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Profitability and Determinants of Output of Rice Production in Anambra State, Nigeria

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ABSTRACT: *The study examined the profitability and determinants of output of rice production in Anambra State, Nigeria. The specific objectives were to: estimate the profitability of rice production; establish the determinants of production output; and identify constraints to rice production in the area.Multistage, purposive and random sampling methods were used to select respondents. Though 378 copies of the questionnaire were administered to the farmers by personal interview, 315 adequately filled copies were sorted and used in data collation. Primary data used for the study were collated and analyzed by means of descriptive and inferential statistical tools such as the enterprise budgeting technique (gross margin, net farm income, mean net farm income and net return on income) Ordinary Least Squares (OLS) regression, One- way ANOVA and Scheffe's Multiple Comparison test. Findings on the profitability of rice production in the area showed that per hectare gross margin figures were ₦315,300, ₦285,600, ₦302,800 and ₦301,233 for Anambra, Aguata and Awka Agricultural zones, and the State (study area) respectively. Net return on investment figures were 1.49, 1.23, 1.30 and 1.35 respectively. The NROI values indicate that for every N1.00 investments in rice productions in the three zones and the State the farmers are likely to realize on one hectare ₦1.49 in Anambra Agricultural zone, ₦1.23 in Aguata zone, ₦1.30 in Awka zone and on the average ₦1.35 in the State, hence rice production is a profitable enterprise in the area. Meanwhile, Schefee's Multiple Comparison test indicated no significant difference between per hectare mean net farm incomes realized by farmers from paired agricultural zones. Findings on the influence of socio-economic characteristics of the farmers on production output indicated that five regressors (educational level, farming experience, farm size, amount of credit obtained and cost of inputs) exerted independent and statistically significant influences on output while the rest six did not have significant influence on output. Constraints to rice production posited insufficient fund as the most serious problem of rice production in the area, followed by scarcity and high cost of labour, scarcity and high cost of quality seeds, among others. Government should encourage financial institutions to make loans available to farmers and form cooperative societies to obtain bulk purchase of high quality seeds and other input resources.*

KEY WORDS*:* profitability, output, constraints, production

INTRODUCTION

Rice is among the three leading food crops of the world with maize and wheat being the other two and all the three directly providing not less than 42% of world's required caloric intake. Rice is a staple food in Nigeria and could be found in the homes of the higher class, the middle-income earner and the poor (Onya, Okezie, and Ejiba, 2019). Nigeria is Africa's leading producer of rice, consumer of rice, and incidentally one of the largest rice importers in the world. (FAO, 2017). Due

to its increasing contribution to the per capita calorie consumption, the demand for rice has been increasing at a much faster rate than domestic production in Nigeria and more than in any other African country since mid-1970s (FAO, 2004). Nigeria produced approximately 2 million Metric tonnes (MT) of milled rice in 2008. The Nation's annual production level has increased from 5.5 million tonnes in 2015 to 5.8 million tonnes in 2017 and imported roughly 3 million metric tonnes, including the estimated 800,000 metric tonnes that is suspected to enter the country illegally on an annual basis (USDA, 2017; Udemezue, 2018).The consumption of rice in Nigeria has grown rapidly over the past decade and is currently at an all-time high of 7 million MT (USDA, 2017). The rice importation bill rose from₦22 Billion in 1999 to ₦96 Billion in 2002 (NCRI, 2004). Report has it that between 2005 and 2015, Nigeria's monthly import bill rose from ₦148 billion to ₦917 billion (Onya, et. al., 2019). In 2016, about 58,260MT of rice was imported into Nigeria from Thailand, according to the Thai Rice Exporters Association. This represents a huge reduction when compared to about 805,765 MT recorded in 2015. By November 2017, the figure reduced to 23,192 MT and between January and November 2018, the figure had crashed to 6,277 MT. Within the years, the Thai Exporters statistics show that there had been a 72.9 per cent reduction in quantity of export to Nigeria while the export value had also crashed by 72.2 per cent. This, clearly, confirms that there has been reduction in Nigeria's rice import figures.

Rice generates more income for Nigerian farmers than any other cash crop in the country. This is becausefarmers commonly sell 80 per cent of total production and consume only 20 percent. The increasing demand for rice may be attributed to its numerous uses and importance. It is a major source of food for about half of the world's population supplying basic energy needs of the people(Nwike and Ugwumba,2015). An interesting reason for it being so popular, nutritionists suggest is its ease of digestion. Even the sick, elderly and babies can digest this grain easily if cooked. Besides, rice provides 21% of global human per capita energy and it is low in fat and protein, compared with other cereal grains. Rice also provides minerals, vitamins and fiber although; all constituents except carbohydrates are reduced by milling. Rice is used for industrial purposes for beverages, roofing materials, flour and starch, livestock feed, medium for growing tropical mushroom and compost(Effiong, 2005; Idiong, 2005). Nigeria has the potential to be self-sufficient in rice production, both for food and industrial raw material needs and for export.Rice production in Nigeria has been on the increase though not yet sufficient to meet the demands of the growing population.

