ECONOMIC ANALYSIS OF RAIN FED RICE (*Oryza sativa*) PRODUCTION IN MUBI NORTH LOCAL GOVERNMENT AREA OF ADAMAWA STATE, NIGERIA

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Abstract: The research determined the Economic Analysis of Rain Fed Rice Production in Some Selected Villages of Mubi North Local Government Area of Adamawa State, Nigeria. A multi-stage random sampling technique was used to select 109 rain-fed rice farmers in eight villages of the four Districts of Mubi North Local Government Area with the aid of questionnaire. Descriptive and inferential statistics were employed for the analysis of the data. The gross margin per hectare was (₦30,529.44) and the return per naira invested was₦0.43/ha indicating that in every one naira invested on rice production ₦0.43 emanated as a return,which revealed that rice production is profitable in the study area. Maximum Likelihood Estimate of the stochastic frontier production function revealed that farm size, quantity of fertilizer, seed and hired labour were significant at 1% and 10% level of significance and the gamma (ϒ) coefficient of 79.9% implying that farm size, quantity of fertilizer, seed and hired labour contributed 79.9% of the total output of rice obtained by the farmers included in the model. The technical efficiency ranged between 0.39 - 0.95 with a mean of 0.75, indicating that there is a scope for improving technical efficiency by 25% with the existing technology. Age of the farmer, literacy level, family size, and access to credit were found to increase technical efficiency of the farmers. The study, recommend revitalization of extension services through government agricultural transformation agenda, accessibility to credit facilities and affordability and availability of farm inputs at subsidized rates.

Keywords: Economic, efficiency, Mubi North, production, rain-fed, rice

Introduction

Agricultural production involves the process of combining input resources in to organized productive unit under management with ultimate objective to maximize profit, maximize satisfaction and minimize cost or a combination of some or all of the motives of a farm enterprise (Olayide and Heady, 1982). Profitability is a positive return to working capital and capital invested in various productive assets including land. In case of capital assets, profitability should ensure return of capital and also return to capital at rate equal to or exceeding the prevalent market rate of interest.

In agricultural production, the profit obtained depends largely on the cost of inputs used, efficient technology employed and a good market price for the products. The study of costs and return therefore, help the farmers to determine the viability of their farm business and guide them in enterprise selection (Alimi, 2000).Cost refers to the value of inputs used in production while profit is obtained by subtracting the costs from the revenue. Farm costs are often divided in to fixed and variable costs. Fixed costs are incurred in fixed assets such as building, land, fences and other permanent assets, on the other hand; variable costs are those costs incurred on assets that can be liquidated, examples are the costs of fertilizer, animal feed, labour and agrochemicals (Olukosi and Erhabor, 1988).

Materials and Methods

The study area

The study was conducted in Mubi North Local Government Area of Adamawa State, Nigeria.It is located between latitude 10^0 $10^1$and 10^0 50^1 N of the equator and longitude 13^0 10^1 and 13^0 30^1 E of the Greenwich meridian. The area has a mean annual temperature of 32.36^0C ,it has an average annual rainfall ranging between 900 mm and1050 mm with a distinct dry season which begins in October and ends in April, while wet seasons begins in May and ends in October. It shares common boundaries with Cameroun and Mubi South to the east, Hong local government to the south and Michika local government to the west. Mubi North local government consists of four districts namely: Mubi, Ba'a, Fali and Mayo - Bani. It has an estimated land area of 871.9 km^2 and an estimated population of 177,782 (Adebayo, 1999). The major economic activity of the people is farming, dominant crop cultivated in the area are rice, maize, cowpea, sorghum, groundnut and sugar cane and the major livestock reared in the area are cattle sheep, goat, poultry and pig.

Sources of data and sampling techniques

Both primary and secondary data were used. The secondary sources of data including review of annual reports, books, census data, journals and statistical documents whereas the primary sources of data were mainly from the field survey. A multi stage random sampling technique was applied for the selection of respondents for the study. Mubi North local government area was selected because of its prominence in rice production; this may be attributed to its favourable rainfall pattern as well as fertile soil. Out of the four districts in the local government two villages each were selected to arrive at eight villages. The villages were Digil, Hurida, Bahuli, Vimtim, Muchalla, Kiriya, Muva and Betso. The selections of these villages in the districts were purposive because preliminary survey revealed the areas of rice production. A proportionate random sampling was used to select 120 rain fed rice farmers based on their population size.

