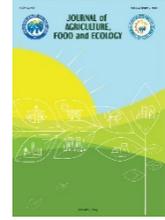




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Profitability Analysis of Maize Farming in North West Nigeria

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Abstract

This aim of the research analyzed profitability of maize farming in North West, Nigeria. Primary data were utilized based on a well-organized questionnaire. The questionnaires were administered to 200 maize producers. The data were analyzed using descriptive statistics, farm budgetary techniques, and Cobb-Douglas regression model. The result shows that approximate 82% of maize producers were male. The mean age of maize producers was 48 years. They are smallholder farmers with an average farm size of 1.12 hectares. The producers had an average of 13 years in maize farming. They are literate, can read and write with an average of 11 years of attending school education. The total variable cost (TVC) and total fixed cost (TFC) was calculated at 200.8 US Dollars and 43.75 US Dollars per hectare, they recorded 82.11% and 17.89% of total cost (TC), respectively. The gross margin (GM) and net farm income (NFI) was estimated at 830.08 US Dollars and 786.32 US Dollars per hectare, respectively. The rate of return on investment (RORI) or return per US Dollar invested in maize farming was calculated at 3.22. This implies that for every one US Dollar invested into maize farming, approximately 3.22 US Dollars are made as revenue, that is approximately 2.22 US Dollars was realized as profit. The significant factors influencing output of maize among producers were labour, farm size, seeds, agrochemicals, and fertilizers. The study concluded that maize farming is profitable in the area. The study recommends that government and private organizations should provide capital in the form of technologies such

as improved seeds, fertilizers, agrochemicals, and machines for mechanized farming to increase productivity. The machines and technologies will reduce drudgery and the cost incurred in maize farming.

Keywords: Socio-Economic Features, Farm Budgetary Techniques, Cobb-Douglas Regression Model, Financial Analysis, Depreciation of Assets

1. Introduction

Maize (*Zea mays*) is one of the most important and significant cereal crop in the sub-Saharan Africa [1]. More than 300 million Africans depend on maize as the major staple food crop, and it has vast potentials to address the challenges of food insecurity in Nigeria [2]. Maize comes after wheat and rice in terms of global importance [3]. The grains are rich in vitamins C, A, and E, essential minerals, protein dietary fibre, and calories [4]. Maize provides food for man, feed for livestock, and raw materials for agro-based industries. Maize can be used to produce starch, alcohol, dextrin, sugar, syrup, corn bread, corn flakes. It is also used for making pap, popcorn, porridge, soup and the grain can be boiled and consumed. Despite the economic importance of maize, it has not been produced to meet the food and industrial needs of the country, this is due to low productivity from maize farms, and the producers have not adopted improved technologies for maize output. There is a demand and supply gap of 4 million metric tons of maize. According to Ibrahim et al. (2008) [5] and Awotide et al. (2008) [6], who noted that use of local seeds, inadequate fertilizer inputs, use of manual labour, and lack of farm land limit the maize output in Nigeria. The resources like fertilizers, pesticides, herbicides are scarce, and when available the resource poor maize producers cannot afford to purchase the required quantities. This study is supported by Lopez et al. (2019) [7] who reported that meeting the increasing food demand calls for intervention that could lead to increased crop productivity. One of the main connection with increased productivity in agriculture has been the use of chemical fertilizers. The use of fertilizers in Africa is generally low compared to other developing regions, this might be because of high fertilizers prices concerning crop prices, and not enough financial resources of the producers, or lack of knowledge of how to use or where to buy fertilizers [8]. According to Alabi and Safugha (2022) [9] who emphasized that low productivity is the main cause of low value added along the maize value chain which leads to high poverty level. Nigeria in 2021 and 2022 produced approximate 12744450 tons and 12948920 tons of maize, which represents 1.06 % and 1.11% of the world output, respectively (Figure 1). Similarly, in Nigeria, the maize area in 2021 and 2022 approximates 6205280 hectares and 5800000 hectares, respectively (Figure 2). The world output of maize in 2021 and 2022 approximates 1207996141.74 tons and 1163497383 tons, respectively (Figure 1). The world area of maize in 2021 and 2022 approximately 205694243 hectares and 203470007 hectares, respectively (Figure 2) [10]. Maize productivity and profitability in Nigeria is low due to traditional methods of farming, land fragmentation, poor irrigation facilities, non-availability of credit, mis-use of modern agricultural technology, and impact of climate change [11]. According to Abdulaleem et. al. (2019) [1] who highlighted that maize output is quite low because maize producers do not have adequate knowledge of resource combination, and the resource available at their disposal is even now well allocated, and this lead to low output. Maize yield is persistently low with widened gaps in Africa compared to the rest of the world over the years. The development economists, food system analyst, policy makers are debating about the continued lags in Africa maize yields, and the design of interventions to overcome these yield gaps.

