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Analysis of Technical Inefficiency in Rice Production among Farmers in Ezza South LGA of Ebonyi State of Nigeria (Application of Stochastic Frontier Production)

Ume Smiles Ifeanyichukwu[1*], Ezeano Caleb Ike[2], Eluwa Akubuike N.[3] and Ebe Felix[4]

[1]Federal College of Agriculture Ishiagu, Ebonyi State, Nigeria.
[2]Department of Agricultural Economics and Extension, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.
[3]Department of General Studies, Federal College of Agriculture, Ishiagu, Ebonyi State, Nigeria.
[4]Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Author USI designed the study, wrote the protocol, and wrote the first draft of the manuscript. Author ECI managed the literature searches, analyses of the study performed the spectroscopy analysis. Author EAN managed the experimental process and author EF identified the species of plant. All authors read and approved the final manuscript.

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ABSTRACT

This study mainly measure the level of technical inefficiency and the determinants factors among rice farmers in Ezza south of Ebonyi State, Nigeria using stochastic frontier production function. Multi- stage random sampling technique was used to select 120 rice farmers from which input and output data were collected. The instruments of data collection were well structured and pretested questionnaire and oral interview. The estimated farmers' levels of technical inefficiency ranged

**Corresponding author: Email: umesmilesi@gmail.com;*

from between 0.24 and 0.98 with mean technical inefficiency of 0.56. The determinants of technical inefficiency in rice production in the study area were farming experience and household size. The limiting factors to rice production in the study area were high cost of improve inputs, poor access to credit, poor access to information and problem of diseases and pests. High technical efficiency could be attained through efficient allocation of the employed resources which is vital to rice green revolution in the study area in particularly and the country in general. Furthermore, there is need to enhance both old and new entrant farmers' productivity through adequate access to improved production inputs.

Keywords: Technical; inefficiency; rice; production; farmers.

1. INTRODUCTION

The agricultural sector has been performing very noteworthy roles in providing food and income to majority of people in rural of sub-Saharan Africa. It is the mainstay of the economy of most countries in the region's by contributing substantially to export earnings and employs majority of total labour forces [1]. In this region, the bulk of the farming population is small holder farmers, of who are faced with numerous limitations to their farming operations. Chiefly among them is inefficiency in resource use and of which several studies have attested to its roles in undermining households' food security status and income [2]. Efficiency is a very important factor of productivity growth especially in our developing agriculture where resources are meagre and opportunities for developing and adopting better technologies have lately started dwindling [3]. Nevertheless, to improve the farmers' productivity, requires that their resources must be used more efficiently with attention paid on attaining production goal without waste (technical efficiency) [4,5,6]. Technical efficiency (TE) is ability of farmer to produce a given level of output with minimum quantity of inputs. TE can be measured either as input conserving oriented technical efficiency or output-expanding oriented technical efficiency [7,8]. The role of increased efficiencies in general is a viable tool in output maximization especially when complemented by set of policies aimed at promoting resource conservation [9].

Rice is the most important cereal crop in the world after wheat and more than half of the human race needed rice as a source of calories [10]. The growing demand for rice in the world is attributed to its ease of preparation for the table and rising income of the population especially the urban dwellers [11]. The other uses of rice as asserted by [5,12] are industrial uses (beverages, roofing materials, flour and starch), livestock feed, medium for growing tropical mushroom and compost [13].

In Nigeria, all efforts by Nigeria government through her policies and programmes to boost rice production, yet poor yields still continually challenging the farmers as opined by numerous studies. For instance, [1] reported a tremendous decline in rice yield of about 3.184 million mt, 2.516 million mt and 1.955 million mt, in 2006, 2009 and 2012 respectively. The consequences of these stagnations and decrease in rice production is wide poverty and low standard of living which characterized more than 75% of the rural population of who rice production constitutes their foremost steady of livelihood [14]. These dminishing production levels of rice with concomitant increase in land use and of course other productive resources could be ascribed to inefficiency in allocation of available farm resources. Broadly, the factors that influence farmers' efficiency may be summarized into agent and structural factors [15]. Agent factors are those associated with the farm manager such as education level, age and social capital, while structural factors are either on-farm (for example farm location, farm size, fertility and drainage) or off-farm (such as market and transport infrastructure). [16] grouped these factors into three broad categories: farm-specific variables (intensity of inputs like labour, fertilizers and seeds; farm size; organizational structure such as tenure; crop variety), economic factors (prices of inputs; marketing infrastructure), and environmental factors (rainfall; temperature).