Data analysis

The empirical Gross margin used as adopted by Mohammed *et al*. (2009) and Maurice (2012) are out lined below:

Gross margin:

$GM=\sum P_iY_i - K_jX_i$ ..... (1)

Where:

GM = Gross margin (₦ /ha)
P_i = unit price of output (kg/₦)
Y_i = Quantity of output (kg/ha)
K_j = Unit cost of variable input (₦/ha)
X_j = Quantity of variable input (kg/ha)
$\sum$ = Summation sign.

Stochastic frontier production model:

$\text{Ln } Yi = \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \beta_5 \ln x_5 + \beta_6 \ln x_6 + v+u$ ……. (2)

Where:

Y_i = Output of rice in kg
X_1 = Cultivated land area for rice in hectares
X_2 = Quantity of fertilizer in kg
X_3 = Quantity of rice seed planted in kg
X_4 = Quantity herbicide used in liters

X_5 = Sum of family labour used in mandays
X_6 = sum of hired labour used in mandays
V_i = random variables
U_i = non-negative random variables which are assumed to count for technical inefficiency in production.

It is assumed that the technical inefficiency effects are independently distributed and U_i arises by truncation (at zero) of the normal distribution with mean, U_{ij} and variance δ^2, where U_{ij} is defined by:

$U_{ij} = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 \ldots\ldots\ldots$ (3)

Where:
U_i = Inefficiency effects
Z_1 = Age of farmer (In years)
Z_2 = Literacy level (In years)
Z_3 = Farming experience (In years)
Z_4 = Extension contact (dummy)
Z_5 = Gender of the farmer (dummy)
Z_6 = Family size (number persons in household)
Z_7 = Access to formal credit (dummy)
$\Upsilon = O_u^2 / O_v^2$: This measures the effect of technical efficiency variation of observed output.

Results and Discussion

Cost and return analysis

The result of cost and return analysis is presented in Table 1 The result shows that average variable cost per hectare was ₦23,348.43 and the total revenue per hectare was ₦53,877.90. The Gross margin per hectare was ₦30,529.44.The result also shows that labour constitute of about (50%) of the total variable cost followed by the cost of fertilizer (17%), cost of empty sack (2%) had the least. However, the findings further revealed that the production of rice in Mubi North Local Government Area is profitable since the gross margin estimated has a positive value. The profitability is further supported by a return per naira invested which stood at₦0.43, inferring that in every one naira invested on rice production, ₦0.43/ha emanate as a return. This agrees with the findings of Madugu *et al.* (2017) that rice production is profitable in Mubi area with a gross margin of ₦16,977.65/ha.

Table 1: Average cost and returns/ha for rainfed rice farmers

Variable	Value (₦)	% Share total in Variable Cost
A. Variable cost		
Cost of rent on land	908.05	3.89
Cost of fertilizer	4,033.91	17.28
Cost of herbicides	1,008.48	4.32
Cost of seeds	1,778.02	7.61
Cost of labour	11,692.67	50.08
Cost of ploughing	2,089.80	8.95
Cost of empty sacks	539.91	2.31
Cost of transportation	1,297.59	5.56
Total variable cost/ha	**23,348.43100**	
B. Return		
Total output (kg)	267,850.00	
Average price per kg	70.00	
Total revenue per hectare	**53,877.90**	
C. Gross Margin		
Gross margin/ha	**30,529.44**	
D. Gross Ratio/ha	**0.43**	

Source: Field survey, 2015.

Maximum likelihood estimate (MLE) of rain-fed rice production

The statistical test result obtained from the stochastic frontier production function analysis is presented in Tables 2 and 3. Table 2 indicates that there is a positive and significant relationship between farm size, fertilizer, seed and hired labour and the output of rice in the study area, which agrees with findings of Maurice *et al.* (2015) who also found a positive relationship between farm size, seed and hired labour and technical efficiency. This also indicates that total rice production increases by the value of each coefficient of the variable input used in the production, with their sum showing that input allocation is in stage I of the production function. The sum of their elasticity is 0.967 which is less than one indicating positive decreasing return to scale. By implication, the farmers are positioned in irrational zone, possibly due to lack of productive resources to migrate to stage II of production function. This shows that effort should be made to use resources judiciously not to waste it in the cause of allocation, that is, more of the variable inputs should be optimally allocated to achieve a better output (Maurice, 2012).The estimated sigma square (σ^2) which indicates that parameter has a positive effect on efficiency and vice versa was 1.693 which is significantly different from zero at 1% level, also shows that one sided error term dominates symmetry error, indicating a good fit and correctness of the specified distribution assumptions. Likewise the gamma (Υ) was estimated at 0.799 in the study area which indicates that about 80% of the total variation in rice output was due to technical inefficiencies of the farmers in the area. Table 2 further shows that the coefficient of literacy levels, farming experience, extension contract, sex of the farmers and access to credit had the expected positive signs. Age of the farmers, literacy level and access to credit were found to be statistically different from zero at 1% and 5%, respectively. This implies that efficiency of the farmer will increase as the age of the famer advances, the more he acquire formal education and the more they have access to credit.