The previous study of Sadiq et al. (2013) [12] investigated the profitability and production efficiency of small-scale maize production in Niger state, Nigeria. A multi-stage sampling technique was adopted to select 200 respondents. The data was collected with the use of a structured questionnaire. Data from the field was subjected to analysis using descriptive statistics and budgetary technique. The socio-economic characteristics of the farmers show that 67% of the farmers were male. The mean age was 36 years. The cost and returns analysis indicated that maize production was profitable with an average net farm income of 104.38 US Dollars per hectare, and a gross ratio of 0.39, a production efficiency index of 2.50 per farmers.

The study of Adesiyon (2015) [13] focused on economic analysis of maize production in Osun State: a case study of Ilesa East and West of Osun State, Nigeria. A random sampling technique was used to select 100 respondents. Primary data were collected with the aid of a well-structured questionnaire. The data were evaluated using profitability analysis and regression technique. The results show that maize production was profitable with an estimated value of 93 US Dollars per hectare. The regression analysis shows that land, labour, quantity of fertilizers, and level of education were positive and significant factors affecting output of maize, while quantity of maize seeds, herbicides, and insecticides were negative and significant factors affecting maize output.

The work of Taru et al. (2012) [14] investigated the economic efficiency of maize production in Yola north local government area of Adamawa State, Nigeria. A simple random sampling technique was utilized to select 120 maize farmers. The data were analyzed using descriptive statistics and regression analysis. The results show that fertilizer, seed, and land were significant factors influencing the output of maize. The efficiency ratio computed showed that land, seed, and fertilizer were under-utilized. The elasticity of production was greater than one which implies increasing return to scale.

The study of Olarinde (2011) [15] analyzed technical efficiency differentials among maize farmers in Nigeria. A multi-stage stratified random sampling procedure was used to select 300 farmers. The data were analyzed using descriptive statistics and stochastic frontier production models. The significant factors affecting farmers' efficiency level in Oyo State were years of experience in maize farming, extension services, and farm distance. The scale coefficients were 1.801 and 1.258 for Oyo and Kebbi States which indicated increasing returns to scale. The results of the t-test show a significant difference in the mean technical efficiencies between the two states. The mean technical efficiencies were 0.5588 and 0.5758 for Oyo and Kebbi States.

The research of Biswas et al. (2023) [16] analyzed profitability and input use efficiency of maize cultivation in selected areas of Bangladesh. A purposive sampling technique was applied for the study. Primary data were used, the data were analyzed using descriptive statistics, Cobb-Douglas production frontier, profitability analysis, gross return, net return, undiscounted benefit-cost ratio, and input – use efficiency. The results show that the coefficients of land preparation cost, irrigation cost, urea, triple super phosphate and muriate of potash were significant at different levels of probability for marginal, small, and medium maize production. The profit-cost was 1.72, 1.53, and 1.40 for marginal, small, and medium maize production, respectively.

The work of Tuyisenge et al. (2024) [17] investigated the cost-benefit of rice and maize production. A comparison study in Rwangingo, Marshland, Nyagatare and Gatsibo District, Rwanda. A multi-stage sampling technique was employed to select 271 respondents. Primary data were used. The data were analyzed using descriptive statistics, profitability analysis, and stochastic production function. The results showed that labour was statistically significant at 1% and positively affected the output of maize farmers. The capital and labour were statistically significant at 1% and positively affected the output of rice farmers. Maize and rice production gave cost-benefit ratio of 1.5 and 1.9, respectively.