This study is justified in the following ways; firstly, estimation of technical inefficiency in resources use will guide researchers and policy designers to raise productivity through improving efficiency without increasing the resource base or developing new technology. More so, estimation of the extent of inefficiency could also help in deciding whether to improve efficiency or to develop new technology to raise farmers' agricultural productivity by researchers and government. The study would further serve as source of research information for scholars for further studies in related subjects and also provides useful information for agricultural extension agents for effective dissemination of information to farmers. Finally, the findings of this research should be able to guide the farm managers, including the would be farmers as well as potential investors to define their production strategies and forecast the possible results with respect to factor input uses both in mono and mixed cropping system. This could of course, encourage them to invest more and also attract youths to the land.

Specifically, the objectives of the study are to:

1. describe the socio-economic characteristic of the farmers.
2. determine the technical inefficiency in resources use by rice farmers in the study area.
3. estimate the profitability of rice production in the study area.
4. identify the constraints to rice production in Ezza North LGA.

2. EMPIRICAL APPLICATION OF TECHNICAL EFFICIENCY AND CONCEPT OF EFFICIENCY OF RESOURCE USE

[17] studied the technical efficiency of Hausa potato (*Solesnostemon roundifoliuspoir*) production in southern Kaduna state, Nigeria. They analyzed primary data generated from a sample of 60 farmers by stochastic frontier modeling using maximum likelihood estimation. Results of the analysis show that material input, labour and wage rate affected the output of Hausa potato. The spread of technical efficiency indices was large with the best farm having 0.12 and the worst farm having 0.9 and the mean being 55. They observed that improve technology could be applied to improve current resource endowment to boast Hausa potato output. [14] applied stochastic production frontier model in estimating a production frontier for the upland rice farmers across gender in Anambra agricultural zone of Anambra State. Data from 120 sample farmers were used in the empirical analysis, 60 males and 60 females. The result showed that only level of education and access to credit were found to be positive and significant at 1% between the two farmers groups. The mean economic efficiencies for the male and female farmers were 0.65 and 0.61 respectively, indicating wide range of opportunities for improvement of upland rice farmers which could be through the use of improved production inputs.

[18] studied the relative economic efficiency among gender cassava farmers in Anambra State of Nigeria. Primary data generated from 120 sample farmers (60 males and 60 females) was analyzed by stochastic frontier modeling using maximum likelihood estimation. The result shows that educational level and membership of cooperative were positive and significant in the same farmer groups. More so, among the male group, the best practicing farmer having 0.78 and the worst farmer having 0.56 with mean efficiency of 0.65. The female group had best practicing farmer and worst farmer having 0.72 and 0.52 respectively with mean of 0.62.

[19] studied the technical efficiency in food crop production in Gombe State, Nigeria. They analysed primary data generated from a sample of 123 food crop farmers by stochastic frontier modeling using maximum likelihood estimation. Results of this analysis revealed that family labour, hired labour and material inputs were the major factors that affected the output of food crops. The distribution of technical efficiency indices revealed that the current state of technology used by the sample farmers was inferior. The spread of technical efficiency indices was large with the best farm having 0.89 and the worst farm having 0.13 and the mean being 0.69. Although they did not examine the factors responsible for this wide variation, these scholars observed that a superior technology is needed; this could be applied to the current resources endowment to enhance food crop output. This would involve the use of improved seeds and the application of agro-chemicals in food crop production. Also, the excess and hence inefficient use of family labour could be reduced through the creation of alternative use of family labour could be reduced through the creation of alternative employment opportunities in the study area. This will tend to absorb excess family labour and hence enhance efficiency in food crop production, having 0.72 and 0.52 respectively with mean of 0.62.

