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TECHNICAL EFFICIENCY OF RICE FARMERS IN NIGERIA: A WAY OUT OF ECONOMIC RECESSION

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Abstract

The need to reduce food import bills and enhance farmers' technical efficiency, most especially in a recessed economy like that of Nigeria is germane. Improving farmers' technical efficiency which in turn will boost productivity is one of the exit routes. The study analysed the determinants of rice farmers' technical efficiency in Nigeria. Harmonized Nigeria Living Standard Survey (HNLSS) conducted by National Bureau of Statistics was used for this study. Input and output data of 130 rice famers across the country were used. Descriptive statistics and Stochastic Frontier Production Function were the analytical techniques adopted. Fertilizer input and farm size were observed to enhance the output of rice and rice farmers' technical efficiency respectively at 5% level. Efficient Fertilizer distribution and land policy options that would favour rice farmers should be intensified to ensure increased efficiency and productivity. This would reduce food import bills, reduce government expenditure and create a pathway towards economic recovery.

Key words**:** *rice farmers, technical efficiency, recessed economy, Stochastic frontier model*

INTRODUCTION

Nigeria recorded food import bills of about ₦1.923 trillion (USD 9.28) per annum at current prices between the period of 1990 – 2011, amounting to about ₦1.0 billion worth of food per day. This however was in multiple of five times of the export value (Vaughan *et al*, 2014) [11]. Four commodities including rice, fish, wheat and sugar jointly account for an annual food import bill of ₦1.3 trillion even though there is potential production capacity in Nigeria as mentioned by Ajasa, (2016) [4]. As one of the measures in moving the country out of recession, there must be a concerted effort in drastically reducing food import bills and enhancing local production of these crops that are mainly imported. A sure means of ensuring this is through increasing the productivity and efficiency of Nigerian farmers, especially rice farmers.

Inefficiency in rice (regarded as a strategic food security commodity) production has been identified as one of the factors contributing to low rice productivity in Nigeria. The presence of shortfalls in efficiency means that output can be increased without the need for new technology (Akinbode, 2011) [6].

The country's estimated annual demand for milled rice is 5.2 million tons, while the average national production is 3.3 million tons, while the supply and demand gap of 1.9 million tons can only be bridged by importing rice. The importation of rice to bridge the demand and supply gap is worth ₦365billion (Ayanwale and Amusan, 2012) [8].The major reason for the importation of rice is the inability of the local farmers to meet domestic demand due to low productivity. The inability of the Nigerian recessed economy to satisfy the domestic demand and the consequent growth of rice import quantity and value remains a cause of concern. This necessitates the need for local farmers to increase their efficiency in input use, in order to bridge the demand-supply gap in rice production in Nigeria. Many technical efficiency studies (Ajibefun et al, 2002; Adepoju, 2008) [5] carried out are usually state or region based. This study covered the entire country with the inclusion of all the zones or regions.

The pertinent questions the study intended to address include:

-How technically efficient are rice farmers in Nigeria;

-What are the factors that could enhance the technical efficiency of rice farmers in Nigeria

The main objective of the study was to determine the factors influencing the technical efficiency of farmers in Nigeria. The specific objectives are to:

-Determine the level of technical efficiency of rice farmers in Nigeria,

-Examine the determinants of technical efficiency of rice farmers in Nigeria

The need for empirical measure of farmers' efficiency in rice production is germane. This will serve as a guide to food policy makers with reference to rice production in an economy that could no longer support the huge import bill. This will provide performance indicator and create improving policy environment that will improve efficiency of rice production in the country, which could serve as a pathway to economic recovery.

MATERIALS AND METHODS

The study area is Nigeria. The data employed for the analysis was from secondary source obtained from the Harmonized Nigeria Living Standard Survey (HNLSS) collected by National Bureau of Statistics in 2010 [10]. Descriptive statistics such as frequency distribution, percentages and mean were used to determine socio-economic characteristics of 130 rice farmers and their level of technical efficiency.

In addressing objective 2, stochastic frontier function was adopted, implicitly stated as:

$$Yi = f(Xi,\beta) + \varepsilon_i \quad (1)$$

The explicit equation is stated as:

$$\ln Yi = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \varepsilon_i \quad (2)$$

where:

Yi = Output of rice of the ith farmer (Kg)

Xi = Vector of inputs used by the ith farmer

X_1= Farm size (hectare)

X_2= Total labor used in crop production (man-day)

X_3 = Quantity of seeds used in cultivation (kg)

X_4 = Total quantity of pesticides (litre)

X_5 = Volume of herbicide (litre)

$X6$ = Fertilizer (Kg)

β = Vectors (coefficient) to be estimated

$\varepsilon_i(u_i + v_i)$ = Error term: the symmetrical disturbance which captures the random error effects on output. It is also assumed to be independently and identically distributed as N (O, S_v^2). It accounts for error and other factors beyond the control of the farmer (Vi)and (Ui)efficiency component that captures the technical inefficiency of the ith farmer.

According to Aigner et al., 1977 [3], technical efficiency of the farmer is expressed below:

$$TE_i = Y_i/Y_i^* \quad (3)$$

where:

TE_i = Technical efficiency of the ith farmer

Yi = Observed output of the ith farmer (kg)

Yi* = Potential output (kg).