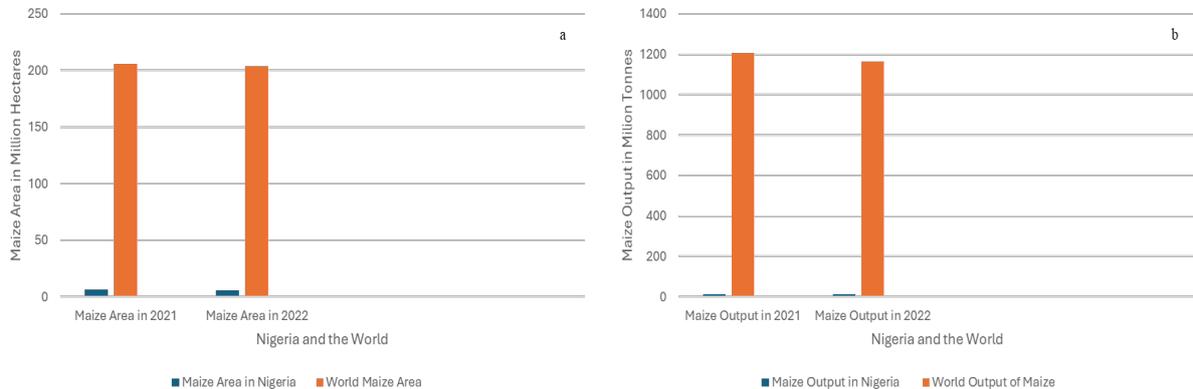


Figure 1. Maize production area (ha) and commodity (tons) (b) in Nigeria and the World

The study proffer answers to the following research questions: (i)What is the socio-economic features of maize producers in the study area? (ii)What is the cost and returns analysis of maize production in the study area? (iii)What are predictors affecting the output of maize producers in the study area? This study analyzed profitability of maize farming in Northwest, Nigeria. Specifically, the objectives include describing the socio-economic features of maize producers, (ii) estimate the costs, returns and profitability of maize production among farmers, and (iii) evaluate the predictors affecting the output among maize producers.

The study was guided by the following hypotheses stated in null forms: (i) Maize production is not profitable in the study area? (ii)The input predictors such as family labour, farm size, seeds, herbicides, fertilizers, hired labour, pesticides, and capital do not have any significant influence on the output of maize farmers in the study area.

2. Materials and Methods

This research was carried out in Northwest which comprise of Kano and Kaduna States, Nigeria. This research utilizes the use of a multi-stage sampling technique. The multi-stage was used for a number of reasons, such as cost reduction, time efficiency, flexibility, and enhances reliability. Additionally, when you have a large population, geographically spread, and you can obtain a probability sample without a complete sampling frame, obtain a more reliable estimate of population parameters such as mean or proportion. You draw a sample from a population using smaller groups or units at each stage. In the first stage, two states were randomly chosen based on the fact they are major maize producing states in the region. In the second stage, 4 local government areas were randomly selected from each stage making a total of 8 local government areas. In the third stage, 2 villages were randomly selected from each local government area making a total of 16 villages. At the fourth stage, a mean – based random sampling approach was utilized to select 200 maize producers within the villages. The sample frame of maize producers consists of approximately 400 respondents. The sample number of 200 respondents comprising of 100 smallholder maize producers selected each from state, respectively. Primary sources of data were utilized based on a well-designed questionnaire that was subjected to reliability and validity test. This sample number was estimated based on the formula advanced by Yamane (1967)[18] as follows:

$$n = \frac{N}{1+N(e^2)} = \frac{400}{1+400(0.05^2)} = 200 \dots \dots \dots (1)$$

Where,

n = The Sample Number

N = The Total Number of Maize Producers (Number for the 2 States)

e = 5%

The data obtained were evaluated using both descriptive and inferential statistics:

Farm Budgetary Technique

The Gross margin analysis (GM) and net farm income (NFI) are one of the farm budgetary tools. The GM is defined as the difference between the gross farm income (GFI) and total variable cost (TVC):

$$GM = \sum_{i=1}^n P_i Q_i - \sum_{j=1}^n P_j X_j \quad (2)$$

$$GM = TR - TVC \quad (3)$$

Where,

GM = Gross Margin in Naira

TR = Total Revenue (₦)

TVC = Total Variable Cost (₦)

NFI = Gross Margin (GM) – Total Fixed Cost (TFC)

$$NFI = \sum_{i=1}^n P_i Q_i - \sum_{j=1}^n P_j X_j - K \quad (4)$$

Where

NFI = Net Farm Income (Naira)

