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Resource use efficiency in rice production in the lower Anambra irrigation project, Nigeria

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Increasing the output of rice to match the growing demand for rice is a global challenge, and with growing world population, the need becomes more pertinent. For developing countries with high population density like Nigeria, the importance of rice in the food security status of the population cannot be questioned. Although the production of rice in Nigeria has been increasing over time, there is need to move towards sustainable land and water management. This has placed considerable demand to increase productivity per unit of land. The way in which the resources in rice production are utilized is a crucial pointer to the manager of a way to re-organize production to ensure higher productivity. This study examined resource use efficiency in rice production using the Cobb Douglass production function. Respondents for the study were randomly selected among farmers in the Lower Anambra Irrigation Project. The study showed that although rice production is profitable in the area, some resources were not efficiently being utilized. Recommendations for increasing the output of rice were proffered.

Key words: Costs and return, gross margin, staple crop, production function.

INTRODUCTION

Rice (*oryza sativa*) as a crop has received widespread attention from International and regional bodies due to its importance. Research work continues to go on to develop better varieties of the crop suited to a particular climates. In West Africa, under the umbrella of the West African Rice Development Authority (WARDA), some countries of West Africa of which Nigeria is one, are carrying out intensive research and promotion of the cultivation of the crop (WARDA, 1996).

Among the cereal grains, rice is the second only to wheat in terms of total world production (Goni et al., 2007). A recent Food and Agriculture Organization (FAO) estimate of cereal supply and demand puts the 2015/2016 world wheat production at 758.0 million tonnes followed by rice which is 497.8 million tonnes, while data for other grains is aggregated together as

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coarse grains (FAO, 2017). It is a preferred food in urban centers of many countries including Nigeria (Igbokwe, 2001) and in institutions, because of the relative ease of preparation in catering for large numbers of people (Akande, 2002).

In Nigeria, its importance is seen in the fact that it is accepted amongst all cultures (Okeke et al., 2008; Onimawo, 2012), and is normally preferably prepared in social functions. As noted earlier the ease in preparation and its wide usage in festivities have made rice a popular meal in most households in Nigeria, with almost similar recipes for preparation across the cultures. It is estimated that the per capita consumption of rice is about 24.8 kg (Adeyeye et al., 2010).

Rice is a semi- aquatic plant which thrives well in wet parts of the landscape where other cereal crops cannot survive, but is less tolerant of low soil moisture than other crops (Huke, 1976). This means that, it can only be produced where there is enough water within the crop growth cycle. Almost all agro-ecological zones in Nigeria can support rice growth (Akande, 2002; Daramola, 2005). On the basis of water availability, there are two major rice farming systems namely: upland rice and wet paddy or swamp rice. The swamp rice or wet paddy describes a system where the land on which rice is grown is water logged for most part of the year. Such lands are located close to river banks, or in lowland plains covered with water from a dam (FAO, 1984).

Upland rice refers to a system of growing rice on both flatlands and sloping lands that depend on rainfall for moisture (IRRI, 1975). The major rice ecosystems in Nigeria are lowland upland rain-fed, lowland rain-fed, upland rainfed and supplementation of precipitation by Irrigated production systems which together account for 97% of rice produced in Nigeria (Daramola, 2005).

Rice is processed simply by removal of husk and bran. Fat and protein content are low (Erhabor and Ojogho, 2011), so it can store well in a hot and damp climate. It has been noted that rice is the leading food in parts of the world with high population density and in areas where dietary levels are not adequate (Bouman et al., 2007; Huke, 1976).

In terms of consumption in Nigeria, rice is the fourth most important staple crop, rising from a fifth position in the 1960’s (Akande, 2002; Cadoni and Angelucci, 2013; Osifo, 1971). It is thus not surprising to note that rice production in Nigeria has been increasing over the decades (Figure 1).

This spectacular growth in production could be attributed to a variety of factors including the rapidly growing per capita demand for rice, expansion of cultivated area, and the influence of government policies and programs in the rice sector (Erhabo and Ojogho, 2011; Ogundele and Okoruwa, 2006; WARDA, 1981).

This growth notwithstanding, the demand for rice in Nigeria far outstrips the domestic supply (Bamidele et al., 2010; Kebbeh et al., 2003; Odomenem and Inakwu, 2011). The growth in demand is attributed to factors such as increasing population, increased income levels, and rising urbanization (Akande, 2002; Cadoni and Angelucci, 2013).

