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TECHNICAL EFFICIENCY OF SWAMP RICE FARMERS IN EBONYI SOUTH AGRICULTURAL ZONE, EBONYI STATE, NIGERIA

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ABSTRACT

Technical efficiency of resource use is imperative for increased rice production in Nigeria. The study attempted to determine the technical efficiency of swamp rice farmers in Ebonyi south agricultural zone, Ebonyi state, Nigeria. Specifically, the study analyzed the socio-economic characteristics of the swamp rice farmers, determined the technical efficiency of the swamp rice farmers as well as the distribution of technical efficiency among swamp rice farmers in the study area. Purposive and random sampling technique were used to select sixty respondents for the study. Structured questionnaire was the instrument of data collection. Data collected were analyzed using descriptive statistics and stochastic production frontier. Results showed that the swamp rice farmers were in their active age (47years), predominantly male (70%), had average education (8 years spent in school) and married (86.7%). The maximum likelihood estimates showed that the variables of farm size, seed and labour were determinants of technical efficiency. The mean level of technical efficiency was 75.9% suggesting that an estimated 24.1% of the output is lost due to technical inefficiency in swamp rice production.

Keywords: Technical efficiency, Swamp rice, Stochastic frontier.

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Contribution/ Originality

This study contributes in the existing literature on technical efficiency of Swamp Rice Farmers in Nigeria. The paper's primary contribution is finding that the mean level of technical efficiency was 75.9% suggesting that an estimated 24.1% of the output is lost due to technical inefficiency in swamp rice production.

1. INTRODUCTION

Rice is one of the world's most important staple food crop consumed by more than half of the world population with over 40million people in Africa [1]. In sub-Saharan Africa, West Africa is the leading producer and consumer of rice and in 2008, Nigeria accounted for 48 % of the total rice output in West Africa [1]. Nigeria is endowed with favorable ecologies for rice cultivation and rice is cultivated in all the agro-ecological zones of Nigeria.

However continued fluctuation in rice production in the country is an indication of limited capacity of the Nigeria rice economy to match domestic demand which can be attributed to the inability of the rice farmers to obtain maximum output from the resources committed to the enterprise [2]. The limited capacity of Nigeria rice sector to meet the domestic demand could be attributed to low resource productivity. Domestic rice production

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lags behind the demand for the commodity and central to this explanation is the issue of technical efficiency of the rice farmers in the use of resources. Rice production in Nigeria is mainly in the hands of small-scale resource poor farmers who are still using unimproved farming methods. Increased production of rice therefore can be achieved if farmers efficiently utilize the available resources at their disposal. In a production context, technical efficiency relates to the degree to which a farmer produces the maximum feasible output from a given bundle of inputs (an output oriented measure), or uses the minimum feasible level of inputs to produce a given level of output (an input oriented measure).

This study attempted to determine the technical efficiency of swamp rice farmers in Ebonyi South Agricultural Zone in Ebonyi State, Nigeria. It specifically analyzed the socio-economic characteristics of the swamp rice farmers, determined the technical efficiency of the swamp rice farmers as well as the distribution of technical efficiency among swamp rice farmers in the study area.

2. METHODOLOGY

The study area was Afikpo South and Ohaozara Local Government area in Ebonyi South agricultural zone, Ebonyi state, Nigeria. Ebonyi south agricultural zone comprises Afikpo North, Afikpo South, Ivo, Ohaozara and Onicha Local Government Areas.Afikpo South and Ohaozara were Afikpo South Local Government is comprised of the Edda clan. It is bordered by Unwana to the East, Akaeze to the West, Amasiri to the north and Afikpo to the north-east and Ohafia to the south, It has an area of 378km^2 and a population of 157,072 persons [3]. Ohaozara Local Government area has an area of 12km2 and a population of 148,626 people [3]. The climate of Ebonyi south agricultural zone is characterized by bimodal rainfall with peaks in July and September. The people are predominantly farmers. The main crops produced are rice, yam, maize, groundnut, palm, sugar cane, etc. the area boast of a tourist site, Ndibe beach in Afikpo. Apart from farming, the inhabitants also engage in other occupations like trading and manufacturing.

