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Analysis of Rice Productivity among Beneficiaries of Anchor Borrowers Programme in Adamawa State, Nigeria: Data Envelopment Analysis Approach

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Authors' contributions

This work was carried out in collaboration among all authors. Author AB carried out the statistical analysis, designed the study and wrote the protocol and first draft of the manuscript. Authors IMS and AI supervised the study and literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Rice production in Nigeria has always been dominated by small scale farmers using traditional crude methods which are inefficient, resulting in low yield. Various measures have been taken by the government to improve rice production with the view of achieving self-sufficiency in rice production for consumption as well as export. Despite these measures, rice has not been sufficiently produced to meet the demand of the growing population in Adamawa State. So many problems might have contributed to this, which could be due to lack of adaptable rice varieties and low level of productivity of resources used by the rice farmers among others. Recently, the federal government introduced the anchor borrowers programme (ABP) with the goal of helping rice farmers to achieve desired output using improved production resources. This paper examined rice productivity and factors affecting rice farmers' productivity among beneficiaries of anchor borrowers programme in Adamawa State, Nigeria. A multistage random sampling procedure was used in selecting the respondents. A structured questionnaire is administered to 139 farmers spread across 3 Local Government Areas to obtain information on farmer's socio-economic variables, inputs used and output obtained in rice production. The objectives were analyzed using descriptive statistics, data

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envelopment analysis and OLS regression. The DEA result for level of productivity revealed that the average technical efficiency of 0.71, a minimum of 0.02 and a maximum of 1.0, indicating that the inefficient farmers could decrease their levels of input usage by 29% to produce the same levels of outputs to be at the same level with the frontier farmers. The results showed that the double log functional form gave the best line of fit. R^2 value was about 86% and statistically significant at 1% level. Seed (0.882), family labour (0.712), hired labour (0.109), herbicide (0.548), fertilizer (0.200) and land (0.211) were positively and significantly related to productivity at different probability levels. Based on the findings, the study concluded that the mean technical efficiency (productivity) score was 0.71 indicating a high level of productivity. The study also found that all the production factors used by rice farmers among anchor borrower's beneficiaries had a positive influence on the productivity levels of the rice farmers. Hence, productivity among rice farmers depends largely on their production factors.

Keywords: Productivity; ABP; data envelopment analysis; regression; Adamawa State; rice farmers.

1. INTRODUCTION

Productivity is an average measure of the efficiency of production. It measures the quantity of outputs in a production process relative to the level of inputs. The more output resulting from a given level of input, the more productive the process. Rice (*Oryza sativa L.*) is an annual crop and one of the most widely consumed staple foods in the world. It is the most important grain with regards to human nutrition and caloric intake, providing more than one fifth of the calories consumed worldwide. Rice is second only to wheat in terms of total world production [1]. Its world production has risen steadily from about 200 million tonnes of paddy rice in 1960 to 758.9 million tonnes in 2017 [2]. Most of the increase in global rice production comes from Asia, which accounts for 89 percent of global output. China and India are the largest producers of rice, each with a share of 29.6 percent and 22.6 percent of global production respectively. Nigeria has a world share of 0.8 percent. Rice has a global area harvested of 162.8 million hectares and an average yield (productivity) of 4.51 tonnes per hectare in 2017 [2].

In Nigeria, rice is cultivated and consumed in all parts of the country. Its production in the country rose from 0.26 million tonnes in 1960 to 5.8 million tonnes in 2017 [2]. It ranks sixth after sorghum, millet, cowpea, cassava and yam in terms of its average yield. The average yield of rice in Nigeria decreased from 2.07 tonnes per hectare in 1990 to 2.00 tonnes per hectare in 2017 which is very low compared to 5.3 tonnes per hectare and 4 tonnes per hectare in Mauritania and Madagascar respectively [2]. The land area under rice cultivation in Nigeria increased from 1.2 million hectares in 1990 to 3.2 million hectares in 2017 [3].

In order to boost rice production in Nigeria, governments have at various times come up with policies and programmes. These include Federal Rice Research Station (FRRS) (1970), Abakaliki Rice Project (ARP) (1978), Presidential Initiative on Rice (PIR) (1999), National Rice Development Strategy (NRDS) (2009) and Rice Intervention Fund (RIF) (2011) among others. The programmes and policies have the objective of increasing productivity and scale of production among others by providing incentives to rice farmers for achieving rice self-sufficiency. Nevertheless, most of these programmes and policies were terminated without achieving their objectives [4].