Fasoyiro and Taiwo (2012) observed that in Nigeria rice is mainly produced by small scale farmers whose production are characterized by low output resulting from production inefficiency, aging farming population and low technological knowhow. The situation is further aggravated by thefact that most of the cultivators hardly estimate their enterprise profitability or otherwise. Profit maximization is one of the major objectives of business enterprises and is grossly dependent on how best the productive resources are harnessed (Afolabi Adegbite, Ashaolu and Akinbode, 2013). Researchers like Ouedraogo (2015) studied technical and economic efficiency of rice production in Kou Valley, Burkina Faso. Angulu (2012) examined profitability and technical efficiency of swamp rice farmers in Niger State. Nwalieji (2016) studied comparative profit analysis of rice production enterprise among farmers in Anambra and Ebonyi States, Nigeria. Amaechina and Eboh (2017) studied Resource use efficiency in rice production in the lower Anambra irrigation project, Nigeria whileNwike and Ugwumba (2015) studied profitability of rice production in Aguata agricultural zone of Anambra State. Therefore, there is dearth of information on theprofitability and determinants of output of rice production in Anambra State, Nigeria, hence this studyexamined the profitability and determinant of output of rice production in Anambra State, Nigeria with a view to estimating the profitability of rice production; establishing the determinants of production output; and identifying the constraints to rice production in the area.

The following null hypotheses were tested in the study:

i. There is no significant difference between the profits realized by farmers from the selected agricultural zones.
ii. Socio-economic factors of the farmers do not significantly influence their production output.

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METHODOLOGY

The study wascarried out in Anambra State. The State is made up of 21 Local Government Areas(LGAs)and four Agricultural Zones (AZs). The study population comprised all the rice farmers in the four agricultural zones (AZs) of the state namely Onitsha, Aguata, Awka and Anambra. Multistage, purposive and random sampling techniques were used to select respondents for the study. The first stage involved purposive selection of three (Anambra, Awka and Aguata) most active rice producing zones(Anambra State Ministry of Agriculture)out of the four (4) agricultural zones in the State.Second stage involved purposive selection of three (3) LGAs from Anambra and Aguata zones and one (1) LGA from Awka zone. These LGAs are known majorly for rice production in the State. A total of seven (7) LGAs were sampled.Stage three involved the purposive selection of three most active rice producing communities in each of the selected seven (7) LGAs, making it a total number of 21 Communities. The fourth and final stage wasthe random sampling of 18 farmers from each of the 21selected communities giving a sample size of 378 respondents. Primary dataused for the study were collected by means of well-structured and pre-tested questionnaire. Three hundred and seventy eight copies of questionnaire were administered to the farmers with the help of trained enumerators. The questionnaires were designed to collect data on the following: a. the socio-economic characteristics of the rice farmersand production variables of thefarmers and constraints associated with rice production.

Measurement of Variables

a.Socio-economic variables were measured as follows:

i. Farmer's age: Farmers actual ages were determined in years

ii. Education level: This was measured as the number of years the farmer spent in formal school. It is expected to have a positive influence on profitability

iii. Farming experience: This was measured as the number of years of experience acquired by a farmer in rice production business. It could have a positive or negative relationship with rice profitability

iv. Household size: This comprises the total number of people living and feeding together in a house. It is expected to have a negative influence on profitability

v.Gender: This was doneusing dummy variable to represent sex, taking the value of 1, if the farmer is a male and 0, if otherwise. This could have either a negative or positive influence on profitability.

vii. Amount of credit accessed: Actual amount in ₦

viii. Marital Status: The measurement of marital status of the respondents was done using dummy variables, taking the value of 1, if the farmer is married and 0 if otherwise.

ix. Membership of co-operative society: This was done using dummy variables, taking the value of 1, if the farmer is a member and 0, if otherwise. This could have either a negative or positive influence on production output.

x. **Extension contact**: Total number of extension visits/contacts within the period of production

xi. Farming Status: dummy variables; 1 if the farmer is a full time farmer and 0, if otherwise.

xii. Cost of inputs: Measured as actual amount spent on inputs (₦)

b. Production variableswere measured as follows:

i. Rice Production Output: The output of rice per farm wasmeasured as the total quantity measured in kilogrammes or tonnes from the production unit(s) of a farmer for a production period of one farming season.

ii. **Rice seeds:**This is the quantity of seeds planted by the farmer per hectare in kq

iii. Farm size: The standard unit of measurement of farm size is the hectare (ie. 10,000m^2 or 2.47 acres).

iv. Labour: This refers to the human physical and mental efforts expended in production process. In agriculture, labour could be provided by either the farmer and the family (Family labour) or hired from the market (Hired labour) and group labour (working on members' farm by group of farmers in alternative days). Labour is measured in man-days. A man-day is the average amount of work that can be carried out by an adult male in 8 hours of a day. The prevailing wage rate man-day will be used as the average rate for various farm activities.

v. Fixed cost items: These include annual interest on loan; annual depreciation of farm machinery and equipment.

Depreciation: The straight-line method of depreciation is the simplest and most often used technique and was employed in this study. The method estimates value of an asset at the end of the period during which it was used to generate revenues (useful life), and will expense a portion of original cost in equal increments over that period. The salvage value (scrap value) is an estimate of the value of the asset at the time it will be sold or disposed and may be zero.

