

Analysis of Economic Efficiency of Cassava Farmers in Abak Local Government Area of Akwa Ibom State, Nigeria

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Abstract

Cassava is a crucial staple crop in Nigeria, yet farmers often face challenges in achieving optimal profitability. The study analyzed the economic efficiency of cassava farmers in Abak Local Government Area of Akwa Ibom State, Nigeria. The specific objectives were to; describe the socio-economic characteristics of cassava farmers in the study area; determine the economic efficiency of cassava farmers in the study area and to estimate the determinants of economic efficiency among cassava farmers in the study area. We also examined the constraints militating against cassava production in the study area. A multistage sampling procedure was used in selecting 120 respondents for the study. Primary data were obtained using structured questionnaire and the data obtained were analyzed using descriptive statistics and stochastic frontier production function. The result showed that the mean age, household size, farming experience, and farm size of the sampled respondents were 39 years, 4 persons, 6 years and 1.9 hectares, respectively. The mean, minimum and maximum economic efficiency for cassava production were 0.72, 0.35 and 1.00 respectively. The results of the estimated stochastic production function and the determinants of economic inefficiency showed that labour ($p < 0.01$) was found to be a significant input in cassava production while age ($p < 0.01$), household size ($p < 0.05$), education ($p < 0.01$), farming experience ($p < 0.05$), and access to extension ($p < 0.01$) were the determinants of economic inefficiency of cassava production in the study area. We also found that the major constraints militating against cassava production were, high cost of fertilizer (13.7%), theft (13.7%), lack of access to credit (13.7%), inadequate access to land (13.7%), and poor road network (13.7%) while poor extension services (9.3%) and high cost of labour (8.5%) were the other constraints militating against cassava production in the study area. The study recommends that outreach programs should be strengthened to provide farmers with timely information, technical support, and best practices for cassava production, thereby reducing economic inefficiencies.

Key words: Cassava, Production, Economic Efficiency, Inefficiency

1.0 Introduction

One of the most cultivated arable crops in the root and tuber crop group within the tropical region of Nigeria is cassava (*Manihot esculenta*) (Otálora *et al.*, 2022). It is the fifth most important staple crop after maize, rice, wheat, and potatoes, and the second most vital African staple consumed per calorie, after maize (Mukherjee *et al.*, 2024). Nigeria leads the world in cassava production due to the crop's significant economic impact on the nation. Twenty-four of the thirty-six states in Nigeria grow cassava (Oni and Akanle, 2018). Nigeria produced approximately 45 million tonnes, or nearly 19% of the global production, compared to 33 million tonnes in 1999. The average yield per hectare is 10.6 tonnes (Eguono, 2015). The FAO (2018) estimates that 278 million tonnes of cassava were produced worldwide in 2018, with Africa producing about 170 million tonnes, or roughly 56% of the total (FAOSTAT, 2019). During that period, Nigeria produced about 60 million tonnes (FAOSTAT, 2019). Africa's leading producer of cassava, Nigeria accounts for nearly one-fifth (21%) of the world's total production. Cassava and its components are in high demand within the domestic economy. According to researchers, Nigeria is West Africa's largest producer. Due to its production, which since 2017 has accounted for 20.4% of the global output, Nigeria has emerged as the world's leading producer of cassava (Olutosin and Sawicka, 2019).

Cassava is a staple food crop that is widely grown in Africa and can thrive in any kind of soil or climate. Its starchy, thickened roots are a great source of low-cost calories, which is why it is significant. Cassava leaves, which have a protein content of 7–12%, are also used as a vegetable in traditional soups and stews. Between 40 and 50 percent of all calories in Southern and Central Nigeria come from cassava (Chuks, 2014). Cassava is a nutrient-dense staple food that must provide at least 2400 calories per person per day for national food security (Parmar *et al.*, 2017). In order to make cassava flour, starch, chips, and other Nigerian specialties like Abacha, Akpu (Fufu), and Garri (Eba), Nigerians could process cassava locally (Agricdemy, 2018). Its root starch is used in many industries, such as food production, pharmaceuticals, textiles, plywood, paper, adhesives, and the creation of ethanol biofuel (FAO, 2013).

