Acta Sci. Pol.
Silv. Colendar. Ratio Ind. Lignar. 25(1) 2026, 15–23
ACTA FORESTRY
www.forestry.actapol.net pISSN 1644-0722 eISSN 2450-7997 https://doi.org/10.17306/J.AFW.2026.1.2

ORIGINAL PAPER

Received: 30.01.2026
Accepted: 09.03.2026

SOCIO-ECONOMIC DETERMINANTS OF KOLA NUT PRODUCTION IN ODIGBO LOCAL GOVERNMENT AREA, ONDO STATE, NIGERIA

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ABSTRACT

Kola nut production plays a vital role in Nigeria's agricultural economy, serving as both a source of income for rural farmers and a significant export commodity. Despite its importance, production faces challenges arising from socio-economic factors and climate variability. The study examined the socio-economic determinants of kola nut production in Odigbo Local Government Area, Ondo State. A multi-stage sampling technique was used to select 90 respondents, and data were collected through a well-structured questionnaire. Descriptive and inferential statistics were employed for analysis. The results showed that males constituted 65.5% of respondents, with a mean age of 57.7 years; 44.5% had engaged in kola nut production for 16–20 years. About 54.4% had access to credit, while 94.4% had access to farmland an average of 7.7 acres. The majority (86.7%) reported that climate change had reduced profitability, while 66.7% linked it to increased pest and disease incidence. Regression analysis revealed that age ($\beta = -2.185$, $p < 0.01$), farming experience ($\beta = 9.248$, $p < 0.01$), household size ($\beta = -16.552$, $p < 0.01$), farm size ($\beta = 13.822$, $p < 0.01$), labor ($\beta = 0.003$, $p < 0.01$), and selling price ($\beta = 0.001$, $p < 0.05$) significantly influenced production. The study concludes that kola nut production remains a viable agribusiness but is constrained by socio-economic and climatic factors, recommending government and stakeholder interventions through climate education, financial literacy, and irrigation adoption to enhance productivity. Moreover, policy measures focusing on farmers employing climate-smart agricultural practices are recommended.

Keywords: kola nut production, socio-economic, determinants, farm size, labor, irrigation systems, Nigeria

INTRODUCTION

Kola belongs to the family *Sterculiaceae* and is native to the tropical rainforest zones of West Africa. It is believed that kola trees are native to Ghana and Côte d'Ivoire, and the spread of kola to other regions where it is cultivated was brought about by human activity (Chinweike et al., 2020). Kola is also cultivated in Jamaica, Indonesia, and South America (Asogwa, 2014). The Kola nut tree is a woody evergreen plant that can reach a height of 10–20 meters. It has a straight stem and large dark green leaves with a tough, leathery texture (Beyer, 2020). The pods are usually borne in clusters, each containing 4–40 seeds or nuts (depending on the variety) when opened. The seeds are enclosed in a soft, white, thick seed coat called the testa. Each seed, known as the kola nut, consists of two large fleshy cotyledons that constitute the embryo (Agwulanma et al., 2021).

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Kola nut has been associated with several health benefits, including the regulation of the menstrual cycle, the reduction of difficult labor, treatment of respiratory issues, improvement of gastrointestinal health, enhancement of mental health, aid to digestion, and remedy of hangovers. Kola nut produces stimulatory effects on the cardiovascular and neuroendocrine systems when consumed in large quantities (Beyer, 2020). In folkloric medicine, it has been used in the treatment of parasitic infections, rheumatism, depression, asthma, whooping cough, and low libido (Ezuruike and Prieto, 2015). Its anti-diabetic and antioxidant properties have been demonstrated *in vitro* and *in vivo* (Ayinde et al., 2022). Furthermore, amid the rising global demand for electricity, a blend of kola nut husks and cocoa pod husks has become a viable energy resource for power generation (Ajewole et al., 2021). Kola nuts are highly valued and attract considerable attention, especially during social functions such as weddings, naming ceremonies, and burials, where they are used in the reception of guests and visitors (Kanu, 2020). Kola nut is used as an ingredient in the production of cola beverages such as Coca-Cola, as well as in wine, chocolate, and confectionery (Asogwa et al., 2012). Kola nut is also used in the manufacture of pharmaceuticals and dyes. Kola-nut is sometimes used as animal feed because of its high nutrient content. Broilers fed kola nut pod husk meal diets demonstrated strong growth performance (Kanu, 2020). It is widely held that kola-nut suppresses hunger, thirst, and reduces sleepiness (Chinweike et al., 2020). Kola nut has a bitter and sharp taste, which becomes milder on drying.