[20] focused on schooling as the only source of technical efficiency which is a great weakness. Townsend. [4] analysed the in efficiency of wine producers in Western Cape of South Africa. The objective of the study was to test the relationship

among farm size, returns to scale and efficiency. They used DEA approach for panel data and found that most of the farmers experienced constant returns to scale. On average, farms experiencing increasing returns to scale were smaller than those experiencing constant returns to scale. The relationship between farm size and returns to scale was, however, not consistent. The inverse relationship between farm size and efficiency was found to be weak and not consistent across the wine producing regions. One limitation of this study is that wine producers are more specialised and profit motivated. The results may therefore, not be generalised for the smallholder subsistence agriculture.

[21] examined technical inefficiency and productivity of Ethiopian maize farmers, comparing the performance of farmers within technology demonstration programme and those without. They found the farmers within the programme more technically efficient. Another study in Ethiopia, [20], examined the effect of education on the productivity of cereal farmers. 72 It used average and stochastic production functions and found positive correlation between schooling and farmer efficiency. The study further observed that a farmer needed to have a minimum of four years of schooling for education to have a significant effect on technical efficiency. [20] further explored the impact of education externality on the technical efficiency of the Ethiopian rural farmers. They noted that average schooling at village level improved technical efficiency of the farmers. An additional year of schooling was found to increase technical efficiency by 2.1 percentage points. Education externality occurs through adoption and diffusion of technologies that shift the production frontier to the right.

There is a growing concern about the ever worsening food crisis and the capacity of Nigeria and other developing countries to satisfy the food requirement of a fast growing population with declining domestic products despite the sizeable number of farmers engaged in farming [22]. The problem could be attributed to among others, the efficiency in the use of resources (land, labour and capital). These resources are relatively scarce to the farmers and have to be organized efficiently given the numerous alternative uses to which they can be employed [23].

Efficiency of resource use is the relative performance in transforming given inputs into output [8]. Efficiency is of three types – technical, allocative and economic efficiency [9,24]. Technical efficiency according to [13] is a measure of firm’s success in producing maximum output from a given set of input. [19] described technical efficiency as attainment of production goal without wastage. Efficiency that measures the average productivity of input according to [11] can only be a meaningful index of technical efficiency, if any of the resources is limited in the production process. Technical efficiency can be measured either as input conserving oriented technical efficiency or output expending oriented technical efficiency [7].

Allocative efficiency is ability to produce at a given level of output using the cost minimizing input ratio [25]. Economic efficiency as opined by [26], as capacity of firm to produce a predetermined quality of output at minimum cost for a given level of technology. According to [27], economic efficiency is the ability of a farmer to maximize profits. Economic efficiency is said to have occurred when a firm chooses resource and enterprise in such a way as to attain economic optimum. The economic optimum implies that a given resource is considered to be the most efficiently used since its marginal value productivity is sufficient to offset its marginal cost [18]. Nevertheless, economic efficiency is a product of technical and allocative efficiencies [28] and is influenced by sectarian and market forces [4].

Farm efficiency measurement is very vital especially among farmers in developing countries. This is true when one considers that majority of the farmers in this country is resource poor [18]. Farm efficiency measurement through frontier approach has been widely studied. Frontier involves the concept of maximally in which the function sets a limit to the range of possible observation. The observation of points below the maximum possible output can occur but there cannot be any point above the production frontier given the technology. Deviations from the frontier are attributed to inefficiency [8,29].

Frontier studies are classified according to method of estimation. [8] grouped these methods into broad categories – parametric and non-parametric method. The parametric method can be deterministic programming and stochastic frontier. These two forms of parametric are called Data Envelopment Analysis (DEA) [5,29]. The stochastic frontier analysis and the DEA are the mostly commonly used method. Both methods estimate the efficiency frontier and calculate the firm's technical, cost and profit efficiency relative to it.