Nigeria is currently the largest producer and consumer of rice in West Africa (Cadoni and Angelucci, 2013; Daramola, 2005; Oyinbo et al., 2013). Nigeria meets its demand deficit through importation of rice from other countries (Ogundele and Okoruwa, 2006; Akinbile, 2010, Adenuga et al., 2013; Obayelu et al., 2017). Currently, Nigeria is the second largest importer of rice in the world (Cadoni and Angelluci, 2013; Oyinbo et al., 2013).

In an attempt to bridge the supply/demand gaps, the Federal Government of Nigeria, under various regimes have come up with programmes and policies to stimulate greater local production and consumption of locally produced rice and other staple crops (Cadoni and Angelluci, 2013; Ajijola et al., 2012; Ogundele and Okoruwa, 2006; WARDA, 2003). The country has the capacity in terms of fertile land, agro-climatic conditions and labour to substantially increase its rice production and output (Coalition for African Rice Development (CARD), 2009).

The attendant benefits this would provide to all in the rice value chain are enormous and worth pursuing. For instance this would create further employment in the production, processing, and marketing aspects of the rice value chain. Also it is important to enhanced accessibility from the production site to the market that this will generate. Apart from increasing income and contributing to food security, increased rice output overtime may turn around the supply-demand gap, saving foreign exchange for the nation.

The Lower Anambra Irrigation project in Omor Anambra State is the focus of this study. Rice is the sole crop grown here. The Irrigation project is situated in Anambra state which is one of the states of South-eastern Nigeria, noted for its high population density (Okafor, 1991), with an estimated density of 1,500-2,000 persons per square kilometer with most people residing in urban areas (Ministry of Economic Planning and Budget, 2005). Rice is also a staple crop here and has grown in importance with the changing socio-economic status of the population. The combination of high population density and insufficient land for agriculture drives the need for increased output of rice in existing rice production technologies. With a poverty estimate of 51% in 2005 and 57.70% in 2008 based on a poverty mapping conducted through the support of reforming the Institutions program (SRIP) of the European Union (EU-SRIP, 2008), there is a need to produce more food and at the same time alleviate poverty in the state.

Increasing the output of rice at a low unit cost so that

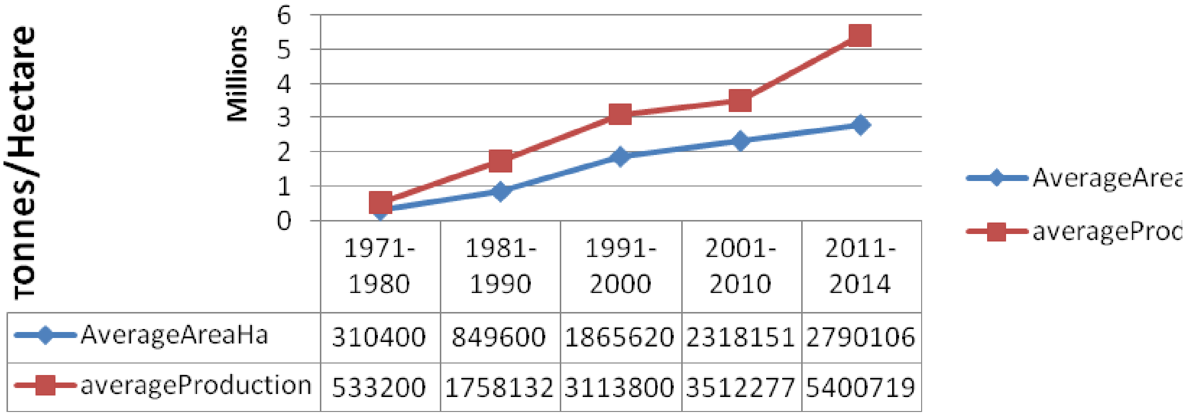

Figure 1. Nigeria rice production trend 1971-2014. Source: Calculation with data from FAOStat 2017.

farmers can be assured of reasonable profits and poor consumers can purchase at low prices becomes a growing challenge. According to Coalition for African Rice Development (CARD) (2009), rice yield in the Irrigation schemes in Nigeria has the potential to reach 7 to 9 tonnes/hectare, while rainfed lowland has the yield potential of 3.0 to 6.0tonnes/ha but this potential is not being realized. The rainfed lowland realizes only 1.5 to 3.0t/ha of rice (CARD, 2009), while irrigated rice realizes 3.5t/ha (Cadoni and Angelluci, 2013).

