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Production Cost Efficiency and Profitability of *Abakaliki* Rice in Ihialia Local Government Area of Anambra State, Nigeria

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ABSTRACT: The study focused on the production cost efficiency and profitability of *Abakaliki* rice in Ihialia Local Government Area of Anambra State, Nigeria.. A random sampling technique was employed to select a total of 100 Abakaliki rice farmers from the study area. Data collection was achieved through the administration of structured questionnaire assisted with personal interview. Data analysis was done using descriptive statistics, gross margin analysis and stochastic frontier cost function. The results of the study showed that the Abakaliki rice production was profitable with average gross margin, net profit and return per naira invested of ₦141,607.22/ha, ₦126,056.33/ha and 3.54 respectively. With the exception of depreciation and output of rice, all the variables under consideration had positive and significant effect on the total cost of rice production. They were all significant at 5% level of probability. The farmers had cost efficiency ranging from 1.001 - 1.122 with the average of 1.048. Majority (90%) of them had efficiency range close to the frontier (1.001 - 1.100). Since the Abakaliki rice production was profitable and there was high level of cost efficiency, the farmers should be encouraged to expand their holdings and boost rice production. ©JASEM

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KEY WORDS: Cost efficiency, stochastic frontier, Abakaliki Rice, inefficiency factors.

INTRODUCTION

Rice is one of the world most important cereal. It is a staple food for more than 50% of the world population (Okoruwa and Ogundele, 2004) and accounts for about 60 – 70% of total food intake in the world (FAO, 2004). About 90% of rice is eaten in the form of various cooked preparations (FAO, 2010) in addition to its uses as livestock feed, raw material for industries, fuel and mulching material. Furthermore, rice production generates employment and provides income to its operators. In view of the enormous importance of rice, there has been growing concern on how resources can be efficiently utilized to boost its production, especially by minimizing production cost to maximize profit.

Rice is grown in over 100 countries of the world (Oko *et al*., 2012). Over 95% of the global rice production comes from the developing countries (FAOSTAT, 2008 a) and Nigeria is the leading producer of the commodity in the West African sub-region (FAOSTAT, 2008 b). Rice is grown in virtually all the Agro-ecological zones of the country with the highest proportion of the production coming from the North Central Agro-ecological zone. However, the production of the commodity did not meet the increasing demand due to the rapidly increasing population growth and shift in consumers' preferences towards rice (Ahmadu, 2011). Consequently, the country becomes the need importer of rice, in fact one of the largest importer in the world (Erhabor and Ahmadu, 2013). Nigeria annual rice import bill stood at about US$1 billion (Trade-Invest Nigeria, 2009). This situation calls for urgent attention.

There are 20 wild and two cultivated species of rice in the world. The two cultivated varieties are *Oryza*

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sativa (Asian rice) and *Oryza glabberima* (African rice). *Oryza sativa* is the most commonly cultivated specie throughout the world today (Oko and Ugwu, 2010). However, new rice varieties (NERICA –New Rice for Africa) which are the hybrids between the African and Asian rice developed by the West African Rice Development Associations (WARDA) have been introduced. The African rice is believed to have originated from the wild rice (*O. barthii*) about 3500 years ago and was domesticated in the inland delta area of Nigeria from where it spread to other parts of Africa. Some of the good qualities of the African rice varieties relative to the Asian rice are: tolerant to fluctuations in water depth, iron toxicity, infertile soils and adaptation to the ecological conditions of Africa. Their negative features compared with the *Oryza sativa* include easy shattering of seeds, the grain is brittle and difficult to mill and the yields are lower. Due to the superior attributes of the Asian rice, its introduction into Nigeria gradually displaced the African rice (Oko *et al*., 2012). Specifically, variety 79 (long grain) of the Asian rice was first introduced by British to the Abakaliki area of Eastern Nigeria in 1942 (Welsch, 1963). After many years of testing and demonstration, its cultivation by small-scale farmers began to spread and it remains one of the major rice variety produced in the East part of Nigeria.