The technical efficiency distribution is shown in Table 3. The predicted technical efficiencies differ substantially among the rice farmers and ranging from 0.39 the minimum to 0.96 the maximum with their mean technical efficiency of 0.75. The result further shows that majority (28.44%) of the farmers have technical efficiency of 0.80 – 0.89, this also indicated that there is a wider distribution of technical efficiencies in the production level in the area, which revealed that there is a considerable room for effecting improvement in technical efficiency of the farmers in the study area.

Table 2: Maximum likelihood estimates of the parameters of the stochastic frontier production function

Variables	Parameter	Coefficient	t-ratio
Production factors			
Constant	β_0	1.943	18.040*
Farm size (X_1)	β_1	0.285	3.730*
Quantity of fertilizer (X_2)	β_2	0.021	1.960***
Quantity of seed (X_3)	β_3	0.469	5.200*
Quantity of herbicide (X_4)	β_4	0.078	1.620
Family labour (X_5)	β_5	0.064	0.170
Hired labour (X_6)	β_6	0.050	1.960***
Inefficiency effects			
Constant	δ_0	-1.858	-0.954
Age of the farmer (Z_1)	δ_0	1.632	3.582*
Literacy level (Z_2)	δ_2	-0.076	-2.395**
Farming Experience (Z_3)	δ_3	-0.129	-1.493
Extension contact (Z_4)	δ_4	-0.004	-0.005
Sex f the farmar (Z_5)	δ_5	-0.015	-0.836
Family size (Z_6)	δ_6	0.053	1.384
Access to credit	δ_7	-0.141	-2.040**
Diagnostic statistic			
Sgma square (σ^2)		1.693	8.329*
Gamma (Υ)		0.799	22.830*
Sum of elasticity		0.967	

*significant at 1% level, ** significant at 5% level, *** significant at 10% level

Source: Computer Printout version 4.1c

Table 3: Technical efficiency distribution of the respondents

Efficiency level	Frequency	Percentage
0.30-0.39	2	1.83
0.40-0.49	6	5.46
0.50-0.59	10	9.17
0.60-0.69	24	22.02
0.70-0.79	22	20.18
0.80-0.89	31	28.44
0.90-1.00	14	12.84
Total	**109**	**100**
Mean	0.75	
Minimun	0.39	
Maximun	0.96	

Source: Field Survey, 2015.

Constraints of rainfed rice production

The major constraints affecting rainfed rice production is presented in Table 5. The results reveals that majority (88.99%) of the farmers indicated that lack of credit facilities are the major problem affecting their productions. 84.40% of the farmers also reported that high cost of fertilizer is one of their major problems.79.82% reported lack of herbicide as their major problem. Good number (74.31%) indicated land form as their constraints.Other challenges indicated are lack of innovation (64.22%) poor pricing (66.06%), high cost of transportation (63.30%) among others. This is similar to the findings of Mohammed *et al.* (2009) who found lack of credit facilities, high cost of input and high cost of transportation are among the constraints affecting rice production.

Table 4: Constraints of rain fed rice production in the study area

Constraints	Frequency	Pproportion	Ranking
Inadequate credit	97	88.99	1
High cost of labour	12	11.01	10
Lack improved seed	33	30.28	9
High cost of herbicides	87	79.82	3
High cost fertilizer	92	84.40	2
Effect of culture	6	5.50	11
Lack of innovation	70	64.22	6
Limited farm size	69	63.30	7
High cost of transportation	69	63.30	7
Poor pricing	72	66.06	5
Land form	81	74.31	4

Source: Field survey, 2015

Conclusion

It is therefore, concluded that rice production in the study area was profitable and the production was in stage I of the production function which is irrational stage of production. There is a positive and significant relationship between the farmer's age, literacy level, access to credit and the technical efficiency of the farmer. The study suggested that accessibility to land and credit to the rice farmers should be boosted in other to access input and other production needs of famers and more effort should be intensified on the part of the Government in educating the famers so as to boost their efficiencies rice production.

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