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Determinants of Productivity among Farmers in Ondo State of Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author WOF was responsible for the collection of data, analysis and consequent writing of the manuscript. While author MAYR gave professional guidance at every stage of the study especially in the area of interpretation to ensure the study went smoothly. Both authors read and approved the final manuscript.

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ABSTRACT

This study examined the determinants of cocoa productivity in Ondo State of Nigeria. Primary data were used and collected by using semi-structured questionnaires administered to 140 respondents who were farmers from three selected local government areas which constituted the sampling blocks of the multistage random sampling technique. The methods of data analysis employed were both descriptive and inferential. Determinants of productivity were analyzed using Ordinary Least Square (OLS) method to estimate the parameters of estimates of the variables thereby giving the relationship between the output and the explanatory variables. The results of the study showed that cocoa production was in stage II of production in the study area with return to scale (RTS) of 0.956. The RTS is decreasing in nature being less than unity but positive. This showed that cocoa production in the study area is productive with rooms for improvement on the side of farmers by using efficient techniques that can enhance their productivity. The variables such as farm size, quantities of fungicides and fertilizers, age of farmer and farming experience are positively related

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to cocoa output while other variables insecticides, labour, age of farm (age of cocoa trees), family size and educational status (years spent in school) are negatively related to cocoa output. Of these variables, quantity of fertilizer used, labour and educational status of the farmers were statistically significant at 5% meaning they are the major determinants of cocoa productivity in the study area while other variables are statistically insignificant at any level.

Keywords: Productivity; return to scale; output and cocoa.

1. INTRODUCTION

Cocoa was introduced to Nigeria in 1874 and had since played significant roles in the nation's economy [1]. When viewed from the perspective of foreign exchange earnings, no single agricultural commodity has earned more than cocoa in terms of this. Cocoa also provides a veritable source of raw materials for several agro-allied industries such as chocolate industries as well as source of revenue to governments of states involved in cocoa production. Cocoa also provides source of foreign earnings to central government. There have been various efforts targeted at boosting cocoa production in the past the most recent of such efforts was the distribution of 26 million seedlings of cocoa in the year 2000 to the 14 cocoa producing states in Nigeria to replace the old trees which was equally aimed at improving the productivity of cocoa and at the same time improving income earnings of farmers due to increased output expected of such efforts. The beneficiaries of this gesture included states like Ondo (the study area), Ogun, Osun, Oyo, Ekiti, Kwara and Kogi. Others were Edo, Delta, Cross River, Adamawa, Taraba and Akwa Ibom [2]. Of these states, the study area is among the top five in terms of quantity of cocoa production. Over the years agriculture has undoubtedly contributed to the economic growth of countries involved in its production including Nigeria considering its contribution to the GDP of such countries. Nigeria as a country is naturally endowed with cultivable and fertile land. According to [3,4] the country has 71.2 million hectares (72.4%) cultivable land of the total land area of about 98.3 million hectares, presently only 34.2 million hectares (34.8%) of the cultivable lands are being cultivated pointing to the underutilization of the cultivable land. Despite the importance of agriculture in the achievement and sustenance of food security in the country the sector has either been abandoned totally or left in the hands of the smallholder farmers who still rely on crude methods of agricultural production which has led to unproductivity in the cocoa sector. Cocoa contributed immensely to the economy of the old western region of Nigeria where the study area played some key roles before the oil boom the country witnessed in the early 70s. Agricultural sustenance of countries is not limited to Nigeria. [4,5] affirmed that 50 percent of the world's population still depend on subsistence agriculture for food and raw materials. However, despite the prominent roles cocoa has played in the economic fortunes of the country in the past, the productivity has been on the downward trend which was majorly caused by subsistence level at which the farmers are still operating even when there are varieties of sophisticated methods currently available. Until her transition into the league of oil exporting nations due to the oil boom of the 1970s, Nigeria was among the leading cocoa producing nations [2]. Consequently, the attention of government shifted from the potentials and fortunes inherent in agriculture, cocoa also received its own share of the neglect. [6] noted that cocoa production in Nigeria witnessed a downward trend after 1971 season during which its volume of export declined to 216,000 metric tons and 150,000 metric tons in 1976 and 1986 respectively thereby reducing the country's market share to about 6% and to fifth largest producer to date [7]. However, apart from the general neglect suffered by the agricultural sector by the government, the low level of education among subsistence farmers in Nigeria has made it difficult for them to adopt new and modern methods of farming as being introduced. [8] posited that the performance of Nigerian agriculture so far indicates that the farmers have neither used nor absorbed most of the modern technologies as being introduced to them. 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 of Nigeria which happens to be one of the best if not the best presently in terms of quantity of production among the cocoa producing states in Nigeria considering its climatic condition which is considered favourable to cocoa production bearing in mind that cocoa is highly selective in terms of weather and climatic requirements.