Mathematically, depreciation is expressed as:

$$D = \frac{C - S}{L}$$

Where: D = Annual depreciation expense
C = Cost of fixed asset
S = Scrap value
L = Useful Life span (years)

Note: The average current market prices of inputs and outputs were employed in working out revenue and cost figures for data analysis.

Constraints to rice production

A 3-point Likert type scale method was used to determine the degree of seriousness of rice production problems. The scale employs an ordinal level of measurement where the responses from the respondents were ranked in a sort of dimension or disaggregated along a continuum as follows:
Very serious = 3
Serious= 2
Not serious = 1

Determination of cut-off point

$$X = \frac{\sum f}{n} = \frac{3 + 2 + 1}{3} = \frac{6}{3} = 2.00$$

To make inferential statement, the mean score was compared with the critical mean (2.00). If the calculated mean of a problem is greater than the standard critical value, then that problem is regarded as serious, otherwise not serious.

METHOD OF DATA ANALYSIS

Objectives of the study were accomplished by means of the following analytical tools**:**
Objective i, the profitability of rice production was realized using the enterprise budgeting technique involving the computation of gross margin, net farm income, mean net farm income and net return on income. Objective ii, to determine the influence of socio-economic factors of the farmers on production output, was achieved using (OLS) multiple regression analysis and Objective iii, constraints to rice production in the area and part of objective i were achieved using descriptive statistic such as means, frequencies and percentages.

Specification of Formulas and Models

Gross Margin and Net Farm Income

Profitability of rice production was achieved using the enterprise budgeting techniques (Gross margin and Net-farm income) as used by Nwike and Ugwumba 2015; Chidiebere-Mark,*et. al*., 2019 and Igboji, *et.al.*, 2015).

The method is mathematically given as:

i. $GM = TR - TVC$

Where: GM= Gross margin (₦)
TR=Total Revenue (₦)
TVC=Total variable cost (₦)

ii. NFI = TR – TC or GM – TFC

Where**:**
NFI = Net Farm Income (₦)
TR = Total Revenue (₦)
TC = Total Cost (₦) = TVC+TFC
GM = Gross Margin (₦)
TFC = Total Fixed Cost (₦)

iii. $NROI = \frac{TR}{TC}$

Where:
NROI = Net Return on Investment (₦)
TR = Total Revenue (₦)
TC = Total Cost (₦)
IfROI >1= profit, and
If ROI <1= loss.

Multiple Regression Model

Multiple Regression analysis as adopted by Igboji *et al*. (2015)was used to determine the influence of socio-economic characteristics of the rice farmers on production output. The implicit and explicit forms of the multiple regression models to be employed for the analyses are respectively given as:

OTP= f (GEN, AGE,EDU, EXP, SIZ, MST, EXC, FST,HHS,COC, COI; e)

and

$$\textbf{OTP} = \beta_o + \beta_1 GEN + \beta_2 AGE + \beta_3 EDU + \beta_4 EXP + \beta_5 SIZ + \beta_6 MAS + \beta_7 EXC + \beta_8 FST + \beta_9 HHS + \beta_{10} COC + \beta_{11} COI; e$$

Where:
OTP= Output (kg)
GEN=Gender (dummy variables, 1 for male and 0 for female.)
AGE=Farmers age (years)
EDU = Years of formal education
EXP= Years of experience in rice production
SIZ = Number of hectares of landthe farmer use for commercial rice production
MAS= If married = 1, otherwise = 0
EXC= Total number of extension visits/contacts within the period of production
FTS = Type of occupation (dummy: if the farmer is a full time farmer 1, and 0, if otherwise.
HHS=Household size (actual number of persons in the household)
COC = Amount of credit obtained
COI= Cost of inputs measured in actual amount spent (₦)
e = Error term
β_o = Constant
$\beta_1 – \beta_{12}$ =Coefficients of the parameter estimates

The above equation was fitted with the data and tried with four (4) functional forms of the multiple regression model(linear, exponential, semi-log and double log). On the basis of economic, statistical and econometric reasons, the estimated equation with the best fit was chosen as the lead equation.

Hypotheses Testing

The testing of stated null hypotheses for the study were done as follows:
Hypotheses I : test for significant difference in the means of profits attained by farmers from selected agricultural zones was achieved using Analysis of Variance (ANOVA) and Scheffe's Multiple Comparison Test.

Hypotheses 11: Determinants of production output was tested for individual significance of the regression parameters using t- statistic and for the overall significance of the estimates of the regression parameters using F –Statistic. Results of the OLS regression analysis was based on

standard statistical and econometric criteria such as the values of co-efficient of determination (R^2), t-values and *a priori* expectations of signs and magnitudes of the regression coefficients and

RESULTS AND DISCUSSION

Profitability of Rice Production in the Area

The per hectare profitability of rice production was determined for the three selected Agricultural zones and for the State (pooled data) by means of the enterprise budgeting technique.The amount of fund invested in a production enterprise is a very important determinant of production output, income, hence profit, all things being equal. Rice farmers in the State spent various amounts of money on both the variable and fixed inputs to produce one hectare of rice. The variable costs incurred in rice production by the farmers include rice seeds, herbicides, insecticides, fertilizers, land preparation, other labour charges, transportation and miscellaneous costs. The fixed cost items include annual depreciation values of tools and equipment and interest on loan.