According to Battese and Coelli, 1996 [9] as cited by Ahmadu and Erhabor (2012) [2], the inefficiency model has been adopted as given below.

$$R = \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 + \beta_5 Z_5 + \beta_6 Z_6 + \beta_7 Z_7 + E_i \quad (4)$$

where:

R = Technical inefficiency of the ith farmer

Z_1 = Age of farmers (Years)

Z_2 = Household size

Z_3 = Farm size (Hectare)

RESULTS AND DISCUSSIONS

Table 1 shows the socio-economic characteristics of the rice farmers in the study area. As shown in the Table, about 62% of the farmers are married, which indicates that rice farming is dominated by famers that have members to cater for. A greater percentage of the farmers (85%) have no access to credit, which may greatly affect their level of efficiency and productivity.

Also, a greater percentage of the population, over 69% are within the productive age of 42 years, having 6 household members on the average. The majority of the rice farmers however cultivates less than one hectare of land.

Table 1.Socio-economic Characteristics of the Rice Farmers in Nigeria

Variables	Frequency	Percentage
Marital status		
Monogamous	80	61.54
Polygamous	38	29.23
Widowed	1	0.77
Never married	11	8.46
Access to credit		
Yes	19	14.62
No	111	85.38
Household size		
1-5	59	45.38
6-10	54	41.54
11-15	17	13.08
Mean	6	
Age group (years)		
<30	28	21.54
30-60	87	66.92
>60	15	11.54
Mean	42.07	
Farm size(hectares)		
<1.00	77	59.23
1.00-5.00	48	36.92
5.01-10.00	1	0.77
>10.00	4	3.08
Mean	1.364	

Source: HNLSS, 2010 Survey Data [9].

The descriptive statistics of inputs used by rice farmers in Nigeria was profiled in Table 2.

A rice farmer in Nigeria cropped an average of 1.36 hectares of land, planted ₦947 worth of rice seeds and applied 11.45 tons of fertilizer; and 702 litres and 291 litres of herbicides and pesticides respectively. The low cost of maize seeds planted could be due to the fact that farmers usually obtain the seeds to be planted from the previous harvest.

Table 3 shows the estimated coefficient of the production frontier and their corresponding levels of statistical significance. The significant variables include fertilizer and herbicide at 5% level of significance, while labour is significant at 10%.The $\sum^2$of 0.4969627 and gamma γ of 0.938771 were significant at 5% level.

Application of 1 kg of fertilizer increased rice farmers' output by 0.455.

Table 2. Basic statistics of rice production in Nigeria

Variable	Mean	Standard Deviation	Max	Min
Fertilizer (Kg)	11451.64	18170.74	0	150000
Seed cost (Naira)	947.3077	1822.154	0	18000
Total hectares	1.363106	1.420491	0.0072	6.5
Herbicide (Litres)	702.2989	680.3985	100	4800
Pesticide (Litres)	291.5327	866.1345	0	6000
Labor (Mandays)	20830.55	175066.8	300	2000009

Source: Data from NBS, 2010.

However, labour and pesticides application tend to reduce the output of the farmers, conforming with the finding of Ashagidigbi *et al.*(2011) [7], who found out that labour has an inverse relationship with the output of egg producers . The negative relationship between labour and output of maize farmers could be as a result of the need to replace labour with mechanization. Also, the level of maize infestation could be insignificant causing the application of pesticides not to increase output. The mean efficiency level of rice farmers in Nigeria is 88.6%. The significant value of sigma squared $\sum^2$ shows the presence of inefficiency effects in rice production in the study area while the significant gamma (γ) of 0.938771 indicates that about 93% variation in output of the rice production would be attributed to technical inefficiency effects alone while only 7% would be due to random effects. The results revealed that factors significantly influencing farmers' technical inefficiency are age, household size and farm size at 5%, 5% and 10% level respectively. Age of farmers tends to enhance farmers inefficiency, while household size and farm size reduce it. In order words, for farmers to be technically efficient, increase in farm land is germane. This is important as majority of the farmers are small holders cultivating less than one hectare of land.

Table 3. Stochastic Production Function Estimate

Variables	β Coefficient	T-Ratio
Constant	0.11582143***	24.232582
Pesticide	-0.40575115	-0.64804
Labor	-0.28868125*	-1.8805725
Herbicide	-0.57034320**	-2.0546729
fertilizer	0.45588941**	2.0767785
seed	0.43246923	0.68311932
Inefficiency model (Z_i)		
intercept	0.51861261	0.53891600
Household size	0.10587445**	2.3493483
Age	-0.17706923**	-2.7457912
Farm size	-0.85117912***	-3.4655440
sigma-squared ($\sum^2$)	0.49696267***	3.7103507
Gamma (γ)	0.93877110***	44.172773
Mean Efficiency: 88.6%		

Log likelihood function = 0.87325006

CONCLUSIONS

Arising from the findings of this study, there could be an improvement in the combination of inputs, especially in a recessed economy like Nigeria in order to enhance rice farmers' technical efficiency and productivity. This could be achieved through ensuring availability of fertilizer and farmland.

Therefore, efficient fertilizer distribution policy measure that will ensure timely availability of fertilizers to farmers should be intensified.

Secondly, government should formulate land use policy that would ensure easy accessibility of farmers to productive land in order to boost productivity and reduce our food import bill during this economic recession period.

Young and capable farmers should also be encouraged to engage in rice farming to boost production of rice in the country.

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