



## Economic Analysis and Determinants of Maize Production in Oyo State, Nigeria

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### Abstract

The economics and determinants of maize production in Oyo State, Nigeria were assessed in this study. Data were collected with the aid of a structured questionnaire from 120 maize farmers selected through a multistage sampling procedure. Descriptive statistics, budgetary technique and multiple regression were the analytical tools employed. Findings from the study revealed that majority (90.8%) of the maize farmers are male with an average age of 41 years. Many (58.3%) of the maize farmer attained secondary education and 94.2% married. Budgetary analysis result revealed that a total cost of ₦91,923.18 was incurred per hectare per planting season by the maize farmers with total revenue of ₦180,220.79 and gross margin of ₦120,678.19. The return to investment value of 0.96 implies that for every ₦1 invested in maize farming, ₦1.96 is obtained as returns, with a profit of ₦0.96. Multiple regression analysis revealed that maize profitability is significantly influenced by age ( $p < 0.01$ ), marital status ( $p < 0.05$ ), farming experience ( $p < 0.1$ ), cost of inputs ( $p < 0.05$ ), access to credit ( $p < 0.01$ ) and access to market ( $p < 0.1$ ). Findings from the study concluded that maize production is a profitable enterprise in the study area, although most of the farmers cannot access credit facilities which in turn affected their output level. Farmers are therefore encouraged to join cooperative society to enable them to pool resources together for fund mobilization and increase their credit access as this will stimulate their production and output level, likewise the amount of income and profit realized.

**Keywords:** Costs, Credit, Economic, Maize, Output, Returns

### Introduction

Agriculture is of greatest importance to economic growth, development and industrialization, particularly among the developing countries of the world including Nigeria (Praburaj, et al., 2018; Pawlak and Kołodziejczak, 2020). Mgbakor *et al.* (2014), submitted that no meaningful development can take place in a developing country without the proper development of the agricultural sector as this will bring about self-sufficiency in food production and reduction in the governments' annual spending on food importation which is one of the characteristics of a developed nation. In 2019, agriculture contributed 26.09% to the Gross Domestic Product (GDP), with crop production contributing the largest compared to 8.78% from the oil sector (NBS, 2019). Over 80% of the farmers in the country are subsistence farmers who cultivate few hectares of land but play an essential role in the nations' food security and yet remain poor (FAO, 2015;

Mgbenka and Mbah, 2016). Maize (*Zea mays*) is an important staple food in African countries, especially in Nigeria where it plays a principal role in the food basket of the country (Andersson *et al.*, 2017). Maize is an important cereal crop occupying second place after rice in the diet of most Nigerian households. It is a high yielding crop with several uses ranging from food source in the human diet, a major ingredient in livestock feed production and raw material to many agro-allied industries. Furthermore, maize is also employed in beer and starch production (IITA, 2007; Ogunniyi, 2011). Maize is largely a source of carbohydrate that supplies energy and also other nutrient elements like protein, iron, vitamin B, and minerals.

The demand for maize in Nigeria is increasing at an alarming rate owing to its competitive demand between human foods needs and livestock feed (Sadiq *et al.*, 2013). Ogunsumi *et al.* (2005) submitted that growing

maize by small-scale farmers can subdue hunger among households because food security will be guaranteed, manpower needed to cultivate the land is energized through food provision and the resultant effect could speed up food production. According to the FAO, about 4.7 million tonnes of maize were produced on between 1990 and 2015 in Nigeria and the contribution of maize to total grains produced increased from 8.7% in 1980 to about 22% in 2003. Furthermore, FAO in 2017 reported that Nigeria produced 10.5 Million metric tons of maize in 2016/2017. In spite of the several government programmes over the years like the National Accelerated Food Production Programme (NAFPP), Operation Feed the Nation (OFN), Green Revolution Programme (GRP), Agricultural Development Projects (ADPs) and Maize Multiplication Programme (MMP) implemented over the years to raise farmers efficiency and productivity in maize production, the achievement of output target is still low (Babatunde and Oyatoye, 2005). Furthermore, due to competition for maize as a food source among humans and livestock, there is the need to increase the output level among farmers to meet up with the supply requirements.