GM = Gross Margin (Naira)

P_i = Price of Maize Output i^{th} ₦/Kg

Q_i = Quantity of Maize Output i^{th} (Kg)

P_j = Price of Input j^{th} (₦/Kg)

X_j = Quantity of Input j^{th} used (Kg)

K = Total Fixed Cost (TFC)

Depreciation of Assets

The straight-line depreciation method is stated as:

$$D = \frac{P - S}{N} \quad (5)$$

D= Depreciation of Farm Production Assets (Naira)

P= Purchase Cost of Farm Asset (Naira)

S= Salvage Value of Farm Asset (Naira)

N= Number of Years of the life span of the Farm Asset (Years)

Financial Analysis

The formula of Gross Margin Ratio (GMR) is defined as:

$$GMR = \frac{\text{Gross Margin}}{\text{Total Revenue}} = \frac{GM}{TR} \quad (6)$$

The operating ratio (OR) is stated thus:

$$OR = \frac{TVC}{GI} \quad (7)$$

Where, OR= Operating Ratio (Units); TVC means Total Variable Cost (Naira); GI is defined as Gross Income (Naira).

The rate of return invested per naira is stated thus;

$$RORI = \frac{NI}{TC} \quad (8)$$

Where, RORI= Rate of Return per Naira Invested (Units); NI= Net income from Maize Production (Naira); TC= Total Cost (Naira).

The Cobb-Douglas Regression Model (CDRM)

The Cobb-Douglas regression model is stated as:

$$\text{Log } Y_i = \beta_0 + \sum_{i=1}^8 \beta_i \text{Log } X_i + \dots + \beta_n \text{Log } X_n + \varepsilon_i \quad (9)$$

$$\text{Log } Y_i = \beta_0 + \beta_1 \text{Log } X_1 + \beta_2 \text{Log } X_2 + \beta_3 \text{Log } X_3 + \beta_4 \text{Log } X_4 + \beta_5 \text{Log } X_5 + \beta_6 \text{Log } X_6 + \beta_7 \text{Log } X_7 + \beta_8 \text{Log } X_8 + \varepsilon_i \quad (10)$$

Where,

Y_i = Output of Maize (Kg)

X_1 = Family Labour (Mandays)

X_2 = Farm Size (Hectares)

X_3 = Seeds (Kg)

X_4 = Herbicides (Litres)

X_5 = Fertilizer Usage (Kg)

X_6 = Hired Labour (Mandays)

X_7 = Pesticides (Litre)

X_8 = Capital (Naira)

β_0 = Constant Term

$\beta_1 - \beta_8$ = Regression Coefficients

ε_i = Noise Term

3. Results and Discussion

Socio-Economic Features of Maize Producers

The summary socio-economic figure of maize producers was presented in Table 1. Averagely, the maize producers were 48 years of age (SD = 9.03). This implies that they are strong, young, energetic, and resourceful. This signifies that they can easily adopt innovations, new research findings, and farm technologies. This result is similar with the outcome of Olasehinde et al. (2023) [2] who obtained an average age of 50 years (SD = 14.932) among maize producers in Nigeria. The maize producers were small-scale farmers with average farm size of 1.12 hectares of farm land. They had about 13 years' (SD= 4.82) experience in maize farming. This outcome is supported by Abdulaleem et al. (2019) [1] who reported an average of 13.8 years farming experience among maize farmers in southwest, Nigeria. He emphasized that high experience among maize farmers help them to cope with risks and uncertainty thus increasing their efficiency and productivity. They had formal education, and can read and write with average of 11 years of attending school education. The household sizes were large with average of 8 people per household. About 92% of maize producers were married. Approximate 87% (SD = 0.36) are members of cooperative organization, this enables them to access to credit, share ideas and information, and sell their maize produce in bulk. Approximate 82% of maize producers were male, while 17% of the respondents were female. This study agrees to the work of Paudel and Matsuoka (2009) [19] who investigated cost efficiency of maize production in Nepal, a case study of the Chitwan district and obtained that the average family members were 6 persons, the age of farmers were 44.95 years, and the maize area was 0.65ha. This work agrees to the outcomes of Ogundari et al. (2006) [20] who investigated economies of scale and cost efficiency in small scale maize production, empirical evidence from Nigeria and obtained an average educational level and farming experiences of 11.82 and 13.60 years, respectively. This study is in line with outcomes of Abdul et al. (2017) [21] who obtained an average age of 39 years and mean household size of 9 people per household among maize farmers in Adamawa State, Nigeria. This work is in line with research of Maurice et al. (2015) [22] who reported a farming experience of 18 years and mean farm size of 2.12 ha among crop farmers in Adamawa State, Nigeria.