2. MATERIALS AND METHODS

2.1 Study Area

This study was carried out in Ondo State of Western Nigeria with a land area of 14,606 square kilometers (sq.km) and population of 3.44 million according to 2006 national population census [9]. The favourable climate accounts for why over 80% of the inhabitants are farmers out of which majority are predominantly cocoa farmers. The tropical climate of the state is mainly of two seasons; rainy season (April-October) and dry season (November-March). The temperature ranges between 21℃ and 29℃ and humidity is relatively high. The state is divided into 18 Local Government Areas (LGAs) for administrative convenience. The state has an annual rainfall of between 1150 mm to 2000 mm. The farmers in the area also grow other cash crops such as kolanut, palm tree, coffee and food crops such as yams, maize, cocoyam etc. mostly at subsistence level.

2.2 Sampling Technique

The multistage random sampling technique was adopted for this study. The first stage involved a purposive selection of Idanre, Ile Oluji and Odigbo local government areas in Ondo state as representative blocks. This is because the selected local government areas are reputable for being the leading areas in cocoa production in Ondo state. The second stage involved a simple random selection of fifty (50) farmers from each of the selected local governments making up a total of one hundred and fifty (150) cocoa farmers for the study out of which 140 questionnaires were eventually used for analysis due to incomplete information. The remaining questionnaires were subsequently discarded. Data were collected with the use of semi-structured questionnaires [10-13]. Data on the socio-economics characteristics, inputs and quantity of outputs among others were collected from the farmers.

2.3 Data Analysis

Descriptive and inferential analyses were used to analyze the data collected for the study. Descriptive statistics used included mean, minimum and maximum values. The inferential analysis used to examine cocoa productivity and its determinants in the study area was ordinary least square (OLS) parametric method which has been found effective in this kind of analysis. Though there are other methods that have been used in estimating productivity but OLS method has proven to be highly effective in relationship measurements in the case of investigating determinants. The t-test was used to test the statistical significance of the variables [4,14].

2.4 Model Specification

The production function for the cocoa production in the study area is specified by the OLS model as follows;

$$Y_i = \beta_0 + \beta_i X_i \quad (1)$$

Where,

Y_i = cocoa output for i^{th} farmer (tonnes),
X_i = the explanatory variables associated with i^{th} farmer,
β = parameters estimated,
i = 1, 2, 3,…,10.

From (1) above, we can take the natural logarithm of both sides to give the linear form of the production function as follows;

$$\log Y = \beta_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + \beta_7 \log X_7 + \beta_8 \log X_8 + \beta_9 \log X_9 + \beta_{10} \log X_{10} + \mu \quad (2)$$

Where,

Y = output of cocoa (tonnes/hectare)
X_1 = farm size (ha),
X_2 = quantity of insecticide used (litre),
X_3 = quantity of fungicide used (litre),
X_4 = quantity of fertilizer used (tonnes),
X_5 = labour (man day),
X_6 = age of the farm/age of cocoa trees (years),
X_7 = age of farmer (years),
X_8 = family size,
X_9 = farming experience (years),
X_{10} = educational status (years spent in school),
β_1 - β_{10} = the parameters estimated,
lns = natural logarithms,
μ = error terms.