The major chemical components of kola nut are caffeine, theobromine, and theophylline, which are xanthine derivatives (Ajewole et al., 2021).

Nigeria accounts for about 88% of the total world production of kola nuts (Ariyo et al., 2021). It has been reported that about 10% of the kola-nuts produced in Nigeria are exported, while 90% are consumed within the country (Ndagi et al., 2022). Kola nut is a key economic cash crop for a considerable proportion of Nigerians involved in kola nut farming, industrial utilization, trading, and marketing (Ashaye et al., 2017. The kola-nut is the fruit of the kola tree, which is native to the tropical rainforests of Africa (Oluwalana et al., 2016). Other tropical nations such as Gabon, the West Indies, and Brazil have also adopted its cultivation. The two most well-known species, *Cola nitida* and *Cola acuminata*, are among the many that exist; however, only six are found in West Africa. Kola-nut production varies considerably across Nigerian states. Adepoju (2015) reported a significant positive impact of kola nut production on employment creation, poverty alleviation, industrial development, and socio-cultural values, further noting its importance as a stimulant and as animal feed.

Kola nut is an important economic crop in the south-west region of Nigeria, produced extensively in the Odigbo Local Government Area of Ondo state and in other south-western states (Ekiti, Oyo, Ogun, Osun), while being predominantly consumed in Northern Nigeria (Yakubu et al., 2015). It is a tropical tree crop with over 20 species, of which two main species are grown in Nigeria: *Cola nitida* (Gbanja) and *Cola acuminata* (Abata). However, Ndagi et al. (2022) identified key challenges of kola nut production, including low yield, lack of information on improved technology, pest and disease infestation, lack of government support, and poor transportation infrastructure. Despite these challenges, farmers still hold kola nut production in high esteem, and vast areas of land remain available for kola nut production. While considerable literature has highlighted the importance of the kola nut, little attention has been paid to its socio-economic contribution and uses (Asogwa et al., 2015). Kola nut is one of the most valuable plants in the world, but its full potential has yet to be identified and exploited. Little is known about the kola nut and its various uses by rural dwellers in Nigeria. In more developed regions of the world, however, it is used to treat ailments, suppress hunger, and enhance alertness (Adebowale and Odesanya, 2015).

Despite its importance, kola nut production continues to be affected by challenges related to market access, land tenure systems, financing, and climate change. Investigating these socio-economic factors offers critical insights into the constraints faced by farmers, as well as opportunities for enhancing productivity and sustainability in the sector (Ogunniyi and Akintoye, 2020).

In addition to economic factors, social dynamics such as gender roles and family labor also play a pivotal role in kola nut production. In many parts of Nigeria, women are often responsible for the production

and marketing of kola nuts; however, they face considerable limitations in terms of land ownership and access to resources (Adebayo et al., 2021). The availability of capital and the adoption of improved technologies are equally crucial for improving kola nut farming productivity. Studies have shown that access to education positively influences farmers' adoption of improved farming practices, which can result in higher yields and increased income levels (Nwalieji and Ojike, 2018). Similarly, financial constraints are a significant determinant of agricultural productivity, with limited access to credit hindering farmers' ability to invest in essential inputs such as fertilizers and machinery. Consequently, analyzing the socio-economic factors affecting kola nut production can inform policies aimed at addressing these financial barriers and improving farmers' livelihoods (Ajayi et al., 2021).

Hypotheses:

H_1: Socio-economic characteristics of farmers significantly influence kola nut production.

