



### DETERMINANT FACTORS OF TECHNICAL EFFICIENCY IN YAM PRODUCTION IN MORO LGA, KWARA STATE, NIGERIA

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## ABSTRACT

This paper investigates the determinants factors of technical efficiency using the stochastic frontier production function which incorporates the inefficiency model. A sample of 150 yam farmers were randomly selected from 17 wards of Moro LGA in Kwara State, Nigeria. Data was collected from the respondents with the aid of a structured interview schedule. The empirical result showed that land size, fertilizer, seedling, and use of herbicides were the main factors determining technical efficiency while age, experience, household size and contact with extension agent were the main determinants of the technical inefficiency of yam farmers. The mean technical efficiency was 0.636 which means that 36.4% of the technical output was not achieved. The result also indicates that land size, fertilizer, seedling, and herbicides are significant in yam production. And a significant relationship between age, household size, extension contact and years of experience and the output of the yam producers as it influences their technical efficiencies. The study concludes that land size, fertilizer, seedling, and use of herbicides were the main factors determining technical efficiency while age, experience, household size and contact with extension agent were the main the main determinants of inefficiency and thus recommends youths be encouraged to form cooperative organization and into yam production with attractive incentives like easy access to farm inputs, cooperate financing, easy exposure to markets.

Keywords: Technical efficiency, Inefficiency, Yam farmers, Stochastic, Moro LGA.

## INTRODUCTION

Yam belongs to the genus "Dioscorea" and family "Dioscoreaceae", a tropical crop with many species, which originated from Southeast Asia and was brought into West Africa in the 16th century. Out of the Countries that produces yam, Nigeria stands out, accounting for over 70% of the world production (Food and Agriculture Organization (FAO, 2020). According to the food and Agricultural Organization report, Nigeria produced 18.3 million metric tons of yam from 1.5 million hectares, representing 73.8 percent of total yam production in Africa (FAO, 2019).

The increase in yam production in Nigeria is almost at an exponential rate. This is evident by the fact that yam production increased from 45,409.800 tons in 2016 to 46,912.650 tons in 2017 at end of the year with an average of 30,343.870 tons between 1995 and 2017. According to the National Bureau of Statistics (2017), The highest production was 46,912.650 tons in 2017 and lowest was 22,522.500 tons in 2001 (NBS, 2017).

Over the years, the farm hectare of yam production has been increasing with corresponding increases in the usage of inputs. Unfortunately, the increase in output seems not to have been commensurable with those in input usage (Reuben and Barau, 2012). However, the Nigerian Government made concerted efforts to encourage larger investment in the agricultural sector, including product such as yam for export. In 1998, the Nigerian Government initiated an Export Promotion Incentive Scheme. Under this scheme, some staple





foods including yam were delisted from the export prohibition list. In 2001, the Nigerian Government initiated the Root and Tuber Expansion Program (RTEP) to improve farmers' productivity and profits from root and tuber crops (Niger State Bureau of Statistics, 2012). In 2003, an export subsidy of 10% on agricultural commodities was introduced and remained in place till date (Akande and Ogundele, 2009).

Despite the government initiatives, Oladeebo and Okanlawon (2010) noted that the absolute level of yam production has remained static over a decade. Agbaje *et al.* (2005), further averred that major tuber crops have too low outputs to justify the increasing cost of modern farming inputs especially fertilizer. The last three decades have not only witnessed a decline in the role of yam production but also a decline in the traditional role of agriculture to drive the economy. Increased agricultural output is however required for reduction of widespread hunger and poverty. It is not new that a large chunk of agricultural outputs is presently being produced by resource poor farmers with low income and high incidence of poverty (Ugwumba and Omojola, 2012). This static trend may not be unconnected with production resources which are not being efficiently utilized.

The problem is there are many obstacles impending yam production in the study area, these are insufficient input, problem of pest and diseases, farmer to headers, and unpredictable weather. For these reasons, farmers tend to produce yam inefficiently, this necessitates the research to find out or identify the factor militating against the achievement of farmers objective which is optimum production in the study area. The objectives of the study are to identify the determinants of technical efficiency of yam production and the factors impeding on technical efficiency of yam production in the study area.