Eze and Ibekwe (2007) identified unavailability of timely agricultural credit among other factors as a major factor affecting optimal agricultural output among farmers in Nigeria. Credit availability in farming activities help the farmers to enjoy economies of scale through bulk sourcing of farm inputs, thereby enhancing productivity growth. In addition, Awotide *et al.* (2015) found that in rural areas of developing countries like Nigeria, credit constraints were identified to have significant adverse effects on farm output, farm investment and farm profit. Adebayo and Adeola (2008) further submitted that credit is a catalyst that drives production. It helps in the adoption of modern production techniques that will improve output, promote standard of living by reducing poverty level among small scale farmers. Furthermore, while several works abound on impact of credit use on technical efficiency and profitability of some other crops like cassava, rice among others, very few studies have been conducted on credit use among maize farmers particularly in the study area. This study therefore fills this literature gap. Findings from this study will be of great benefit to the farmers and other stakeholders in the agricultural industry, as it will help highlight those variables that could be better managed to improve maize production and profitability. This study specifically described maize farmers' socioeconomic characteristics; determined the factors affecting maize production and assessed the costs and returns to maize production.

## Methodology

### Study area

The study was conducted in Oyo State, Nigeria. Oyo State is situated in the South-Western part of Nigeria and bounded in the North by Kwara State, in the South by Ogun State and West partly by Ogun State and Benin Republic. It has a land mass of 28,454km<sup>2</sup> and made up

thirty-three (33) Local Government Areas (LGAs) with four Agricultural Development Project Zones (ADP's) and twenty-eight (28) blocks for administrative convenience. The agricultural zones are Ibadan/Ibarapa, Oyo, Ogbomosho and Saki. It is the third most populated city in the country with an estimated total population of 7,010,864 persons (NBS, 2017). The study was carried out in Oyo ADP zone. The inhabitants are mainly agrarian in nature as a result of large expanse of farmlands that supports the cultivation of arable crops. Also, maize was mostly cultivated among the farmers in the study area.

### Sampling procedure

A multistage sampling technique was employed in selecting the maize farmers interviewed for this study. Stage one involved a random selection of one zone (Oyo) from the four Agricultural Development Programme zones in Oyo State. Random selection of 3 blocks out of the 6 blocks from the zone was done in stage 2, which was followed by random selection of 4 cells each from each block, which gave a total of 12 cells. In stage 4, proportionate sampling to size with a minimum of 10 farmers was carried out across the 12 cells to give a total of 120 maize farmers.

### Analytical techniques

Information relating to farmers' socioeconomic characteristics, costs of various inputs, returns associated with maize production was primarily elicited with the aid of a structured questionnaire administered to the farmers. Interview guide was also employed to assist the illiterate farmers. Collected data were analyzed using both descriptive and inferential statistics. Descriptive statistics (frequencies, percentages and tables) were employed for the socioeconomic characteristics, budgetary technique (cost and returns) to estimate the profitability and multiple regression to identify the determinants of profit from maize production.

#### a) Profitability analysis

Determination of profit level in maize farming involved the estimation of the associated costs and returns. The costs of every input employed (fixed and variable), quantity of output (maize) produced in kg and the price per kg. Profitability ratios like Net Farm Income (NFI), Gross Margin (GM) and Benefit - Cost Ratio (BCR) were calculated from the cost and return analysis. The mathematical expressions are stated as follows:

$$\text{Net Farm Income (NFI)} = \text{Profit } (\pi) = \text{TR} - \text{TC} \dots\dots (I)$$

$$\text{Gross Margin (GM)} = \text{TR} - \text{TVC} \dots\dots (ii)$$

$$\text{Benefit-Cost Ratio (BCR)} = \text{TR}/\text{TC} \dots\dots (iii)$$

$$\text{Return on Investment (ROI)} = \text{NFI}/\text{TC} \dots\dots (iv)$$

Where;

Total cost (TC) = Total Fixed Cost (TFC) + Total Variable Cost (TVC)

TR = Total Revenue (₦) = Output (Q) \* Price (P) = PQ

TVC = Total Variable Cost (₦)

TFC = Total Fixed Cost (₦)

According to Olaoye *et al.* (2016), an agricultural venture is profitable provided that  $TR > TC$ ;  $BCR > 1$ ;  $ROI > 0.00$ ; Net Farm Income and Gross margin are positive.