A multistage purposive and random sampling technique was adopted in the selection of respondents for the study. Firstly, Afikpo South and Ohaozara Local Government area were purposively selected based on the dominance of rice farming in these LGA's. Second, two communities were randomly selected from each of the Local Government to give a total of four communities. Thirdly, three villages were randomly selected from each of the four communities to give a total of twelve communities for the study. A list of swamp rice contact farmers was obtained from Ebonyi State ADP (EBADEP) office at Onu-Ebonyi. Lastly, five farmers were randomly selected from the list of Swamp rice farmers to give a total of sixty farmers for the study. Structured questionnaire was administered to the respondents. Descriptive statistics and stochastic production frontier function was used to analyze data for the study.

2.1. Model Specification

The stochastic production frontier function allows for the simultaneous estimation of individual technical efficiency of the respondent farmers as well as determinants of technical efficiency [4]. It is expressed as follows;

$$Y = f(X_i;ß) \exp(V_i - U), I = 1,2,3....N \quad \ldots\ldots (1)$$

Where;

Y: is the output ith enterprise (farm)

X: is the vector input quantities used by the ith enterprise

ß is a vector of unknown parameters to be estimated

f( ): represents an appropriate function (e.g Cobb-Douglas, Translog, etc.)

V_i: is a symmetric error, which accounts for random variation in output due to factors such as weather, disease outbreak, measurement errors etc, which are beyond the farmer's control.

$U_i$is a non-negative random variable representing inefficiency in production relative to the stochastic frontier, that is aone sided error component.

The $V_i$are random effects which is assumed to be N----(O; δv^2) and independent of the U_i which are non-negative truncation of the N-----(O; δu^2) distribution (i.e half-normal distribution or exponential or gamma distributions). The technical efficiency of an individual enterprise is defined in terms of the ratio of the observed output to the corresponding frontier output, given the available technology.

Technical efficiency (TE) = $Y^*/Yi = f(Xi\beta) \exp(V_i-U_i) / f(X_i\beta) \exp(V_i) \exp(-U_i)$ ...(2)

Where;

Y: is the observed output and Y* is the frontier output.

The parameters of the stochastic frontier production function (equation 3) was accomplished by Maximum Likelihood Estimation (MLE) available in Frontier 4.1. This technique was developed by Battese and Coelli [4] and has been used extensively by various authors in estimating technical efficiency among crop farmers.

The specified swamp rice production function is given as follows;

$$LnY = \beta_0 + \beta_1 LnX_1 + \beta_2 LnX_2 + \beta_3 LnX_3 + \beta_4 LnX_4 + \beta_5 LnX_5 + \varepsilon_i \quad \ldots (3)$$

Where;

Ln represents the natural logarithm

Y = Output of Rice in kilograms (kg)

X_1 = Farm size (ha)

X_2 = Seed (kg)

X_3= Labour (man-days)

X_4 =Ferilizer (kg)

X_5= Herbicide (litres)

β_0 = Intercept

ε_i= Random error

$\beta_0$to $\beta_5$are coefficients to be estimated.

3. RESULTS AND DISCUSSION

3.1. Socio-Economic Characteristics of Swamp Rice Farmers

The results of the socio-economic characteristics of the swamp rice farmers in the study area are presented on table 1.

Table-1. Socio-economic characteristics of the swamp rice farmers

Descriptive statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Age	60	21.00	70.00	47.6333	10.75295
Education	60	.00	16.00	7.9333	5.48609
Gender	60	.00	1.00	.7000	.46212
Maritalst	60	.00	1.00	.8667	.34280
Hhsize	60	1.00	16.00	7.3167	3.64757
Farmingexp	60	2.00	50.00	21.9167	12.03567
Farmsize	60	.50	4.00	1.8625	.83156
Extensionvisit	60	.00	1.00	.8000	.40338

Source: Field Survey Data, 2015

The results of the investigation on distribution of rice farmers according to age shows that the maximum age of the rice farmers was 70 years with a mean age of 48 years. This shows that the swamp rice farmers are still within their active age. Results on education reveals that the mean number of years spent in school was 8 years. This

implies that the rice farmers had basic education and can understand the need for resource efficiency in production. Itam, et al. [5] posit that an educated farmer has the capacity to understand and adopt improved

technology that would shift his production frontier upwards.

The result of the distribution of swamp rice farmers by gender showed that majority of the farmers were male, given a mean of 0.70 representing 70% of the farmers. This is expected given the high labour requirement of rice farming and the low mechanization of farming in the study area. This is consistent with the findings of Nwalieji, et al. [6] that rice farming is a male dominated enterprise.