Oluwatusin (2014) worked on the technical; efficiency of yam using the stochastic parametric approach. The work revealed that the cost of vam sett used, labour used, and farm size were significantly different from zero and of importance in production of yam. Also, the year of formal education, farming experience and access to credit were the main socioeconomics characteristics affecting the technical inefficiency of yam farmers. In addition, the technical efficiencies of the yam farms ranged between 0.343 and 0.962 with a mean of 0.698. This shows that on the average, farmers were able to obtain about 70% of potential output from a given mix of inputs. Ndubueze-Ogaraku et al. (2021) examined the determinants of the technical efficiency of small holder yam farmers in Nigeria. Their results suggested that farmers were fairly educated and mainly males (75%) with a mean age of 36 years. Farmers level of education and their age showed negative influence on technical efficiency, while household size and farming experience showed positive influence on technical efficiency. MLE estimates indicated that coefficients of farm size and yam seedlings were significant at 5% while fertilizer and labour were not significant. Mean efficiency of yam farmers was 94.6%, indicating an allowance of 5.4% for improvement. Ekunwe and Orewa (2017) worked on the technical efficiency and productivity of yam in Kogi state. Their research revealed that most of the respondents were males with a mean age of 53 years. Furthermore, their findings showed that the technical efficiency of the farmers varied from 0.05-0.95 with a mean of 0.62, while only about 23% of the farmers had a technical efficiency exceeding 0.80. Their findings also showed that yam production is profitable in the state with a profit of \$108,299.67/ha. Chisonum *et al.* (2021) worked on the technical efficiency of resources used among yam producers in Delta State. There was presence of technical inefficiency effects in yam production, although technical efficiency was found to be high with a mean technical efficiency of 0.83 and with 79.3% of the respondents having technical efficiency of 0.80 and above. The educational level of the respondents, extension agent visit, and household size were found to be the variables that contributed to technical efficiency achievement of the farmers.





Furthermore, Okeoghene *et al.* (2013) examined the determinants of yam production and resource use efficiency under agro forestry system in Edo state. Their result revealed that farm size, yam seed and years of farming were significantly positive to yam production in the area. The results of the efficiency estimation, however, indicated that farm size (1.55), yam seed (1.5) were underutilized while hired labour (0.24), hoes (0.46) and machetes (0.32) were over-utilized. The regression also showed that the farmers were in the first stage of production which is increasing return to scale (using the elasticities). Adesiyan *et al.* (2016) analyzed the economics of yam production and efficiency among small holder farmers in Southeastern Nigeria. The results indicate that labour and material inputs are the major factors that influence changes in yam output. The effects of selected farmer-specific socio-economic characteristics on observed inefficiencies among the farmers were also examined. Farmer-specific variables, such as education, farming experience and access to credit, were the significant factors implicated for the observed variation inefficiency among yam producers.

Ariyo *et al.* (2020) also worked on the challenges hindering yam production in the study area and they found out that Inadequate capital and planting materials, high cost and inaccessibility to inputs, and poor produce price etc. are the problems of yam production. Furthermore, Idumah and Owombe (2020) examine the challenges hindering yam production and found out that, lack of credit facilities, inadequate storage facilities and the inconsistent policies by the government were the main challenges hindering yam production are problem of land tenure system, consistent inconsistency by the government, unfavorable government policies and lack of credit facilities. Tanko and Alidu (2017) also examined the constraints hindering yam production in Northern Ghana and they found out that problem of land ownership, inadequate credit facilities and insufficient inputs are the main problems to yam production was inadequate credit facilities and formulation of unfavorable policies by the government.

# MATERIALS AND METHODS

### The Study Area

Moro local government was created out of the Ilorin Native Authority in 1976. It shares boundaries with Oyo and Niger State respectively. The headquarters is located at Bode-Saadu. The Local Government has 17 wards. (Alara, Ajanaku, Arobadi, Babadubu, Bode-Saadu, Ejidongari, Jebba, lanwa, logun/jehunkunnu, Oloru, Pakunmo, Womi/Ayaki, Shao, Gbugudu/Malete, Okutala, Okemi and Megida). It has an area of 3,272 km<sup>2</sup> and a population of 108,792 at the 2006 census. Its' major towns are Bode-Saadu, Ipaiye, Lanwa, Ejidongari, Olooru, Malete, Jebba, Arobadi, and Elemere. The predominant languages are Yoruba, Hausa, and Fulani. Moro is famed for its Yam, Corn, Cassava, Groundnut and Rice farms. It also has large deposits of mineral resources such as Granite, Talc, Dolomite, Tin, Stone, Marble, and Silica sand (Kwara State Government [KSG], 2020). Primary data was used for this research. **Sampling Procedure** 

A three-stage sampling technique was used. In the first stage, five wards were randomly selected from 17 wards in the Local Government. At stage two, five villages were randomly selected at each of the five wards previously picked. At the final stage, ten yam farmers were randomly selected from each of the five villages picked out. A total of 150 yam farmers were used for the study.