Apart from biophysical and institutional factors, a key socio-economic factor in assessing crop performance is the resource use efficiency in the farm**.** An examination of resource allocation scenarios in existing rice production systems would provide starting point information on why rice productivity is less than desired in Nigeria.

This study therefore examines resource use efficiency in the Lower Anambra Irrigation Project (LAIP), Anambra state. The LAIP is a public sector irrigation scheme with the objectives of contributing to food production so as to achieve self sufficiency in food, introduction of advanced farming techniques for high production together with intensive training of staff and farmers, and formulation of optimum cropping pattern, establishment of farm management and farmers' organization (LAIP, 2000). In Nigeria, more than 90% of rice is produced by resource poor small scale farmers (CARD, 2009; Muhammad-Lawal et al., 2013), and most of the farmers have small farm sizes of about 1 to 5 hectares (Odozi, 2014). Given this average size of farm land, economies of application of relevant technologies remain elusive.

Increasing the output of rice and consequently the supply entering the market depends primarily on the quantity of labour, suitable land and capital under the control of farmers, the existing production techniques and constraints as well as access to additional resources and techniques (Winch and Kivunja, 1978).

The incentive for farmers to increase their production of rice will depend upon the relative profitability of rice vis-à-vis the other crops in their farming systems; the ability and cost of adopting technologies; the ability and cost of reducing present rice production constraints; the perceived risk associated with new planting materials and techniques (Winch and Kivunja, 1978). As the Nigerian government's priority is to promote productivity in staples including rice (FMARD, 2016), there is need to examine the efficiency of production so as to proffer policy guideline.

Although rice as a crop and product has attracted several studies in Nigeria, many focused on policy, consumption and marketing dimensions (Cadoni and Angelucci, 2013; Daramola, 2005; Ifejirika et al., 2013; Emodi and Madukwe, 2011; Erhabor and Ojogho, 2011; Adeyeye et al., 2010; Bamidele et al., 2010; Daramola, 2005), while several studies focused on productivity and resource use efficiency in rice production, in other parts of Nigeria. For instance Ogundele and Okoruwa (2006) ascertained technical efficiency differential between improved rice variety farmers and those who planted traditional varieties of rice in Kaduna, Kano and Ebonyi states of Nigeria. The stochastic frontier model was used in the study and showed that there was no significant difference in efficiency between the two categories.

A study by Kebbeh et al. (2003) focused on constraints and opportunities for irrigated rice farming in six irrigation schemes mainly in Northern Nigeria. In the Lake Chad basin, Goni et al. (2007) examined resource use efficiency in rice production using a Cobb-douglas Production function.

Results and findings from these studies cannot be easily applied to rice production in Southeastern Nigeria given the agro-ecological differences between the study areas.

There is need to examine the resource allocation scenarios amongst rice farmers in Southeastern Nigeria, particularly in the highly populated states like Anambra, hence this study. Although the area under study is within a public sector irrigation facility, the rice production studied was under rainfed system as the irrigation scheme had become dilapidated.

Resource use efficiency

Farm resources are inputs of labour, capital, land and management. These are combined in different ways to produce outputs. An increase or decrease in output is a result of the level and or method in which the resources used in production are combined. As defined by Olayide and Heady (1982) agricultural productivity is the index of the ratio of the value of total farm output to the value of the total inputs used in farm production.

Productivity can be enhanced by increase in quality of inputs, changes in techniques, better trained labour, substitution of capital for labour, better organization of production and new ideas even when there are no changes in the quantity and proportion of factors (Olayide and Heady, 1982; Lipsey, 1983).

Optimal productivity of resources denotes an efficient use of resources in the production process. Efficiency is concerned with relative outcome of the processes and activities and techniques used in converting a set of inputs into output. According to Upton (1996), the economic optimum can be obtained by comparing the cost per unit of a resource input with the marginal product earned. The economic optimum is then obtained where the marginal value product equals the unit factor cost (Upton, 1996).

As defined by Ellis (1993), technical efficiency is the maximum obtainable level of output that can be gotten from a given level of production inputs. For a farm to be considered as a perfectly efficient farm, this ratio has to be unity (Olayide and Heady, 1982). This means that the larger the amount of the input the smaller the size of this ratio (Timmer, 1980).

Efficiency techniques can be considered therefore as those techniques that give higher output for a given set of inputs than other possible techniques with lower total production cost. Differences in technical efficiency according to Minjidadi and Norman (1982) can be attributed to at least four factors: differences in managerial ability; the employment of different levels of technology as indicated by the quality or type of input employed; different environmental qualities like soil, rainfall and solar radiation; and non economic and non technical factors which can prevent some farmers from working hard enough on their plots, thus failing to achieve the best level of farm output.