In the production and processing of cassava, economic efficiency is the best use of inputs and resources to maximize output and profitability (Dogba *et al.*, 2020). This entails making the best use of resources like labor, capital, land, and technology to reduce waste and inefficiencies and increase yields and financial rewards for farmers. In order to achieve the most economical and fruitful results, economic efficiency in cassava production entails making educated decisions about planting strategies, fertilization, pest management, and harvesting practices (Kollie, 2020). The production of cassava is a major contributor to the economic efficiency of numerous regions globally. The crop is a valuable resource for generating income and ensuring food security because of its adaptability and resilience. Because cassava requires comparatively less inputs than other crops, it can be produced economically. Cassava can grow in a variety of environmental conditions with the right management techniques, providing farmers in developed and developing nations with a steady source of income.

Natural disasters, population pressure, environmental degradation, and social unrest are just a few of the challenges faced by cassava farmers. Their low productivity may also be the consequence of outdated technology, ineffective input allocation, and inefficient use of productive resources. Cassava production has suffered major setbacks in the majority of Nigerian farming communities for a variety of reasons, including socioeconomic, cultural, technological,

and environmental problems. Because of this, the majority of farmers are unable to produce at optimal levels and make money as a result (Ohen *et al.*, 2014).

To maximize output, farm resources must be used as profitably as possible, and the price of the finished product must change to reflect the capacity of the market. The ability of cassava farmers to adopt new technologies and achieve sustainable production is reliant on their level of profit efficiency. This is primarily determined by the prices of inputs and outputs that fluctuate, as well as the costs associated with fixed production factors. Due to their inability to address this issue, farmers' output and income have significantly decreased. Farmers will experience much reduced profits and subpar use of farm resources if this scenario escalates. This implies that managing the problems of an unsuitable mix of agricultural resources and output price fluctuations is essential to farm enterprises' and their long-term viability (Balaniuk *et al.*, 2023).

There is a dearth of information on economic efficiency in cassava production as little or no study have rigorously estimated the economic efficiencies of resources use of cassava farmers in Abak L.G.A, Akwa Ibom State, Nigeria. While studies like Akpan *et al.* (2017) analyzed economic efficiency in Oruk Anam L.G.A and Esiobu (2019) focused on allocative efficiency in Imo State, the specific context of Abak L.G.A remains underexplored. This study is of significant importance to policymakers, agricultural extension agencies, and development partners seeking to enhance the productivity and profitability of smallholder cassava farmers in the Niger Delta region. By identifying the key drivers of inefficiency and the major production constraints, the findings will inform targeted interventions to improve livelihoods and contribute to regional food security. It was on these backdrops that the study rigorously addressed the following research questions;

1. What are the socio-economic characteristics of cassava farmers in the study area?
2. Are the cassava farmers economically efficient in the study area?
3. What are the determinants of economic efficiency among cassava farmers in the study area?
4. What are the constraints militating against cassava production in the study area?

2.0 Research Methodology

2.1 Study Area

The study was conducted in Abak Local Government Area which is located in the rain forest belt of the Niger Delta region of Nigeria between longitude $07^{\circ} 27' 06''$ - $07^{\circ} 50' 06''$ E and latitude $04^{\circ} 50' 27''$ - $50^{\circ} 50' 90''$ N. It is naturally endowed with a large expanse of fertile land of clay, sandy and loamy soils. The area is noted for the production of Cassava and supplies the cassava to other parts of the state and even beyond. The study area has perennial streams, abundant rainfall of over 250mm per annum, a total landmass of 305 km^2 and a population of over 700,000 by the 2006 census gazetted into 5 clans and 91 villages.

