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Full Length Research Paper

Economic analysis of profitability and determinants of productivity among cocoa farmers in Ondo State

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This study examined the profitability of cocoa farmers in Ondo State and determined their productivity determinants. Multi-stage sampling technique was used to collect primary data from 200 cocoa farmers. Data collected were analyzed using descriptive statistics, budgetary analysis and Ordinary least squares (OLS) regression models. The results revealed the mean age of the farmers was 55years while men (82.5%) dominated cocoa production in the study area. The majority (90.5%) of the farmers were married, 60% had household sizes between six and ten persons with average of about 6 persons while they had average of 21 years in cocoa farming experience. The study also revealed that a mean of 2.35 hectares' farm size was cultivated by the respondents. The study also showed that cocoa production is profitable with mean gross margin estimated to be ₦171,624.91 while the profit margin and benefit cost ratio were 44.8% and 1.81 respectively. The regression analysis result showed that household size, labour, farm size, improved seedlings, fertilizer and pesticide were the major factors influencing productivity of cocoa in the study area. The study recommended that cocoa production should be promoted to meet the needs of the expanding industrial sector, increase foreign exchange earnings, enhance job creation and increase farmers' income. There is a need for more training programs on most efficient ways of production to increase productivity of cocoa in the study area.

Keywords: Cocoa, productivity, profitability, determinant

INTRODUCTION

Cocoa (*Theobroma cacao* L.) is an important crop around the world. It is a cash crop for growing countries and a key import for processing and consuming countries. It serves as a foreign exchange earner in Nigeria and some parts of the West African sub region. About 70%of the world supply of cocoa originates from Africa. Reports from the Cocoa Association of Nigeria, (2016) showed that Cote d'Ivoire is the world's leading cocoa producing country with 1,650,000 tonnes, followed by Ghana with 800.000 tonnes, Indonesia in third position with 520,000 tonnes and Nigeria occupying the fourth position with 280,000 tonnes. Cocoa farming presents one of the best business opportunities in agribusiness (Okpokiri *et al*., 2016). The demand for cocoa seeds worldwide is extremely high and the price in international market is quite encouraging to farmers. Coco plant is a small, evergreen tree that grows exclusively in the deep tropical region of the world. On the average, a single cocoa tree produces between 20-30 pods at a time and each pod contains about 20-50 seeds, known as cocoa beans. The beans are very useful in the production of cocoa beverage, chocolate candies and cocoa butter which are very rich in proteins, fats, carbohydrates and Vitamin B complex. Among others, cocoa production in Nigeria performs the following economic roles which include provision of raw materials for cocoa industries, provision of revenue for the government; contribution to aggregate export earnings and provides sources of income to farmers and to many other groups. It also provides market for various agro-chemicals such as herbicides,

insecticides, fungicides and fertilizers. It also provides employment for thousands of people both at the farm level and at the industrial processing stage (Adedeji *et al.,* 2011). Cultivation of cocoa at the farm level is a delicate process as crops are susceptible to various conditions including weather patterns, diseases and insects. Unlike larger industrialized agricultural business, the vast majority of cocoa still comes from family-run small farms who are often confronted with outdated farming practices and limited organizational leverage. With a steady demand from worldwide consumers, there are numerous efforts and funds committed globally to support and improve cocoa farm sustainability (WCF, 2009). World data showed that about 2.5 million producers of cocoa are smallholder farmers that produce 4.1 million metric tons of cocoa beans in more than 50 countries for a total export value of US$8.4 billion in 2012 (Offor *et al*., 2017). It is obvious that increased productivity in the cocoa industry is paramount to improvement in rural standards of living. Abayomi, (2006) noted that it is capable of increasing not only per capita income; reduce spatial inequalities between rural and urban areas, but also to reduce the unprecedented mobility of rural-urban migration. Obviously, this is a phenomenon that often resulted in the stagnation of the rural economy. Agbota, (2013) claimed that cocoa contributed $900m to Nigeria's economy in 2012. This implies that cocoa is a source of income to farmers, industrialists and government (Osundare, 2013). Oladosu and Sanusi, (2004) opined that cocoa farming, processing and marketing provide employment for about 40% of inhabitants in cocoa producing zones in Nigeria. In addition, Ndubuto *et al*. (2010) opined that Nigeria has comparative advantage in the production and exportation of cocoa, thus more effort is needed to increase its productivity in Nigeria and make the country the leading producer of cocoa in the world. Despite rapid yield growth in agricultural production all over the world, the realized yields are still well below their genetic potential. Deviations from potential yields appear to vary remarkably among countries and regions even after adjusting for different soil, moisture and temperature environments. Other conditioning factors, such as different farm sizes and management capacities, access to markets, and legislative/institutional factors, play heavily in determining yield performance (FAO, 2011). There are many factors that determine how productive the cocoa enterprise is and what it ought to be in Nigeria as a whole and the study area in particular. This study investigated some of such determinants in Ondo State which is the leading cocoa producing state in Nigeria considering its climatic condition which is favourable to cocoa production (Onoja et al., 2012). The broad objective of the study is to examine the profitability and determinants of productivity among cocoa farmers in Ondo State, Nigeria while the specific objectives are to: describe the socio-economic characteristics of cocoa farmers in the study area; estimate the costs and returns to cocoa production in the study area; and determine the factors influencing the productivity of cocoa farmers in the study area.