Allocative or price efficiency refers to the ability to choose levels of input and outputs that maximize profit given relative prices (Ellis, 1993).

MATERIAL AND METHODS

The area studied was Anambra state, Nigeria. Anambra state has a total land area of 4,415.54 m^3 and a population of 4.182.032 persons (NPC, 2006).

More than 50% of the population are engaged in agricultural production in the area of food crops, tree crops, fisheries and livestock (Anambra State Agricultural Development Programme (ANADEP), 2006). The actual area cropped with rice in Anambra State is estimated at 12,000 hectares, and the production systems are rainfed lowland and rainfed upland (Ecosystems Development Organisation (EDO), 2003). The rice potential for the state remain largely untapped (EDO, 2003; LAIP, 2000).

A purposive selection of the Lower Anambra Irrigation Project (LAIP) in Aghamelum Local Government area in the state was done due to the large scale of rice production in the area. The irrigation project has a land area of 5,000 hectares. From this, 3,850 hectares were developed for irrigated cropping while the rest (1,150 hectares) is used for rainfed farming (LAIP 2000). There are two distinct seasons in the local government area: the rainy and dry season. The duration of the rainy season is about 7 to 8 months in the area, starting from April/May to October/November. The average annual rainfall in the area is approximately 1,730 mm and this is bi-modally, distributed with peaks in July and September. The area records a maximum temperature of 38°C and a minimum temperatures of 22°C annually (Urama and Hodge, 2004).

Respondents for the study were selected using purposive and simple random sampling methods. Because the study was on rice, the Lower Anambra Irrigation project area was purposively selected in the first instance as it is a major rice growing area. A total of 160 farmers were randomly selected from the list of farmers involved in rainy season production. After data cleaning, 143 farmer responses were finally used for the study.

The data were obtained from primary sources using structured questionnaires. A pilot test of the questionnaire was done so as to remove ambiguity and ensure accuracy. Apart from the socio-economic characteristics of the farmers, data collected included farmers input level and costs, and output level and price data.

To measure resource productivity and enterprise profitability the Cobb- Douglass production function and Gross Margin Analysis were used. These are specified as follows:

$$Y = aX_1^{b1}X_2^{b2}\ X_3^{b3}\ X_4^{b4}X_5^{b5}\ ei$$

Where
Y = Output of rice (kg)
X_1 = Land (farm size in hectares)
X_2 = seed (rice seed in kg).
X_3 = Labour (measured in mandays)
X_4 = Fertilizer (measured in Kg)
X_5 = other agrochemicals used (₦).

b_1, b_2, b_3, b_4, b_5, are elasticity of response of X_1, X_2, X_3, X_4, and X_5 to output respectively

a = intercept
ei = error term

In order to determine the resource use efficiencies, the b-values as obtained from the regression results were used to determine the allocative efficiency by estimating the ratio of the Marginal Value Product (MVP) of each input to the factor price or Marginal Factor Cost (MFC) of the factor input. Thus allocative efficiency is best achieved where:

$$\text{Allocative Efficiency} = \frac{MVP}{MFC} = 1$$

Where:

MVP = Marginal Value Product of the resource input
MFC = Marginal Factor Cost of the resource input

If the value of the above ratio is more than one, it means that the farmers were under utilizing the production resource. If on the other hand, the above ratio is less than one, it implies that the survey farmers were over utilizing the production resource. Gross Margin (GM) is specified as follows:

GM = TR – TVC

where

GM = Gross margin (₦) per hectare
TR = Total revenue (₦) per hectare
TVC = Total variable cost (₦) per hectare

From the Gross Margin the Net Profit is derived as follows:

Net Profit = GM – FC

Where FC is the fixed costs of production like rent, depreciation on farm implements

Cost of production and management practices in rice production

The cost of one season production for one hectare of irrigated rice field was not completely uniform amongst the respondents because of certain variations like differences in intensity of weed, time of carrying out operation, disease and pest occurrence, and so many other variables. The averages of the costs and quantities harvested were computed and used in calculations. The average yield of paddy rice was 26.14 bags of 202 kg bag all being equivalent to 4705.2 kg of paddy rice per hectare. The farmers rented the rice fields in plots from the irrigation agency in LAIP.