3. RESULTS AND DISCUSSION

3.1 Socio-economic Characteristics of the Farmers

The distribution of the respondents according to their socio-economic characteristics is as shown

in Table 1. The results showed that the age of the farmers ranged between 0 and 75 years. The mean age was 45 years while the modal age group was 31 and 45 years age bracket. This means that the cocoa farmers in the study area are relatively young. Majority of the cocoa farmers in the study area were male who constituted 76.4% while the female constituted 23.6%. In terms of religion belief, majority of the respondents in the study area were Muslims and constituted about 67.1% while the remaining 32.9% were Christians. Considering the marital status of the respondents, majority of them were married and constituted about 80.7% of the respondents while the single and widow constituted 7.9% each and widower constituted the remaining 3.6%. The result also showed that the mean family size in the study area was 12 with respect to the number of people. The families with largest members had between 11 and 20 members which constituted 51.4% while families with between 1 and 10 members constituted 37.9% and lastly those with between 21 and 30 members constituted 10.7%. This implies that majority of them had relatively large family size and this makes the labour readily available for their farming activities. The relatively large family size prevalent in the study area was not unconnected with the religion belief of the respondents as pointed out earlier that majority of them were Muslims and as such polygamy was the prevailing family type in the study area. The average farming experience in the study area was 18 years. Majority of the farmers had between 11 and 20 years of farming experience followed by 39.3% who had between 21 and 30 years. In most cases the farmers had started cocoa farming before they owned their respective personal farms. This means that farmers in the study area were generally experienced as far as cocoa production was concerned most importantly with the prevailing technology as of the time this survey was conducted. Furthermore, going by the educational status of the farmers in terms of the number of years spent in school the average years spent in school by the respondents was 12 years which was equivalent of secondary school going by Nigerian educational system while 65% of the respondent spent between 10 and 14 years in school and a very few who constituted 2.9% spent between 0 and 4 years in school. In the same vein, a low percentage of 12.1 spent more than 14 years in school that is those who were graduates from various tertiary institutions and 20% were primary school holders who spent between 5 and 9 years in school. This implied that literacy level in the study area was relatively high connoting that majority of the farmers could read as well as write which accounted for the high productivity of cocoa production in the study area going by the results of this study. In this sense, farmers were able to apply the available resources at their disposal in optimal proportions to ensure high turnover in addition to being able to read application methods and instructions on chemicals used in their production activities. The farmers also engaged in other occupations apart from farming whether as primary or secondary. The result showed that 51.4% of the respondents engaged in other occupations such as crafts, transport business, daily hawking, working on other people's farm for monetary compensation and other paid activities out of which 26.4% were engaged in private businesses and the remaining 22.1% are civil servants working in various government establishments.

3.2 Production and Productivity Analysis

The results showing the level of output of cocoa as accounted for by the explanatory variables are as shown in Table 2. The results showed that there was positive relationship between the cocoa output and farm size, age of farmer, quantities of fertilizers and fungicides used, farming experience. The technical implication of this is that as more of these variables were employed the output of cocoa increased. This result is in congruent with the findings of [4,15] on similar studies. However, the results showed that there was negative relationship between the output of cocoa and family size, which is consistent with the findings of [16]. Similarly, there was negative relationship between cocoa output and insecticides used and age of farm (age of cocoa trees), educational status (i.e. years spent in school) and labour. The positive relationship between the output and age of the farmer is unexpected and in contrast with a priori expectation considering the fact that the more ageing the farmer becomes the more unproductive. The relationship between the output and farm size, fungicides, age of farm, farming experience and fertilizer are expected and in line with a priori expectation. However, the relationship that existed between output and insecticides, labour, age of farmer, family size and educational status (i.e. years in school) are unexpected and not in congruent with a priori expectation. The negative relationship that existed between output and insecticides, labour and family size might have resulted from misuse and misapplication of the affected resources due

to many factors. Furthermore, the positive relationship between output and age of farmer might have been as a result of experience garnered by the farmers over time due to ageing and lastly the negative relationship that existed between the output and educational status though unexpected but might have been due to other factors such as deliberate abuse and misuse of resources in some cases that has nothing to do with the educational status of the farmers concerned. From the results as presented on Table 2, it is evident that variables such as quantity of fertilizer used, educational status and labour were statistically significant at 5% level while other variables in the model were statistically insignificant at any known level of significance in explaining the level of output of cocoa in the study area. The R^2 value of 0.95 indicated that 95% of the changes in the cocoa output were explained or accounted for by the explanatory variables as specified in the OLS model earlier. This result is in congruent with those of [4,16,17].

