

Efficiency Appraisal of Cocoa Farming in Ondo State, Nigeria

Odegbade O. O¹, Aina O. S^{2*}, Igelige G. E¹, Hassan B³, Mshelia K. J³

¹Department of Agricultural Economics and Extension, Ambrose Ali University, Ekpoma, Edo State, Nigeria

²Department of Cooperative Economics and Management, Federal College of Horticulture, Dadin-Kowa, P.M.B. 108, Gombe State, Nigeria

³Department of Agricultural Extension and Management, Federal College of Horticulture, Dadin-Kowa, P.M.B. 108, Gombe State, Nigeria

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*Corresponding author: Aina O. S

Abstract

Original Research Article

The study analyzed the costs and returns of cocoa farming in Ondo State, Nigeria. The socio-economic characteristics, sources of finance, cost and returns and constrain associated with cocoa production were examined. Data were collected from 90 respondents by means of structured questionnaire. Data collected were analyzed using descriptive statistics, ranking and budgetary analysis. The results revealed that, average age of the respondents was 57.2 years. This indicates that majority of the respondents are aged, male (78.9%), married (75.6%), had more than 20 years farming experience (53.3%) and source their capital through personal savings (94.4%). The gross margin analysis showed that cocoa production incurred a total variable cost of ₦64,588.38 and earned total revenue of ₦90,584.50 per hectare with gross margin of ₦25,995.12 and total cost of ₦74,059.09 and net revenue of ₦16,524.41. The Benefit Cost Ratio (BCR) was 1.22. This is an indication that for every naira invested on cocoa production there is a gain of 22 kobo. The RTS of the variable inputs was 1.359 which implies that cocoa production resources were underutilized. The analysis of the estimated gamma coefficient (γ) showed that there was technical inefficiency effect in the production of cocoa in the study area. The major constraints to cocoa production were inadequate credit facilities, high cost of transportation, labour inadequacy, low produce price, high cost of fertilizer, pest and diseases, theft, bad weather and poor infrastructure. The study recommends, Construction of good road by government to reduce cost of transport and spoilage. Introduction of extension education programmes for the Farmers by government, to improve their technical knowledge and skills and Cocoa farmers should be encouraged by Government and Non-Governmental organization to have access to adult literacy education in order to enlightening them on the benefit of loan from formal source.

Keywords: Efficiency, Appraisal, Cocoa, Farming, Ondo, Nigeria.

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INTRODUCTION

Cocoa is one of the most important cash crops that play a vital role in uplifting the country's economy. The contribution of cocoa to both gross domestic product (GDP) and total value of export are vast and have been reported by many authors (Erelu 2019, Folayan *et al.*, 2016). Cocoa belongs to the family *steruliaceae* and genus *Theobroma*, its natural habitat is the lower story of the ever green forest. There are over twenty species in the genus but *Theobroma cacao* is the only one cultivated widely. Cocoa believed to have taken place about 1874 through the Spanish Island Fernadopo and the initial development of the cocoa industry was entirely due to South America from where it spread to different part of the world and indeed West

Africa which became the major producer from the mid-1960s (Amos, 2017).

Recently, with the application of molecular marker, cocoa was reclassified as belong to the family Malvaceae (Alvasion *et al.*, 2019). Cocoa was introduced to West Africa in the nineteenth century and its introduction to Nigeria was initiative and entrepreneurship of peasant farmers. The colonial government later became interested in cocoa cultivation and seedlings were supplied from the botanical garden at Ebute-meta, Lagos in 1887 for field trial (Oduwole, 2018). One of the earliest commercial planting was made near Ibadan and the cultivation of cocoa gained its first impetus in Ibadan province which produced the bulk of Nigeria cocoa up to the early twentieth century.