The use of deterministic approach is affected by noise and measurement error [29] while stochastic frontier is generally preferred because of its inherent stochasticity [25]. The major features of the stochastic production frontier is that the disturbance term is a composite error consisting of two components, one symmetric, the other one sided component. The symmetric component, V_1 captures the random effects due to measurement error, statistical noise and other influence and assumed to be normally distributed. The one sided components, U_1 captures randomness under the control of the firm. It gives the deviation from the frontier attributed to inefficiency, it is assumed to be either half normally distributed or exponentially distributed.

Stochastic frontier production function was independently proposed by [29,5,30]. It is represented as specified:

$$U_1 = f(X_1B) \exp (V_1 – U_i)_i = 12 \ldots\ldots N \quad (1)$$

Where

- U_1 = output of J^{th} firm.
- X_1 is the corresponding M_{x2} = vectors of input quantities used by the farmers
- B is a vector of unknown parameter to be estimated
- f denotes the appropriate functional form (such as Cobb Douglas and translog) [29].

3. MATERIALS AND METHODS

The study was conducted in Ezza North Local Government Area of Ebonyi state. Nigeria. Ezza North comprises of towns and villages. Ezza North is located between longitude 7º31 and 7º 31E of Greenwich meridian, latitude 5º41 and 6º45N of Equator and altitude 116 meters above sea level. The LGA covers an area of about 305 KM^2 with a population of about 145,619 people [31]. It is bounded in the North by Ebonyi Local Government Area and Ohaukwu local government Areas, in the East by Ezza South Local Government Area (LGA) and Abakaliki Local Government Area (LGA). In the South by Ohaozara Local government Area (LGA) while in the West by Ishiele Local government Area (LGA). The area is endowed with minerals and has tropical climate with annual rainfall of about 1800 mm - 2000 mm, mean temperature of about 28℃ - 42℃ and relative humidity of 65%. The main seasons experienced in the area are dry season and raining season. The main crops cultivated are rice, yam, and cassava productions. The people also engage in livestock production, namely: sheep, goat, pig and poultry. The people also engage in other economics activities such as hunting, tailoring, barbing, petty trading, mechanics, salon and civil services.

Multi-stage random sampling technique was used to select town, village and respondent. Firstly, three towns out of five were randomly selected. Secondly, four [7] villages were randomly selected, from each of the selected towns. This brought to a total of twelve [12] villages. Finally, ten [10] rice farmers were randomly selected from each of the twelve [12] villages. This gave a total of one hundred and twenty (120) farmers for detailed study.

The information used for this study was derived from primary and secondary sources. Primary data were obtained through the use of structured questioners and informal or oral interview of respondents. The secondary sources were derived from review of related literatures, text books, conferences papers, seminar, journals, published and unpublished thesis, workshop, internets, and government publications.

The objectives 1, socio-economic characteristics and objective 4, constraint to rice production were captured using descriptive statistics such as percentage and frequency distribution. The technical inefficiency in resources use, objectives 2 was assessed using Cobb-Douglas functional form of the stochastic frontier production function, Cobb-Douglas has advantages over the other functional forms and is widely used in frontier production study in most developing agriculture, [8,4,3]. The Cobb - Douglas frontier production function is specified as follows:

$$\ln yi = ß_0 + ß_1 \ln x_{1i} + ß_2 \ln x_{2i} + ß_3 \ln x_{3i} + ß_4 \ln x_{4i} + ß_5 \ln x_{5i} + V_1 - u_i \quad [2]$$

Where, the subscript I indicates the ith farmers in the sample, in= natural logarithm, y_i= output of rice (kg), x_2= farm size (hectares), x_3= total labour (man hours), x_4 chemical fertilizer (kg), x_5 Capital input (N), v_i= random errors, u_i= technical inefficiency effects predicted by the model.

Determinants of technical Inefficiency, (U_i) could be achieved using the following model which is formulated and estimated jointly with stochastic frontier model in a maximum likelihood estimated procedure using the computer software frontier version 4.1 [8].

$$Ui= \alpha_0 + \alpha_I Z_1 = \alpha_2 Z_2 + \alpha_3 Z_3 + \alpha_4 Z_4 + \alpha_5 Z_5 + e_i \quad (3)$$

Where u_i= technical inefficiency effect, Z_1= the age of the ith farmers, Z_2= years of experience of the ith farmers in rice production, Z_3 education status of the farmers, Z_4= extension contact, Z_5= household size. α_s= are unknown scalar parameter and e_i= error term.