Table 1: Per hectare cost structure of rice production in the area

Item	Anambra Zo	% TC	Aguata Zo	% TC	Awka Zo	% TC	Anambra St	% TC
Variable Costs:								
Rice seeds	25,000	12.28	24,800	11.70	24,300	11.53	24,700	11.87
Herbis./Insectis.	23,000	11.30	22,000	10.38	22,400	10.63	22,467	10.80
Labour charges	55,500	27.26	56,000	26.62	52,000	24.68	54,500	26.19
Land preparation	24,000	11.79	25,000	11.80	26,000	12.34	25,000	12.02
Fertilizers	30,000	14.73	26,500	12.81	28,000	13.29	28,167	13.54
Transportation	24,600	12.08	23,600	11.14	20,000	9.49	22,733	10.93
Miscellaneous	10,000	4.91	10,000	4.72	10,000	4.75	10,000	4.81
TVC	192,100	94.35	187,900	88.67	182,700	86.71	187,567	90.16
Fixed Costs:								
Depr on equipm.	4,500	2.21	6,000	2.83	9,000	4.27	6,500	3.12
Int. on loans	7,000	3.44	18,000	8.49	19,000	9.02	14,000	6.73
TFC	11,500	5.65	24,000	11.33	28,000	13.29	20,500	9.85
Total Cost	203,600	100.00	211,900	100.00	210,700	100.00	208,069	100.00

Source: Field survey, 2022. Note: Zo = Zone. TC = Total Cost. St = State. Herbis./Insectis = Herbicides/Insecticides. TVC = Total variable cost. Depr on equipm = Depreciation on equipment. Int. on loans = Interest on loans. TFC = Total Fixed Cost.

The per hectare cost structure for rice production in the study area according to selected Agricultural zones and the State (pooled data) is shown in Table 1. It could be seen from the table that the farmers incurred a total variable cost (TVC) of ₦192,100 per hectare in Anambra Agricultural zone, ₦ 187,900 per hectare in Aguata Agricultural zone and ₦182,700 per hectare in Awka Agricultural zone. On the average, the farmers spent a TVC of ₦187,567 to produce one hectare of rice in the study area. With regards to fixed costs, the farmers spent a total fixed cost (TFC) of N-₦11,500 in Anambra zone, ₦12,000 in Aguata zone, ₦14,000 in Awka zone, and average of ₦12,500 in the study area. The TVC accounted for 90.15% of the TC of rice production per hectare while the TC remains 9.85%. Out of the total variable cost, cost of labour emerged the most important cost of rice production per hectare in the area, amounting to ₦54,500 or 26.11% of the total cost (TC, ₦208,067). This was followed by cost of fertilizers (₦28,167 or 13.54%), land preparation (₦25,000 or 12.02%), rice seeds (₦24,700 or 11.87%), transportation (₦22,733 or 10.93%), herbicides and insecticides (₦22,467 or 10.80%), and the least miscellaneous cost (₦10,000 or 4.81%). This result compares favourably with Nwike and Ugwumba (2015) who reported that TVC constituted 96.02% of TC of rice production. Similarly, Jirgi *et al.* (2009) identified labour charges as the most important variable cost of rice production in Niger State, Nigeria.

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Table 2: Output of the enterprise budgeting analysis/ Per hectare costs and return of paddy rice production in the area

Item	Anambra Zo	% TC	Aguata Zo	% TC	Awka Zo	% TC	Anambra St	% TC
TR/Farm Income	507,400		473,500		485,500		488,800	
Variable Costs:								
Rice seeds	25,000	12.28	24,800	11.70	24,300	11.53	24,700	11.87
Herbis./Insectis.	23,000	11.30	22,000	10.38	22,400	10.63	22,467	10.80
Labour charges	55,500	27.26	56,000	26.62	52,000	24.68	54,500	26.19
Land preparation	24,000	11.79	25,000	11.80	26,000	12.34	25,000	12.02
Fertilizers	30,000	14.73	26,500	12.81	28,000	13.29	28,167	13.54
Transportation	24,600	12.08	23,600	11.14	20,000	9.49	22,733	10.93
Miscellaneous	10,000	4.91	10,000	4.72	10,000	4.75	10,000	4.81
TVC	192,100	94.35	187,900	88.67	182,700	86.71	187,567	90.16
Fixed Costs:								
Depr on equipm.	4,500	2.21	6,000	2.83	9,000	4.27	6,500	3.12
Int. on loans	7,000	3.44	18,000	8.49	19,000	9.02	14,000	6.73
TFC	11,500	5.65	24,000	11.33	28,000	13.29	20,500	9.85
Total Cost	203,600	100.00	211,900	100.00	210,700	100.00	208,069	100.00
Gross Margin	315,310		285,600		302,800		301,233	
Net Farm Income	303,800		261,600		274,800		280,733	
MNFI (NFI/n)	303,800		261,600		274,800		280,733	
ROI (FI/TC)	2.49		2.23		2.30		2.35	
NROI (NFI/TC)	1.49		1.23		1.30		1.35	

Source: Field survey, 2022. Note: TR = Total Revenue. Zo = Zone. TC = Total Cost. St = State. Herbis./Insectis = Herbicides/Insecticides. TVC = Total variable cost. Depr on equipm = Depreciation on equipment. Int. on loans = Interest on loans. TFC = Total Fixed Cost. MNFI = Mean Net Farm Income. ROI = Return on Investment. NROI = Net Return on Investment.