In 2015, Anchor Borrowers' Programme (ABP) was initiated and implemented by the Federal Government of Nigeria through the Central bank of Nigeria to assist farmers to achieve a strong and viable agricultural base with more integrated value chains, enhanced food security and higher productivity. The ABP was introduced in 2017 in Adamawa State targeting rice production. Rice is one of the most important cereal crops grown in the state and is consumed in a variety of ways. Its cultivation is often on the small-scale basis using an unimproved farming system. Adamawa State produced 219 thousand tones, representing four percent of the total rice output in Nigeria in 2017. The average yield of rice in Adamawa State is 3.3 tonnes per hectare in 2017 which is low compared to 3.6 tonnes per hectare in Benue state [5].

To encourage rice production, the ABP programme provides inputs such as improved seed, fertilizer, agrochemicals and cash for farm labour to the farmers. The outcome of these programme therefore need to be assessed to analyze their effects on the goal the government

wants to achieve through the ABP. Based on these, the study attempts to answer three questions: what are the socio-economic characteristics of rice farmers? What are the levels of productivity among the beneficiaries? and What are the factors influencing productivity among the ABP beneficiaries?

2. METHODOLOGY

2.1 Background to the Study Area

The study was conducted in Adamawa State, Nigeria. It has an approximate land area of 38,741 square km and is divided into 21 Local Government areas. It lies between latitudes $9^0 20^I N \; and \; 9^0 33^I N$ and longitudes $12^0 30^I E \; and \; 12^0 50^I E$. It shares borders with Taraba State from the South and West, Gombe State by its Northwest, Borno State to the North and it has an international boundary with the Cameroon Republic along its eastern border. It is projected to have a population of 4.06 million people in 2018 using annual growth rates of 3.6% per annum [6].

The State has a tropical climate marked by dry and rainy seasons. The rainy season commences in April and ends in late October. The wettest months are August and September. The mean annual rainfall pattern shows that the amounts range from 79 mm in the north-west part to 197 mm in the southern part [7]. The mean annual rainfall is less than 1000 mm in the central and north-western part of the State. On the other hand, the north-eastern strip and the southern part have over 1000 mm of rainfall.

Adamawa state has a typical West African Savanna climate with high temperature which is relatively distributed throughout the year. The maximum temperature in the state is 39.7°C particularly in April while minimum is as low as 15.2°C between December and January. Mean annual temperature in the state ranges from 26.7°C in the south to 27.8°C in the north eastern part of the state [7].

The major economic activity of the inhabitants is agriculture. Adamawa state agriculture contributes 0.43 percent to the national gross domestic product (GDP). The economy remains diversified across livestock (37.1 percent), crop production (16.6 percent), wholesale and retail trade (6.6 percent), real estate (23.0 percent) and road transportation (6.8 percent) of state GDP. The land used for agriculture is 485348 hectares [8]. The main food crops grown are maize, sorghum, millet, rice, cowpea, groundnut, sweet potato, yam and cassava. The farming system employed is either mono-cropping or mixed cropping.

2.2 Sampling Procedure

Multistage sampling procedure was used in drawing sample size for the study. Adamawa state consists of three senatorial zones namely; Adamawa North, South and Central senatorial zones. All the three senatorial zones were included in the survey because the rice growing areas transverse all the zones. The first stage involved purposive selection of one Local Government Area from each of the three senatorial zones well known for rice production and where ABP has been implemented. This information was obtained from the Adamawa agricultural development programme (AADP). The L.G.As selected were Numan, Girie and Michika. The second stage involved purposive selection of twelve villages proportionately from the three L.G. As in the first stage. The list of rice farming villages benefiting ABP in the three L.G.As was obtained from AADP office. Twelve villages with the highest number of beneficiaries across the three LGA's were selected. That is three villages from Numan, five villages from Girie and four villages from Michika LGA. The third stage involved estimation of sample size from the sample frame using [9] (equ 2.1). Finally, the number of respondents in each village were selected randomly using [10] (equ 2.2) as shown in Table 2. The sampling frame is the list of rice farmers benefiting from ABP in the selected villages which was obtained from AADP.

2.3 Sampling Size

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

Therefore, sample size (n) = $\frac{1277}{1 + 1277(0.08)^2}$

n = $\frac{1277}{9.1728}$ = 139

Where

n = Sample size
N = Population size
e = level of precision (acceptable sample error).