Each plot is comprised of eight chains. Two plots in the rice scheme, add up to one hectare therefore, a hectare has 16 chains. For most of the operations, labour is paid for per chain of field worked. The first activity undertaken is land clearing and preparation. This is mostly done using tractor, although a few farmers used human labour for this activity. After harrowing, the rice seed is planted by broadcasting across the chains in a manner to ensure even spread. This is usually done by two people.

After two weeks, if there are some portions of the field that did not germinate well, “patching” is done to fill up those portions, by replanting, this time more carefully to ensure germination. The number of people involved in patching is determined by the severity of the germination gap. This is followed by fertilizer application which is by broadcasting too. Two people on the average carried out this activity. The pesticide as well as herbicide used are in liquid form and are applied by spraying using sprayer. Weeding is done using human labour. The average charge for this activity was N580 per chain.

When the rice starts producing panicles, the next thing is to guard against the pests. The major pest in the area is the bird. The farmers guard against it by engaging labourers to watch and drive out birds from the field. Some put a scare crow in addition. The rice is cut when fully mature at about three months after planting. The sheaves are then threshed using a threshing machine to remove the seeds from the sheaves. Thereafter, winnowing is done to separate the sheaves from the seeds. The seeds are then bagged and transported out of the farm. The average costs involved in these processes are as outlined in the results section.

RESULTS

The Cobb-Douglas Production function was used to determine the influence of inputs used for rice cultivation on the output of rice in LAIP. The predictor variables were land, (X1), seed (X2), Labour (X3), fertilizer (X4) and Agrochemicals (X5). The regression result is presented in Table 1.

The overall F-value (F= 217.6751; $p \leq 0.05$) of the regression is significant at 5%. The significant variables are seed, land and fertilizer. These accounted for 88% of the total variation in the output of rice in the location. This study shows that fertilizer has a positive influence on yield. Since the co-efficient of Cobb Douglas equation is the elasticity, it can be said that a unit increase in the level of fertilizer will lead to a 30% increase in rice yield.

Farm size also influenced yield positively. From the table, since the coefficients are the elasticities, it can be said that when a farmer increases his farm size by a unit, output would increase by 108%. The quantity of seed used was also significant but had a negative sign.

Resource use efficiency in rice production

The coefficients of the relevant explanatory variables obtained were used to calculate the efficiency of resource utilization as presented in Table 2. The table shows the measures of efficiency of resource use in rice production in LAIP Omor. The parameters such as the average physical product (APP), marginal physical product (MPP), Marginal value Product (MVP), marginal factor cost (MFC) and the ratio of MVP to MFC were derived and are presented in the table. It shows that there is allocative inefficiency in the utilization of resources. All of the resources were underutilized.

Gross margin analysis

For a gross margin and profit analysis to be done, a crop enterprise cost and return statement or budget is needed. According to Johnson (1990), variable costs are those

Table 1. Estimated Cobb-Douglass function for rice in LAIP.

Variable	Regression coefficients	Standard error	t-value
Intercept	3.729	0.397	9.38
Land	1.081*	0.187	5.77
Seed	-0.233*	0.687	-3.39
Labour	-0.089	0.136	-0.65
Fertilizer	0.302*	0.105	2.86
Chemicals	-0.035	0.041	-0.87

R^2 = 0.88; * = Significant at 1%.

Table 2. Efficiency of resource use in rice production.

Resource	APP (kg)	MPP(kg)	MVP(N)	MFC(N)	MVP/MFC
Land	5229.69	5655.21	232881.54	2200	105.8
Seed	50.73	11.84	487.762	196	2.488
Fertilizer	20.25	2.54	251.898	84	2.998

Note: APP = Average physical product, MPP =Marginal Physical product, MVP= Marginal Value Product, MFC= Marginal Factor Cost.

costs that vary in roughly direct proportion to the level of activity or area planted. They are costs over which a manager has control at a given time (Kay et al., 2008).

The gross margin is the difference between value of production and the marginal cost of that production. In practice, it is taken as the surplus (or deficit) left after variable costs have been subtracted from value of production or gross income. The Table 3 below shows the cost and return statement for rice production in LAIP. The average yield of paddy was 26 bags weighing 202 kg each on the average. The total revenue derived from this was N 216, 320. The major variable cost component was labour used for various farm operations.

