

An Empirical Study of Cocoa Production in Ondo State, Nigeria

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ABSTRACT

The decline and inconsistency in cocoa output in Ondo State motivated this study. As a result, the study described the socio-economic characteristics and measured the level of technical efficiency in cocoa production for 2017 in Ondo State, Nigeria. A parametric frontier model (DEA) under Constant Returns to Scale was used. Using a two-stage sampling procedure. 40% of the communities with the highest level of cocoa production in the selected local government areas (LGAs) were purposively selected and a simple random sampling of 24% of cocoa farmers from the communities chosen to give a sample size of 210 cocoa farmers. The data were collected using a structured questionnaire assisted with a personal interview schedule and analyzed using descriptive statistics and Data Envelopment Analysis (DEA). The result showed that male farmers dominated cocoa production with a mean age of 52years, the majority (99.05%) were married, the mean household size of 7, the age of cocoa farm was 47years, the farming experience of 23 years, respectively and most (79.05%) of the farmers had formal education. The DEA input-oriented efficiency measurement showed a mean farmers' Technical Efficiency of 0.85, indicating an efficiency gap and that the farmers were operating about 15 % below the frontier. Most (76%) of the farmers had Technical Efficiency (TE) between 0.80 – 0.90, with minimum and maximum Technical Efficiency (TE) of 0.62 and 1.00 respectively. The study concluded that cocoa farmers and farms were aging implying less energy available for input utilization in production and poor output obtained from the plantations in the Study Area, hence, technical inefficiency. Rehabilitation of cocoa plantations and encouragement of youth participation by relevant agencies and government through inputs subsidization and provision of grants will help to raise technical efficiency in cocoa production in the Study Area.

Keywords: Cocoa; Technical Efficiency; DEA; production; Ondo State.

INTRODUCTION

Cocoa (*Theobroma cacao*) plays a significant role as a driver of economic growth and as a result has been widely accepted in many of the cocoa-growing economies across Africa, Asia, and Latin America [17]. According to the United Nations Conference on Trade and Development [19], Cocoa is a highly competitive and lucrative economic cash crop ranked highest in terms of income generation amongst other agricultural activities in the global markets [12, 14]. Cocoa is one of the major foreign exchange earners for some African countries such as Ghana, Cote D'Ivoire, Nigeria, and Cameroun, with Nigeria being the fourth largest producer after Cote D'Ivoire, Ghana and Indonesia contributing about 12% of total world production [11, 14]. According to [3] and [2], Cocoa plays a significant socio-economic role in Nigeria, accounting for about 2% of national export earnings. Over 200,000 rural households in 14 cocoa-producing states depend on cocoa for most of their cash income. The GDP from Agriculture in Nigeria averaged at ₦3,736,080.83 from 2010 until 2017 with cocoa production accounting for only 0.3% of this amount [18].

Ref [14], [18] observed that over 500,000 farmers are engaging in cocoa production in Nigeria, the majority of who are largely smallholders, producing more than 200,000 tonnes of cocoa per year from over 600,000 cultivated hectares of land. Over 50% of this quantity is produced in Ondo State alone with substantial quantities produced in Oyo, Osun, and Ogun State. Despite these, according to [16], its production is not consistent in terms of its yearly production. Specifically, in the years 2012/2013 to 2015/2016 production records of 238000, 248000, 195000, and 200000 metric tonnes respectively The inconsistent yield was traced to disease incidence, pest attacks, decreasing available labour force, and the aging of trees resulting in low yield.

This necessitates the need to examine the current yield of Cocoa in the Study Area in order to draw conclusions and make recommendations that will boost the quality and yield of the cash crop in the Nation as a whole.