According to Oyedele (2007), since the introduction of the crop into Nigeria in about 1874, it has grown to major export crop. Nigeria is the third largest producer of cocoa in Africa, producing about 12 percent of the total world production behind Ivory Coast which produces 35 percent and Ghana 13 percent (Oduwole, 2018). At present, the production capacity of cocoa in Nigeria has reached about 315,000 metric tones per annum. In past year cocoa production in Nigeria increase by 20% from 2017 to 2018. This place Nigeria as the fourth position in the World after Ivory Coast, Indonesia and Ghana (Erelu, 2019). Nigeria competes favourably with other frontline producing nations in supplying but this has been reducing in recent years as a result of inefficiency in the use of resources by coco farmers. The implication of this has been reduced cocoa production at a time when there are more processing industries and the increase in demand for Nigeria cocoa as a result of the growth in consumption of chocolate in the world over (Amos, 2017). Nigeria Cocoa and cocoa beans are usually exported raw or unprocessed form to chocolate processing plants in these countries. The cocoa is typically exported to confectionary companies to make chocolate products, such as candy, cakes and chocolate beverages.

However, the production of this crop in Nigeria has suffered a reduction in recent years owing to a number of factors such as low yield, in consistence production pattern, diseases incidence and pest attack, use of simple tools and negligence of the agricultural sector by the past administration. The crucial role of efficiency in increasing agricultural output has been widely recognized by researcher and policy makers. Increasing the level of efficiency in cocoa production, farmers who operates optimally along their production function while being much less successful in shifting from production function to higher one could help in the resolution of the obvious decline in agricultural exports with respect to important export crops. Therefore, effort must be devoted in the analysis of farm level efficiency in developing countries like Nigeria. If farmers were not making efficient use of existing technology, efforts designed to improve efficiency would be more cost effective than introducing new technologies as a means of increasing agricultural output. The study therefore, examines the factors that determine production efficiency and the sources of inefficiency of cocoa farmers in Ondo State.

METHODOLOGY

The Study Area

The study was carried out in Ondo State. Ondo State is located in the South West zone of Nigeria. The State lie between the latitude 5.45⁰N and 8.15⁰N and longitudes 4.00⁰E and 6.00⁰E, The National Population Census 2006 estimated the State population as 3,441,024. The State covers an area of over 14,595 square kilometers and divided into 18 Local

Government Area. The tropical climate of the State is broadly divided into two seasons; rainy season (April to October) and dry season (November to March). Temperature throughout the year ranges between 21⁰C to 29⁰C and humidity is relatively high. The annual rainfall varies from 2,000mm in the Southern areas to 1,150mm in the Northern areas (OSADP, 2021).

Agriculture is the dominant occupation of the people of Ondo State providing income and employment opportunities for over 70% of the population. Apart from farming, the inhabitants also engage in other occupations like trading and manufacturing commerce. The people of the riverine area of the State are predominantly fishermen. However, there is substantial cultivation of tree and cash crops such as Cocoa, Kolanut, Oil palm, Rubber, Cashew and Coffee. The prominent food crops grown in the area include yam, rice, plantain, maize, cocoyam, tomato and pepper while sweet potato and beans are grown in some localities in commercial quantities. Farmers in the State are predominantly small scale. They still depend on traditional methods of farming.

Sampling Technique

A multistage sampling technique was adopted in this study to select cocoa farmers in the study area. The first stage was purposive selection of three (3) Local Government Areas (LGAs). These are Idanre, Ifedore and Ondo West LGAs based on the prevalence of cocoa farmers in these areas. Second stage was random selection of five (5) communities from each LGA using simple random sampling technique. The third stage was selection of six (6) farmers from each community using simple random technique and thus, making a total of ninety (90) cocoa farmers from the three LGAs.

Method of Data Collection

Primary data was used for this study. The primary data were collected from cocoa farmers with the aid of a well structured questionnaires and interview schedule.

Method of Data Analysis

Both qualitative and quantitative techniques were employed in analysis of data. Descriptive statistics such as frequency distribution, percentages were used to analyze the socio-economic characteristics of cocoa farmers and the constraints militating against cocoa production in the study area while budgetary analysis was used to estimate the profitability of cocoa farmers in the study area. The model is express as follows:

i) Gross Margin Analysis:

$$\begin{aligned} GM &= TR - TVC & NR &= TR - (TVC + TFC) \\ TC &= TVC + TFC & TR &= P \times Q \end{aligned}$$

Where:

GM = Gross Margin. TVC = Total Variable Cost.
TFC = Total Fixed Cost. TC = Total Cost.