3.3 Elasticity of Production and Return to Scale of Cocoa

Table 4 showed the elasticity of various inputs used in cocoa production with the overall return to scale in cocoa enterprise among the farmers in the study area. The result showed that farm size, fertilizer and fungicides are positive and less than unity which indicated decreasing positive returns to scale while those of labour and insecticides were negative which indicated inappropriate usage proportions. This means that the former sets of inputs with positive elasticity were utilized in efficient manner and as such have kept the production in rational stage of production (i.e. STAGE II). Meanwhile, the return to scale (RTS) which is the summation of elasticity of various inputs used was 0.956. This showed that the overall cocoa production in the study area is in rational stage of production that is stage II where the overall elasticity of production is less than unity but greater than zero. This form of production is efficient and the return to scale is decreasing but positive in nature. The economic implication of this is that for a unit increment in the combined inputs used in production processes in the study area there was 0.956 corresponding increment in cocoa output.

Table 1. Distribution of respondents according to their Socio-economic characteristics

Variables	Frequency	Percentage
Age (Years)		
0 – 15	27	19.1
16 – 30	06	4.2
31 – 45	57	40.6
46 – 60	47	33.6
61 – 75	03	2.1
	140	**100**
Sex		
Male	107	76.4
Female	33	23.6
	140	**100**
Religion		
Christianity	46	32.9
Islam	94	67.1
	140	**100**
Marital status		
Single	11	7.9
Married	113	80.7
Widow	11	7.9
Widower	05	3.6
	140	**100**
Family Size		
1 – 10	53	37.9
11 – 20	72	51.4
21 – 30	15	10.7
	140	**100**
Farming experience (years)		
0 – 10	12	8.6
11 – 20	73	52.1
21 – 30	55	39.3
	140	**100**
Educational status (years)		
0 – 4	4	2.9
5 – 9	28	20.0
10 – 14	91	65.0
> 14	17	12.1
	140	**100**
Other occupation		
Civil servant	31	22.1
Private business	37	26.4
Others	72	51.4
Total	**140**	**100**

**Field Survey, 2012*

Table 2. Estimates of the production function

Variables	Parameter	Coefficients	Standard error	t- value
Production function model				
Constant	β_0	1.520	0.884	1.719
Farm size	β_1	0.072	0.092	0.786
Insecticide quantity (litre)	β_2	-0.008	0.009	-0.889
Fungicide quantity (litre)	β_3	0.004	0.005	0.780
Quantity of fertilizer used (tonnes)	β_4	9.029	3.024	2.986**
Labour	β_5	-0.005	0.002	-2.653**
Age of farm/cocoa trees (years)	β_6	-0.006	0.041	-0.150
Age of farmer (years)	β_7	0.001	0.011	0.092
Family size	β_8	-0.001	0.024	-0.042
Farming experience (years)	β_9	0.018	0.020	0.899
Educational status (years)	β_{10}	-0.069	0.032	-2.151**
Diagnostic parameters				
R^2	0.950			
Adjusted R^2	0.947			

**Field survey, 2012*

Table 3. Descriptive statistics

Variables	Mean	Minimum	Maximum	SD
Output (tonnes)	20.98	8.99	37.88	8.04
Age of farm (years)	12.70	10.00	17.00	2.34
Age of farmer(years)	45.25	26.00	61.00	9.10
Family size	12.28	1.00	29.00	6.01
Farming experience (years)	18.06	4.00	30.00	6.37
Educational status (years)	12.13	4.44	16.00	2.97

**Field survey, 2012*

Table 4. Elasticity of production and return to scale (RTS)

Variables	Elasticity
Farm size	0.034
Labour	-0.030
Fertilizer	0.957
Insecticides	-0.031
Fungicides	0.026
RTS	**0.956**

**Field survey, 2012*

4. CONCLUSION

With reference to the findings of this study, it is evident that the cocoa production in the study area is productive considering the return to scale (RTS) of 0.956 which showed that for every 100 percent increase in combined inputs used in cocoa production there is corresponding 95.6 percent increase in the corresponding output of cocoa. This means that the production in the study area is in the stage II phase of production that is economically classified as rational stage of production. However, there are still rooms for improvement by adopting more sophisticated methods of production to make the production more technically efficient thereby increasing productivity of cocoa in the study area. This can be achieved by intervention of various stakeholders in the cocoa sub-sector of agriculture with the goal of increasing cocoa output at affordable and technically efficient level. Of the variables tested, quantity of fertilizer used, labour and educational status of the farmers are statistically significant meaning they are the major determinants of cocoa productivity in the study area while other variables were statistically insignificant at any level of significance.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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