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# Method of Data Collection

The data was collected with the use of a structured questionnaire for information on efficiency of yam production. Data was collected on the demographic variables and production information.

# Method of Data Analysis

The SF approach is appropriate for agricultural application, especially in developing countries where the data are heavily influenced by measurement errors and the effects of weather (Bekele, 2003). The stochastic frontier function used by Onu *et al.* (2000) and Parikh and Shah (1995) as derived from the error model of Aigner *et al.* (1977) were employed to achieve technical efficiency of yam production and the determinants of technical efficiency of yam production in the study area. The Cobb-Douglas production function was fitted to the frontier model of yam production.

The stochastic frontier production function model was specified as:

 $Y = f(Xi, \beta) + e$ 

where;

Y is output in a specified unit,

X denotes the actual input vector,

 $\beta$  is the vector of production function parameters and

e is the error term that is decomposed into two components, V and U where:

Yi = Output of the ith farm

Xi = Vector of inputs used by the ith farm

 $\beta$  = A vector of the parameters estimated ei = Composite error term

Vi = Random error outside farmer's control

Ui = Technical inefficiency effects

The specific model is explicitly written as:

 $LnY_{j} = \beta_{0} + \beta_{1}Ln X_{1} + \beta_{2}LnX_{2} + \beta_{3}LnX_{3} + \beta_{4}LnX_{4} + \beta_{5}LnX_{5} + \beta_{6}LnX_{6} + ei \qquad \dots (2)$ where;

 $Y_i$  is output of Yams (kg)

J is 1, 2, 3 ... 360 Yam farmers.

 $\beta_0 = \text{Constant}$ 

 $\beta_1 - \beta_6 =$  Parameters estimated

 $X_1 =$ land size(hectares)

 $X_2 =$ fertilizer (kg)

 $X_3 = seedling (kg)$ 

 $X_4 =$  herbicides (litres)

 $X_5 = pesticides (litres)$ 

$$X_6 = labour (man-days)$$

Ui = Technical Inefficiency for the ith term

 $\beta_i$  is regression coefficients of inputs (input elasticities) and

 $e_{i=}v_i - u_i$  is the error term.

The inefficiency model is given as:

$$U_{ii} = \delta_0 + \delta_i \, \mathbf{Z}_{IJ} \qquad \dots (3)$$

Where  $U_{ii}$  is the inefficiency. An explicit equation can be expressed as

$$U_{ij} = \delta_0 + \delta_1 Z_{i1} + \delta_2 Z_{i2} + \delta_3 Z_{i3} + \delta_4 Z_{i4} + \delta_5 Z_{i5} + \delta_6 Z_{i6} \qquad \dots (4)$$
  
where;





- $U_i$  = technical inefficiency of the ith farmer
- $\delta 1 \delta 6$  = Parameters to be estimated
- $Z_1 =$  Farmer's age (years)
- $Z_2$  = years of farming experience of the ith farmer in yam production
- $Z_3$  = Household size of ith farmer (number of people)
- $Z_4$  = years of formal education of the ith farmer
- $Z_5$  = contacts with extension agents measured as dummy (yes = 1, otherwise = 0)
- $Z_6$  = gender of the ith farmer measured as dummy (male = 1, otherwise = 0)

### **RESULTS AND DISCUSSION**

The distribution of farmers technical efficiency indices derived from the analysis of stochastic frontier production function was provided in Table 1. The result showed that 34% of the farmers had attained between 0.71 and 1 efficiency level. 48.7% of the farmers attained technical efficiency of below 0.5, while 34% attained technical efficiency of over 0.7. The magnitude of the mean efficiency reflects the fact that most sampled farmer carry out food production under technical condition involving the use of inefficient tools, unimproved seedlings, under application of fertilizer etc.