The small farmers have small holdings besides scarcity of capital and labour. Occasionally, crop failure is experienced due to the flooded rice field. In addition, productivity is often low (Oko et al., 2012). Increasing yield per unit area of the rice crop to boost its production remains a challenge. Ahmadu (2011) identified efficiency of resource use as one of the measures to increasing rice productivity and production. Thus, efficicency study has assumed an important dimension in rice production because resources are scarce and there is need to improve rice productivity. The success of any farm business largely depends on the ability of the farmer to efficiently combine scarce resource in the right proportion to achieve a given level of output. The ability of the farmer to produce the maximum level of output possible with minimum quantity of inputs under a given technology is known as his technical efficiency, while his allocative efficiency is the degree of success in obtaining the best combination of inputs in producing a specified level of output having regard to the relative prices of the inputs (Adeoti, 2006). Cost efficiency as noted by Egbobion and Erie (2011) is the ability of a farmer to produce the maximum level of output possible at minimum cost outlay under a given technology and time. A cost efficient operation will result in large profit for the farmer; and only a farmer that can achieve this will sustain the farm business. Therefore, the objective of this study is the analysis of production cost efficiency and profitability of Abakiliki rice in Ihialia Local Government Area of Anambra State, Nigeria.

The specific objectives are to: examined the socio-economic characteristics of Abakaliki rice farmers in the study area; determined the profitability of the Abakaliki rice production; estimate the cost function of rice production; and determine the cost efficiency and the inefficiency parameters of the farmers in the study area.

METERIALS AND METHODS

*Study Area***:** The study was carried out in Ihiala Local Government Area of Anambra State. The Local Government Area is located in the southern part of Anambra State. It has a total land mass of 252 km^2 and the population of 302,158 persons (Gwillim, 2007). Ihiala consists of several communities/villages, among which are Amorka, Azia, Iseke, Mbosi, Okija, Orsumoghu, Ubuluisuzor and Uli. It lies in the favoured agricultural belt of the State and has tropical climate with the rainy season between April and October and a dry season from November to March. The major occupation of the inhabitants of the area is agriculture; and the area is noted for rice production because of source of water provided by River Urasi which flows through the villages.

Sampling Procedure and Data Collection: A random sampling technique was employed to select a total of 100 Abakaliki rice farmers from the study area. The identification of farmers in the area was facilitated by the assistance and cooperation of the indigenes and Agricultural Extension Agents attached to the area by the Anambra State Agricultural Development Project (AADP). Data were collected by means of a structured questionnaire administered to the respondents, complemented with personal interview.

The data collected covered the socio-economic characteristics of the respondents, costs of inputs, and output and its unit price.

Data Analysis: Data analysis was done using descriptive statistics, gross margin analysis, and stochastic frontier cost function and inefficiency model. The Gross Margin for the rice production is given as:
GM = TR – TVC … (1) Where: GM = gross margin in naira, TVC = total variable cost in naira

The stochastic frontier cost function as given by Battese and Coelli (1995) and used by Obeng and Adu (2014) is implicitly specified as follows:
$C = f(P_{i,} Y_{i,} \beta) + (V_i + U_i)$ … (2) Where:
C = total cost of production in naira, P_i = vector of input prices of the ith input (₦), Y_i = output of the ith farmer (kg), β = unknown coefficients to be estimated, f = suitable functional form such as Cobb-Douglas function, V_i = white noise which accounts for random effects on production beyond the control of the farmers, U_i = error term accounting for inefficiency of the farmers.

The model is explicitly linearized into log form as follows: $InC = \beta_o + \beta_1 InP_1 + \beta_2 InP_2 + \beta_3 InP_3 + \beta_4 InP_4 + \beta_5 InP_5 + \beta_6 InP_6 + \beta_7 InY_{7+} V_i + U_i$ ….. (3)

Where: P_1 = unit cost of labour (₦), P_2 = unit price of herbicides, (₦) P_3 = unit cost of fertilizer (₦),
P_4 = price of seeds (₦), P_5 = unit cost of transportation (₦), P_6 = unit cost of depreciation (₦),
β_o = constant intercept, β_1, … β_7 = unknown coefficients to be estimated, In = natural logarithm
All other variables are as earlier defined.
Other parameters also estimated along with the β's are sigma squared, δ_s^2 and gamma, γ.