2.2 Sampling Procedure and Method of Data Collection

Multistage sampling procedure was used in selecting the respondents used for the study. In the first stage, 3 clans were randomly selected from the 5 clans. The second stage also involved random selection of 2 villages each from the selected clans, giving a total of 6 villages. The final stage involved a random selection of 20 cassava farmers making a total of 120 respondents for this study. Primary data used for the study were obtained by using structured questionnaire.

2.3 Analytical Techniques

Descriptive statistics like mean, tables, percentage, and frequency count were employed, and the stochastic frontier production function was used to calculate economic efficiency. It was assumed that the Cobb-Douglas frontier production function specified the production technology used by the farmers (Tadesse and Krishnamoorthy, 1997)

Defined as:

$$\ln Y_i = \ln \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + V_i - U_i \dots \dots \dots \text{Equation 2.1}$$

Where:

Y – Cassava Output (₦),

X₁ – farm size (₦),

X₂ – herbicides (₦),

X₃ – cuttings (₦),

X₄ – labour (₦),

V_i – random errors,

U_i – technical inefficiency as defined below,

$$U_i = \delta_0 + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} + \delta_4 Z_{4i} + \delta_5 Z_{5i} + \delta_6 Z_{6i} + \delta_7 Z_{7i} + \delta_8 Z_{8i} + \delta_9 Z_{9i} + \delta_{10} Z_{10i} + \delta_{11} Z_{11i} \dots \dots \dots \text{Equation 2.2}$$

Where:

Z₁ – Gender (dummy)

Z₂ – Age (years)

Z₃ – Household Size (numbers)

Z₄ – Marital status (dummy)

Z₅ – Education (years)

Z₆ – Monthly Income (₦)

Z₇ – Farming experience (years)

Z₈ – Membership of cooperative (dummy)

Z₉ – Access to credit (dummy)

Z₁₀ – Access to extension services (dummy)

Z₁₁ – Farm size (hectares)

Stata 12 was utilized in tandem to obtain estimates for every parameter of the inefficiency model and the stochastic frontier production, following the methodology of Kavoi and Mbeche (2016).

3.0 Results and Discussion

3.1 Socioeconomic Characteristics of the Respondents

The socioeconomic characteristics of respondents discussed as gender, age, educational level, marital status, are presented in Table 3.1. Gender distribution based revealed that greater proportion (51.7%) of the sampled respondents in the study area were male. This implies that male dominated cassava production activities in the study area, this result proves positive since men tend to have unparalleled access to agricultural resources (Ankrah *et al.*, 2020). Another implication would be that male dominance may have resulted from the high physical demands of cassava production, which many females may not have been able to handle. These demands include clearing, making beds, controlling weeds, managing pests and diseases, and harvesting.

The sample mean age was 39 years old, as indicated by the age distribution of the respondents. This suggests that the farmers in the research area are at the peak of their physical and mental

capabilities, which is necessary for carrying out many of the farm tasks. Because the farmers are still capable of making thoughtful decisions and are able to endure the hardships, strain, and stress associated with cassava production, this has a positive impact on the area's cassava production. The outcome supports the findings of Adetarami *et al.* (2022) that a farmer's zeal for more lucrative income-generating activities increases with age.

The majority of respondents (67.5%) were married, according to the distribution of respondents based on marital status. This indicates that married people are the primary cassava farmers in the region. According to the outcome, the majority of farmers would presumably get their labor from family members. Married farmers are more likely to have access to family labor, which lowers labor hiring costs for certain production tasks and boosts farm net returns. This finding is consistent with the opinions of Adetarami *et al.* (2022) and Uzochukwu *et al.* (2021), who suggested that married farmers constituted the majority of cassava farming households.

The average household size of the sampled respondents was four people, according to the household size results. This suggests that cassava farmers with moderate household sizes make up the majority of the study area. A moderately sized household guarantees labor availability and lowers the cost of hired labor. The size of a household has an inverse relationship with agricultural production because larger households require more family labor, which lowers the cost of hiring labor. This statement is anticipated to be true, though, if other household members are involved in farming. This result corroborates the findings of Adetarami *et al.* (2022) and Uzochukwu *et al.* (2021), who found that labor is complimented by large and average household sizes, increasing production and lowering hired labor costs.