The technical efficiency of the sampled farmer was less than 1, indicating that they are producing below the maximum efficiency frontier. A range of technical efficiency was observed across the sampled farms where the spread was large. The best field had technical efficiency of 0.932, while the worst field had 0.173. The mean technical efficiency was estimated to be 0.636 which implies that about 36.4% of technical output was not achieved. This implies that on the average, the respondent farmers were able to obtain 63.6% of optimal output from the given mix of production inputs.

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Efficiency class	Frequency	Percentage
Less than 0.5	73	48.7
0.5-0.6	14	9.3
0.6-0.7	12	8.0
0.7-0.8	11	7.3
0.8-0.9	29	19.4
0.9-1.0	11	7.3
Total	150	100
Mean	0.636	
Standard deviation	0.174	
Minimum	0.173	
Maximum	0.932	

**Table 1:** Frequency distribution of technical efficiency estimates

## **Determinant Factors of the Technical Inefficient in Yam Production**

The estimation of the stochastic frontier model shows that land size, fertilizer, herbicide, and seedling are all significant to attaining technical efficiency. Land size was found to be positively significant at 1% level. This implied that the higher the land size, the higher the technical efficiency. This is in line with work of Tanko and Alidu (2017) which opined that land size is a key factor in determining profit efficiency of yam producers. Fertilizer coefficient was positive and significant. This showed that the higher the use of fertilizer, the higher the technical efficiency, it corroborates the work of Adesiyan *et al.* (2016) which opined that fertilizer use may contribute positively to technical efficiency of yam production. This is





evident for the fact that land use increases the use of fertilizer. It is also in tandem with the work of Okeoghene *et al.* (2013) which intimated that high use of input such as fertilizer increases the technical efficiency of yam production. The result revealed that seedling was negatively significant, implying the more the use of seedling the more it reduces the technical efficiency of yam. This is truer as it will result in planting over population. Herbicide coefficient was found to be positive and significant. It is an indication that the use of herbicide increases the technical efficiency of yam production.

The parameter estimate of the inefficiency model indicates that age, experience, household size and extension contact significantly affect the technical inefficiency of yam producers. Age and extension visits affect inefficiency negatively and significantly which means that the higher the age and extension visits, the lower the inefficiency. Years of farming experience and household size had a positive and significant effect on the inefficiency of yam production. This is an indication that the higher the years of farming experience and household size, the higher the technical inefficiency of yam producers. In the same vein, pesticides, labour, and cost of land were found to be positively related to technical efficiency but not significant.

The value of lambda (1.4331) is significant and well above zero. This implied that inefficiency is rejected at 1 %.

Variables	Coefficient	Std. Error	t-ratio	p-value
Efficiency model				
Cost of land	1.54265e+06	2.41431e+06	0.6390	0.5246
Land size	4861.64	1164.99	4.173	0.0001***
Fertilizer	4334.23	1076.15	4.028	0.0001***
Seedling	-3793.12	1025.90	-3.697	0.0004***
Herbicides	781.263	400.570	1.950	0.0545*
Pesticides	160.851	317.711	0.5063	0.6140
Labour	170.556	218.778	0.5071	0.7140
Inefficiency model				
Age	-140647	58641.2	-2.398	0.0187**
Experience	178078	87307.3	2.040	0.0446**
Household size	156694	75996.2	2.062	0.0423**
Education	116701	112184	1.040	0.3012
Extension contacts	-1.98810e+06	567880	-3.501	0.0007***
Sex	-1.37241e+06	805423	-1.704	0.9921
Diagnostic statistics				
Sigma squared ( $\delta^2$ )	0.613811**			
Gamma (y)	0.834483**			
lambda	1.4331			
Ν	150			

**Table 2:** Determinants of Technical Efficiency and Inefficiency

### CONCLUSION AND RECOMMENATIONS

The research work showed that most yam farmers are above their youthful age and are educated. It also shows that land size, fertilizer, seedling, and use of herbicides were the main factors determining technical efficiency while age, experience, household size and contact with extension agent were the main the main determinants of inefficiency. The study thus recommends that youths be encouraged to form cooperative organisation and into yam





production with attractive incentives like easy access to farm inputs, cooperate financing, easy exposure to markets.

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