Table 1. Summary Features of Maize Producers

Variables	Unit of Measurement	\bar{X}_i	SD
Age	Years	48	9.03
Farm size	Hectare	1.12	0.31
Farming Experience	Years	13	4.82
Formal Education	Years	11	2.14
Household size	Number	8	2.17
Marital Status	1, Married; 0, Otherwise	0.92	0.23
Member of Cooperatives	1, Member; 0, Otherwise	0.87	0.36
Sex	1, Male; 0, Otherwise	0.82	0.37

Source: Field Survey (2024), SD= Standard Deviation

Analysis of Cost, Returns and Profitability of Maize Farming

Estimates of cost and returns together with financial analysis in maize farming is presented in Table 2. The farm budgetary technique which involved the use of gross margin analysis and net farm income was employed. The

various costs incurred and earnings received in maize farming was based on the present market prices at the time of the field survey. The total variable cost (TVC) in maize farming was calculated at 200.83 USD per hectare and this recorded about 82.11% of total cost (TC). The total fixed cost (TFC) was estimated at 43.75 USD per hectare, and this recorded about 17.89 % of TC. The TC is the addition of TVC and TFC, and this was estimated at 244.59 USD per hectare. The gross margin (GM) and net farm incomes (NFI) were estimated at 830.08 USD and 786.32 USD, respectively. This means that maize farming in the area was profitable. The GM ratio and rate of return on investments (RORI) were evaluated at 0.805 and 3.22, respectively. The GM ratio of 0.805 means that for every one USD invested in maize farming, approximately 0.81 USD covered interest, profits, depreciation, and other expenses (marketing and administrative cost). This can be further explained to mean that the maize producers retained 80.5% after accounting for the production cost. That signifies that 80.5% of each Naira earned contributes to covering other expenses and generating net profit. The RORI or return per USD invested in maize farming was calculated at 3.22. This implies that for every one USD invested into maize farming, approximate 3.22 USD is made as revenue, that is approximately 2.22 USD is realized as profit. This finding is supported with results of Alabi and Safugha (2022) [9] who obtained the gross margin ratio of 0.66 among maize producers in Abuja, Nigeria. This outcome is similar with results of Abdulaleem et al. (2019) [1] who obtained GM of 307, 133,27 Naira per hectare among maize farmers in southwest, Nigeria. This study agrees to the work of Ogundari et al. (2006) [20] who reported that the cost of labour accounted for about 66% of the total cost of maize production among farmers in Nigeria, this is because farmers depend heavily on hired labour to do most of the farming operations, thus justify the high cost expended on hired labour. This study agrees to the outcomes of Paudel and Matsuoka (2009) [19] who reported that the cost of labour accounted for 21.07% of the total cost of production among maize farmers in Nepal, this is because of the higher use of family labour for maize cultivation, most farmers were small-scale and do not have enough capital to hire labour and they therefore relied on family labour for most of the farm operations. This study is in line with work of Sadiq et al. (2013) who obtained the net farm income of 305.84 USD and operating ratio of 0.31 among maize farmers in Niger State, Nigeria. This research is also in line with outcomes of Adesiyani et al. (2015) [13] who reported profit of 225 USD and profit-naira ratio of 1.02 among maize farmers in Osun state, Nigeria.