P = Unit price of output (₦/kg)

Q = Total quantity of output, that is maize (kg)

#### b) **Determinants of profit from maize production**

Multiple Regression analysis was employed to examine the determinants of output realized from maize production. This model was explicitly stated in the linear form below:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots \\ \dots \dots \dots + \beta_9 X_9 + u \dots (v)$$

Where:

$Y_i$  = Revenue (profit) from maize production (returns per hectare on maize farmland measured in N)

$\beta_0$  = Intercept

$X_1$  = Age of famers (years)

$X_2$  = Marital status (married 1; 0 otherwise)

$X_3$  = Level of education (number of years spent)

$X_4$  = Household size (number)

$X_5$  = Farm size (hectares)

$X_6$  = Farming experience (years)

$X_7$  = Cost of inputs (naira)

$X_8$  = Access to credit facilities (access = 1; 0 otherwise)

$X_9$  = Access to market (access = 1; 0 otherwise)

u = error term

**A priori expectations** were  $X_2$ ,  $X_3$ ,  $X_5$ ,  $X_6$ ,  $X_7$ ,  $X_8$  and  $X_9$  have a positive relationship with profit level (Y), while  $X_4$  could either have a positive or negative relationship depending on whether the household contributes to production activities or otherwise as well as  $X_1$

## **Results and Discussion**

### **Socio-economic Characteristics of Maize Farmers**

Socioeconomic characteristics of maize farmers in the study area are shown in Table 1. From the result, majority (90.8%) of the farmers are male, while very few (9.2%) are female. This implies that maize farming activity is male dominated, while women are mostly engaged in processing and marketing activities. This is similar to the findings of Nathaniel *et al.* (2015) that most maize farmers are male. Age distribution revealed that a cumulative 80.0% of the farmers are less than 50 years with a mean age of 41.4 years. This means that majority of the farmers are in their active and productive age and therefore best effort can be put in to guarantee optimum productivity. This further corroborates the findings of Oladejo and Ladipo (2012). Majority (94.2%) are married while 2.5% each are single and widowed respectively. Level of education showed that majority of the farmers are literate with as high as 97.4% having one form of formal education or the other, while very few (2.5%) had no-formal education. More than half (58.3%) of the farmers had secondary education. This level of literacy among farmers could bring about more informed decision and possibly increase output level as submitted by Opara (2010) and Adenuga *et al.*

(2013). Large number (56.8%) of the farmers had between 11-20 years farming experience, 28.2% between 1-10 years farming experience; while very few (15.0%) had more than 20 years of farming experience. The mean maize farming experience is 12 years. In terms of household size, majority (81.7%) had between 5-8 persons in their household and very few (5.0%) had between 9-12 persons. The mean household size is 6 persons. Majority (82.5%) of the farmers are small holder farmers who cultivate between 1-3 hectares of farmland, while very few (17.5%) cultivate above 3 hectares of farmland. The mean farm size is 3.2 hectares. Credit accessibility among the farmers is poor as majority (83.3%) lack access to credit facilities, possibly to improve current production status; while very few (16.7%) had access to credit facilities. Majority (88.3%) of the maize farmers had access to marketing facilities that could aid the selling of their products on time, while just a little (11.7%) had no access to marketing facilities.

### **Cost and Returns on Maize Production**

The cost and returns to maize production shown in Table 2 revealed that maize production is a profitable enterprise in the study area given the profitability indices like the Total revenue exceeding the Total cost, Net farm income and Gross margin being positive. Also Rate of return on investment (RORI) is greater than zero. The result revealed that the revenue (TR) realized from maize farming is N180, 220.79. The Total fixed cost (TFC) incurred as N32, 380.58 and this represented 35.2% of the total cost of production. The Total variable cost (TVC) incurred is N59, 542.60 and this represented 64.8% of the total production cost. The total production cost (TC) is N 91, 923.18. Findings revealed that labour cost took the highest share (31.6%) of the total cost in maize production. Fertilizer, maize seeds and herbicide cost accounted for 14.2%, 10.8% and 8.2% of the total cost respectively. This vividly revealed that a huge amount of money is expended on labour and fertilizer procurement in maize production. Depreciation on land, cutlass, hoe, file and wheel barrow constituted 35.2% of the total production cost. The Gross margin or profit from maize production is N120, 678.19. The profit or Net farm income from maize production is N88, 297.61. Furthermore, Rate of return on investment in maize production value of 0.96 implies that on every one naira invested, a return of N1.96 is realized with a profit of N0.96.