The number of respondents in each village was obtained with the help of the formula below as shown in Table 2.

$$NI = \frac{n}{N} \times Ni \quad (2)$$

Where

NI = sample size in each village
n = total number of sample size, that is 139
N = total number of farmers in the targeted population, that is total sample frame
Ni = total number of farmers in each village

2.4 Source of Data

Primary and secondary data were used for this study. The primary data were collected with the aid of structured questionnaire and oral interview schedule. The information collected was based on the 2018 cropping season and information on farm size, seed, fertilizer, family/hired labour, herbicide and output were collected from the rice farmers. Also farmer's socio-economic characteristics such as age, household size, educational level, farming experience, access to credit, extension contact and cooperative membership was obtained from the rice farmers. The secondary data were collected from Adamawa State Agricultural Development Programme which includes a list of ABP beneficiaries.

2.5 Analytical Techniques

Descriptive and the inferential statistics were used for the purpose of data analysis. Mean, percentages and frequency distribution were used to categorize farmers based on their socioeconomic variables. The inferential statistics was Data Envelopment Analysis (DEA) and multiple regression analysis which was used to achieve the objective of the study.

2.6 The DEA Model Specification

Data Envelopment Analysis (DEA) method is a non-parametric mathematical programming technique employed to determine the level of productivity of rice farmers. Productivity level was determined in terms of technical efficiency for rice producers relative to most efficient farmers in the study area [11] and [12]. The efficiency scores were constructed using Data Envelopment Analysis (DEA). The best way to introduce DEA is via the ratio form. For each decision-making unit (DMU); one would like to obtain a measure of the ratio of all outputs over all inputs, such as u"yi/v"xi, where u is an Mx1 vector of output weights and v is a Kx1 vector of input weights. Measures of technical efficiency were obtained by solving the following linear programing problem for each farmer, under an assumption of variable return to scale.

Table 1. Description of variables and expected signs

Variables	Unit of measurement	Expected sign
X_1= seed	Kg	+
X_2=fertilizer	Kg	+
X_3=herbicide	Litres	+
X_4=farm size	Hectares	+
X_5=family labour	Mandays	+
X_6=hired labour	Mandays	+

It should be noted that a positive sign of a coefficient indicates the tendency of a variable to increase productivity

2.7 The Model

$$\text{Max } \emptyset \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$
$$y\lambda^1 = \lambda^1$$

Subject to:

$$\sum_{i=1}^{1} y^i \lambda^i \geq \emptyset y^i$$
$$\sum_{i=1}^{1} x_n^i \lambda^i \leq x_n^o$$
$$\sum_{i=1}^{I} \lambda^i = 1$$
$$\lambda^i \geq o$$

Where

Φ = technical efficiency index
y^i = total rice produced by the ith farmer (kg)
x^i_n= total expenditure on the nth input used in the farm whose efficiency will tested in naira
x_1= land (hectare)
x_2 = seed (kg)
x_3= fertilizer (kg)
x_4= herbicides (ltr)
x_5 = hired labour (md)
x_6 = family labour (md).

Where there are *i* farmers in the sample, λ_i is the weight given to farmer *i* in forming a convex combination of the input vectors. Technical efficiency indices by construction range between zero and one. Higher technical efficiency indices indicate higher productivity levels and technically efficient farmers are those with a technical efficiency index equal to one.

Table 2. Sample distribution

Senatorial Districs	LGA	Villages	Sample Frame	NI=$\frac{n}{N} \times Ni$	Sample Size
Adamawa South	Numan	Kadomti	146	(139/1277) ×146	16
		Imburu	103	(139/1277) ×103	11
		Bolki	98	(139/1277) ×98	11
Adamawa Central	Girei	Mudari	102	(139/1277) × 102	11
		Lanbindo	84	(139/1277) ×84	9
		Tambo	94	(139/1277) ×94	10
		Dakri	96	(139/1277) ×96	11
		Damare	111	(139/1277) ×111	12
Adamawa North	Michika	Michika 1	128	(139/1277) ×128	14
		Vi/Boka	84	(139/1277) ×84	9
		Moda-Ldaka	122	(139/1277) ×122	13
		Bazza	109	(139/1277) ×109	12
Total			1277		139

