Journal of Agripreneurship and Sustainable Development (JASD)
www.jasd.daee.atbu.edu.ng; Volume 6, Number 1, 2023
ISSN (Print): 2651-6144; ISSN (Online): 2651-6365

TECHNICAL EFFICIENCY OF YAM PRODUCTION IN PAIKORO LOCAL GOVERNMENT AREA OF NIGER STATE, NIGERIA

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ABSTRACT
The study examined technical efficiency of yam farmers in Paikoro Local Government Area of Niger State, Nigeria was analyzed using the stochastic frontier production model. Data were collected from 90 yam farmers selected using simple random sampling technique. The data were collected with the aid of structured questionnaire and oral interview were analyzed using Descriptive statistics, stochastic frontier production function. The maximum likelihood estimate (MLE) of the stochastic frontier model production function revealed that the inputs were under-utilized the results of the socio-economic characteristics shows that yam farmers was dominated 50% by male farmers, within the range of 46- 55 years, 47% of the farmers had farm size less-than 1 hectare with at least 10 years' experience. The technical efficiency of farmers differs substantially among the respondents, ranging between 0.325 and 0.952 with a mean economic efficiency of 0.807.

Keywords: Technical efficiency, Productivity, Stochastic frontier, Yam production.

INTRODUCTION
Yam is one of the principal root crops in Nigeria both in terms of land under cultivation and in volume and value of production. It's one of the rich in carbohydrate that are nutritionally superior to most roots and tubers in terms of digestible proteins and minerals like Calcium, Magnesium and Potassium. (Ebewore *et al*., 2013). Tuber crops, such as yam has high relative value per unit of land used in its cultivation when compared with other crops particularly, the cereals (Mbah, 2010). As a food crop, yam has inherent characteristics. Firstly, it is rich in carbohydrates especially starch and has a multiplicity of end use. Secondly, it is more resistant to drought, pest and disease and tolerates different climatic and edaphic conditions (Ugwumba and Omojola, 2012).

Yam is an important source of income for some value chain participants. Yam comprised 32% of farmers' gross income from crops for farmers in eastern Nigeria. The share of the value of yam farm gate sales (31%) was second only to cassava (37%) out of the nine major food crops compared in Nigeria in 2004 (Sanusi and Salmonu, 2010). The higher nutritional quality and market value commanded by yam when compared with other crops like cassava, have encouraged greater investment by the Nigerian government and foreign donors to increase production and improve yam marketing efficiencies to enhance income and food security levels for smallholders. Main initiatives include: Yam Improvement for Income and Food Security in West Africa project and the National Root and Tuber Expansion Programme (Agbaje *et al*., 2010).

MATERIALS AND METHODS
The Study Area
The study was conducted in Paikoro local government area of Niger State, Nigeria. The area which lies between latitudes 926'N to 6:38'E North and longitudes 6.9East to 7.0 East.

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With its headquartered in the town of Paiko about 25 km north to the state capital Minna, Niger State. The State covered a land area of 20,066 Square Kilometers of which about 85% is arable. It has an estimated population of 222,200 people and 7.27 fertility rate. (City population, 2016).

Sampling Procedure

A multi-stage sampling technique was adopted for the study. The first stage entailed purposive selection of Paikoro local government area due to its prevalence production of yam. In the second stage, involves the selection of three (3) villages from the chosen local government area.

The third stage was a random selection of 30 yam farmers from each of the chosen villages to gives a total of 90 sampled farmers for the study.

Analytical Technique

Descriptive statistics such as the mean, frequency distribution, percentages were used to describe the socio-economic characteristics of the respondents. The Stochastic Frontier Production function was adopted using the Cobb-Douglas functional form was used to analyze the technical efficiency of yam farmers in the study area. Functions such as this has been used in other studies to determine technical efficiency of agricultural production (Bakhsh *et al.*, 2006; Erhabor and Emokaro, 2007; Binuomota *et al.*, 2008). Stochastic production function is written as:

where;

Yi = Quantity of output of the farm

The explicit form of stochastic production frontier is specified as:

$\ln Y = \beta o + \beta_1 \ln X_1 i + \beta_2 \ln X_2 i + \beta_3 \ln X_3 i + \beta_4 \ln X_4 i$

where;

ln = The natural logarithm

Y = Output of yam (kg)

βo = Constant term

B_1-β_4 = Regression coefficients

X_1 = Quantity of yam sett (kg)

X_2 = Quantity of fertilizer (kg)

X_3 = Total labour used (man day)

X_4 = Quantity of agrochemical (litres)

The stochastic Frontier Cost Function used in the study is specified as:

$C = f(pi, yi; \gamma) \exp ei \ (i = 1,2,3,\ldots,n)$

where;

C = Represents the minimum cost associated with yam production

Pi = Vector of input prices

Yi =Yam output

γ = Vector of parameters

ei = Composite error term

The explicit form of stochastic frontier cost function is specified as:

$\ln C = \beta 0 + \beta 1 \ln X1i + \beta 2 \ln X2i + \beta 3 \ln X3i + \beta 4 \ln X4i + (Vi + Ui)$

where;

Ln = the natural logarithm

C = Total cost of yam output (₦)

X_1 = Cost of yam sett (₦)

X_2 = Cost of fertilizer (₦)

X_3 = Cost of labour (₦)

X_4 = Cost of agrochemical (₦)

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β_0 = Constant term
B_1- β_4 = Regression coefficients

RESULTS AND DISCUSSION

The age distribution of the respondents in the study area is presented in Table 1. The result revealed that about 50% of the respondents in the study area were within the ages of 46 – 55 years with a mean age of 47 years. This means that they are still in their active productive ages; an economic active age that can make positive contribution to agricultural production. Furthermore, Table 1 revealed that about 14.4% of the respondents had no formal education, about 55% had only primary education, and 18.8% had secondary education while about 5.6% had tertiary education. Thus, with high level of literacy in the study area, yam farmers would easily adopt new technologies which could improve their levels of profits ceteris paribus. This finding is similar to the findings of (Ugwumba and Omojola, 2012) that the average age of 47 years obtained for the yam farmers in Ipao-Ekiti, Nigeria indicate that they were still in their active productive years.