4. RESULTS OF THE FINDING

Table 1 revealed that 55% of the respondents were below 41 years of age, while 45% exceed41years 96.7% of the total respondents were educated, while only 3.3% weren't. 75% of the respondents not having contract with extension workers, while only 25% had contract. The table above shows that 20%, 47% and33% of the respondents fell within the household size of 1 -5, 6- 10 and 11- 15 respectively. Moreover, 87% of the respondents cultivated 1 - 2 hectares. Gamma (y) is estimated to be 0.3814 and is statistically significant at 1% level of probability as contain in Table 2. The result showed that the coefficients of farm size, fertilizer and capital inputs were positively signed and significant at 1% level of probability. The estimated coefficient of education was negatively signed and significant at 5% risk level. The estimated coefficient of education was negatively signed. The sign of the coefficients of extension contact and household size were negative and statistically significant at 5% level of probability respectively.

Table 3 revealed that among the technical inefficiency index ranges, 0.71 – 0.80 contributed the highest of about 33.3% t o the total inefficiency index, followed by 0,61 – 0.70, with percentage contribution of 19.7, while the least (0.021 – 0.30), 2.5%. The maximum technical efficiency was 0.95, minimum technical efficiency of 0.24, while the mean technical efficiency of 0.56

Table 5 shows that all the production inputs considered were all positive with capital production elasticity (0.5775) being the highest, followed by the production elasticity of farm size (0.3156), while the least was production elasticity of seed (0.0801). The sum of production elasticity was 1.077114.

Table showed that 92% of the respondents encountered the problem of high cost of improved inputs, problem of pest and disease (92%?),low soil fertility (85%), poor access to credit (83%), poor access to information (82%) and high cost of labour.

Table 1. Distribution of respondent according to their socio economic characteristics

Variable	Frequency	Percentage
Age		
20-30	22	18
31-40	44	37
41-50	27	22.5
51-60	27	22.5
Total	**120**	**100**
Level of education		
No formal education	4	3.3
Primary education	64	53.3
Secondary education	34	28.3
Tertiary education	18	15
Total	**120**	**100**
Contract with extension agent		
Yes	30	25
No	90	75
Total	**120**	**100**
Experience		
1-10	22	18
11-20	32	27
21-30	66	55
Total	**120**	**100**
Household size		
1-5	24	20
6-10	56	47
11-15	40	33
Total	**120**	**100**
Farm size		
0.1-0.9	18	15
1-2	86	72
3.4	16	13
Total	**120**	**100**

Source: Field Survey 2012

5. DISCUSSION OF THE RESULTS

The high youths involvement in agriculture as reported in Table 1 could be related to recent economic recession being witnessed in the country where lots of employable youths are jobless, hence embark into self-employment, including rice production to eke living [32]. This assertion did not harmonize with [33] who aged farmers dominated their result.

Table 2. Estimation of technical inefficiency on rice production

Variable	Parameters	Coefficients	Standard error	T- value
Constant term	ß0	4.0123	96.4723	0.0415
Seed	ß1	0.0801	0.0831	0.9639
Farm size	ß2	-0.3156	0.0508	-6.2071***
Labour	ß3	0.0373	0.0268	1.2075
Fertilizer	ß4	-0.0556	0.0085	-6.4778***
Capital	ß5	-0.5775	0.09863	-5.8559***
Inefficiency factors				
Constant	Z0	2.9094	96.5447	0.03016
Age	Z1	-0.01611	0.0082	-1.9623*
Experience	Z2	0.0652	0.03511	2.4335**
Education	Z3	-0.04884	0.0209	-2.3335**
Extension Content	Z4	-0.0442	0.0212	-2.8431**
House hold size	Z5	0.0527	0.0212	2.8431
Diagnostic statistics				
Total variance^2		0.2139	0.03125	6.8452***
Variance ratio		0.3814	0.0396	9.6315***
LR test		21.6615		
Log likelihood function		-58.3127		