Source: Field Survey, 2019

2.8 Ordinary Least Square (OLS)

Ordinary Least square (OLS) method was used to determine factors influencing productivity of rice among ABP beneficiaries. The OLS approach estimates the relationship between one or more independent variables and a dependent variable; the method estimates the relationship by minimizing the sum of the squares in the difference between the observed and the predicted values of the dependent variable and is preferred because it is not too computational demanding compared to nonlinear regression. Various functional forms such as the square root, double-log, quadratic, linear, semi-log and cobb-douglass functions were fitted to the data. The lead equation was selected for further analysis. The criteria that guided the selection of the lead equation were: number of significant variables, the signs of the coefficients and the value of the adjusted coefficient of the multiple determinations. The model is specified as shown below:

$$Y_i = \beta_o + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \beta_4 X_{i4} + \beta_5 X_{i5} + \beta_6 X_{i6} + u \text{ --} \quad (4)$$

Where,
Y = productivity level for each rice farmers *i* (%)
X_1 = seed used (kg),
X_2 = fertilizer (kg),
X_3 = herbicides (litres),
X_4 = farm size (hectares),
X_5 = family labour (mandays),
X_6 = Hired labour (mandays),
β_O= constant term,
β_1-β_6= regression coefficient, and u = Error term

3. RESULTS AND DISCUSSION

3.1 Socio-Economic Characteristics of Rice Farmers

The result shows that about 59.7% of the farmers had household size that ranged between 7-14 persons. The mean household size was 8 persons. These findings suggest that large household size could be as a result of the practice of polygamy in most household in the study area. Large household sizes are typical of African traditional agriculture where household size determines the family's scale of production due to farm labour availability. The result of this study implies that rice farmers have adequate household size which may guarantee the availability of labour which in turn reduces expenses on hired labour. The result is in line with the findings of [13] in a study on Economic Analysis of Rice Production in Cross River State, revealed 58.4% of the respondents had household size from 6-15 people and concluded that farmers had enough family labour force for rice production.

The distribution of rice farmers by their farming experience revealed that 59% of rice farmers had 11-20 years of rice farming experience. The mean farming experience found was 12.6 years. This indicates that the rice farmers have the needed experience in rice production. Thus, farmers with more years of farming experience are more efficient, presumably due to their ability to acquire technical knowledge through learning on the job. The years of farming experience has a significant influence on the decision making of

farmers with respect to risk aversion, adoption of improved agricultural technologies and other production related decisions. This finding is in line with [14] who reported that years of farming experience improve productivity and overall efficiency in food crop production in their study on analysis of technical inefficiency in food crop production systems among small-scale farmers in some selected local government areas of Adamawa State. This result also conformed to the result obtained by [15] who indicated 53% of the farmers have been producing for more than 20 years in Kaduna State.

Education is an important socio-economic factor that influences farmer's decision making because of its influence on farmers" awareness, perception and adoption of innovations that can bring about an increase in productivity. The results revealed 76.3% of the farmers had one form of formal education or the other. This result implies that there is potential for increased rice production since education will enable farmers to have access to information on new agricultural innovation which can be adopted to enhance their productivity. This result supports the findings of [16] in a research carried out in Anambra State, where the majority of the farmers had a primary level of education. It is also in line with [14] who reported that education affects productivity through a choice of better inputs and output, and through a better utilization of existing inputs.

Extension contact is very essential to the improvement of farm productivity and efficiency among farmers. The ultimate aim of extension services is to enhance farmers ability to efficiently utilize resources through the adoption of new and improved methods used in rice production instead of using traditional crude methods which are inefficient, resulting to low yield. The distribution of the farmers based on extension contact revealed that 100% of the farmers have access to extension contact. This implies that all the rice farmers in the study area had access to new innovations which can improve their productivity. This confirms the studies of [17] and [18] who reported that extension services enhanced farmers' productivity in the humid forest and dry savannah agro-ecological zones of Nigeria.

Table 3. Socio-economic characteristics of the rice farmers (n=139)

Socio-economic variables	Frequency	Percentage	Mean
Household Size			
< 3	15	10.8	
3-6	31	22.3	
7-10	61	43.9	7.7
11-14	22	15.8	
> 14	10	7.2	
Farming Experience(years)			
≤ 5	30	21.6	
6-10	22	15.8	
11-15	62	44.6	12.6
16-20	20	14.4	
> 20	5	3.6	
Educational Level			
No formal education	33	23.7	
Primary education	31	22.3	
Secondary education	49	35.3	
Tertiary education	26	18.7	
Access to Extension			
Had access	139	100	
Had no access	0	0.00	
Access to Credit			
Had access	139	100	
Had no access	0	0.00	
Number of observation	139		

Source: Field Survey, 2018

In agricultural production, adequate funding is required by farmers to finance their production activities. However, all farmers accessed funds to finance their rice production under ABP activities, which in turn may lead to increase in their levels of productivity. Farmers obtained their funds through formal and informal sources. The result showed 100% of the rice farmers had access to credit. The implication is that the size of rice production will be large and other inputs will increase (hired labour) since capital is available to enhance production. [19] who asserts that credit is a very strong factor that is needed to acquire or develop any enterprise; its availability could determine the extent of production capacity. It also agrees with the findings of [20] who noted that access to credit could have prospects in improving the productivity of farmers and contributing to uplifting the livelihoods of disadvantaged rural farming communities.