H_2: Farm-specific factors, such as farm size and labor availability, positively affect kola nut output.

MATERIALS AND METHODS

The study was carried out in Odigbo Local Government Area (LGA), Ondo State. The LGA is bounded by latitude 6°47′40″ N and longitude 4°52′3″ E, covering approximately 1,818 km^2. It has a population density of approximately 173.5 persons per km^2 and comprises approximately 150 towns and villages with a total population of about 313,600 (NPC, 2016). Odigbo LGA comprises Ore, Oniparaga, Odigbo, Koseru, Ebijan, Ayesan, Araromiobu, Ajue, Ago-Alaye, and Agbagu. The area is a lowland within a humid forest zone, with a mean annual rainfall of 1,320 mm and average monthly temperatures ranging from 27.6°C to 31.6°C. The wet season lasts seven to eight months, while the dry season lasts three to four months. These climatic conditions favor agricultural activities. Farming is the primary occupation of many residents. Major crops cultivated included cocoa, kola nut, oil palm, coffee, rubber, cassava, pepper, plantain, and banana. Other occupations include trading, teaching, tailoring, hunting, and craft making, particularly in the area headquarters and major towns (Owolabi and Aderinola, 2015).

Sampling technique

Sampling procedure and sampling size

A multistage sampling technique was employed. Odigbo LGA was purposively selected due to the high concentration of kola nut farmers in the area.

In the first stage, six communities – Ajebamidele, Leege, Makinde, Kajola, Oniparaga, and Koseru – were purposively selected based on the concentration of kola nut farmers.

In the second stage, the number of kola nut farmers identified through their respective associations was 32, 28, 30, 30, 34, and 26 in Ajebamidele, Leege, Makinde, Kajola, Oniparaga, and Koseru villages, respectively.

Table 1. Sample size
Tabela 1. Wielkość próby

Villages	Identified farmers	50% sampling intensity
Ajebamidele	32	16
Leege	28	14
Makinde	30	15
Kajola	30	15
Koseru	34	17
Oniparaga	26	13
Total	180	90

Sampling size

In view of this, 16 respondents were randomly selected from Ajebamidele, 14 from Leege, 15 from Makinde and Kajola, 17 from Koseru, and 13 from Oniparaga, thereby making a total of 90 respondents, representing a 50% sampling intensity from all identified farmers.

Data collection

Both primary and secondary data were used for the study. Primary data were collected through a field survey using well-structured questionnaires administered to respondents to obtain information relevant to the study objectives. Secondary data were sourced from relevant journals and library materials.

Method of data analysis

Descriptive statistics, including frequency, percentage, and ranking, were used to analyze the study objectives. The Ordinary Least Squares (OLS) regression model was used to analyze Objective 3, which examines the factors influencing kola nut production among respondents.

Model specification

The dependent variable was measured as the quantity of kola nut produced (kilograms per production season). The explanatory variables were selected based on production theory, prior empirical studies on tree crop productivity in Nigeria and other developing countries, and their availability and relevance to kola nut production systems.

The OLS model is specified as follows:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + e$$

Yi = dependent variable (quantity of kola nut produced, kg/production season).

Explanatory variables:

X_1 = Age (years)
X_2 = Marital Status (dummy)
X_3 = Education (years)
X_4 = Monthly Income (Naira)
X_5 = Years of Experience (years)
X_6 = Household size (actual)
X_7 = Farm size/acre (acre)
X_8 = Price sold (Naira)
X_9 = Labor (quantity)
X_{10} = Transportation (Naira)
e = Error term
b = Estimated parameter
a = Constant
i = index for the ith farmer

Diagnostic tests

Multicollinearity was tested using the Variance Inflation Factor (VIF), and all values were below the acceptable threshold of 10, indicating no multicollinearity among the explanatory variables.

The Breusch–Pagan test was used to detect heteroscedasticity. The results indicate that the null hypothesis of homoscedasticity cannot be rejected ($p > 0.05$), suggesting that the residuals exhibit constant variance and that the OLS estimators are reliable.