Table 2. The Estimation of Cost and Returns in Maize Production per Hectare

Items	Kg	Value (Naira)	Value (US Dollar)	Percentage of TC
(a) Cost				
TVC		220, 909.61	200.83	82.11
TFC (Depreciated Cost Included)		48, 141.26	43.75	17.89
TC		269, 050.87	244.59	100.00
(b) Returns				
Quantity (2.1 tons)	2,100			
Price per Kg		540	0.49	
TR		1,134,000	1030.91	
GM		913,090.39	830.08	
NFI		864, 949.13	786.32	
(c) Profitability Ratios				
GMR		0.805		
OR		0.19		
RORI		3.22		

Source: Field Survey (2024) 1,100 Naira = 1 US \$, All Abbreviations as Early Defined

The Predictors Influencing Output of Maize Producers

Table 3 displays the predictors influencing output of maize producers. The Cobb-Douglas regression analysis was used to analyzed that data. Five (5) predictors were significantly different from zero in influencing output of maize producers. The five (5) significant predictors were family labour, farm size, seeds, herbicides, and fertilizers. All the predictors included in the Cobb-Douglas regression model had positive coefficients. The coefficient of farm size was 0.239 and was significantly different from zero at 5% probability level in influencing the output of maize producers. A one percent increase in farm size, while keeping all other predictors constant will give rise to 23.9 % increase in output of maize producers. Similarly, the coefficient of fertilizers was estimated at 0.170, and was significantly different from zero at 5 % probability level in influencing the output of maize producers. A one percentage increase in fertilizer usage, while keeping all other predictors constant will give rise to 17.0 % increase in the output of maize producers. The coefficient of multiple determinations (R^2) was estimated at 0.92, this signifies that 92% of variations in the output of maize producers

was explained by the independent predictors included in the Cobb-Douglas model. The F-value of 342.07 was significantly different from zero at 1% probability level. This means that the model is of good fit. This finding is similar with outcomes of Onuk et al. (2010) [3] who obtained that fertilizers, and agrochemicals are significant predictors influencing output of maize in Plateau State, Nigeria. This study agrees with Tuyisenge et al. (2024) [17] who analyzed cost benefit of rice (*Oryza sativa* L) and maize (*Zea mays* L), a comparison study in Rwangingo Mashland, Nyagatare, and Gatsibo District, and obtained that the significant factors influencing output of maize include seed and labour, respectively. The coefficients of hired labour, pesticides, and capital were not significant in influencing the output of maize farmers. The non-significance of hired labour and pesticides might be due to high cost of the inputs. In addition, capital is not significant in affecting the output due to inability of the farmers to access credit for farm operations. This study is in line with research of Taru et al. (2012) [14] who reported that herbicides and hired labour are not significant in influencing the output of maize in Adamawa State, Nigeria. This work is in line with outcome of Adesiyan (2015) [13] who reported that land, labour, quantity of fertilizer, and level of education were significant factors affecting output of maize among farmers in Osun State, Nigeria.

Table 3: The Cobb-Douglas Regression Result of Factors Influencing Output among Maize Producers

Variables	Parameters	Coefficient	Standard Error	t-Value	
Constant	β_0	1.390**	0.5429	2.56	
Family Labour	β_1	0.132 **	0.0473	2.79	
Farm Size	β_2	0.239**	0.9876	2.42	
Seeds	β_3	0.274**	0.1109	2.47	
Herbicides	β_4	0.201**	0.0841	2.39	
Fertilizers	β_5	0.170**	0.0748	2.27	
Hired Labour	β_6	0.013 ^{NS}	0.0119	1.09	
Pesticides	β_7	0.028 ^{NS}	0.0231	1.21	
Capital	β_8	0.034 ^{NS}	0.0259	1.31	
R^2	0.92				
Adjusted R^2	0.90				
F-Value	342.07***				

Source: Field Survey (2024), NS – Not Significant

*Significant at ($P < 0.10$)., **Significant at ($P < 0.05$), ***Significant at ($P < 0.01$).

4. Conclusion

This study analyzed cost and returns of maize production among farmers in North West, Nigeria. The primary data were utilized based on a well-designed questionnaire administered to 200 respondents using well-trained enumerators. The following conclusion were made based on the null-hypotheses of the study stated:

Maize production is not profitable in the study area?

The gross margin (GM) and net farm income (NFI) per hectare of maize farms was calculated at 830.08 USD and 786.32 USD. The rate of return on investment (RORI) was calculated at 3.22. This confirmed that maize farming was profitable in the area. The null-hypothesis which state that maize production is not profitable in the area was rejected, while the alternative hypothesis which state that maize production was profitable in the area was accepted. This study agrees to the work of Girei et al. (2018) [23] who reported that maize farming was profitable in Nasarawa State, Nigeria with an estimated gross margin and net farm income were 557.31 USD and 482.36 USD, respectively. This study is in line with the outcomes of Sadiq et al. (2013) [12] who obtained net farm income of 305 US Dollars per hectare with outcomes of Adesiyan (2015) [13] who obtained a profit of 225 US Dollars and profit-naira of 1.02 among maize farmers in Osun State, Nigeria.