The results on the marital status of the swamp rice farmers in the study area confirm that about 86.7 per cent of the farmers were married. This implies that the farming households were complex and rice farming provides income to meet the basic needs of the households.

The result of the analysis on household size showed the mean household size to be 7 persons. Higher number of members of the household contributes to family labour. The burden of hiring labour for all activities in rice production, from land preparation to harvesting contributes significantly to labour cost.

The distribution of rice farmers based on farming experience show that rice farming has been a long time practice amongst the farmers in the study area with a mean of 22 years. Farmers with more experience are more likely to accept innovations than inexperienced farmers, and this would enhance their technical efficiency of resource use.

The investigation on farm size revealed that the mean farm size was 1.86 hectares. This is consistent with Nwaobiala and Adesope [7]. The sizes of the farm holdings confirm that these rice farmers are smallholders and there is need for them to efficient use the productive resources available to them for increased productivity. The results on extension visit y extension agents to the swamp rice farmers in the study area showed that up to 80% had extension contact during the planting season. However, there is need for the government and the Agricultural Development programme (ADP) to facilitate timely extension contacts between farmers and extension agents. The provision of information and guidance to farmers in any production season would increase their technical efficiency of resource use.

3.2. Maximum Likelihood Estimates of the Stochastic Production Frontier Function for Swamp Rice Farmers

The Maximum likelihood estimates of the stochastic production frontier function for swamp rice farmers in the study area is presented in table 2.

Table-2. Maximum likelihood estimates of the stochastic production frontier function for swamp rice farmers

Variables	Coefficient	standard-error	t-ratio
Intercept	0.80927823	0.33438997	2.4201629**
Farm size	0.39187047	0.17841825	2.1963586**
Seed	0.36392189	0.18391427	1.9787583*
Labour	-0.091620249	0.041882314	-2.1875642*
Fertilizer	0.028843663	0.029828452	0.96698491
Agro-chemical	0.0050747247	0.042540827	0.11929069
Diagnostic statistics			
sigma-squared	0.18939165	0.056787887	3.3350712
gamma	0.76232491	0.15256058	4.9968668**
log likelihood function = -14.434292			
LR test = 2.8458365			

Source: Field Survey Data, 2015

The result of the technical efficiency of swamp rice farmer's showed that only three of the variables, farm size, seed and labour are significant. Farm size was found to be significant indicating low use of yield enhancing

technology, mechanization and inputs in rice cultivation in Nigeria. Expansion of rice output in Nigeria has been attributed to area expansion.

The coefficient of seed was significant indicating that the quality of seed planted was more important than the absolute quantity. The use of improved quality seeds by swamp rice farmers is expected to increase their output. Labour was significant and negatively signed. The corresponding elasticity did not suggest that increased used of this input will yield more than proportionate increase in output.

Fertilizer and agro-chemicals were not statistically significant. However, the low use of critical inputs such as fertilizer and agro-chemicals may have seriously undermined the yield of the swamp rice farmers.

3.3. Distribution of Technical Efficiency among the Swamp Rice Farmers

The distribution of technical efficiency among the swamp rice farmers is presented on table 3.

Table-3. Distribution of technical efficiency among the swamp rice farmers

Range of technical Efficiency	Frequency	Percentage
<50	3	5.00
50-60	3	5.00
61-70	7	11.66
71-80	22	36.67
81-90	22	36.67
91-100	3	5.00
Total	60	100
Mean efficiency = 0.75938806		

Source: Field survey data, 2015.

The result of the technical efficiency estimates of the cassava farmers shows that efficiencies range from less than 50% to 99% with a mean technical efficiency of about 75.9% (Table 3). This is lower than 90% and 91% obtained by Ogundele and Okoruwa [8] for farmers using traditional and improved variety of rice in his study. The efficiency distribution indicates that (36.7%) of the farmers were in the modal class of above 80%, and another 36.7% where in the modal class of above 70% of technical efficiency. The relatively high levels of efficiency of 75.9% suggesting that only a small fraction of 24.1% of the output is lost due to technical inefficiency in swamp rice production.

4. CONCLUSION

The study showed that swamp rice farmers in the study area are not fully technically efficient in their resource use. This is due to their technical inefficiency. Therefore, there is need to improve the levels of technical efficiency of the farmers given their current resource base and technology. Government should strengthen its policy on the provision of incentives such as access to affordable inputs including land and improved seed.

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