The per hectare profitability of rice production in the area was determined using enterprise budgeting method. It was computed for the three selected Agricultural zones and the study area (pooled data). The technique involves the computation of profitability indicators such as gross margin (GM=TR-TVC), net farm income (NFI = TR – TC or GM – TFC), mean net farm income (MNFI – NFI/n), return on investment (ROI = TR/TC) and net return on investment (NROI = NFI/TC).Output of the enterprise budgeting analysis for one hectare of rice in the area is presented in Table 2. Information in the table showed that rice farmers from the three selected Agriculture zones realized almost the same margin of values on the profitability indicators, which is also reflected in the average computed for the State (Pooled data). For instance, per hectare GM figures were ₦315,300, ₦285,600, ₦302,800 and ₦301,233 for Anambra, Aguata and Awka Agricultural zones, and the State (study area) respectively. The respective per hectare net farm income (profit) for the three zones and study area were ₦303,800,—₦261600, ₦274,800 and ₦280,733 respectively.Furthermore, per hectare mean net farm income for the three zones and the State were ₦303,800, ₦261,600, ₦274,800 and ₦280,733 respectively while NROI figures were 1.49, 1.23, 1.30 and 1.35 respectively. The NROI values indicated that for every ₦1.00 investment in rice productions in the three zones and the State the farmers realized on one hectare ₦1.49 in Anambra Agrucultural zone, ₦1.23 in Aguata zone, ₦1.30 in Awka zone and on the average ₦1.35 in the State. This implies that rice production is profitable in the study area, however, it is more profitable in Anambra Agricultural zone, followed by Awka zone and the least Aguata zone.This finding corroborates Igboji *et al.* (2015), Ume *et al*. (2016) and Okello*et al.* (2019) that rice production is a highly profitable venture in their respective study areas probably because farmers meticulously utilized the necessary inputs and adhered to the required management practices.

Test of hypothesis

No significant difference between the profits realized by farmers from the three selected Agricultural zones.

Table 3: One way ANOVA

Profit (regressand)

Item	Sum of Squares	DF	Mean Square	F	Sign
Between groups	3008340710020.124	2	1504170400143.349	34.015	0.000
Within groups	23711432478142.342	679	43100583415.013		

Table 4: Scheffe multiple comparison test of differences between zonal mean profits

I (Rank)	J (Rank)	Mean Difference	Standard Error	Sign(I-J)
Anambra	Aguata	174,751.486	20,520.36	0.000
Awka		150,473.342	20,520.36	0.005
Aguata	Anambra	-168,376.254	20,712.48	0.000
	Awka	-174,751.486	20,520.36	0.165
Awka	Anambra	-150,473.342	20,520.36	0.005
	Aguata	168,376.254	20,712.48	0.165

Source: Field survey, 2022. Note: Significant at 5% level.

This test was conducted by means of a Oneway ANOVA test and ratified using Scheffe's Multiple Comparison test. The results are presented in Tables 3 and 4. It could be seen from Table 3 that there is significant difference in the mean profits realized by rice farmers in the selected agricultural zones of thestudy area at 5% alpha level (F=35.015). That is, the null hypothesis of existence of no significant difference in mean profits among the zones is rejected and the alternative accepted that there exists significant difference among zonal means. Furthermore, the Scheffe's Multiple Comparison test result (Table 4) shows that there is significant difference between the means of profit attained by rice farmers in Anambra and Aguata agricultural zones and Anambra and Awka zones, but not in Aguata and Awka zones.

Influence of Socio-Economic Characteristics of the Rice Farmers on Output

Table 5: Influence of socio-economic characteristics of the farmers on production output

Variable	Linear	Exponential	Semi-log	Double-log
Constant	3217	17.65	7356	3542
GEN	5243 (1.47)	0.0046 (0.38)	2139 (1.28)	0.9631 (0.77)
AGE	-2744 (-0.96)	-0.00054 (-1.22)	-7784 (-1.51)	-1.047 (-0.54)
EDU	42.37 (2.15)**	0.0126 (1.79)*	1316 (1.85)*	0.1233 (2.26)**
EXP	40.14 (2.36)**	0.0376 (2.45)**	367.5 (2.42)**	0.2265 (3.15)***
SIZ	196.3 (1.84)*	0.050236 (1.91)*	1286 (1.93)*	0.1413 (2.36)**
MAS	2378 (0.75)	0.000073 (0.89)	215.7 (0.63)	1.777 (1.21)
EXC	-3176 (-0.78)	-0.00321 (-1.38)	-3372 (-0.95)	-2.874 (-0.86)

FTS	-1367 (-1.26)	-0.00007 (-0.34)	-5143 (-1.49)	-1.1462 (-0.94)
HHS	3781 (0.87)	0.00025 (0.62)	1976 (0.48)	2.044 (0.83)
COC	4337 (1.69)*	0.00402 (1.55)	3784 (1.21)	0.456 (2.38)**
COI	-13.76 (-4.31)***	-0.0143 (-3.57)***	-149.4 (-3.85)***	-0.1342 (-5.29)***
R2	79.67	78.35	79.32	82.45
R2 (adjusted)	76.32	75.46	75.41	79.84
F-statistic	10.14	8.85	9.19	12.86
D-W statistic	2.01	1.92	1.99	1.98

Source: Field survey, 2022. Note: *; **; *** = Significant at 10%, 5% and 1% probability levels. Acronyms are as defined earlier. D-W = Durbin-Watson.