The cost efficiency (C_{EE}) of the farmers is defined as the ratio of the observed or actual cost of production, C to the corresponding frontier (minimum) cost, C*. The C_{EE} takes the values from 1 and above with 1 defining cost efficient farm (Ogundari *et al*., 2006).
The C_{EE} is expressed as: $C_{EE} = C/C^* = f(P_{i,} Y_{i,} \beta) + (V_i + U_i)/ f(P_{i,} Y_{i,} \beta) + (V_i)$…(4) Where: all variables are as defined earlier. The inefficiency model which is jointly estimated with the cost efficiency model is given as: $U_i = b_o + b_1Z_1 + b_2Z_2 + b_3Z_3 + b_4Z_4 + b_5Z_5$… (5)
Where: U_i = technical inefficiency effects, Z_1 = educational level, Z_2 = age of farmers (years), Z_3 = household size (number of persons), Z_4 = farming experience, Z_5 = extension agents' visit, b_o, b_1, … b_5 = unknown parameters to be estimated.

RESULTS AND DISCUSSION

Socio-economic Characteristics of Respondents: The socio-economic characteristics of the Abakaliki rice farmers are presented in Table 1. Majority (58%) of the farmers were males, indicating that males dominated the Abakaliki rice industry in the study area. The respondents were relatively young as evidenced by 60% of them that were less than 30 years old. About 45% of them had household size of 5 – 8 persons. This means they would contribute to the rice production business through the provision of family labour, all things being equal. About 77% of the farmers had at least primary education, indicating that majority of them were literate. Majority (85%) of the farmers had farming experience ranging between 1 and 20 years, confirming the finding of Egbodion and Erie (2011) on arable crop farmers who had up to 20 years of farming experience. Farm size for the rice production was between 1 and 5 hectares (53%). Sources of farm land and labour were communal (51%) and both family and hired labour (81%) respectively. High proportion (69%) of the respondents admitted Extension Agents visited them. However, the visit was over a long period, on a yearly basis (66%).

*Profitability Analysis of Rice Production***:** The average costs incurred and the revenue obtained per hectare for rice produced in Ihiala Local Government Area of Anambra State was estimated to determine the profitability of rice production in the study area. The results presented in Table 2 showed that the mean total cost of the rice production per hectare was about ₦35,593.00. The major costs of the production in decreasing order of magnitude included rent on land (42.14%), cost of fertilizer (21.74%) and labour cost (14.60%). These production costs accounted for about 79% of the total cost. Thus, any government policies geared towards boosting rice production in the study area have to focus on these cost

components. The results further showed that rice production in study area was profitable. This was indicated by the values of the gross margin, net profit and return per naira invested obtained. In confirmation, Ahmadu (2011) reported that upland, lowland and irrigated rice production are all profitable.

Table 1: Socio-economic Characteristics of Respondents

Variable		Frequency (100)	Percentage (100)
Gender	Female	42	42.0
	Male	58	58.0
Level of education			
	No formal education	23	23.0
	Primary school	49	49.0
	Secondary school	25	25.0
	Tertiary education	3	3.0
Age in years			
	30 & below	60	60.0
	31 – 40	19	19.0
	41 – 50	16	16.0
	>50	5	5.0
Household size			
	1– 4	10	10.0
	5– 8	45	45.0
	9 –12	32	32.0
	>12	13	13.0
Farming experience			
	1-10	45	45.0
	11-20	40	40.0
	21-30	8	8.0
	31-40	7	7.0
Farm size in acres			
	1-5	53	53.0
	6-10	35	35.0
	>10	12	12.0
Source of farm land			
	Inheritance	27	27.0
	Rent	21	21.0
	Communal	52	52.0
Source of farm labour			
	Family	12	12.0
	Hired	7	7.0
	Both	81	81.0
Extension Agents' visit			
	Yes	69	69.0
	No	31	31.0
Frequency of Extension Agents' visit			
	Monthly	34	34.0
	Yearly	66	66.0