### **Determinants of profit from Maize Production**

Multiple regression analysis was used to examine the determinants of profit from maize production in the study area. The result showed on Table 3 revealed that six explanatory variables (age, marital status, farming experience, cost of inputs, access to credit and access to market) are significant factors influencing profitability of maize production at different probability levels. The diagnostic statistics revealed that the model is fit. The co-efficient of multiple determination,  $R^2$  value of 0.987 indicated that 98.7% of the variation in maize profit was jointly explained by the explanatory variables (age,

marital status, farming experience, cost of inputs, access to credit and access to market age, marital status, farming experience, cost of inputs, access to credit and access to market). The estimated coefficients conform to *a priori* expectations. The F-ratio is 900.46 and statistically significant at 1%.

The coefficient of farmer's age ( $X_1$ ) was positive and significant at 1%. This means that as the farmers' age increases, the output from maize production also increases possibly due to mastery and perfection of the technicalities involved in maize production activities. Specifically, one unit increase in the age of the farmer will increase maize output among farmers in the study area by 38.6%. This agrees with the earlier submission of Onyenweaku *et al.* (2010) and Oke *et al.* (2021) that output cum profit level increases with age, possibly due to accumulated knowledge and experience gathered from years of observation and experimentation with various production technologies. Marital status ( $X_2$ ) was statistically significant at 5% but had a negative relationship with maize profit level. This suggests that profit level from unmarried farmers is likely to be higher in the study area than their married counterparts. This may be likely attributed to the fact that married farmers may have more commitments to family matters than farm work or couldn't access resources that can enhance output than their counterparts. Farming experience coefficient ( $X_6$ ) was positive and significant at 10%. This suggests that the more the experience, the more the profit from maize farming. This may probably be due to the fact that perfection sets in with repetition of production activities over time. This result further agrees with the earlier submission of Oyinbo *et al.* (2016) that experience positively influence farmers output level. Cost of inputs coefficient ( $X_7$ ) was positive and significant at 5%. The positive relationship observed also conforms to the *a priori* expectation. The implication of this result is that an increase in the level of input cost possibly due to expansion will increase maize profit level in the study area by 2.7%. This could be achievable in the long run when all fixed inputs are considered variable inputs as a result of optimal usage and expansion level, unlike in the short run when at least one input must be kept fixed in supply. Also, at this expansion stage, output level is meant to increase which implies more input cost and eventually an increase in profit level. This result conform to the earlier findings of positive relationship between input and output as

documented by Adeleke *et al.* (2008); Oyewo, (2011) and Odetola *et al.* (2015). Access to credit facilities ( $X_8$ ) was significant at 1% and also had a positive relationship. This implies that maize farmers who had access to credit facilities will have higher profit levels than those without access. Specifically, access to credit facilities will increase maize profit level among farmers in the study area by 67.4%. This corroborates the earlier findings of Chikezie *et al.* (2012) and Onyekuru *et al.* (2019) who submitted that credit play an important role in agribusiness activities and positively influence output level and its absence affect economic returns. Access to market coefficient ( $X_9$ ) was significant at 10% and had a positive relationship with maize output level in the study area. Access to market facilities will provide an opportunity for the farmers dispose their products on time and as such will encourage the farmers to increase production level which will also increase their profit levels.

Table 4 shows the distribution of the farmers according to the challenges encountered in maize production. Pests and diseases and lack of modern storage facility constituted the major problem facing the farmers as it cut across every one of them. In addition, majority (88.3%) are being challenged with fluctuations in the market price of maize. Another problem encountered was high cost of labour (75.0%).

### Conclusion

The study found that maize farmers were male, married and in their economic active and productive age. They cultivate small hectare of farmlands, lack access to credit facilities and modern storage facilities. Maize farming is a profitable and viable enterprise in the study area from the profitability indices obtained, although cost of labour and fertilizer took a substantial percentage of the total production cost. Major factors influencing maize profit level in the study area include; age, marital status, farming experience, cost of inputs, access to credit and access to market. The study therefore calls for policies targeted at increasing and improving farmers' access to credit and market facilities that would in turn encourage the farmers to increase their scale of production. Maize farmers should organize themselves into groups and possibly join a cooperative society. Modern storage facilities should also be provided to reduce post-harvest losses due to pests and rodents attack.