MATERIALS AND METHODS

Study area

The study was carried out in Ondo State of South-Western Nigeria with a land area of 14,606km^2 and lies between Latitudes 5°45′ and 7°52′ N and longitudes 4°20′ and 6°05′ East with a population of 3,441, 024 (NPC, 2006). The favourable climate accounts for why majority of the inhabitants are farmers out of which most are predominantly cocoa farmers. The state consists of eighteen Local Government Areas. The choice of the study area was born out of its prominence in cocoa production. Agriculture (including fishing) constitutes the main occupation of the people of the state. Ondo state is the leading cocoa producing state in Nigeria. Other agricultural crops grown in the state include yams, cassava, kolanut, cocoyam and palm produce.

Sampling technique

The study employed multistage sampling technique for the selection of its respondents. The first stage involved a purposive selection of four notable cocoa producing Local Government Areas (LGAs) out of a total of fifteen cocoa producing LGAs in the state (Ile oluji, Akure South, Ondo East and Idanre). The second stage involved the random selection of five villages/communities from each of the selected LGAs while the third stage involved the random selection of ten respondents from the selected communities to make a total sample of 200 respondents.

Analytical technique

The data collected were analyzed with descriptive statistics, budgetary analysis and OLS regression models. Descriptive statistics was used to analyze the socio-economic characteristics of cocoa farmers. Budgetary analysis was used to estimate the costs and returns to cocoa production. OLS regression was used to determine the factors influencing productivity of cocoa farmers in the study area.

Budgetary analysis

The budgetary analysis was used to estimate the costs and returns to cocoa production. Revenue is the price per unit output multiplied by quantity of output

Net profit (π) = Total Revenue (TR) – Total Cost (TC) (1)

Gross Margin (GM) = Total Revenue (TR) – Total Variable Cost (TVC (2)

Rate of Returns (ROR) = (TR/TC) (3)

Ordinary least square regression (OLS)

The OLS regression was used to determine the factors influencing productivity of cocoa farmers.
Hence, its specification is given below

$$Y = \beta_0 + \beta_1 X_i + U_i \quad (4)$$

Where, Y is the dependent variable (output), X is a vector of explanatory variables, $\boldsymbol{\beta}$ is a vector of estimated coefficient of the explanatory variables and u_i indicates disturbance term which is assumed to satisfy all OLS assumptions (Gujarati, 1995).

$$Output = \beta_0 + \beta_1 AGE + \beta_2 HHSIZE + \beta_3 LABOUR + \beta_4 EDU + \beta_5 FARMSIZE + \beta_6 MARITAL + \beta_7 YRSEXP + \beta_8 SEEDLING + \beta_9 FERTILIZER + \beta_{10} PESTICIDE + \mu$$

RESULTS AND DISCUSSION

Socio-economic characteristics of cocoa farmers

From (Table1), the average age of cocoa farmer was 55 years old, this shows that the farmers are old and should be able to make reasonable and sensible decisions about cocoa production activities. Majority (82.5%) were male, this indicates that men dominate cocoa production in the study area. Marital status of a person which determines the degree of responsibility of that person has a great significance in agricultural production as it can be explained in terms of the supply of agricultural family labour. It is expected that family labour would be more available where the household heads are married (Oseni and Adams, 2013). About 90.5% of the farmers were married; this implies that more family labour will be available for cocoa production and other farm activities. Furthermore, that majority (60%) of the cocoa farmers in the study area had household sizes between six and ten. This implies that the farmers in the study area have a fairly large household which could probably enhance the availability of family labour and reduces constraint on labour cost in agricultural production. As evident from (Table 1), 38% of the farmers completed secondary school. This implies that cocoa farmers in the study area are literates who could read and write. The distribution of respondents by farming experience shows that an average farmer had about 21 years' experience in cocoa production. This is an indication that farmers have been in the business of producing cocoa for many years. The study also revealed that a mean farm size of 2.35 hectares was cultivated by the respondents. This shows that cocoa production in the study area was mostly on small holdings.