The input predictors such as family labour, farm size, seeds, herbicides, fertilizers, hired labour, pesticides, and capital do not have any significant influence on the output of maize farmers in the study area.

The input predictors in the Cobb-Douglas production function had positive signs and the coefficients were statistically significant in affecting the output of maize farmers. The coefficients of input predictors were estimated as follows family labour (0.132), farm size (0.239), seeds (0.274), herbicides (0.201), and (0.170), hired labour (0.013), pesticides (0.028), capital (0.034). Therefore, the null-hypothesis which stated that the input predictors such as family labour, farm size, seeds, herbicides, fertilizers, hired labour, pesticides, and capital do not have any significant influence on the output of maize farmers in the study area was rejected, while the alternative hypothesis was accepted. This study agrees to the work of Abdulaleem et al. (2019) [1] who reported that farm size, quantity of fertilizers, and capital input were significant factors influencing output of maize

farmers in South west, Nigeria. This study is in line with work of Taru et al. (2012) [14] who reported that land (0.750), seed (0.065), herbicides (0.410) were significant factors influencing output of maize among farmers in Adamawa State, Nigeria.

Based on the outcomes, the following suggestions were made:

- (i) Credit Policy: Credit facilities should be made available to maize producers at single digit interest rate devoid of cumbersome administrative procedures to increase output.
- (ii) Cooperative Groups: The maize producers should join cooperative organizations for easy access of credit and farm inputs, and for them to share ideas and information about maize farming. The cooperative groups, will enable the maize farmers purchase capital inputs at appropriate time and have access to technologies such as improved seeds, fertilizers, agrochemicals, and machines for mechanized farming to increase productivity. The machines and technologies will reduce the cost incurred in maize farming.
- (iii) Extension-Farmers Contact: Extension officers should be employed by government and private organizations to disseminate innovations and research findings to maize producers. The extension agents will also organize workshops, seminars, and capacity buildings for maize farmers
- (iv) Policies on Youth Involvement in Agriculture: Policies should be enacted by government to encourage youth involvement in maize farming.