Table 1 also revealed that 51.9% of the respondents had 21-30 years of farming experience with a mean of 23 years. This shows that the managerial ability of the farmers can be inferred to be reasonably good. It is of the general opinion that experience farmers would be more efficient, has a better knowledge of climatic conditions and are thus expected to run a more efficient enterprise (Oluwatayo *et al.*, 2008). This finding agrees with the findings of Izeko and Olumeze (2012). As one gets proficient in the methods of production, optimal allocation of resources is expected to be achieved. The more experienced one is the lower the profit inefficiency. 46.7% of the respondents did not belong to cooperative association. However, a greater percentage of the respondents (53.3%) are members of cooperative association. The average year of membership is 21 years.

The Table 1 further revealed that majority (47.7%) of the respondents had family size ranging from 8-10. The average household size is 8. The sex distribution of the respondents indicated that more males than females are involved in yam production. 76 out of the 90 respondents which represent 84.4% are males, while 15.6% are females. This may not be unconnected with the tedious nature of yam production which most females cannot contend with. The finding is in agreement with (Nlerum, 2012) who noted that yam production in Rivers State, Nigeria was dominated by males and it could be attributed to the energy demanding activities involved in yam production which require men who are naturally endowed with abundant strength necessary for such jobs.

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Table 1: Socio-economic Characteristics of Respondent

Variable	Frequency	Percentage	Mean
Age			
Less than 30	11	12.22	
30 – 45	16	17.77	
46 – 55	45	50	
Above 55	18	20	
Educational levels			
No formal education	13	14.4	
Primary	55	61.1	
Secondary	17	18.8	
Tertiary	5	5.6	
Farming experience (years)			
Less than 10	10	6.1	
10 – 20	25	26.1	
21 – 30	43	51.9	
Above 30	12	15.9	23
Number of years in cooperative association			
No membership	42	46.7	
1 - 10 years	10	11.1	
11 - 20 years	14	15.6	
Above years	24	26.6	21
Household size			
Less than 5	9	10	
5 – 7	16	17.7	
8 – 10	43	47.7	
Above 10	22	24.4	8
Farm size (hectare)			
Less than 1.0			
1.0 – 3.0	51	56.6	
2.1 – 5.0	20	22.2	
Above 5	5	5.6	2
Gender			
Male	76	84.4	
Female	14	15.6	

Source: Field survey, 2019.

Distribution of the Respondents according to Economic Efficiency Estimates

The frequency distribution of the economic efficiency estimates for the respondents in the study area as obtained from the stochastic frontier model is presented in Table 2. The predicted economic efficiency (EE) differs substantially among the respondents, ranging between 0.325 and 0.952 with a mean economic efficiency of 0.807. This means that if the average farmer in the sample area were to reach the economic efficiency level of its most efficient counterpart, then the average farmer could experience a cost saving of 15% [i.e., 1-

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(80.7/95.2) x100]. The same computation for the most economically inefficient farmer suggests a gain in economic efficiency of 66 percent [i.e., 1-(32.5/95.20) x100].

Table 2: Maximum Likelihood Estimates of Frontier Allocative (Cost) Function for yam production

Variables	Parameters	Coefficient	Standard-error	t-ratio
Production function				
Constant	β0	0.1681	0.0976	1.7224
Yam sett	β1	0.2019	0.0535	3.7773***
Fertilizer	β2	0.2391	0.0842	2.8059***
Labour	β3	0.4145	0.0848	4.8895***
Agrochemical	β4	-0.0632	0.0555	-1.1381NS
In-efficient model				
Constant	δ0	0.0741	0.0284	2.6134
Age	δ1	0.0053	0.0034	1.5412NS
Education	δ2	-0.0195	0.0032	-6.1072***
Farm size	δ3	0.116	0.091	1.2741NS
Farming experience	δ4	-0.2541	0.0313	-8.1089***
Extension visits	δ5	-0.1598	0.058	-2.7550***
Household size	δ6	0.1303	0.1036	1.2573NS
Amount of credit	δ7	0.1718	0.1053	1.6321NS
Variance parameters				
Sigma-squired	δ2	0.1085	0.0216	5.0413***
Gamma	Γ	0.8917	0.0159	55.9521***
Mean efficiency		0.89		
Number of observations		264		

Note: ***P<0.01, **P<0.05, *P<0.10 and NS = Not Significant.

CONCLUSION AND RECOMMENDATIONS

The study concluded that in order to increase of yam production, the following factors are important, e.g., increase in credit facility, size of farmland, education of farmers. In other to increase productivity and their technical efficiency, these can be achieved by considering the factors responsible for the inefficiency, such as increase in yam production, increase in the use of yam sett, fertilizer, labour and size of farmland. Other factors such as socio-economic factors like education level of the respondents, farming experience had significant effect on farmers technical inefficiency. There is a need for farmers to operate at maximum efficiency level in other to close the efficiency gap. Government should make available improved yam seeds with high resistance to decease at affordable prices to farmers. Government should also assist in improving the literacy level of farmers.

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