TR = Total Revenue
 P = Price in Naira
 NR = Net Revenue
 Q = Quantity in kilogram.

$$\text{Benefit Cost Ratio (BCR)} = \frac{\text{Total Revenue}}{\text{Total Cost}}$$

The stochastic frontier production for the defined estimation of the technical efficiency was as:

$$Y_i = (X_i, \beta) + \varepsilon; = 1,2 \dots \dots \dots n$$

$$\varepsilon = V_i - U_i$$

Where:
 Y_i = the quantity of cocoa output
 X_i = Vector of the input quantities of the farm.
 β = Vector of unknown parameters of the farm.
 V_i = the two-sided normally distributed random error that cannot be influenced i.e weather, diseases etc.
 U_i = the one-sided technical inefficiency component with a half normal distribution.

The estimated Cobb-Douglas Stochastic Frontier production function was assumed to specify the technology of cocoa farmers. It was specified in this form:

$$\ln Y_i = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + V_i + - U_i$$

Where:
 Y = Total quantity of cocoa produced (kg)
 X₁ = Age (years)
 X₂ = Farm Size (ha)
 X₃ = Family Labour (man-days)
 X₄ = Hire Labour (man-days)
 X₅ = Fungicide (liters)
 X₆ = Pesticide (liters)
 X₇ = Depreciation on farm fixed implements (Naira).

The technical inefficiency model was specified as follow:

$$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5$$

Where:
 U_i = Technical inefficiency of the farmer
 Z₁ = Sex (Male =1, Female =2)
 Z₂ = Education level of the farmers (years spent in school)
 Z₃ = Farming experience (years)
 Z₄ = Major cocoa crop (kg)
 Z₅ = farm location
 Z₆ = Cooperative society
 δ₁ to δ₆ are coefficient to be estimated; where I = 1,2,3 represents the factors which influenced efficiency of the farmers.

Table 1: Socio-economic Characteristics of Respondents

Variable	Frequency	Percentage (%)
Age (year)		
< 30	4	4.4
30 – 39	4	4.4
40 – 49	15	16.7
50 – 59	26	28.9
≥ 60	41	45.6
Gender		
Male	71	78.9
Female	19	21.1
Marital Status		
Single	4	4.4
Married	68	75.6
Widows	11	12.2
Divorced	7	7.8
Household Size		
≤ 3	5	5.6
4 – 7	42	46.7
8 – 11	34	37.7
≥ 12	9	10
Education Level		
Primary Education	15	16.7
Secondary Education	27	30
Tertiary Education	9	10
No Formal Education	39	43.3
Faeming Experience (year)		
≤ 10	17	18.9
11 – 20	25	27.8
> 20	48	53.3

Source: Field Survey, 2021

Table 1 revealed that the majority of the respondents (45.6%) were between the ages of 60 years and above follow by those between the ages of 50 and 59 years (28.9%). Those who fell within the ages of 40 – 49 years were 16.7% and 30 – 39 years were 4.4% while those with less than 30 years were 4-4%. The average age of the respondents was 57.2 years. This indicates that majority of the respondents are aged, the development therefore deserves some attention from various stake holders in cocoa farming so as to secure the future of cocoa production in Nigeria. The field survey data also revealed that 78.9% were male and 21.1% were female. The dominance of male could be attributed to the cultural settings of the area which allows the males to have easy access to land especially where majority of them are the heads of their respective households. The study also revealed that majority (75.6%) were married and has family responsibility. The study equally revealed that majority (94.4%) of the respondents has more than three (3) household and the

average household size was six (6). Household size is a proxy to labour availability and may influence the adoption of a new technology positively as its availability reduces labour constraints (Oluwatomiwa, 2016). The study revealed that majority (56.7%) had formal education while 43.3% had never attended school. It has been identified that education influences farmer's willingness and ease of adopting new technology which ultimately leads to improved productivity. Majority (53.3%) of the respondents had more than 20 years of farming experience and 27.8% have between 11 – 20 years farming experience while 18.9% had less than 10 years farming experience. The mean farming experience was 25.2 years. This indicates that majority of the farmers are matured and have appreciable years of farming experience that will enable them master farming operation for improved productivity. According to Nwaru (2007), farmers count more on their experience than educational attainment in order to increase their productivity.