Gross margin is given as Total revenue per hectare – Total Variable cost per hectare. In the LAIP scheme total revenue is given as ₦216 320 and total variable cost is ₦123, 518

Gross Margin = TR- TVC

= ₦ 216,320 - ₦ 123,518
= ₦ 92,802

Profit is given by TR - TC

= ₦ 216,320 - ₦ 126,658
= ₦ 89,662

DISCUSSION

The analysis has shown that some resources namely seed, land and fertilizer were significant in influencing yield of rice. Fertilizer had a positive influence on yield. This could be because rice responds highly to fertilizer application.

As noted by Ogundele and Okoruwa (2006), fertilizer is one of the most critical inputs in rice production. Since farm size positively influenced the rice yield, there is room for farm size expansion within the limits of the management capacity of the farmers. The LAIP authorities can do well, to expand the area allocated to farmers in the rainy season, and thus increase an individual farmers allotment.

Use of seed negatively influenced rice output. It could be that they were overusing seeds, as it was observed that they planted rice by broadcasting method, or because of poor seed management practices. It is also possible that farmers were using grains to plant but not seeds, so using additional quantities of seed may not mean much to output.

In a similar study of resource use efficiency by Goni et al. (2007) in the Lake Chad area of Borno state, it was found that labour and fertilizer significantly influenced the rice output at 1% level. Farm size was not significant while seed affected the output at 5% level of significance. The ratio of the MVP to MFC for all the resources shows that, there is allocative inefficiency as resources were underutilized.

Farmers should consider increasing their use of the resources, within the limits of their management capacity and biological relationships, as this has a high potential for farmers to increase their output and income. These

Table 3. Enterprise cost and returns statement for one hectare of rice crop in LAIP.

Item	Unit	Quantity	Price/Unit ₦	Amount ₦
A. Revenue	-	-	-	-
Sale of Paddy Rice	202kgbag	26	8320	216,320
Total Revenue	-	-	-	216,320
B.Variable Costs	-	-	-	-
Seed	Bag	3	4900	14700
Fertilizer	50kg bag	5	4200	21000
Pesticide	Litre	3	1082	3246
Herbicide	Litre	7	1460	10220
Labour	-	-	-	-
Land preparation	Manday	1	6600	6600
Harrowing	Manday	16	400	6400
Planting	Manday	2	500	1000
Patching of Rice Field	Manday	3	600	1800
Fertilizer Application	Manday	2	400	800
Herbicide Application	Manday	3	450	1350
Pesticide Application	Manday	3	430	1290
Weeding	Manday	8	580	4640
Bird Scaring	-	2	4436	8872
Harvesting	-	16	450	7200
Packing of rice panicles	-	10	370	3700
Threshing	-	5	5370 per plot	10740
Winnowing	-	7	560	3920
Gathering	-	6	420	2520
Bagging	-	6	420	2520
Transport	Bag	25	440	11000
Total Variable Costs (B)	-	-	-	123 518
Gross Margin (A-B)	-	-	-	92 802
C Fixed Costs	-	-	-	-
Administrative charge	Ha	1	2 200	2 200
Depreciation	-	-	-	940
Total fixed cost	-	-	-	3140
Total Costs (B + C)	-	-	-	126 658
Profit(TR- TC)	-	-	-	89 662

findings agree with Goni et al. (2007) as their study found that the ratios of MVP to MFC were greater than unity (1) for seed, farm size and fertilizer in the Lake Chad area of Borno State.

The gross margin analysis shows that, the major cost component was labour. This accounted for about 59% of the variable costs in LAIP. It also showed that rice production is a profitable enterprise.

Conclusion

From this study, it can be inferred that although rice production in the scheme is income yielding and profitable, the enterprise is not organized or managed in ways to ensure efficiency. This means that under the current resource management and utilization scenario, increased rice output will not be easily attained. As rice is a major staple crop and its production, processing and marketing are sources of livelihood not only in the area but also all over the nation, there is need to address the underlying factors leading to inefficiency. In the light of this, the following recommendations are proffered:

(1) Since a good proportion of the land in the project area is not put under use in the rainy season, there is need to

increase the size of land allocated to a farmer in the project which utilize economies of scale.

(2) There is need to examine rice seed handling by farmers to ensure that they use viable seeds.

(3) The dilapidated irrigation facilities should be repaired, as rice thrives best with ample water supply, which enable dry season production of the crop.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Adenuga AH, Omotosho OA, Ojehomon VET, Diagne A, Olorunsanya EO, Adenuga OM (2013). Poverty Analysis of Rice farming Households. A multidimensional Approach. Albanian J. Agric. Sci. 12(4):641-651.