Sources: computed from Field Survey, 2015.
, ** and * are significant at 10%, 5% and 1% level of probability*

As against popular auxin most farmers in the study area were educated and the recent adult education and free education programmes of Nigeria government could be invoked to explain the illiteracy level of the respondents in the study area. Education and training are important factors that could enhance farmer's ability to evaluate understand and accept new innovation, for advanced technical efficiency to be accomplished [28]. The result also showed that poor extension outreach in the study and in effects farmers are deprived of the necessary access to improved varieties and technical assistances accompanying extension services in order to advance their production [34]. Extension service is expected to help farmers improving agricultural productivity through dissemination of knowledge, facilitating access to inputs, credit facilities and linking producers to researchers and policy makers [35,36].

Most farmers studied were highly knowledgeable in rice production as indicated in Table 1, which implies the farmers' ability to overcome some problems associated with farming for higher technical and allocative efficiencies [37,12]. [31] gives credence to this assertion, as they opined that the number of years of farming experience farmers has helps he/she to set realistic goals. Large number of house hold size is in conformity with [12] and [19] who reported that relatively large household size is proxy to labour availability for Farming. Large house -hold size although may not guarantee availability of labour, since house-hold members could comprise dependent population [38,25].

The majority of the respondents operated in small scale which is synonymous with [25,39] who reported that most arable farmers in most developing countries operates in small scale hence making agricultural modernization and mechanization problematic. [12,3,18] made similar affirmation.

The estimated variance (0) is statistically significant at 1% level indicating goodness of fit and the correctness of the specified distribution assumption of the composite error term. The estimate of gamma (y) is a measure of the variance parameter and it ranges from 0 to 1. From the table, gamma (y) is estimated to be 0.3814. This can be interpreted that over 38.14% of random variation in rice production among the sampled farmer is explained by inefficiency factors of the farmers which could be from their socio- economic and institutional characteristics and management practices.

The positive signs of the coefficients of farm size, fertilizer and capital were significant at 1% probability level, which implies that any increase by 1% would result to 0.3156%, 0.556% and 0.5775% respectively increase in rice output in the study area.

However, the coefficient for seed and labour were positively signed but not significant. The estimated determinant of technical inefficiency in rice production was also presented in the same table. Variables with negative coefficients have negative relations with inefficiency. The opposite is the case for variables with positive coefficients. The coefficient of age of the farmer was negatively signed, implying that age reduces technical inefficiency or increase technical efficiency. This finding is in consonance with [40,34] who opined that age farmers are often an embodiment of farming experience of the farmer that is capable of increasing their efficiency and concurred with [41,25] who observed that farm level technical efficiency can be increased by additional investment in education including schooling, training and orientation. Nevertheless, [3] disagreed with above finding but rightly remarked that high level of education reduces the desire for farming and therefore the highly educated farmers probability devote much of their time on salaried employment instead as found in most developing countries, hence increasing technical inefficiency.

The positive sign of the coefficient of year of farming experience connotes that any increase in the variable will decrease inefficiency in the resource use by the farmers. [42,11] reported that aftermath of years of experience in farming enhances the farmers' capacity of maximizing their farm output and profit at minimal cost. Extension contact in line with *a prior* expectation was negatively correlated with inefficiency as the parameter indicated. Extension contract helps to boost farmers' adoption of improved technologies and techniques as well as provision of technical assistance to the farmers in order to reduce their technical inefficiencies for higher outputs to ensue [43,44]. The coefficient of household size was positively signed and this implies that Labour availability through large household size could lead to decrease in inefficiency. Nevertheless, [12] was of the opinion that large household size may not ease labour availability to be engaged in farming and this is especially where most of the house hold members are schooling and do not live the with house hold head or and not of labour age.

The wide technical efficiency indices differentials among farmers is an indication of need for efficiency improvement as shown in Table 3. To become most efficient farmer, an average rice farmer, requires, 49.52 $[1\text{-}6\ 56/\ 0.95]^{100}$.