The average number of years that respondents spent in formal education in the study area was 9.2, as indicated by Table 3.1's results. This suggests that most respondents had completed their primary education and were literate enough to accept new technologies that extension agents brought to them in order to increase output and revenue. According to Adeosun *et al.* (2022), education can raise farmers' levels of efficiency. Higher education is anticipated to have a major impact on a farmer's decision-making and capacity to accept new technology.

The majority of respondents (61.7%) were members of the farmers' association, according to the distribution of respondents based on cooperative membership shown in Table 3.1. The study area's farmers were aware of the advantages of becoming members of farm cooperatives. This gives farmers the fundamental production data they need to perform better. To increase output, they also impart their expertise to other farmers.

Distribution of respondents according to credit availability presented in Table 3.1 showed that a higher proportion (51.7%) did not have access to credit facilities in the study area. This suggests that a larger percentage of respondents may not have had the necessary collateral security to obtain credit from official institutions and may not have been aware of certain credit information. With credit, farmers can quickly adopt new technology and buy better inputs to raise output and farm net returns.

The majority of respondents (62.5%) in the study area did not have access to extension services, according to the distribution of respondents based on their availability to such services, as shown in Table 3.1. Cassava farmers benefit from having access to extension services, new innovations

that can boost output, the necessary skills for controlling pests and diseases, and pertinent marketing knowledge.

The mean farm size of the cassava farmers was 1.9 hectares, indicating that they were engaged in small-scale production, according to the distribution of respondents based on farm size as shown in Table 3.1. According to these findings, the respondents were small-scale farmers, which is how most Nigerian farmers are typically classified. The majority of Nigerian farmers, according to Omotilewa *et al.* (2021), are smallholders, with an average farm size of between one and two hectares. The outcome is consistent with Esiobu's (2019) findings, which indicated an average farm size of 1.42 hectares.

Distribution of respondents based on their production experience presented in Table 3.1 showed that, on average, the respondents had worked in production for roughly 6 years. The results are consistent with those of Adetarami *et al.* (2022), who pointed out that a farmer's years of farming experience may indicate the practical knowledge they have gained on how to overcome specific inherent production problems and may have a positive impact on farm income.

The respondents' monthly income distribution presented in Table 3.1 indicates that the sampled respondents' mean monthly income was ₦122,429.2. This suggests that the farmers' income exceeded the minimum wage of ₦30,000 because of their breadth of experience and expertise in cassava cultivation. Another conclusion would be that they might not have enough money coming in each month to pay for some essential farm inputs that are necessary for maximum output. Consequently, cassava growers in the research region would typically engage in small-scale farming practices.

3.2 Economic Efficiency of Cassava Farmers

The distribution of respondents according to efficiency class interval, frequency and percentage of each class interval is described in Table 3.2. The results of the analysis of cassava farmers in the study area showed that the mean, maximum, and minimum economic efficiencies were 0.72, 1.00, and 0.35 as shown in Table 3.2, respectively. This suggests that the study area's cassava farmers with the best practices are 1.00, while the growers with the least practices are 0.35. The analysis also showed that the economic efficiencies of the cassava farmers ranged between 0.35 and 1.00, suggesting that there is a significant difference between the group's best and worst producers. The average economic efficiency of the cassava farmers in the study area was 0.72, indicating that they were reasonably efficient in the use of limited inputs. According to the estimated result, a standard cassava producer in the study area would need to achieve an efficiency profit of 28% [i.e., $1 - (0.72/1.00) \times 100$] in order to be considered the most economically efficient farmer in the group. According to the findings, in order for the least economically efficient cassava farmer in the study area to move up to the top of the category under examination, they will need to achieve an efficiency profit of roughly 65%, or $1 - (0.35/1.00) \times 100$. The results are consistent with those of Esiobu (2019), who found that the average economic efficiency of cassava farmers in Imo State was 0.71.