METHODOLOGY

A. Study Area/Scope

The Study Area was Ondo State, Nigeria, one of the largest producers of Cocoa from the southwestern part of the country [2], [14]. It has an estimated land mass area of about 15,500 square kilometers suitable for cocoa cultivation and lies between latitudes 5° 45' and 7° 52' N and longitudes 4° 20' and 6° 05' E. with an estimated population of the state was 3,460,877 according to [15]. The state is bounded on the north by Ekiti and Kogi States, on the west by Ogun and Osun States, on the east by Edo and Delta States, and to the south by the Bight of Benin and the Atlantic Ocean. The State is made up of three senatorial districts, Ondo North, Ondo South, and Ondo Central. These senatorial districts have eighteen local government areas of which thirteen are into Cocoa farming. These include Akoko North East, Akoko South East, Akoko South West, Owo, and Ose from Ondo North; Akure South, Idanre, Ifedore, Ondo East, Ondo West from Ondo Central; and Ile-Oluji/Oke-Igbo, Odigbo from Ondo South [10].

B. Data Collection/Sampling Procedure

Data was collected from primary sources with the aid of a structured questionnaire, administered through a personal interview schedule. Farmers' information on the socio-economic characteristics of the respondents (age, level of education, etc.) and information on farm production such as farm size, farm experience, inputs, and quantities of output from the cocoa farms were collected.

A three-stage sampling procedure was adopted in choosing the respondents across the three senatorial districts. The first stage of the sampling involved purposeful sampling of Local Government Areas (LGAs) in the Study Area where cocoa production was dominant. Therefore, in Ondo North; Owo and Ose LGAs were chosen. In Ondo Central; Akure South, Idanre, Ondo West LGAs were chosen. While in Ondo South; Odigbo and Ile-Oluji/Oke-Igbo LGAs were selected, making a total of seven (7) Local Government Areas (LGAs). The second stage involved the purposeful sampling of a representative percentage (40%) of communities with the highest level of cocoa production from the total number of communities in the selected LGAs. The final stage involved a simple random sampling of a representative percentage (24%) of cocoa farmers from the selected communities from the different enlisted Local Government Areas in Ondo State to obtain a sample size of 210 respondents.

C. Analysis

The Data Envelopment Approach (DEA), introduced by [5] was used to analyze the result obtained from this study. DEA is a linear programming method for calculating the relative efficiencies of a set of organizations that possess some common functional traits but whose efficiency may vary due to internal differences such as management style. Different analysis options are available in the DEA which include input minimization (or input orientation) which instructs the DEA to reduce the inputs as much as possible without dropping the output levels. Alternatively, when the focus is on raising performance without increasing the resource base, output maximization (output orientation) could be specified.

D. DEA Model Specifications

$$TE_n = \min_{\lambda_i, \theta_n} \theta_n \dots \dots \dots (1)$$

Subject to:

$$\sum_{i=1}^I \lambda_i x_{ij} - \theta_n x_{nj} \leq 0$$

$$\sum_{i=1}^I \lambda_i y_{ik} - y_{nk} \geq 0$$

$$\sum_{i=1}^I \lambda_i = 1 \quad (\text{Constraints})$$

$$\lambda_i \geq 0$$

Where;

i = farms;

j = inputs. The inputs for this study were; x_1 = labour, x_2 = farm size, x_3 = pesticides, and x_4 = fertilizer;

k = output;

λ_i = the non-negative weights for i farms;

x_{ij} = the amount of input j utilized on farm i ;

x_{nj} = the amount of input j used on farm n ;

y_{ik} = the amount of output k produced on farm i ;

y_{nk} = the amount of output k produced on farm n ; and

θ_n = a scalar ≤ 1 that defines the TE of the farm n , with a value of 1 indicating a technically efficient farm and a value less than 1 indicating a technically inefficient farm [6].

The constraint $\sum_{i=1}^I \lambda_i = 1$ in equation (1) ensures the TE_n in equation (1) is calculated under the variable returns to scale (VRS) assumption. When the $\sum_{i=1}^I \lambda_i = 1$ constraint is omitted, constant returns to scale (CRS) is assumed, and equation (1) becomes the TE formulation proposed by Charnes *et al.* (1978).