**Table 1: Socio-economic Characteristics of Maize Farmers**

Personal characteristics	Frequency	Percentage	Mean
<b>Sex</b>			
Male	109	90.8	
Female	11	9.2	
<b>Age (years)</b>			
<30	7	5.8	
30-39	57	47.5	
40-49	32	26.7	
50 and above	24	20.0	41.4
<b>Marital Status</b>			
Single	3	2.5	
Married	113	94.2	
Widowed	3	2.5	
Divorced	1	0.8	
<b>Level of Education</b>			
Non-Formal	3	2.5	
Primary	28	23.3	
Secondary	70	58.3	
Tertiary	19	15.8	
<b>Farming Experience (years)</b>			
1-10	34	28.2	
11-20	68	56.8	
21 and above	18	15.0	12
<b>Household Size</b>			
1-4	16	13.3	
5-8	98	81.7	
9-12	6	5.0	6
<b>Farm Size (hectare)</b>			
1-3	99	82.5	
>3	21	17.5	3.2
<b>Access to Credit</b>			
Access	20	16.7	
Non-access	80	83.3	
<b>Access to market facilities</b>			
Access	106	88.3	
Non-access	14	11.7	

*Source: Computed from Field Survey, 2021*

**Table 2: Costs and returns analysis on maize production**

Items	Mean Cost (naira)	% Total Cost
<b>Revenue</b>		
Quantity of maize (kg)	1,828.91	
Price per kg (naira)	98.54	
<b>Total Revenue (TR)</b>	<b>180,220.79</b>	
<b>Variable Cost</b>		
Maize seeds	9,897.8	10.8
Fertilizer	13,037.8	14.2
Herbicide	7,599	8.2
Labour	29,008	31.6
<b>Total Variable Cost (TVC)</b>	<b>59,542.6</b>	
<b>Fixed Cost (Depreciated)</b>		
Land, cutlass, hoe, file and wheel barrow	32,380.58	35.2
<b>Total Fixed Cost</b>	<b>32,380.58</b>	
<b>Total Cost (TC) = TFC+TVC</b>	<b>91,923.18</b>	100.0
<b>Gross Margin = TR-TVC</b>	<b>120,678.19</b>	
<b>Net Farm Income (NFI) = GM- TFC</b>	<b>88,297.61</b>	
<b>Rate of return on investment (RORI) = NFI/TC</b>	<b>0.96</b>	
<b>Return on investment (ROI) = TR/TC</b>	<b>1.96</b>	

*Source: Computed from Field Survey, 2021*

**Table 3: Regression analysis result of the determinants of profit in maize production**

Variables		Coefficient	Standard error	t-value
Age	X <sub>1</sub>	0.386	0.046	8.35***
Marital status	X <sub>2</sub>	-0.036	0.017	-2.07**
Educational level	X <sub>3</sub>	-0.043	0.034	-1.26
Household size	X <sub>4</sub>	-0.022	0.047	-0.47
Farm size	X <sub>5</sub>	-0.033	0.056	-0.59
Farming experience	X <sub>6</sub>	0.094	0.054	1.74*
Cost of inputs	X <sub>7</sub>	0.027	0.012	2.22**
Access to credit facilities	X <sub>8</sub>	0.674	0.051	13.28***
Access to market	X <sub>9</sub>	0.036	0.019	1.94*
Constant		-596663.39	8958.4	6.66
Number of observation		120		
R <sup>2</sup>		0.987		
Adjusted R <sup>2</sup>		0.986		
F-ratio		900.46		

Source: Computed from Field Survey, 2021

\*\*\*, \*\* and \* denote significance at 1%, 5% and 10% probability levels respectively

**Table 4: Challenges faced by maize farmers in the study area**

Problems	Frequency	Percentage
Fluctuations in market price	106	88.3
Pests and Diseases	120	100.0
Lack of modern storage facilities	120	100.0
High cost of labour	90	75.0

Source: Computed from Field Survey, 2021

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