The Ordinary Least Squares (OLS) regression technique was used to examine the influence of the farmers' socio-economic characteristics on their production output. The dependent variable was output while the independent variables used in the model were gender represented by the acronym (GEN), age of the farmer (AGE), educational level (EDU), farming experience (EXP), farm size (SIZ), marital status (MAS), extension contact (EXC), farming status (FTS), household size (HHS), amount of credit obtained (COC) and cost of inputs (COI). Data on the dependent and the independent variables were inputted in the four functional (linear, exponential, semi-log and double-log) forms of the regression model and ran using the MINITAB statistical software. Output of the double–log form (Table 5) gave the best result in terms of signs and sizes of the parameter estimates and was used as the lead equation.

The equation is given as:
OTP = 3542+0.963 GEN – 1.05 AGE + 0.12 EDU + 0.23 EXP + 0.14SIZ + 1.77 MAS – 2.87 EXC – 1.46FTS +2.04 HHS + 0.46 COC- 0.13 COI

Out of the 11 regressors included in the model, five (educational level, farming experience, farm size, amount of credit obtained and cost of inputs) exerted independent and statistically significant influences on output while the rest six including gender, age, marital status, extension visits, farming status and household size did not have independent and significant influences on output.

Educational Level: The coefficient of the education variable was positive and significant at 5% probability level. This is in line with *a priori* expectation of the positive influence of education variable on output. It implies that high the level of formal education obtained by a farmer, high the quantity of output expected to be produced. It could mean that the rice farmers who obtained higher levels of formal education were more likely to employ better skills, management practices and modern technologies in the production process, thereby producing more and realizing more profit. This result agrees with Okello *et. al.*, (2019) who reported a positive and significant relationship between the education variable and production output. It is, however, at variance with the result of Nwike and Ugwumba (2015) which indicated a negative and not significant relationship between education and the output from rice farming.

Farming experience: The double–log regression output as presented in Table 5 shows the existence of positive and significant relationship between farming experience and rice production output at 1% alpha level. This is in accordance with*a priori* expectation and implies that rice farmers with higher years of farming experience are expected to utilize the abundant skills, management practices and resources acquired over the years, invest more and obtain better output than their inexperience colleagues. It also means that a unit increase in farming experience of the rice farmers brought about a 0.23% increase in output. This result contradicts Igboji *et al*. (2015) who posited a not significant relationship between farming experience and rice output.

Farm Size: the farm size variable exerted a positive and statistically significant effect on rice production output. This is in agreement with *a priori* expectation of positive relationship between farm size and output. This implies larger farm size, all things being equal, larger the output expected output from it. It could mean that the rice farmers who increased the area of land put into rice production and engaged the best prac5trices were likely to produce more output and make higher profit. A 1% increase in farm size led to a 0.14% increase in output. Nwike and Ugwumba (2015) and Ume *et. al*., (2018) in their different studies confirmed the positive and significant influence of farm size on rice output.

Amount of Credit Obtained: Obtaining and properly utilizing credit is the key to business expansion and success. The coefficient of amount of credit obtained had positive and significant influence on rice output at 5% level. This concurs with *a priori* expectation that amount of credit obtained should have positive influence on output. It implied that the rice farmers who obtained credit and utilized it adequately in the business were more likely to have obtained better yield and consequently realized higher profit than those who did not or misappropriated theirs. A 1% increase in amount of credit obtained led to a 0.46% increase in rice output *ceteris paribus*. Nwalieji (2016) reported the importance of credit in the facilitation of increase in productivity and output of rice farmers.

Cost of Input: Cost of inputs has a coefficient that is statistically significant and negative at 1% level of probability. This is in tune with *a priori* expectation of negative relationship between cost of inputs and production output. It implies that higher the cost of inputs, lower the output. The reason could be that, because majority of the rice farmers were educated and could apply the best farming practices, they were able to minimize cost of production and consequently generated greater quantity of output, hence, income and profit. This finding corroborates Magreta *et al.* (2013) and Ayedun and Adeniyi (2019) who reported efficient allocation of resources by rice farmers which led to cost minimization and profit maximization. Ebido *et al.* (2020) also reported a positive and significant relationship between cost of production and output of rice which is a contradiction to this finding.

The coefficient of multiple determination (R^2) of 0.8245 is an indication that 82.45% variations in output (dependent variable) was due to variations in the eleven independent variables. The F-statistic value of 12.86, which is highly significant, implies that the eleven independent variables jointly and significantly influenced the dependent variable; also an indication that the variables were good fit for the model.