Table 3.1: Distribution of Respondents Based on their Socio-economic Characteristics

Variables	Frequency (n=120)	Percentage (%)
Gender		
Male	62	51.7
Female	58	48.3
Age (Mean = 39years)		
Below 30	13	10.8
30 - 40	71	59.2
Above 40	36	30.0
Marital Status		
Single	32	26.7
Married	81	67.5
Divorced	7	5.8
Household Size (Mean = 4 persons)		
Below 4	47	39.2
4 - 5	58	48.3
Above 5	15	12.5
Education (Mean = 9.2years)		
Below 6years	18	15.0
6years - 12years	80	66.7
Above 12years	22	18.3
Membership of Cooperative		
Yes	74	61.7
No	46	38.3
Access to Credit		
Yes	58	48.3
No	62	51.7
Access to Extension Service		
Yes	45	37.5
No	75	62.5
Farm Size (Mean = 1.9ha)		
Below 1ha	5	4.2
1ha - 3ha	114	95.0
Above 3ha	1	0.8
Farming Experience (Mean = 6years)		
Below 5years	39	32.5
5years - 10years	80	66.7
Above 10years	1	0.8
Type of Labour		
Family	61	50.8
Hired	59	49.2
Monthly Income (Mean = ₦122,429.2)		
Below ₦100,000	21	17.5
₦100,000 - ₦150,000	73	60.8
Above ₦150,000	26	21.7

Source: Field Survey Data, 202

3.3. Determinants of Economic Inefficiency

The results of the determinants of Economic Efficiency presented in Table 3.3 shows that the age coefficients were significant at the 1% level and positively signed. The positive coefficient of age (0.15) suggests that older farmers are economically inefficient. This could be due to their reluctance to adopt new technologies and practices. This result is in line with the findings of Wollie *et al.* (2018) and Kollie (2020), who demonstrated a positive correlation between the age of the cassava farmer and the inefficiency of cassava production.

Farmers in the study area will experience a decrease in profit inefficiency as a result of increased household size, as indicated by a negative coefficient with a statistical significance of 5%. Growing families contribute to household labor, which is the most affordable and accessible source of labor for small-scale producers of arable crops (Akpan *et al.*, 2017). These options result in either a decrease in the inefficiency index or an increase in the economic efficiency of farmers.

Cost inefficiency is statistically negatively impacted by education by 1%. It goes without saying that education will increase farmers' productivity efficiency because it will give them access to better technology and industry best practices. This supports the findings of related efficiency studies (Dogba *et al.*, 2020), which show that obtaining a higher level of formal education improves a farmer's capacity to make "better and timely" market decisions.

Table 3.2 Frequency distribution of economic efficiency indices of cassava farmers

Efficiency class	Frequency	Percentage
0.30 – 0.49	13	10.84
0.50 – 0.69	40	33.33
0.70 – 0.89	36	30.00
0.90 – 1.00	31	25.83
Total	120	100.00
Mean	0.72	
Minimum	0.35	
Maximum	1.00	

Source: Field Survey Data, 2023.

Table 3.3 Maximum likelihood estimates of the stochastic frontier production function and determinants of economic inefficiency of cassava farmers