Adeyeye JA, Navesero EP, Ariyo OJ, Adeyeye SA (2010). Consumer preference for rice consumption in Nigeria. J. Humanit. Soc. Sci. Creative Arts 5:26-36.

Ajijola S, Usman JM, Egbetokun OA, Akoun J, Osalusi CS (2012). Appraisal of rice production in Nigeria: A case study of North Central states of Nigeria. J. Stored Prod. Postharv. Res. 3(9):133-136.

Akande SO (2002). An overview of the Nigerian Rice economy. Available at: http://www.unep.ch/etu/etp/events/Agriculture/nigeria.pdf

Akinbile CO (2010). Behavioural pattern of upland rice agronomic parameters to variable water supply in Nigeria. J. Plant Breed. Crop Sci. 2(4):073-080

Anambra State Agricultural Development Programme (ANADEP) (2006). Anambra State Agricultural Development Programme Extension services Report, 2006. Proceedings of the 20th Zonal Research Extension Farmer Input Linkage System (REFILS) workshop, South East Agro-Ecological Zone, held on 21st-25th November, 2006 Yenegoa, Bayelsa State.

Bamidele FS, Abayomi OO, Esther OA (2010). Economic analysis of Rice consumption patterns in Nigeria. J. Agri. Sci. Tech. 12:1-11.

Bouman B, Baker R, Humphreys E, Tuong T (2007). Rice: Feeding the billions. In: Molden D. (ed) Water for food, Water For Life: A comprehensive assessment of water management in Agriculture. Earthscan London and international water management institute, Colombo. http://www.iwmi.cgiar.org/assessment/water%20for%20Food%20Water%20for%20Life/chapters/chapter%2014%20Rice.pdf

Cadoni P, Angelucci F (2013). Analysis of incentives and disincentives for rice in Nigeria. Technical notes series MAFAP, FAO, Rome.

Coalition for African Rice Development (CARD) (2009). National Rice Development Strategy.

Daramola B (2005). Government policies and competitiveness of Nigerian Rice economy. Paper presented at the workshop on rice policy and food security in Sub-Saharan Africa. Organised by WARDA, Cotonou, Republic of Benin, November 2005.

Ecosystems Development Organisation (2003). Multi-Agency Partnerships in West African Agriculture: A Review and Description of Rice Production Systems in Nigeria. Overseas Development Institute.

Ellis F (1993). Peasant Economics Farm Households and Agrarian Development Second edition Cambridge University Press. Cambridge.

Emodi AI, Madukwe MC (2011). Influence of Consumers' Socio-Economic Characteristics on Rice Consumption in South Eastern Nigeria. Libyan Agric. Res. Center J. Int. 2(3):105-111.

Erhabor POI, Ojogho O (2011). Demand analysis for rice in Nigeria. J. Food Technol. 9(2):66-74.

EU-SRIP (2008). Anambra STU Poverty Distribution and Access to social Services in the Twenty One Local Government Areas of Anambra State. Consultants's Report. Ministry of Economic Planning and Budget, Awka.

FAO (1984). Wet Paddy or Swamp Rice (Better Farming Series) third Revised Edition.

FAO (2017). FAO Cereal Supply and Demand Brief. http://www.fao.org/worldfoodsituation /csdb/en/

FAOStat (n.d.) Food and agricultural commodities production. Available at http://faostat.fao.org/site/339/default.aspx

Federal Ministry of Agriculture and Rural Development (FMARD) (2016). The Agricultural Promotion Policy (2018-2020) Building on successs of the ATA, closing Key Gaps. Policy and strategy Document https://www.google.com.ng/?gfe_rd=cr&ei=nsI6WfPLI5DVXpvTibgP#q=agricultural+policy+in+nigeria

Goni M, Mohammed S, Baba BA (2007). Analysis of Resource-use Efficiency in Rice Production in the Lake Chad Area of Borno State, Nigeria. J. Sustain. Dev. Agric. Environ. 3:31-37

Huke R (1976). Geography and Climate of Rice. In International Rice Research Institute (1976) Proceedings of the Symposium on Climate and Rice. pp. 31-50

Ifejirika CA, Arene CJ, Mkpado M (2013). Price transmission and Integration of rural and Urban Rice Markets in Nigeria. J. Agric. Sustain. 2(1):66-83.

Igbokwe EM (2001). Adoption of Rice production Techniques among wetland Farmers in Southeastern Nigeria. Tropicultura 19(4):180-183.