Cost Function Analysis of Rice Production: The maximum likelihood estimates (MLE) of the stochastic frontier cost function for rice production are presented in Table 3. With the exception of depreciation and output of rice, all the variables under consideration had positive and significant effect on the total cost of rice production. They were all significant at 5% level of probability. The positive sign of the variables indicated that as the prices of the inputs increased, the total cost of rice production increased. The estimate for sigma square (0.004) which indicates the goodness of fit for the model was not significant at 5% level of significance. Estimate of gamma coefficient showed that only 0.10% of the variation in the total cost of the rice production was attributed to cost inefficiency of the farmers and this was not significant at 5% level of probability. This result is at variance with previous findings (Backman *et al*., 2009 and Ahmadu, 2011) where high proportion of the deviation of output of rice from the frontier was attributed to technical inefficiency of the farmers

Table 2: Profitability Analysis of Abakalake Rice Production per hectare

	Mean value/ha	**Percentage of total cost (%)**
Revenue	161,649.42	-
Variable cost items		
Cost of labour in naira	5,197.96	14.60
Cost of herbicides in naira	1,760.99	4.95
Cost of fertilizer in naira	7,738.88	21.74
Cost of rice seed in naira	3,647.77	10.25
Transportation cost in naira	1,696.60	4.77
TVC	20,042.20	56.31
Fixed costs		
Rent on farm land	15,000.00	42.14
Depreciation of fixed inputs	550.89	1.55
Total fixed cost	15,550.89	43.69
Total cost	35,593.09	100.00
Gross Margin	141,607.22	-
Net Revenue	126,056.33	-
Return per naira invested	3.54	-

Table 3: Maximum Likelihood Estimates of Stochastic Cost Function for Rice Production

Variable	**Coefficients**	**Standard error**
Constant	1.704*	0.106
Unit cost of labour	0.063*	0.007
Unit price of herbicides	0.307*	0.050
Unit cost of fertilizer	0.200*	0.022
Price of seeds	0.222*	0.066
Unit cost of transportation	0.227*	0.026
Unit cost of depreciation	0.007	0.043
Output of rice		
Sigma square	0.004	0.002
Gamma	0.010	0.163
Log likelihood function	1341.09	

*Significant at 5%.

*Cost Efficiency of Rice Farmers***:** The results of the study (Table 4) showed that the minimum, maximum and average cost efficiency in rice production in the study area were 1.001, 1.122 and 1.048 respectively. Majority (90%) of the rice farmers had efficiency range close to the frontier (1.001 - 1.100). Only 10% had cost efficiency ranging from 1.101 – 1.150. This result showed that most of the farmers operated very close to the frontier, since cost efficiency lies between +1 and infinity and this can be attributed to

high years of farming experience recorded by the farmers. Contrary to previous study, Backman *et al*. (2009) reported that only about 13% of rice farmers operated very close to the frontier with technical efficiency of 0.90 – 0.99.

Table 4: Cost efficiency of Rice Farmers

Cost efficiency range	Frequency	Percentage
1.001-1.050	53	53.0
1.051-1.100	37	37.0
1.101-1.150	10	10.0
Total	**100**	**100.0**
Minimum	1.001	
Maximum	1.122	
Mean cost efficiency	1.048	

*Cost Inefficiency Factors***:** The result of the technical inefficiency which was jointly estimated with the farmers cost efficiency model (Table 5) indicated that educational level of farmers, farming experience and extension agents' visit negatively and significantly influenced the cost inefficiency of the rice farmers at 5% level of probability, indicating that increase in these variables increased farmers' cost efficiency. Age of farmers and household size were not significant. Their positive sign indicated that their increase increased the farmers' cost inefficiency.

Table 5: Cost Inefficiency Factors of Respondents

Variable	Coefficient	Standard error
Constant	0.108	0.030
Education level	-0.032*	0.014
Age	0.001	0.002
Household size	0.002	0.002
Farming experience	-0.003*	0.001
Extension agents' visit	-0.066*	0.022

Source: Field Survey (2014)
*Significant at 5%.

Conclusion: The study has established that Abakaliki rice production in Ihialia Local Government Area of Anambra State was profitable and the farmers operated at high level of cost efficiency. Thus, the farmers should be encouraged by creating enabling environment for them to expand their holdings and boost rice production. This includes ensuring that subsidized farm inputs for rice production reach the farmers timely, farm roads are motorable to reduce transportation cost, provision of take-off grants for the unemployed youth, and training on modern techniques of rice farming.

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