3.2 Levels of Productivity among Rice Farmers

The productivity (Technical efficiency) estimates for rice farmers in the study area was obtained from the data envelopment analysis (DEA) model using input-oriented DEA technical efficiency from variable return to scale data envelopment analysis (VRSTE-DEA).

The productivity (technical efficiency scores) of the rice farmers in Adamawa State are presented in Table 4. The results present the mean, minimum and maximum technical efficiency scores (Productivity) of the rice farmers. The estimated technical efficiency scores for rice farmers range from 0.02 to 1.00, with mean value of 0.71. The implication of this finding is that the rice farmers can reduce their input levels by 29% and still maintain the same level of output. This implies that, on the average inefficient rice farmers could decrease their levels of input usage by 29% and still operate at the same level of productivity.

The results further revealed that the productivity for the best practiced rice farmer was 1.00 and for least efficient rice farmer is 0.02. This implies that the least efficient rice farmer will have to reduce his input usage by 98% without reducing the level of output to reach the level of his most efficient counterpart. The result also showed that the majority (54%) of the rice farmers possess technical efficiency scores (Productivity) exceeding 0.70, implying that rice farmers in the study area exhibit high levels of productivity. This agrees with the findings of [12] who reported 0.63 mean technical efficiency of rice producers in Maiduguri.

The most productive (efficient) farmers were 17 out of 139 farmers and constituted 12.2%. These farmers may have had one form of formal education or the other, average household size of 8 people and have an average farming experience of 12.6 years. These characteristics could be the factors that enhanced them to be the most efficient among the rice farmers.

The wide variation in productivity level estimates is an indication that most of the farmers representing 46.1% (0.1-0.70 technical efficiency scores) are still using their resources inefficiently in the production process and there still exist opportunities for improving on their current level of productivity. These results suggest that the farmers were not utilizing their production resources efficiently indicating that they were not obtaining maximum output from their given quantum of inputs. In other words, the level of productivity among the farmers could increase through better use of available production resources given the current state of technology.

Table 4. Productivity scores of rice farmers (n=139)

Levels (Efficiency Score)	Frequency	Percentages (%)
0.1-0.40	36	25.9
0.41-0.50	13	9.4
0.51-0.60	10	7.2
0.61-0.70	5	3.6
0.71-0.80	8	5.8
0.81-0.90	15	10.8
0.91-1.00	52	37.4
Total	139	100.0
Mean	0.71	
Maximum	1	
Minimum	0.02	
Most efficient farmers	17	12.2

Source: Field Survey, 2018

3.3 Influence of Inputs on Levels of Productivity of Rice Farmers

Table 5 showed the results of the ordinary least square analysis on the factors influencing productivity of rice farmers in Adamawa State. Based on the magnitude of the coefficient of determination (R^2), the size and signs of the

parameter estimates, as well as their statistical significance, the double log function was chosen as the lead equation and the F-statistics was 135.29 and was significant at 1% meaning that the explanatory variables were well fitted into the model. The double log equation was used for further analysis of the data. The coefficient of determination (R^2) of 0.86 implies that 86 percent of the variations in productivity were explained by the joint action of the explanatory variables included in the model.

The coefficient of farm size was significantly and positively related to productivity in the area at 5 percent level of significance. The value of the coefficient was 0.211. This means that one percent increment in farm size will lead to increase in productivity level by 0.211. This is in agreement with *a priori* expectation. This implies that there is a chance to increase the level of productivity by expanding farm size. The high farm size suggests that high levels of productivity among the farmers could be mainly due to increase in farm size rather than increase in technical efficiency. This study is in line with the results of [21] which showed that large farm size enhanced productivity among farmers in the dry savannah and humid forest agro-ecological zones of Nigeria. However, the results from [22] showed that there is an inverse relationship between farm area and crop productivity.