IRRI (1975). Major Research in Upland Rice. International Rice Research Institute, Los Banos, Philippines.

Johnson DT (1990). The business of farming. London: Macmillian P 377.

Kay RD, Edwards WM, Duffy PA (2008). Farm management Sixth edition. New York: McGraw-Hill.

Kebbeh M, Haefele S, Fagade SO (2003). Challenges and opportunities for improving irrigated rice productivity in Nigeria. West African Rice Development Association. Abidjan, Cote d'Ivoire. Viewed 6th June 2008 http://pdf.usaid .gov/pdf_docs/Pnadb849.pdf

Lipsey GR (1983). An introduction to positive economics. ELBS/Weidenfield and Nicolson P 231.

Lower Anambra Irrigation Project (LAIP) (2000). The Rice production program. Lower Anambra irrigation project.

Ministry of Economic Planning and Budget (2005). State Economic Empowerment and Development Strategy (SEEDS). Office of Economic Planning and monitoring, Awka Anambra State.

Minjidadi NB, Norman DW (1982). Determinants of technical efficiency in traditional farms in Zaria areas of Northen Nigeria. J. Agric. Econ. 35(1):41-45

Muhammad-Lawal A, Memudu IJ, Ayanlere AF Muhammedu AB, Olajogun ME (2013). Assessment of the Economics and Resource-Use Efficiency of Rice Production in Ogun State, Nigeria. Agris on-Line Paper Econ. 5(3):35-43

National Population Commission (NPC) (2006). Population Census Report.

Obayelu AB, Adeoti JO, Donstop NPM (2017). Technical efficiency and impact evaluation differentials between the adopters and non-adopters of Nerica in the six baseline states in Nigeria. Rev. Agric. Appl. Econ. 20(1):03-15.

Odomenem IU, Inakwu JA (2011). Economic analysis of rice production in Cross River State, Nigeria. J. Dev. Agric. Econ. 3(9):469-474

Odozi JC (2014). Rice Self Sufficiency and Farm Households: the Role of Climate Change and Technology Response in Nigeria. J. Poverty Invest. Dev. 3:73-84.

Ogundele OO, Okoruwa VO (2006). Technical efficiency differentials in rice production technologies in Nigeria AERC Research Paper 154.

Okafor EC (1991). Population pressure, agricultural change and environmental consequences in South Eastern Nigeria. New York: Social Science Council.

Okeke EC, Enebong HN, Uzuegbunam AO, Ozioko AO, Kuhnlein H

(2008). Igbo traditional Food system: Documentation, Uses and Resaerch Needs. Pak. J. Nutr. 7(2):365-376.

Olayide SO, Heady EO (1982). Introduction to Agricultural Production Economics. Ibadan: Ibadan University Press.

Onimawo I (2012). Traditional Food systems in assuring food security in Nigeria. In Burlingame B. Demini S. (eds) Sustainable Diets for Biodiversity. Directions and Solutions for Policy, Research and Action. Proceedings of the International Scientific Symposium on Biodiversity and Sustaunable Diets United against Hunger. 3-5 November 2010 FAO Rome.

Osifo DE (1971). Economics of the rice industry of the Western state of Nigeria. NISER Ibadan.

Oyinbo O, Omolehin RA, Abdulsalam Z (2013). Household consumption preferences for imported and domestic rice in Kaduna State, Nigeria: Implications for rice quality improvement. PAT 9:29-37.

Timmer CP (1980). Food policy analysis, Baltimore: The Johns Hopkins University Press.

Upton M (1996). The Economics of Tropical Farming Systems. Cambridge University Press, Cambridge.

Urama KC, Hodge I (2004), Irrigation Externalities and Agricultural Sustainability in South Eastern Nigeria. J. Agric. Econ. 55(3):479-501.

WARDA (1981). Annual Bulletin. West Africa Rice development Association.

WARDA (1996). Annual Report 1996. West Africa Rice Development Association.

WARDA (2003). The Nigerian rice economy in a competitive world: constraints, opportunities and strategic choices, strategy for rice sector revitalization in Nigeria. A paper presented at the WARDA technical workshop 20-21 August, Ibadan.

Winch FE, Kivunja CD (1978). Relative importance of Rice in Tropical Africa and the need to increase the farm level economic database. In: Buddenhagen IW, Persley GJ (eds.) Rice in Africa. Proceedings of a conference held at the international Institute of Tropical Agriculture Ibadan. Academic Press, London, England. pp. 11-27.