Table 2: Sources of Finance by the Respondents

Source of Finance	Frequency	Percentage	Rank
Personal Savings	85	94.44	1 st
Relatives	57	63.33	2 nd
Friend	52	57.78	3 rd
Asusu (Contributions)	40	44.44	4 th
Cooperative	27	30.00	5 th
Commercial Banks	4	4.44	6 th

Source: Field Survey, 2021

Multiple Response

Table 2 revealed that personal savings ranked 1st, follow by relatives which was ranked 2nd, friends and Asusu were ranked 3rd and 4th respectively. Cooperative source was ranked 5th while commercial Banks was ranked 6th. The results indicate that majority

(94.44%) get their capital source through personal savings while 30% source their capital through cooperative society. These affect the volume of money in the business and made them to work on a small scale.

Table 3: Cost and Returns Associated with Cocoa Production

Items	Mean Value	Percentage of Total Cost
Cocoa Output (kg)	179,350	-
Variable Cost		
Cost of Labour	99,675	67.97
Cost of Fungicides	15,320	10.45
Cost of Pesticides	12,890	8.79
Total Variable Cost (TVC)	127,885	87.21
Fixed Cost		
Land Rent	5,115	3.49
Depreciation on Fixed Assets	13,637	9.30
Total Fixed Cost (TFC)	18,752	12.79
Total Cost (TC)	146,637	100
TVC/ha	64,588.38	
TC/ha	74,059.09	
TR/ha	90,584.50	
GM/ha	25,996.12	
NR/ha	16,525.41	
Benefit Cost Ratio (BCR)	1.22	

Source: Field survey, 2021

NB

$$TR = P \times Q$$

$$211\text{kg} \times \text{₦}850 = 179,359$$

$$\text{Average land} = 1.98 \text{ ha}$$

The budgetary analysis (Table 3) showed that the total variable cost (TVC) form the bulk 87.21% of the total cost (TC) while the total fixed cost (TFC) was 12.79%. This implies that farmers who want to be cost efficient have to reduce TVC, especially the cost of labour that is more than half (67.97%) of the total cost. TFC is small (12.79%) probably because of very low cost of land rent in the area. This is typical of the core rural communities in South-Western Nigeria where most land are currently held by inheritance as presented in the result of the finding.

Table 3 also showed the Gross Margin involved in cocoa production in the study area with total output of 106.57kg at a price of ₦850 per kg which gives total revenue of ₦90,584.50 per hectare. The total variable cost per hectare incurred by the cocoa producer in the study area was ₦64,588.38 and the gross margin per hectare was ₦25,996.12. The total cost was ₦74,059.09 per hectare and the net revenue per hectare obtained from the area of study was ₦16,525.41. This is an indication that cocoa production is profitable in the study area. The benefit cost ratio (BCR) was 1.22. This is an indication that for every naira invested on cocoa production there is a gain of 22 kobo.

Table 4: Estimate of Stochastic Frontier Production Function for Cocoa Production.

Variables	Parameter	Coefficient	Standard Error	t-ratio
Constant	β_0	-2.203	0.138	-1.328
Age	β_1	0.377	0.391	0.875
Farm Size	β_2	-0.012	0.135	-0.058
Family Labour	β_3	-0.085	0.215	-0.375
Hire Labour	β_4	0.175**	0.642	2.691
Fungicide	β_5	0.168*	0.587	2.159
Pesticide	β_6	0.137**	0.318	2.921
Depreciation	β_7	0.599**	0.135	3.722
Sigma Squared	δ^2	0.393**	0.036	6.814
Gamma	γ	0.031	0.168	0.137

Source: Field Survey, 2021

NB: * Mean P < 0.05; ** Mean P < 0.01

Table 4 showed the estimated coefficient of the parameters and associated test statistics that all production variables except farm size and family labour were positive. The estimated parameter coefficients of all the variables are significant at 5% level except that of age and farm size. The positive coefficients imply that these variables have direct relationship with cocoa output. In other words, cocoa output increase by the value of their corresponding coefficients with a unit

increase in their usage. Age has a positive coefficient but not significant at 5% level. Family labour and farm size had negative coefficient which imply inverse relationship with cocoa output and the coefficient are not significant at 5% level. The two variables are not important factor that influence cocoa output in the study area. The estimate sigma square value (0.39) of cocoa production in the study area is significantly different from zero at 5%. This shows a good fit of the model.