Some factors affecting the efficiency of the cocoa farmers in the study area denoted by U_i were identified using the ordinary least square regression model. The factors were socio-economic characteristics of the farmer that were assumed to affect their efficiency.

$$U_i = a_0 + a_1Z_{1i} + a_2Z_{2i} + a_3Z_{3i} + a_4Z_{4i} + a_5Z_{5i} + a_6Z_{6i} + a_7Z_{7i} + a_8Z_{8i} + e \dots\dots\dots (2)$$

Where:

U_i = Technical efficiency for an individual farmer

Z_1 = Age of farmer (years)

Z_2 = Educational status of farmer (dummy: 0 for informal, 1 for formal)

Z_3 = Sex of farmer (dummy: 0 for male, 1 for female)

Z_4 = Household size (number of people feeding from the same pot)

Z_5 = Age of cocoa plantation (years)

Z_6 = Marital status (dummy: 0 = unmarried; 1 = married)

Z_7 = Farming experience of the farmer (years)

Z_8 = Access to extension agents (dummy: 0 = No; 1 = Yes)

a_i = Scalar parameter to be estimated

e = error term

RESULTS AND DISCUSSION

A. Socio-economic Characteristics of Cocoa Farmers in Ondo State

As shown in Table I, 88.1 % of the respondents were male cocoa producers while 11.9 % were females. This signified that cocoa production in the study area was dominated by males which is typical in African farm households. This is expected because of the very tasking nature of the cocoa production which makes the business very tedious for the female to handle effectively as also observed by [3], [8], [13] in a related study. The age distribution of the cocoa farmers indicated that 36.86 % were between ages 41 and 50 years, implying that the majority of the farmers were in their active age, whereas the mean age and deviation in the age of the farmers were about 52 years and 11 years respectively, signifying that the cocoa farmers in the study area were aging and may not have the required strength for the task operations involved in cocoa production hence hampering productivity and efficiency.

Table I: Distribution of Socio-economic Characteristics of Cocoa Farmers in Ondo State

Characteristics		Freq	%	Mean	SD
Sex	Male	185	88.10		
	Female	25	11.90		
Age	≤ 30	6	2.86		
	31 – 40	19	9.05		
	41 – 50	76	36.19		
	51 – 60	69	32.86		
	≥ 61	40	19.05	51.57	10.70
Educational status	Non-formal	44	20.95		
	Formal	166	79.05		
Marital status	Unmarried	2	0.95		
	Married	208	99.05		
Household size	≤ 4	17	8.10		
	5 – 8	145	69.05		
	9 – 12	43	20.48		
	≥ 13	5	2.38	7.00	2.13
Farming experience (yrs)	≤ 10	24	11.43		
	11 – 20	65	30.95		
	21 – 30	52	24.76		

	≥ 31	69	32.86	23.90	9.24
Occupation	Farming only	94	44.76		
	Trading	51	24.29		
	Civil service	21	10.00		
	Others	44	20.95		

The study also revealed that 79.05% of the cocoa farmers had formal education while 20.95% were without formal education. This means that the majority of the cocoa farmers in Ondo State were literate and so should be able to access the formal sources of information as well as adopt technological innovations that would facilitate improved efficiency and productivity in their production. This was corroborated in a similar study by [1].

About 99.05 % of the farmers in the study area were married which indicated a great level of opportunity for the farmers to make rational decisions on their farm operations alongside their spouses. It also implies that marriage is highly treasured by cocoa farmers in Ondo state especially because it can lead to increased family size which will consequently impact the availability of family labour supply.

The study shows that 69.05 % of the cocoa farmers in Ondo State had a household size between 5 and 8 with an average of 7 persons which is in line with the African tradition of large family size to contribute to farm labour [4].

