014. Asian Journal of Advances in Agricultural Research, 9(4), 1-6.

Antia-Obong, E. A., & Otung, I. A. (2019). Growth Rate Analysis for domestic production and import of Beer of Barley in Nigeria. Middle East Jouirnal of Africulture Research, 08(01), 21-27.

Antia-Obong, E. A., Eno, W. C., & Obot, A. P. (2024). Analysis of Coconut Production trends under three policy phases in Nigeria. KSU J. Agric Nat, 27(3), 665-673.

Antia-Obong, Essien Akpan; Bhattarai, Keshab R;. (2012). Growth Trends and Sources of Output Growth for Oil palm and Groundnut Production in Nigeria (1961-2007). Trends in Agricultural Economics, 5(3), 96-103.

Atairet, E. A., & Umoh, G. S. (2022). Climate Vulnerability and Income Inequality Among Bonga Fishers in the Coastal Communities of Akwa Ibom State, Nigeria. Journal of Agricultural Economics, Extension and Rural Development, 5(1), 53-63.

Atairet, E. A., Umoh, G. S., & Atairet, A. C. (2024). Socio-economic factors Influencing Fishers' Adaptation to Climate Change in the Atlantic Coast of Akwa Ibom State, Nigeria. Direct Research Journal of Agricultural and Food Science, 12(2), 222-231.

Braun, A. R. (2022, February). All About Alliums: Flavors, Health Benefits, and Cooking Techniques. Retrieved February 07, 2025, from NUTRITION & FOODSERVICE EDGE EXPRESS: https://www.anfponline.org/docs/default-source/legacy-docs/docs/ce-articles/cc022022.pdf

Cattivelli, A., Conte, A., Martini, S., & Tagliazucchi, D. (2021). Influence of Cooking Methods on Onion Phenolic Compounds Bioaccessibility. Foods, 10(5), 1-19.

Emmanuel, K. P., Sulaiman, A., & Abu, I. A. (2024). FACTORS INFLUENCING ADOPTION OF RECOMMENDED ONION PRODUCTION TECHNOLOGIES AMONG FARMERS IN WESTERN AGRICULTURAL ZONE OF BAUCHI STATE, NIGERIA. Nigerian Journal of Agriculture and Agricultural Technology (NJAAT), 4(2), 90-104.

Galavi, A., Hosseinzadeh, H., & Razavi, B. M. (2021). The effects of Allium cepa L. (onion) and its active constituents on metabolic syndrome: A review. Iran J Basic Med Sci, 24(1), 3-16.

Garba, D., & Alexander, W. A. (2023). The Challenges of Regional Integration and Effective Implementation of African Continental Free Trade Area (AfCFTA) Policy in Africa. African Journal of Politics and Administrative Studies (AJPAS), 16(2), 712-734.

Gardiner, R. K., & Smedley, A. (2024, August 5). Agriculture of Africa. Retrieved August 7, 2024, from Africa Economy: https://www.britannica.com/place/Africa/Agriculture

Godara, Rajinder; Krishan, Bal;. (2020). An Economic Analysis: Trend & Performance of Agriculture Production in Haryana. International Journal of Innovative Science and Research Technology, 5(6), 1184-1189.

Ikuemonisan, Edamisan Stephen; Mafimisebi, Taiwo Ejiola; Ajibefun, Igbekele;. (2020). Cassava production in Nigeria: trends, instability and decomposition analysis (1970-2018). Heliyon, 1-9.

Jagannath; Tayade, P M; Nandeshwar, N S; Shende, N V; Mallesh; Vinodakumar, S N;. (2013). Decomposition analysis of agricultural growth. Eco. Env. & Cons, 19(4), 1-6.

Jung, M., Kim, J., Kim, E. Y., Yoo, C., Ko, D., Lee, H., et al. (2024). Climate change impacts on Allium crop production: Insights from long-term observations in South Korea. Heliyon, 10, e34749.

Khan, F. U., Nouman, M., Negrut, L., Abban, J., Cismas, L. M., & Siddiqi, M. F. (2024). Constraints to agricultural finance in underdeveloped and developing countries: a systematic literature review. International Journal of Agricultural Sustainability, 22(1), https://doi.org/10.1080/14735903.2024.2329388.

Moneychimp. (2019). The Rule of 72 -Why it Works. Retrieved June 13, 2019, from http://www.moneychimp.com/features/rule72_why.htm

Nemeth, K., Takacsova, M., & Piskula, M. K. (2003). Effect of Cooking on Yellow Onion Quercetin. Polish Journal of Food and Nutrition Sciences, 12(53), 170-174.

Nugroho, A. D., Ma'ruf, M. I., Nasir, M. A., Fekete-Farkas, M., & Lakner, Z. (2024). Impact of global trade agreements on agricultural producer prices in Asian countries. Heliyon, 10(2), e24635.

Ochar, K., & Kim, S.-H. (2023). Conservation and Global Distribution of Onion (Allium cepa L.) Germplasm for Agricultural Sustainability. Plants, 12(18), 1-19.

Onyeaka, H., Nwauzoma, U. M., Akinsemolu, A. A., Tamasiga, P., Duan, K., Al-Sharify, Z. T., et al. (2024). The ripple effects of climate change on agricultural sustainability and food security in Africa. Food and Energy Security, 13(5), e567.

Rosenberg, M. (2024, Aprl 27). Geography. Retrieved August 7, 2024, from The 7 Contoinents Ranked From Largest to Smallest: https://www.thoughtco.com/continents-ranked-by-size-and-population-4163436

Sharma, Hemant; Parihar, T B; Kapadia, Kalpana;. (2017). Growth rates and Decomposition Analysis of Onion Production in Rajasthan State of India. Economic Affairs, 62(1), 157-161.

Simola, A., Boysen, O., Ferrari, E., Nechifor, V., & Boulanger, P. (2022). Economic integration and food security – The case of the AfCFTA. Glocal Food Security, 35, 100651.

Tawfeeq, A. A., Shallal, E. N., Abdulwahid, A. M., & Aldahham, B. J. (2023). ANTIOXIDANT ACTIVITY OF RAW AND COOKED ONIONS IN RABBIT DOE NUTRITION. Online Journal of Animal and Feed Research, 13(2), 137-142.

Zegeye, M. B., Alemu, T. A., Sisay, M. A., Mulaw, S. G., & Abate, T. W. (2024). Factors affecting onion production: An empirical study in the Raya Kobo district, Amhara regional state, Ethiopia. PloS One, 19(6), e0305134.