The coefficient of fertilizer was positive and statistically significant at 5 percent, with a magnitude of 0.200. The result implies that an increase in the use of fertilizer leads to increase in productivity level by value equal to that of the coefficient. This is in agreement with *a priori* expectation. This means that the level of productivity of rice increased as the quantity of fertilizer applied increased. Fertilizer has the quality of improving the fertility of the soil thereby leading to higher levels of productivity. This supports the finding of [23] which observed that the use of fertilizer increased agricultural productivity in Nigeria.

Similarly, the result revealed the coefficient of family labour was significant at one percent with a value of 0.071. This is in agreement with *a priori* expectation. This implies that any increase in family labour inputs will bring about an increase in the level of productivity of the rice farmers. This indicates the importance of family labour in agricultural production and in rice production in particular. This is due to the fact that rice production involves a lot of activities which are done manually. This result is similar to that of [24] who studied economics analysis of beniseed in the Mubi Local Government Area of Adamawa State found that the coefficient of family labour was positive and contributed positively to farm productivity.

The coefficient of hired labour was positive and significant at one percent with a magnitude of 0.109, is in line with the *a priori* expectation. The result indicated one percent increase in hired labour in rice production would lead to an increase in level of productivity to the magnitude of the coefficient. This confirms the studies of [25] which showed that hired labour contributed positively to farm productivity.

The estimated coefficient of seed is reported to be statistically significant at one percent level and a magnitude of the coefficient was 0.882. This implies that increase in the quantity of seed in the farm unit could lead to increase in the level of productivity of the farmers by 88.2%. This is in agreement with *a priori* expectation. The reason is that, *ceteris paribus*, higher seed rate in kilogram per hectare will lead to greater number of stands per hectare resulting in higher output or it could be as a result of proper application or use of these resources. This is contrary to the findings of [26] who observed that quantity of seed sown was inversely related with productivity.

Table 5. Influence of inputs on productivity of rice farmers

Variables	Coefficient	Standard Error	t-ratio	p-value
Constant	2.037	0.274	7.44***	0.000
Farm size	0.211	0.100	2.10**	0.038
Fertilizer	0.200	0.095	2.10**	0.038
Herbicide	0.548	0.107	5.10***	0.000
Hired Labour	0.109	0.030	3.62***	0.000
Family Labour	0.071	0.019	3.78***	0.000
Seed	0.882	0.084	10.55***	0.000
R^2		0.86		
F-value		135.29		

****= significant at 1%, **= significant at 5%*

The coefficient of herbicide was positive and significant at one percent with a magnitude of 0.548 and in agreement with *a priori* expectations. This means that the more quantity of herbicide applied, the higher is the level of productivity. Herbicides kill or inhibit the growth of unwanted vegetation such as weeds which destroy rice crops on the farm, thereby ensuring that more crops are harvested. Thus, increases levels of productivity of rice farmers. This supports the findings of [25] which observed that the use of herbicide increased agricultural productivity of crop farming in the dry savannah and humid forest agro-ecological zones of Nigeria.

4. CONCLUSION AND RECOMMENDATIONS

Based on the findings, the mean technical efficiency (productivity) score was 0.71 indicating a high level of productivity. The factors influencing productivity among the ABP beneficiaries such as seed (0.882), fertilizer (0.200), herbicide (0.548), hired labour (0.109), family labour (0.071) and farm size (0.211) were positive and significant. This means all the inputs used by rice farmers among anchor borrower's beneficiaries had a positive influence on the productivity levels of the rice farmers. Hence, productivity among rice farmers depends largely on their production factors.

The following recommendations were made:

i. Most socio-economic attributes of the rice farmers investigated had meaningful bearing on the production ability to procure and use the production inputs. Hence, policies targeting increase in farm size should be implemented since the farmers were small scale farmers, either by increasing the input (package) given to the rice farmers.
ii. Due to high levels of productivity, there is the need to consider policies focused on enhancing productivity directly to motivate the ABP beneficiaries. Such policies as investment in irrigation.
iii. There was an indication that investment in the input used in rice production by the ABP farmers has productivity enhancement potential, as such policies geared towards increasing rice productivity should consider investment in the inputs (package) used by the farmers towards achieving effective productivity.

5. LIMITATIONS OF THE STUDY

Limitations to this study could be attributed to the following; Most of the respondents were reluctant in giving information needed. However, indirect and cross questioning were used to obtain reliable information. Most of the respondents' estimates were provided by memory recall because of poor record keeping of farm activities. Probe styles were used to elicit reliable and accurate information. Because of the security problem facing the state, it was difficult to access some of the study area but with the help of the enumerators who are used to the terrain of the area; alternative routes were used to get to the area.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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