Cost saving to attain the status of the most efficient rice farmer among the sampled best 10 category, while the least performing farmer would need 52.41 $(1\text{-}0.24/0.95/0^{100}$ to become the most efficient rice farmer among the worst sampled farmer The sum of production elasticity (Return to scale) was 1.0711, implying that the farmers are in stage 111 of production phase as revealed in Table 4. This was necessitated by high and positive coefficient of capital. The farmers in the study area over utilized their resources since their elasticity were less than 1.

Table 3. Frequency distribution of technical inefficient index

Technical inefficiency index	Frequency	Percentage
021- 0.20	3	2.5
0.31-0.40	10	8.3%
0.41- 0.50	12	10
0.51-60	22	18.9
0.61-0.70	23	19.7
0.71-0.80	40	33.3
0.81-0.90	10	8.3%
Maximum technical efficiency	0.95	
Minimum technical efficiency	0.24	
Mean technical efficiency	0.56	
Mean of best 10		
Mean of worst 10		

Sources computed from Field Survey, 2015

Table 4. Elasticity of production and return to scale

Input	Electricity
Seed	0.0801
Farm size	0.3156
Labour	0.03
Fertilizer	0.0556
Capital	0.5775
Return to scale	1.07114w

Source: Field Survey; 2015

High cost of improved production inputs as encountered by the respondents as contain in Table 5 has negative implication on agricultural development as substantial number of farmers resorted to the use of local varieties which had genetically broken down, resulting in poor yield [40]. Pest and diseases problems was disincentive to rice production as most farmers are either ignorant or cannot purchase the much needed pesticides for effective control, thus low yield results [38]. More so, many of the respondents encountered problems of low fertility and this could be linked to erosion and other poor farming soil management practice of which if not checkmated appropriately, farmers' efforts will be rewarded misery [11].

Poor access to credit as shown in Table 5 was a hindrance to rice production in the study area. The poor access of farmers to credit is a negative sign to agricultural development since credit is a vital catalyst in farming as it helps to procure production inputs and in payment of hired labour [28].

In addition, many of the respondents encountered the problem of poor access to information on improved agricultural innovation. This is occasioned chiefly by high ratio of extension agent - farmers which symbolize agricultural setting in most developing countries, consequently leading to poor extension outreach which is detriment to agricultural development [13]. Extension services as opined by [40] are the intermediary for propagation of innovation and technical assistance to the farmers.

Finally, high cost of labour was identified as hindrance to rice production and this could be majorly as a result of urban migration of energetic youths for white collar job and the few who may not be opportune to be enticed by urban drift, recourse to charge high prices in order to meet up with the urban counterparts [26].

Table 5. Distribution of respondents according to limiting factors to rice production

Problems	Frequency	Percentage
Poor access to credit	100	83
High cost of improved farm input	110	92
High cost of labour	80	67
Pest and disease infestation	110	92
Low soil fertility	102	85
Climate	20	17
Lack of information and communication	98	82
Poor germination	28	23
Theft	14	12

**Multiple responses.*
Source; Survey Data 2015

6. CONCLUSION AND RECOMMENDATIONS

The major conclusion drawn from the study were that the rice famers were technical inefficient in the use of their resources in rice production. Furthermore, the determinant factors to farmers' technical inefficiency were farming experience, level of education and household size. In addition, the major limiting factors to rice production in the study area were poor access to credit, high cost of labour and poor access to extension services. Based on the results, the following recommendations were proffered.

1. Credits should be made available to famers through micro-finance bank, agricultural credit scheme and any other government credit facility agencies at reduced interest rate and affordable collaterals.
2. Improving the deplorable road network in rural areas in order to facilitate farmers' produce to be transported from farms to the designated markets in urban area where such where the produce will command better price. This will help to boost farmers profit and thereby increase their financial status.
3. Federal Government fertilizer subsidy policy should be sustained in order make the input available at farm level at affordable price by poor resourced farmers.
4. Policy options aimed at providing motivation to extension agents for effective dissemination of innovation to the farmers should be formulated.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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