It was also discovered that about 58 % of these farmers had adequate experience of above 20 years in cocoa production enterprise and so can make quality decisions and adopt meaningful innovations that will help them improve their efficiency and productivity.

B. Technical Efficiency of Cocoa Farmers in the Study Area

As shown in Table II the mean technical efficiency (TE) of the cocoa farmers was 84.1 %. The minimum and maximum technical efficiency were 0.622 and 1.000 respectively. The farmers were operating about 16 % below the frontier indicating an efficiency gap or presence of inefficiency in their minimization of the amount of input utilized which was required to produce their various output levels.

As a result, the farmers have the potential to manage or minimize their input usage by 16 % to realize the same output level as the most technically efficient counterpart farmer. This is consistent with the findings of [7] who reported that 88 % of farmers in Cross Rivers State were technically efficient in their input management.

Ref [13] also reported that the mean technical efficiency on the management of input for cocoa farmers in the Southwest region of Nigeria was 81.3 % signifying a shortfall in their efficiency measurement by 12% and 18.7% respectively.

Table II: Distribution of Technical Efficiency of Cocoa Framers in the Study Area

Range	Frequency	Percent
0.601 - 0.700	15	7.1
0.701 – 0.800	26	12.4
0.801 – 0.900	160	76.2

0.901 – 1.000	9	4.3
Total	210	100.0

Min. = 0.622 Max. = 1.000 Mean = 0.841

C. Determinants of Efficiency of Cocoa Farmers in the Study Area

The result presented in Table III is the Ordinary Least Square (OLS) result for factors militating against the efficiency of the cocoa farmers in the Study Area.

It was observed that farming experience, age of cocoa plantations as well as access to extension service were the only socio-economic variables that significantly influenced the efficiency of cocoa farmers in Ondo State.

However, the farming experience of the cocoa farmers had a positive influence on the technical efficiency of the farmers showing that with the experience gathered by the farmers over the years, they have been able to reduce waste of input in their production.

The age of cocoa plantations and access to extension agents were found to significantly reduce the efficiency of the farmers. The aging of many of the cocoa plantations needs to be managed through rehabilitation for farmers' efficiency to be improved in the Study Area.

Table III: Table showing determinants of Technical Efficiency of Cocoa Farmers in the Study Area

<i>Variable</i>	<i>Parameter</i>	<i>Coefficients</i>	<i>Standard Error</i>	<i>t-ratios</i>
Constant	θ_0	0.184	0.570	0.323
Sex	θ_1	0.153	0.137	1.115
Age	θ_2	0.007	0.008	0.875
Educational status	θ_3	0.074	0.131	-0.569
Marital status	θ_4	0.004	0.660	0.007
Household size	θ_5	-0.012	0.027	-0.444
Farming experience (yrs)	θ_6	0.017	0.005	3.400*
Age of farm (yrs)	θ_7	-0.015	0.007	-2.143*
Access to extension service	θ_8	-0.275	0.113	-2.434*
sigma-square	δ	0.323	0.091	3.546*
Gamma	Γ	0.691	0.103	6.694*

* significant @ 1%

CONCLUSION AND RECOMMENDATION

Although the study revealed that cocoa production in the study area was a viable and profitable enterprise, the cocoa farmers were concluded to be fairly efficient in their management of input during production. The study

recommends that government and non-governmental assistance are needed for the provision of hybrid cocoa seedlings to the farmers for the rehabilitation of old cocoa plantations. Also, the support of government and non-government organizations are highly needed by farmers in the provision of funds to support the farmers in their production venture. Extension agents should also improve in training and re-training the farmers, particularly on how to utilize their inputs efficiently to avoid wastage and improve their production efficiency.