Constraints to Rice Production in the Area

Table 6: Problems militating against rice production in the area

Problem	Mean Score	Rank	Remark
Insufficient fund	2.9	1st	very serious
Scarcity and high cost of labour	2.8	2nd	very serious
Scarcity and high cost of quality seeds	2.5	3rd	very serious
Climate change/irregular rains	2.1	4th	very serious
Inadequate mechanization	2.0	5th	serious
Poor price of product	1.9	6th	serious
Poor storage facilities	1.8	7th	serious
Scarcity of land	1.7	8th	serious
Poor irrigation facilities	1.6	9th	serious
Flooding of farm land	1.5	10th	serious
Poor road infrastructure	1.4	11th	serious
Pests and diseases attacks	1.0	12th	not serious
Fire outbreaks	0.9	13th	not serious

Source: Field survey, 2022.

The Rice farmers in Anambra State encountered many challenges during the production process. These challenges were scaled using a 3-point Likert-type method and the result is presented in Table 6. Information from the table showed that insufficient fund was the most serious problem of rice production in the area with a mean score of 2.9. This was followed by scarcity and high cost of labour (2.8), scarcity and high cost of quality seeds (2.5), climate change / irregular rains (2.1), inadequate mechanization (2.0), poor price of product (1.9), poor storage facilities (1.8), scarcity of land (1.7), poor irrigation facilities (1.6), flooding of farm land (1.5), poor road infrastructure (1.4), pest and disease attacks (1.0) and fire outbreak (0.9). The problem of insufficient fund was at the top of the very serious constraints to rice production in the area. This was envisaged especially for new entrances into the business as being encouraged by many Government initiatives on increasing rice production. Nwalieji (2016) confirms inadequate fund as the most se4rious problem militating against rice production especially for start–offs. The 2nd very serious problem identified in this study was scarcity and high cost of labour. The reason for this problem could be traced to the migration of youths to the cities in search of white collar jobs that they feel are better paying and less tedious. This finding is in line with that of Nwike and Ugwumba (2015), though indicated as the first major constraint to rice production in Aguata agricultural zone of Anambra State. Scarcity and high cost of quality seeds was the 3rd very serious constraint to rice production with mean score of 2.5. Ume *et al.* (2016) also identified this problem as a very serious problem to rice production since the quality of rice seeds planted significantly determine output per hectare (yield).The 4th problem was climate change/irregular rains. Many rice farmers in the area, especially early and late planters, complained about irregular rain falls leading to serious scarcity of water during the periods of filling of the seeds, hence production of shaffy-paddy and poor yield. Ajatomobi *et al.* (2010) had earlier reported the potential treats to rice production by worsening climate change challenges. Similar notifications were made by NCRI (2004), Maniyong *et al.* (2005) and Ume *et al.* (2018). The 5th, 6th, 7th, 8th, 9th, 10th, and 11th serious constraints to rice production were inadequate mechanization, poor price of product, poor storage facilities, scarcity of land, poor irrigation facilities, flooding of farm land, and poor road infrastructure respectively. The problems of pest and disease attacks and fire outbreaks described as the 12th and 13th constraints to rice production in the area were regarded by the farmers as not serious. Nwike and Ugwumba (2015), Nwalieji (2016), Ume *et al.* (2016) and Ume *et al.* (2018) in their various studies reported the mix of these constraints as serious and not serious constraints to rice production.

CONCLUSION AND RECOMMENDATIONS

Rice production in Anambra State is economically profitable, though there still exist some economic efficient gaps among the farmers. These gaps could be attributed to the identified problems militating against rice production in the area. Profitability of rice production by the farmers would improve if adequate policy measures are adopted to mitigate the constraints identified in the study especially insufficient funds, scarcity and high cost of labour, scarcity and

high cost of improved seeds, and climate change/irregular rains.Based on the findings, the following recommendations were made ; Scarcity and high cost of labour was identified as a very serious constraint to rice production. Government should discourage the rising rate of rural-urban drift of labour through the provision of good feeder rural roads, education, health and electricity infrastructure that will make life more meaningful for the youths, attract private investors and create more job opportunities in the rural areas and to further increase rice yield and enable rice farmers earn better income, high yielding varieties of rice that are resistant to pests and diseases attacks must be introduced. Both government and private sector participants responsible for the supply of these varieties of rice should endeavor to obtain early supplies from reputable research institutions and seed companies and ensure availability at the right time.

REFERENCES

Afolabi O. I., Adegbite D. A., Ashaolu O. F. and Akinbode S. O (2013). Profitability and resource-use efficiency in poultry egg farming in Ogun State. *Nigeria African Journal of Business Management*. 7(16), 1536-1540.

Ajetomobi, J A; Abiodum, A and Hassan R. (2010). Impacts of Climate change on rice agriculture in Nigeria. *Tropical subtrop Agroecosyst*. 14, 613-622.