Table 5: Technical Inefficiency Factors

Variable	Parameter	Coefficient	Standard Error	t-ratio
Constant	δ_0	0.793	0.529	1.586
Sex	δ_1	0.319	0.341	1.401
Education Level	δ_2	-0.216	0.136	-1.272
Farming Experience	δ_3	-0.061	-0.063	-0.054
Major Cocoa Crop	δ_4	0.218	0.299	0.668
Location	δ_5	-0.188**	0.064	-2.635
Cooperative	δ_6	-0.163	0.272	-0.739

Source: Field Survey, 2021

NB: ** mean significant at 5% level.

The parameter estimates from the inefficiency model included in the stochastic frontier production analysis in Table 5, reveal that membership of cooperative, farming experience, farm location and level of education had negative coefficients. These

suggest that, with a unit increase in each of these variables, the level of technical inefficiency of the farmers reduce (i.e technical efficiency increase). This also underscore the importance of education, membership of cooperative, farming experience and

farm location in raising cocoa production. Farm location had significant relationship with cocoa output.

Table 6: Elasticities of Production (EP) and Return to Scale (RTS)

Variable	Age	Farm Size	Family Labour	Hire Labour	Fungicide	Pesticide	Depreciation	RTS
Elasticities	0.377	-0.012	-0.085	0.175	0.168	0.137	0.599	1.359

Source: Field Survey, 2021.

The return to scale (RTS) analysis which served as a measure of resource productivity is given in Table 6. The RTS (1.359) was obtained from the summation of the coefficients of the estimated inputs (elasticities) which indicates that cocoa farmers in the study area were experiencing increasing returns to scale

(stage I) of production. This result implies that, optimum efficiency of production has not been achieved. It means farmers can still increase their level of output at the current level of resources, in other word; technologies for cocoa production were underutilized.

Table 7: Constraints Associated with Cocoa Production in the Study Area (n=90)

Constraints	Frequency	Percentage	Rank
Inadequate Credit Facilities	88	97.78	1 st
High Cost of Transportation	86	95.56	2nd
Labour Inadequacy	85	94.44	3rd
Low Produce Price	77	85.56	4th
High Cost of Fertilizer	75	83.33	5th
Pest and Diseases	68	75.56	6th
Theft	52	57.78	7th
Bad Weather	32	35.56	8th
Poor Infrastructure	15	16.67	9th

Source: Field Survey, 2021.

Multiple Responses

The major constraints faced by the farmers were identified by the respondents and presented in Table 7. Inadequate credit facilities ranked first among the major constraints considered. One possible explanation for this is that most of the farmers who wanted to increase the scale of their production but were constrained due insufficient funds. Next to inadequate credit facilities was high cost of transportation which was ranked second. Farmers needed to carry their produce from farm to market for sale. Many farmers regretted that most of the roads from farm to the market were not motorable, resulting in high cost of transportation of their commodity. The distance to the point of sales could affect the cost of production which consequently reducing the profit margin. Third in the ranking was inadequate labour. Cocoa production is labour intensive and the young able bodied are no longer interested in farming which lead to inadequate labour. Low produce price ranked 4th. Decrease in price will lead to decrease in the quantity produced and supply to the market and it will in turn lead to decrease in profit. High cost of input (fertilizer) was ranked 5th. Cocoa production is an input sensitive and requires adequate fertilizer for higher output. Other constraints encountered by cocoa farmers in the study area were pest and diseases, theft and bad weather.

CONCLUSION AND RECOMMENDATION

The result of the socio-economic analysis revealed that cocoa production was male dominated as 78.9% were male. The studies also revealed that majority of sampled farmers were relatively adults.

About 56.7% of the farmer had primary school education and above. This is a good pointer to improved productivity. The household members was fairly large, (94.4%) of the respondents has more than three (3) household and the average household size was six (6), and could enhance savings in cost of labour. The majority of the farmers operated on a small scale farming. The profitability analysis showed that cocoa production was profitable in the study area. The study recommends the following:

- i. Construction of good road by government to reduce cost of transport and spoilage.
- ii. Introduction of extension education programmes for the Farmers by government, to improve their technical knowledge and skills.
- iii. Cocoa farmers should be encouraged by Government and Non-Governmental organization to have access to adult literacy education in order to enlightening them on the benefit of loan from formal source.
- iv. There should be policy by federal government that encourage the supply of sufficient and affordable labour or farm production.

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