Table 2. Diagnostic results
Tabela 2. Wyniki diagnostyczne lub: Wyniki testów diagnostycznych

Variable	Variance Inflation Factor (VIF)
Age	1.85
Marital Status	1.42
Education	2.11
Monthly Income	2.37
Years of Experience	2.05
Household Size	1.73
Farm Size	1.67
Price Sold	1.58
Labor	1.94
Transportation	1.61
Diagnostic Test	**Result**
Breusch–Pagan test	$\chi^2 = 2.41$ ($p = 0.12$)
Mean VIF	2.03

RESULTS AND DISCUSSIONS

The multiple regression analysis on the determinants of kola nut production revealed that the age of farmers ($\beta = -2.185$ $p < 0.01$), years of farming experience ($\beta = 9.248$, $p < 0.01$), household size ($\beta = -16.552$, $p < 0.01$), farm size ($\beta = 13.822$, $p < 0.01$), and labor used ($\beta = 0.003$, $p < 0.01$) significantly influenced production levels. However, age and household size had negative coefficients, indicating that older farmers tend to record lower output levels, possibly due to reduced physical capacity and declining labor productivity. Similarly, the negative coefficient for household size suggests that larger households may impose higher dependency burdens, thereby reducing the resources available for farm investment. In contrast, years of farming experience, farm size, and labor availability were positively related to kola nut production. This implies that experienced farmers are more likely to

Table 3. Multiple Regression Analysis on Determinants of Kola Nut Production
Tabela 3. Analiza regresji wielokrotnej czynników determinujących produkcję orzechów kola

Model	Variables	Beta (coefficient)	Standard error	t-values	Sig.
	Constant	–178.054	141.312	–1.260	0.211
X1	Age	–2.185***	0.512	–4.272	0.000
X2	Marital Status	26.877	17.696	1.519	0.133
X3	Education	17.235	21.487	0.802	0.425
X4	Monthly Income	0.000	0.000	0.935	0.353
X5	Years of Experience	9.248***	3.256	2.841	0.006
X6	Household Size	–16.552***	4.684	–3.534	0.001
X7	Farm Size (acres)	13.822***	5.148	2.685	0.009
X8	Price sold	0.001**	0.001	2.143	0.035
X9	Labor	0.003***	0.001	3.008	0.004
X10	Transportation	0.001	0.001	0.951	0.345
R2		0.584			

Source: author survey, 2025. **Significant at 5%, ***significant at 1%.
Źródło: opracowanie własne, 2025. **Istotne dla 5%, ***istotne dla 1%.

adopt efficient farming practices and manage their farms more effectively. Likewise, larger farm sizes and adequate labor availability contribute to increased production capacity.

The selling price of kola nut was also positively significant ($\beta = 0.001$, $p < 0.05$), indicating that higher market prices encourage farmers to increase production. The R^2 value of 0.584 implies that approximately 58.4% of the variation in kola nut production is explained by the variables included in the model. These findings align with previous studies such as Oluwatayo and Adedeji (2019), who emphasized the productivity advantage of younger farmers, and Oyewo and Oladeebo (2023), who identified farm size as a critical factor in agricultural output. Overall, the results show that practical experience, land access, and labor availability are crucial determinants of kola nut production. The findings further indicate that kola nut production is significantly influenced by farmers' experience, farm size, labor availability, and market price. These factors highlight the need for targeted policy interventions aimed at improving farmers' access to land, labor, and market information. It is therefore concluded that age, years of farming experience, household size, farm size, selling price, and labor availability are the major determinants of kola nut production in the study area.