Amaechina , E. C. and Eboh E C. (2017). Resource use efficiency in rice production in the lower Anambra irrigation project. *Nigeria Journal of Development and Agricultural Economics*, 9(8), 234-242

Angulu, U (2012). Profitability and technical efficiency of swamp rice production in Niger State, Nigeria. A thesis submitted to the School of Postgraduate Studies, Ahmadu Bello University

Ayedun, B and Adeniyi, A (2019). Efficiency in Rice Production in Nigeria.*Acta Scientific Nutritional Health.* 3(7), 86-94

Central Bank of Nigeria (CBN) 2003 Bulletin

Ebido, C.E., Okoli, T.O. and Ugwumba, C.O. (2020). Technical Efficiency and Profitability of Rice Production in Anambra State, Nigeria. *International Journal of Innovative Agriculture and Biology Research*,8(2), 29-39

Effiong, E.C (2005). Efficiency of production on selected livestock enterprises in AkwaIbom state. Nigeria PhD thesis. Department of Agricultural Econoimcs, Michael Okpara University of Agriculture, Umudike.

Fasoyiro, S. B., &Taiwo, K. A. (2012).Strategies for Increasing Food Production and Food Security in Nigeria.*Journal of Agricultural & Food Information, 13(4),* 338-355.

Federal ministry of agriculture and rural development (FMAERD) (2004). State of Nigerian agriculture. Ministerial press release. Minister of Agriculture and Rural Development Nigeria,

Food and Agricultural Organisation (2017). Nigeria at a Glance

Food and Agriculture Organisation (FAO) (2004). Production year book, Trade, Rome, Italy.

Idiong, I. C. (2005). Evaluation of technical, allocative and economic efficiencies in rice production systems in Cross River State, Nigeria. An unpublished PhD Thesis, University of Calabar, Nigeria.

Igboji, C. Anozie, R.O. & Nneji, C. P. (2015). Analysis of socio-economic factors and profitability of rice production among small scale farmers in Ebonyi State. *Journal of Agriculture and Veterinary Science. 8(2), 20-2*

Jirgi, A. J.; Abdulrahman, M. and Ibrahim, F. D. (2009). Adoption of improved rice varieties among small scale farmers in Kacha Local Government Area of Niger State, *Nigeria. Journal of Agricultural Extension. 13*(1), 95-98

Magreta, R.I.; Edriss, A.K.; Mapemba, L. and Zingore, S. (*2013).* Economic efficiency of rice production in smallholder irrigation schemes; A case of Nkhate irrigation scheme in Southern Malawi. P*aper presented at the 4th International Conference of the African Association of Agricultural Economists, September 22-25, Hammamet, Tunisia*

Manyong .V. M., Ikpi, A. M., Olayemi, J.K., Yusuf , S.S., Omonoma, R.A. and Idachaba, F.S.(2005). Agriculture in Nigeria; identifying opportunities for increased commercialization and investment. USAID, IITA, University of Ibadan

National Population Commission (NPC) (2006). Population and housing census ofFederal Republic of Nigeria

National Population Commission (NPC) (2020). Population and housing census ofFederal Republic of Nigeria

National Cereals Research Institute (2004). *Training manual on rice production:* For the presidential initiative on rice production, South East Zone of Nigeria.: NCRI Publication.

National Bureau of Statistics (NRS)(2018).

Nwalieji, H. U. (*2016).* Comparative profit analysis of rice production enterprise among farmers in Anambra and Ebonyi States, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology. 8(3), 1-11*

Nwike, M.C and Ugwumba, C.O.A (2015). Profitability of rice production in Aguata Agricultural Zone, Anambra State, Nigeria: A profit function approach. *American Journal of Agricultural Science*. 2(2), 24-28

Onya, S.C., Okezie, C.A. and Ejiba, I.V. (2019). Double hurdle modelling approach to local rice consumption in Ikwuano Local Government Area of Abia State, Nigeria. *Agro-Science Journal of Tropical Agriculture, Food, Environment and Extension,*18 (2), 20-25

Okello, D. M.; Bonabana-Wabbi, J. and Mugonola, B. (2019). Farm level allocative efficiency of rice production in Gulu and Amuru districts, Northern Uganda. *Agricultural and Food Economics,*7(1), 1-19.

Osabuohien, E., Okorie, U. &Osabohien, R. (2018). Rice Production and Processing in Ogun State, Nigeria: Qualitative Insights from Farmers' Association. In Obayelu, E. (Eds).*Food Systems Sustainability and Environmental Policies in Modern Economics* (pp. 188-215), Hershey, PA: IGI Global. DOI: 10.4018/978-1-5225-3631-4.ch009.

Ouedraogo, S. (2015). Technical and economic efficiency of rice production in the Kou Valley (Burkina Faso): a stochastic frontier approach. *Asian Economic and Social Society*. *5*(2), 53-63.

Scheffé, *H. [1959]*. The Analysis of Variance. New York: Wiley.

Udemezue, J.C. (2018). Analysis of rice production and consumption trends in Nigeria. *Journal of Plant Science and Crop Protection.* 1(3), 1-

Ume, S. I; Ezeano, I; Eluwa, N and Ebe, F. (2016). Analysis of technical inefficiency in rice production among farmers in Ezza South LGA Of Ebonyi State of Nigeria ; Application of stochastic frontier production. *Archives of Current Research International*. *5(2), 1-12,*

Ume, S. I; Ezeano, C. I, Edeh, O. N and Udefi, I O. (*2018).* Resource use efficiency of uplan rice farmers in Ivo Local Government Area of Ebonyi State. *Asian Research Journal of Arts & Social Sciences, 7(2): 1-10,*