Estimation of profitability of cocoa production in the study area

The result of costs and returns of cocoa production by farm sizes is presented in (Table 2). It was found that about 88.31% of the total cost of production was on variable inputs of which cost of labour accounts for 72.22%. This suggests that the respondents incurred more cost on labour which increases their total cost of production and thereby reduce their profit. The mean values of the total variable and fixed costs were ₦163, 394.64 and ₦21, 630.69 respectively while the mean value of the total cost was ₦185, 025.33. Net income was ₦149, 994.22 which was measured by subtracting total cost from total revenue indicating that the enterprise is profitable. Subtracting the total variable cost from total revenue, the gross margin equals ₦171, 624.91. Profitability ratios included in this study are profit margin which gives a value of 44.8% indicating that for every ₦1.00 generated from the enterprise, a net income of 0.44 is earned as profit. The rate of returns gives 0.81 which implies that from every ₦1.00 invested into the enterprise, a net income of ₦0.81 is realizable. The operating expenses ratio with values of 0.49 shows that from every ₦1.00 generated from the enterprise ₦0.49 is invested as a running cost into the investment. Also benefit cost ratio of 1.81 implies that for every ₦1.00 invested on cocoa production ₦1.81 is realized as income. All these ratios confirm that cocoa farming is a profitable enterprise.

Determinants of productivity in cocoa farms in Ondo State

The summary of the regression analysis to determine the factors influencing productivity of cocoa in the study area is presented in Table 3. In our models namely linear, semi-log, exponential and double-log models were estimated. In selecting the model for the economic analysis, model selection criteria such as coefficient of multiple determination (R^2), adjusted R^2, F-statistics and its p-value, sign magnitude of the coefficient and the number of significant variables. Linear model was eventually chosen as the lead equation which is given as follows:

$$Y = -208.011 - 0.196X1 + 6.762X2 + 0.004X3 + 0.268X4 + 6.154X5 + 15.365X6 - 0.632X7 + 0.133X8 + 11.303X9 + 0.299X10$$

The results showed that a relationship existed between output and the explanatory variables in the model. The coefficients of household size, labour, education, farm size, marital status, quantities of seedlings, fertilizer and pesticides had positive signs, implying that these variables

Table 1. Socio-economic characteristics of respondents

Variables	Frequency	Percentage
Age		
< 40.00	18	9.0
41.00 - 50.00	46	23.0
51.00 - 60.00	85	42.5
61.00 - 70.00	39	19.5
71.00+	12	6.0
Total	200	100
Mean	55.00	
Gender		
Male	165	82.5
Female	35	17.5
Total	200	100
Marital status		
Single	4	2.0
Married	181	90.5
Widowed	15	7.5
Total	200	100
Household size		
≤ 5	76	38.0
6 - 10	120	60.0
>10	4	2.0
Total	200	100
Mean	6.20	
Education		
No Fomal Education	42	21.0
Adult Literacy/Arabic	15	7.5
Vocational School	2	1.0
Primary Education	59	29.5
Secondary Education	76	38.0
Tertiary Education	6	3.0
Total	200	100
Years of Farming Experience		
< 10.00	20	10.0
11.00 - 20.00	112	56.0
21.00 - 30.00	38	19.0
31.00 - 40.00	25	12.5
41.00+	5	2.5
Total	200	100
Mean	21.36	
Farm Size(Hectare)		
< 2.00	135	67.5
2.01 - 4.00	51	25.5
4.01 - 6.00	10	5.0
6.01+	4	2.0
Total	200	100
Mean	2.35	

had a direct relationship with cocoa output. As more of these variables are employed, there will be an increase in total output of cocoa. On the other hand, the coefficients of age and years of farming experience had negative signs, implying inverse relationship with output. The estimated R^2 of the linear model is 0.90 implying that 90 percent of the observed variations in total output of the cocoa were explained by the explanatory variables incorporated in the model.

The coefficient of household size which could serve as source of family labour in the agricultural sector was positive and statistically significant at 5%. This implies that as household member increase by one, the farm output will also increase. Thus, the larger the family member, the more labour is available for farming activities. This finding agrees with that of Amos, (2007) that household size plays an important role in determining the yield of farmers in the study area. The coefficient of labour was positive and statistically significant at 1%. This shows that increase in labour availability tends to increase cocoa productivity as labour activities are required in the production process and some

Table 2. Results of budgetary analysis of cocoa farmers in Ondo State.