Table 4 presents the perceived effects of climate change on kola nut farming. The results show that windstorms have a high impact, as reported by 62.2% of farmers. This may be due to the vulnerability of the study area to windstorms, which can cause physical damage to trees and negatively affect their health and yield. This finding is consistent with Obianamma (2025), who identified climate change as a factor affecting crop productivity, including kola nut. Additionally, 77.8% of farmers reported a high impact in terms of increased need for irrigation systems, indicating a growing reliance on irrigation due to changing rainfall patterns. Furthermore, 65.5% of respondents indicated that the regeneration of kola nut trees is affected by changing climate patterns, which could have long-term implications for production. Similarly,

Table 4. Assessment of perceived climate change impacts on kola nut production
Tabela 4. Ocena postrzeganego wpływu zmian klimatu na produkcję orzechów kola

Effects of climate change	High	Low	Not at all
To what extent has erratic rainfall affected kola nut flowering and fruiting?	42 (46.7)	48 (53.3)	0 (0)
How significant is the impact of increased temperatures on kola nut tree growth?	27 (30.0)	63 (70.0)	0 (0)
To what degree has prolonged drought reduced kola nut yield?	50 (55.6)	40 (44.4)	0 (0)
How much does flooding affect kola nut tree health and productivity?	20 (22.2)	70 (77.8)	0 (0)
To what extent have windstorms caused damage to kola nut trees?	56 (62.2)	34 (37.8)	0 (0)
How significant is the effect of soil degradation (caused by climate change) on kola nut production?	26 (28.9)	64 (71.1)	0 (0)
How much have climate-related changes increased pest infestations in kola nut farms?	50 (55.6)	40 (44.4)	0 (0)
To what extent has climate change contributed to the spread of diseases affecting kola nuts?	60 (66.7)	30 (33.3)	0 (0)
To what extent has the need for irrigation systems increased due to climate change?	70 (77.8)	20 (22.2)	0 (0)
How significant is the effect of climate change on the timing of kola nut planting and harvesting?	36 (40.0)	54 (60.0)	0 (0)
To what degree has climate change reduced the profitability of kola nut farming?	78 (86.7)	12 (13.3)	0 (0)
How much has climate variability affected access to markets for kola nut farmers?	46 (51.1)	44 (48.9)	0 (0)
To what extent have extreme weather events increased the cost of maintaining kola nut farms?	43 (47.8)	47 (52.2)	0 (0)
How significantly has climate change affected the viability of maintaining kola nut farming as a livelihood?	47 (52.2)	43 (47.8)	0 (0)
To what degree has the regeneration of kola nut trees been affected by changing climate patterns?	59 (65.5)	31 (34.4)	0 (0)

Source: field survey, 2025.
Źródło: badania terenowe, 2025.

46.7% of farmers reported that erratic rainfall affects kola nut flowering and fruiting. This suggests that irregular rainfall patterns can disrupt critical stages of plant development, leading to reduced yields. These findings are supported by (IPCC 2007), which reported that climate change has serious effects on crop regeneration and water availability, thereby reducing productivity. Moreover, 86.7% of respondents indicated that climate change has reduced the profitability of kola nut farming, highlighting its significant impact on economic viability. This result is supported by Mirzabaev (2013), who reported that climate change influences farmers' revenue. Prolonged drought was reported by 55.6% of farmers as reducing kola nut yield, which is a major concern since water scarcity directly limits crop growth and development. Similarly, 55.6% reported that climate-related changes increased pest infestations, likely due to favorable environmental conditions for pest proliferation. In the same vein, 66.7% of farmers indicated that climate change contributes to the spread of diseases, as changing environmental conditions can facilitate disease transmission. Furthermore, 51.1% of respondents reported that climate variability affects access to markets, suggesting that climate-related disruptions can hinder transportation and market accessibility. Overall, climate change poses significant environmental, economic, and production-related challenges to kola nut farming.

CONCLUSIONS

The study examined the socio-economic determinants of kola nut production in the Odigbo Local Government Area, Ondo State, Nigeria. The findings reveal that kola nut farming in the study area is predominantly practiced by experienced farmers with moderate farm sizes and access to family labor. Regression analysis showed that age, farming experience, household size, farm size, labor availability, and selling price significantly influence kola nut production. While advancing age and larger household sizes negatively affected production, farming experience, farm size, labor availability, and favorable market prices positively influenced output levels. Furthermore, the study revealed that climate change poses significant challenges to kola nut farming through erratic rainfall, drought, windstorms, and increased pest and disease infestations. These environmental factors have negatively affected both productivity and profitability among farmers.