REFERENCES

1. Akinlagbe, O.M. & A.R. Ajayi (2010). Assessment of Farmers' Benefits Derived from Olam Organization Sustainable Cocoa Production Extension Activities in Ondo State, Nigeria. *Journal of Agricultural Extension*. 14(1), 11-12.
2. Agbongiarhuoyi, A.E., Abdulkarim, I.F., Fawole, O.P., Obatolu, B.O., Famuyiwa, B.S. & Oloyede, A.A. (2013). 'Analysis of farmers' adaptation strategies to climate change in cocoa production in Kwara State', *Journal of Agricultural Extension*. 17(1):1119-1944. <http://dx.doi.org/10.4314/jae.v17i1.2>
3. Akinfiresoye, W.A., Adebayo, S.A. & Olarewaju O.O. (2022). Analysis of Social Economic Factors Affecting Cocoa Production in Ile Oluji Community of Ondo State, Nigeria. *Asian Journal of Social Sciences and Management Studies* Vol. 9, No. 2, 25-30, 2022.
4. Amos, T.T. (2007). Analysis of Backyard Poultry Production in Ondo State, Nigeria. *International Journal of Poultry Science*. Vol.5 (3)
5. Charnes, A., Cooper, W.W., & Rhodes, E. (1978). Measuring Efficiency of Decision Making Units. *European Journal Operational Resource*. 2:429-444.
6. Coelli, T.J. (1995). "Recent Developments in Frontier Modeling and Efficiency Measurement." *Australian Journal of Agricultural Economics*. 39:219-245.
7. Eyitayo, A.O., Okafor, C., Ejiola, M.T., & Enitan, F.T. (2011). Technical Efficiency of Cocoa Farms in Cross River State, Nigeria. *African Journal of Agricultural Research*. 6(22):5080-508.
8. Fasoranti, M.M. (2006). "A Stochastic Frontier Analysis of Effectiveness of Cassava-Based Cropping Systems in Ondo State, Nigeria." Ph.D Thesis, Department of Agricultural Economics and Extension, FUTA, Akure.
9. ICCO, (2016). Global Cocoa Production for 2015-2016. <https://www.icco.org/may-2016-quarterly-bulletin-of-cocoa-statistics/>
10. Ministry of Economic Planning and Budget, (MPB). Akure. Research and Statistics Department, 2009. Digest of Agricultural Statistics.35-38.
11. Nkamleu, G.B., Nyemeck J., & Gockowski, J. (2010). Technology Gap and Efficiency in Cocoa Production in West and Central Africa: Implications for Cocoa Sector Development, Working Papers Series No 104. African Development Bank, Tunis, Tunisia.
12. Ngoong, J.T., & Forgha N.G. (2013). An Analysis of the Socio-Economic Determinants of Cocoa Production in Meme Division, Cameroun. *Greener Journal of Business and Management Studies*. 3(6):298-308.
13. Popoola, O.A., Ogunsola, G.O., & Salman, K.K. (2015). Technical Efficiency of Cocoa Production in Southwest Nigeria. *International Journal of Agricultural and Food Research*. 4(4):1-14.
14. International Cocoa Organization, ICCO. (2014). International Cocoa Organization Regional Seminar on the functioning of cocoa future markets and Econometric Modelling of the Cocoa market, Indonesia, July 2014.
15. National Population Commission (NPC) (2006). List of Nigerian states by population. https://en.wikipedia.org/wiki/List_of_Nigerian_states_by_population
16. Statista (2016). The Statistics Portal for Market Data, Market Research on Cocoa Production.
17. Taphee, B.G., Musa, Y.H., & Vosanka, L.P. (2015). Economic Efficiency of Cocoa Production in Gashaka Local Government Area, Taraba State, Nigeria. *Mediterranean Journal of Social Science, Rome Italy*. 6(1):570 - 576.
18. Trade Economics (2018). National Bureau of Statistics: Nigeria GDP Annual Growth Rate.
19. UNCTAD/UNDP (2004). Global Programme: Using Competitiveness and Social Efficiency for Sustainable Human Development – Experiences in Bolivia, Morocco, Senegal and Viet Nam.