Items	Mean amount (₦)	Percentage of Total costs
REVENUE		
Quantity of Cocoa (kg)	856.82	
Price per kg (₦)	391.25	
Total Revenue (TR)	335019.55	
VARIABLE COST		
Cost of Seedlings	1505.25	0.81
Cost of Labour,	133633.00	72.22
Cost of Fungicides	11678.25	6.31
Cost of Insecticides	5994.25	3.24
Cost of Fertilizer	10583.89	5.72
Total Variable Cost (TVC)	163394.64	88.31
Gross margin (TR-TVC)	171624.91	
FIXED COSTS		
Cost of Cutlass	1862.00	1.01
Cost of Hoe	1565.25	0.85
Cost of Sickel	809.34	0.44
Cost of Knapsack sprayer	1674.48	0.91
Cost of Wheelbarrow	2433.31	1.32
Cost of Motorcycle	10077.38	5.45
Cost of Vehicle	3208.93	1.73
Total fixed cost	21630.69	11.69
Total Cost (TC) = (TFC + TVC)	185025.33	100
Net Income (NI) = (GM - TFC)	149994.22	
Profit Margin = F/A *100	44.8	
Return per Capital Outlay = F/E	0.81	
Operating Cash Expenses Ratio = B/A	0.49	
Benefit Cost Ratio = A/E	1.81	
Net Farm Income Ratio = F/C	0.87	

Source: Data Analysis, 2017.

Table 3. Multiple regression estimates for the determinants of productivity on cocoa.

Model/Variables	Linear	Semi-log	Exponential	Double-log
Intercept	-208.011**	-7551.152***	5.472***	-4.589***
	(-2.314)	(-13.218)	(46.922)	(-8.175)
Intercept	-203.315**	-7556.66***	5.480***	-4.565***
	(-2.257)	(-13.214)	(46.816)	(-8.133)
Age	-0.196	14.216	-0.001	0.005
	(-0.157)	(1.172)	(-0.678)	(0.043)
Household size	6.762**	-5.469	0.004	-0.005
	(2.309)	(-0.846)	(0.974)	(-0.157)
Labour	0.004***	663.168***	0.000***	0.893***
	(40.736)	(18.859)	(37.017)	(25.838)
Education	0.268	25.256	0.001	0.036
	(1.114)	(0.701)	(0.342)	(1.007)
Farm size	6.154**	31.956	0.010***	0.027
	(2.208)	(1.172)	(2.729)	(1.018)
Marital status	15.365	76.182	0.007	0.085
	(0.613)	(0.753)	(0.213)	(0.853)
Years of farming experience	-0.632	--38.258	0.000	-0.050
	(-0.481)	(-0.688)	(-0.115)	(-0.920)

Table 3. Contd.

Improved seedling	0.133**	-13.436	0.000**	0.000
	(2.360)	(-0.846)	(2.498)	(-0.021)
Fertilizer	11.303**	83.259	0.014**	0.094
	(2.122)	(0.954)	(2.024)	(1.096)
Pesticide	0.299*	41.763**	0.000**	0.056***
	(1.788)	(2.194)	(2.119)	(2.982)
R-Squared	0.901	0.832	0.883	0.901
Adjusted R-Squared	0.896	0.812	0.877	0.889
F statistics	172.215	41.593	142.764	76.580
Prob > F	0.0000	0.000	0.000	0.000

Source: Data Analysis, 2017

Note: *** = Significant at 1%, ** = Significant at 5%, * = Significant at 10%. Values in parentheses are t-ratios.

of these farm activities like land clearing, seed planting; weeding chemical/fertilizer applications and harvesting are still done manually. The coefficient of farm size was positive and statistically significant at 5%. This implies that increase in farm size tends to increase the output of the farmers. This implies that as the area of farmland cultivated increases output also increases. Farm size had a significant effect on output. The quantity of seedlings used by the farmers shows a positive relation to output and statistically significant at 5%. This shows that as the farmers use more improved seedlings their output will increase. It has been reported that increase in agricultural productivity could be achieved by promoting the production and use of these improved seedlings. There was a positive relationship between the level of output of cocoa and the quantity of fertilizer and pesticide used by the farmers and statistically significant at 5% and 10% respectively. This scenario is expected as the level of production depends largely on the quantities of these inputs used on the farm

Conclusion

The study observed that cocoa farming is a profitable enterprise in the study area as indicated by the costs and returns to cocoa production presented in (Table 2) above. This shows that government and other institutions should intensify their effort in promoting cocoa production with the aim of meeting the needs of the expanding industrial sector, increasing foreign exchange enhancing job creation and farmers' income; increasing processing capacity of factories, establishing and strengthening of small/medium-scale enterprises to produce fast moving consumer cocoa products from cocoa and its by-products and improving cocoa marketing in the states presently producing and /or with the potential to produce cocoa. Household size, labour, farm size, improved seedlings, fertilizer and pesticide were significant variables greatly influencing the yield of cocoa farmers. Therefore, to revitalize cocoa economy/industry, efforts must be geared towards increasing its productivity by supply of timely subsidized inputs such as improved seedlings, fertilizers, herbicides, insecticides and other farm implements and mechanization of farm operations so as to boost their production activities. There is also a need for more sensitization programmes on the use of improved technologies in cocoa production and effective evaluation team to guide the farmer and also get feedback from them.

Authors' declaration

We declared that this study is an original research by our research team and we agree to publish it in the journal.

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