The study, therefore, concludes that improving access to land, labor, market opportunities, and climate adaptation strategies is essential for enhancing kola nut production and sustaining the livelihoods of farmers.

RECOMMENDATIONS

Based on the findings, the following recommendations are made:

Government agencies and other stakeholders should conduct targeted awareness campaigns to educate farmers on climate change phenomena and their effects on kola nut production.

Financial institutions should be encouraged to develop more accessible and flexible credit facilities tailored to the specific needs of kola nut farmers.

Training programs in financial literacy, cost management, and investment planning should be provided to farmers to strengthen their capacity to manage production costs effectively.

Agricultural extension services should intensify efforts to introduce and train farmers in modern kola nut farming techniques, including the use of improved varieties, integrated pest and disease management, and sustainable farming practices.

Furthermore, farmers should be encouraged and supported to engage in value-added processing of kola nut as a means of increasing income and reducing post-harvest losses arising from perishability.

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SPOŁECZNO-EKONOMICZNE DETERMINANTY PRODUKCJI ORZECHÓW KOLA W OBSZARZE SAMORZĄDU LOKALNEGO ODIGBO, STAN ONDO, NIGERIA

ABSTRAKT

Produkcja orzechów kola odgrywa istotną rolę w gospodarce rolnej Nigerii, pełniąc funkcję zarówno źródła dochodu dla rolników wiejskich, jak i znaczącego towaru eksportowego. Pomimo jej znaczenia, produkcja boryka się z wyzwaniami wynikającymi z czynników społeczno-ekonomicznych oraz zmienności klimatu. W badaniu przeanalizowano społeczno-ekonomiczne determinanty produkcji orzechów kola w obszarze samorządu lokalnego Odigbo w stanie Ondo. Do wyboru 90 respondentów wykorzystano technikę losowania wielostopniowego, a dane zebrano za pomocą ustrukturyzowanego kwestionariusza. Do analizy wykorzystano statystykę opisową i indukcyjną. Wyniki wykazały, że mężczyźni stanowili 65,5% respondentów, przy

średniej wieku 57,7 lat; 44,5% badanych zajmowało się produkcją orzechów kola przez 16–20 lat. Około 54,4% miało dostęp do kredytów, natomiast 94,4% posiadało dostęp do gruntów rolnych o średniej powierzchni 7,7 akra. Większość (86,7%) zadeklarowała, że zmiany klimatu obniżyły rentowność, a 66,7% powiązało je ze zwiększonym występowaniem szkodników i chorób. Analiza regresji wykazała, że wiek ($\beta = –2{,}185$, $p < 0{,}01$), doświadczenie w rolnictwie ($\beta = 9{,}248$, $p < 0{,}01$), wielkość gospodarstwa domowego ($\beta = –16{,}552$, $p < 0{,}01$), wielkość gospodarstwa ($\beta = 13{,}822$, $p < 0{,}01$), siła robocza ($\beta = 0{,}003$, $p < 0{,}01$) oraz cena sprzedaży ($\beta = 0{,}001$, $p < 0{,}05$) miały istotny wpływ na produkcję. Badanie pozwala na wyciągnięcie wniosku, że produkcja orzechów kola pozostaje opłacalnym agrobiznesem, lecz jest ograniczana przez czynniki społeczno-ekonomiczne i klimatyczne. Autorzy rekomendują interwencje rządu i interesariuszy w zakresie edukacji klimatycznej, wiedzy finansowej oraz wdrażania systemów nawadniania w celu zwiększenia wydajności. Ponadto zaleca się podjęcie działań politycznych koncentrujących się na wspieraniu rolników stosujących praktyki rolnicze inteligentne klimatycznie (*climate-smart agriculture*).

Słowa kluczowe: produkcja orzechów kola, społeczno-ekonomiczne, determinanty, wielkość gospodarstwa, praca, systemy nawadniania, Nigeria