Variables	Coefficient	Std. Err	t	P-values
Land	2.03e ⁻¹⁰	2.87e ⁻⁰⁶	0.00	1.00
Herbicides	-6.85e ⁻¹⁰	2.30e ⁻⁰⁶	-0.00	1.00
Cuttings	8.67e ⁻¹⁰	5.60e ⁻⁰⁶	0.00	1.00
Labour	0.1494895	4.28e ⁻⁰⁶	3.5e ⁺⁰⁴	0.000***
Constant	9.093994	0.0000523	1.7e ⁺⁰⁵	0.000
/Insig2v	-41.04887	598.0225	-0.07	0.945
/Insig2u	-1.560888	0.1290994	-12.09	0.000
<i>Inefficiency model</i>				
Gender	-0.020392	0.0176808	-1.15	0.251
Age	0.0135181	0.0028675	4.71	0.000***
Household size	-0.0984613	0.0438978	2.24	0.027**
Marital status	-0.010904	0.0208485	-0.52	0.602
Education	-0.1783279	0.330913	-5.39	0.000***
Monthly income	-2.21e ⁻⁰⁸	5.00e ⁻⁰⁷	-0.04	0.965
Farming experience	-0.0164331	0.0061964	-2.65	0.009**
Membership of cooperative	0.0424925	0.0379082	1.12	0.265
Access to credit	0.0433368	0.032116	1.35	0.180
Access to extension services	-0.2735915	0.0361533	7.57	0.000***
Farm size	0.0248132	0.0187737	1.32	0.189
Wald Chi ² = 1.37e+09				
Prob>Chi ² = 0.000				

Source: Field Survey Data, 2023. Computed Using Stata 12

*** = 1% level of significance, ** = 5% level of significance, * = 10% level of significance

Table 3.4: Distribution of constraints militating against cassava production

Constraints	Frequency**	Percentage
High cost of fertilizer	120	13.7
Theft	120	13.7
Lack of access to credit	120	13.7
Poor extension services	81	9.3
Inadequate access to land	120	13.7
Inadequate capital	120	13.7
High cost of labour	74	8.5
Poor road network	120	13.7

Source: Field Survey Data, 2023. ** Multiple response analysis

Farming experience has a negative correlation with economic inefficiencies, with a statistical significance of 5%. The implication is that a farmer can improve some of the cost implications and discover new channels for obtaining market information [inputs and output] if they have more experience growing cassava. This finding is consistent with that of Abdul-kareem and Sahinli (2018), who found that farming experience increases cassava's productivity and efficiency.

The estimates of access to extension services show a negative correlation with economic inefficiencies, with a negative coefficient at the 1% level of statistical significance. This suggests that farmers who used extension services more frequently learned modern techniques for lowering inefficiencies in production costs. Additionally, the outcome suggests that extension services provide farmers with access to markets and economic agents, giving them a competitive edge throughout the cassava value chain. The outcomes support the conclusions made by Mutoko *et al.* (2015).

3.4 Constraints Militating against Cassava Production in the Study Area

The constraints militating against cassava production are presented in Table 3.4. The findings indicated that the main factors impeding cassava production in the study area were high fertilizer costs (13.7%), theft (13.7%), lack of credit access (13.7%), insufficient land access (13.7%), and a poor road network (13.7%). The least significant factors were poor extension services (9.3%) and high labor costs (8.5%). Their gross margin would be lowered by the high cost of agricultural inputs like fertilizers and the labor-intensive process of getting farm produce and inputs to market. The rate at which farm inputs and other resources are becoming more expensive, along with the lack of access to credit facilities that could have helped them improve their financial circumstances when it comes to buying farm inputs, deters would-be cassava farmers from investing in this business. These constraints are consistent with the findings of Ohen *et al.* (2014), who identified similar challenges among cassava farmers in Cross River State, Nigeria.

4.0 Conclusion

The results of the analysis showed that cassava farmers in the study area were moderately economically efficient. It was evident that socioeconomic characteristics played a significant role in the economic efficiency of cassava farmers in the study area. Household size, education, farming experience and access to extension were identified as key contributors to economic inefficiency. These results underscore the importance of addressing these socio-economic factors to enhance overall productivity and sustainability in cassava farming practices within the study area. Further research and targeted interventions focusing on these determinants can potentially lead to improved outcomes and better resource utilization for cassava farmers and will lead to

better contribution of cassava farmers to the agricultural sector in Akwa Ibom State and the Nigerian nation.

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