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References

- [1] Abulaleem, M.A., Oluwatusin, F.M & Ojo, O.S. (2019). Efficiency of Maize Production among Smallholder Farmers in Southwest, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology*, 30 (4), 1 – 10
- [2] Olasehinde, T.S., Qiao, F., Mao, S. (2023). Impact of Improved Maize Varieties on Production Efficiency in Nigeria: Separating Technology from Managerial Gaps. *Agriculture*, 13, 611. <https://doi.org/10.3390/agriculture13030611>
- [3] Onuk, E.G., Ogara, I.M., Yahaya, H & Nannim, N. (2010). Economic Analysis of Maize Production in Mangu Local Government Area of Plateau State, Nigeria. *Production, Agriculture, and Technology*, 6, (1), 1 – 11
- [4] Muhammed, S (2013). Determinants of Grain Production and Technical Inefficiencies in Ethiopia. *Journal of Agricultural Economics*, 49, 2, 171 – 184.
- [5] Ibrahim, F.D., Alhassan, Z.S., Ibrahim, M & Ibrahim, P.A (2008). Private Sector (Candell Company) and Boosting Maize Production: A Case Study of R-Box Technology Adoption in Badeggi, Bida Local Government Area of Niger State, pp 136 – 145
- [6] Awotide, D.O., Fashina, O.M., Ologbonjo, A.C., & Agbola, P.O (2008). Relationship between Credit Access and Technical Efficiency of Maize Farmers in Abeokuta North Local Government Area of Ogun State, Nigeria. In: E.A. Aiyedun, P.O. Idisi & J.O. Nmadu (Eds). Proceedings of the 10th Annual National Conference of the Nigerian Association of Agricultural Economics, 7 – 10 October, 2008, University of Abuja, Abuja, Nigeria, pp 259 – 266.
- [7] Lopez, G., Kolem, H.B., Srivastava, A.K., Gaisaer, T & Ewert, F (2019). A Model-Based Estimation of Resource Use Efficiencies in Maize Production in Nigeria. *Journal of Sustainability, MDPI*, 11, 5114
- [8] Morris, M., Kelly, V.A., Kopicki, R.J., & Byerlee, D (2007). Fertilizer Use in African Agriculture: Lessons Learned and Good Practice Guidelines, The World Bank, Washington, DC, USA, 2007.
- [9] Alabi, O.O., & Safugha, G.F. (2022). Efficiency of Resource-Use and Marginal Value Productivity Analysis Among Maize Farmers, Abuja, Nigeria. *International Journal of Agriculture, Forestry and Life Sciences*, 6(2):28-33.
- [10] FAO (2024). Food and Agriculture Organization, Data Base, Rome, Italy, 2024
- [11] Chandio, A.A., Jiang, Y Gessesse, A.I & Dunya, R (2017). The Nexus of Agricultural Credit, Farm Size, and Technical Efficiency in Sindh, Pakistan: A Stochastic Production Frontier Approach. *Journal Saudi Soc Agric. Sci.* <https://doi.org/10.1016/j.sas.2017.11.001>
- [12] Sadiq, M.S., Yakassai, M.T., Ahmad M.M., Lapkene, T.Y., & Abubakar, M (2013). Profitability and Production Efficiency of Small-Scale Maize Production in Niger State, Nigeria. *IOSR Journal of Applied Physics*, 3 (4), 19 – 23
- [13] Adesiyun, O.F (2015). Economic Analysis of Maize Production in Osun State: A Case Study of Ilesa East and West of Osun State, Nigeria. *Journal of Economic and Social Development*, 6 (9), 268 – 272.
- [14] Taru, V.B., Lamba, C & Jare, N (2012). Economic Efficiency of Maize Production in Yola North Local Government Area of Adamawa State, Nigeria. *Agro-Science Journal of Tropical Agriculture, Food, Environment and Extension*, 11 (2), 1 – 8.
- [15] Olarinde, L.O (2011). Analysis of Technical Efficiency Differentials among Maize Farmers in Nigeria. African Economic Research Consortium, Nairobi, Pg 1 – 27.
- [16] Biswas, R., Molla, M, M,U., Faisal-E-Alam, M., Zonayet, M & Castanho, R.U (2023). Profitability Analysis and Input Use Efficiency of Maize Cultivation in Selected Areas of Bangladesh. *Land* 12, 23

- [17] Tuyisenge, H.N., Bizoza, A.R., Manirere, J.D., & Mutamuliza, E (2024). Cost Benefit Analysis of Rice (*Oryza sativa* L.) and Maize (*Zea mays* L.). A Comparison Study in Rwangingo Marshland, Nyagatare and Gatsibo Districts. *International Journal of Progressive Sciences and Technologies*, 42 (2), 281 – 292.
- [18] Yamane, T. (1967). *Statistics: An Introductory Analysis*, 2nd Edition., New York: Harper and Row. Pp. 33-50.
- [19] Paudel, P & Matsuoka, A. (2009). Cost Efficiency Estimates of Maize Production in Nepal: A Case Study of the Chitwan District. *AGRIC. ECON-CZECH*, 55, (3), 139 – 148.
- [20] Ogundari, K & Ojo, S.O. (2007). Economic Efficiency of Small Scale Food Crop Production in Nigeria: A Stochastic Frontier Approach. *Journal of Social Science*, 14 (2), 123 – 130.
- [21] Abdul, M., Tashikalma, A.K., Maurice, D.C & Shittu, F.M (2017). Analysis of Cost Efficiency of Rain-Fed Maize Production in Yola South Local Government Areas of Adamawa State, Nigeria. *Global Journal of Agricultural Sciences*, 16, 67 – 73.
- [22] Maurice, D.C., Adamu, Y & Joseph, M (2015). Analysis of Cost Efficiency in Food Crop Production among Small-Scale Farmers in Adamawa State, Nigeria. *Global Journal of Agricultural Sciences*, 14, 17 – 25.
- [23] Girei, A.A., Saingbe, N.D., Ohen, S.B., & Umar, K.O (2018). Economics of Small-Scale Maize Production in Toto Local Government Area, Nasarawa State, Nigeria. *Agrosearch*, 18 (1), 90 – 104.