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DETERMINANTS OF RESOURCE USE EFFICIENCIES AMONG LOWLAND RICE FARMERS OF ENUGU STATE, NIGERIA

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ABSTRACT

The gap in supply and demand of rice could be due to observable differentials in the allocative efficiency of the rice farmers in Nigeria. Therefore, the study focused on the determinants of resource-use efficiencies and profitability of lowland rice farmers of Enugu State, Nigeria. A multistage sampling technique was used to collect cross-sectional data from 300 smallholder rice farmers across the six agricultural zones of the State. The gross margin (GM) analysis was used to estimate the profitability while the marginal value product-marginal factor cost (MVP-MFC) was used to evaluate the efficiency of rice farming. The Stochastic Frontier Cost Function was also used to estimate the determinants of resource use efficiency among lowland rice farmers in Enugu state. The results from the GM showed that rice production is profitable with an average rate of returns on investment (ROI) of 2.80. The MVP-MFC analysis showed that all the input factors hypothesized were over-utilised indicating the existence of large-scale resource-use inefficiency among lowland rice farmers of the state. Education and age were the only socio-economic variables that affected the allocative efficiency of the rice farmers. The study recommends a farm-level policy directed towards the encouragement of younger adults since they are more likely to adopt innovation and boost efficiency and investment in extension education for advisory services to facilitate resource-use efficiencies.

Key words: gross-margin, resource-use efficiency, marginal value product

INTRODUCTION

The importance of agriculture to Nigeria's overall development cannot be overstated. In recent years, the agricultural industry, which employs the majority of the workforce, has made a considerable contribution to Nigeria's Gross Domestic Product (GDP). The sector remains critical to the country's overall economic growth and development. Agriculture generated 21.2% of the nation's GDP in 2018, compared to 25.7% and 52.01% from industry and service sectors, respectively (NBS, 2019). Despite its importance, Nigeria's crop productivity has remained poor (Amaechina and Eboh, 2017). Agricultural output has increased over time as a result of more land under cultivation rather than improved yields (Ajoma *et al*., 2016). Most agriculture yields in Nigeria are below their potential yields, according to the empirical literature. Cereal yields in Africa, for example, are less than half of the global average, and rice yields are similar (CBN, 2012). Furthermore, the average yields of rice, sorghum, and maize in Nigeria are predicted to be 1.98, 1.50, and 1.78 t ha^{-1}, respectively, whereas the prospective yields are 6.0, 5.0, and 5.0 t ha^{-1}, respectively (NAERLS and PCU, 2011; NBS, 2012). The low yield might be linked to inefficient agro-input management, as well as the impact of socio-economic issues, policy and institutional barriers, and poorly managed extension services on resource-use efficiencies. The empirical literature suggests that agricultural productivity is generally poor as a result of inadequate and irregular use of fertilizers which is estimated at 107 kg ha^{-1} among rice farmers in Abuja, Nigeria (Ajah and Ajah, 2014; Opata *et al.,* 2019; Uche *et al.,* 2021). According to the Federal Government of Nigeria in rice transformation agenda 2011, the recommended fertilizer rate for rice is 300 kg NPK plus 200 kg urea ha^{-1}. Because of low fertility status of many Nigerian soils, adjusted rate of NPK of 400 kg NPK plus 150 kg urea ha^{-1} is also used (Obalum *et al*., 2014; Nwite *et al*., 2017). Therefore, there is a need for this study on the drivers of resource use efficiency to demonstrate empirically the primary variables influencing yield differentials.

Rice is one of the few crops in Nigeria that has been designated as a staple crop (Idiong, 2007). It has grown in importance as a source of energy for both urban and rural homes (Ajoma *et al*., 2016). Rice is not just an important source of food, but it is also a major employer of labour and a source of income for many people. More than 70% of residents are employed in various activities along the rice value chain, from planting to consumption, in places where rice is farmed (Ogundele and Okoruwa, 2006; Binuyo *et al*., 2016). Rice can be grown in practically all the agro-ecological zones in Nigeria

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(Okeke *et al*., 2008; Amaechina and Eboh, 2017). This is due to Nigeria's comparable ecological conditions to that of Southeast Asia, where the crop is commercially farmed. A total of 4.7 million ha of land might be cultivated, but only 2.7 million ha are used. Rice output, on the other hand, has increased over the last 40 years, going from less than 1 million tons in the 1970s to more than 4.3 million tons in 2010 (Binuyo *et al*., 2016). Despite an increase in rice output, local production has not kept pace with demand (Ndubueze-Ogaraku and Ogbonna, 2016). In terms of rice consumption, the country uses about five million tons per year. The inadequacy of indigenous production to meet domestic demand has resulted in the country spending billions of naira on rice importation. On average, Nigeria imports 1.8 million tons of milled rice each year. This places the country second only to Indonesia in terms of rice imports (Diagne *et al*., 2011; Ajoma *et al*., 2016). Nigeria, for example, spent ₦5 billion on rice imports in 2018 (CBN, 2019). To reverse imports and free up scarce foreign reserves for use in other sectors, some policies have prioritized growing domestic rice production (WARDA, 2003; Adeola *et al*., 2008). Incorporating enhanced technology and agricultural research is one strategy to boost productivity and increase agricultural production (Okello *et al*., 2019). According to Nwalieji *et al*. (2014), efforts to administer new technologies will not be cost-effective if existing inputs and technologies are not adequately used. As a result, using current technologies rather than developing new ones is more cost-effective in this case. To justify this proposition, determining whether farmers are efficient in their use of the limited resources at their disposal and an analysis of their resource-use efficiency becomes crucial.

Although various studies on the efficiency of Nigeria's rice sector have been undertaken, each has a different focus. Some of the studies focused on the adoption of improved rice varieties, policy, and marketing (Adeola *et al*., 2008; Okorie, 2012; Nwalieji *et al*., 2014) while others focused on the technical efficiency of rice production (Opata *et al*., 2019). Binuyo *et al*. (2016) investigated the technical efficiency of rainfed lowland rice production in Niger State Nigeria, while Osayinlusi and Adenegan (2016) used a production function technique to investigate the determinants of rice farmers' productivity in Ekiti State Nigeria. Because of disparities in socio-economic features, income, and agro-ecological variances in the study locations, the results and findings from these studies cannot easily be transferred to rice production in southeast Nigeria, particularly in Enugu State. Again, it is necessary to investigate the determinants of resource-use efficiency among rice farmers in Enugu State, which was the aim of this study. The drivers of resource-use efficiency among lowland rice farmers, as well as the gross margin and marginal value product-marginal factor cost (MVP-MFC), were explored here, contributing to inefficient rice studies.

The capacity to choose input and output levels that maximize profit based on relative prices is referred to as resource-use efficiency (Inoni and Ike, 2006; Ajoma *et al*., 2016; Amaechina and Eboh, 2017). As a result, the farm's resource-use efficient level of production is where it produces the least expensive input combination. Lowland refers to a large area of terrain with a generally low elevation. It can also be referred to as a land area below sea level. Lowland rice farming is the cultivation of rice on flooded or irrigated terrain.

MATERIALS AND METHODS

Study Area

The research was conducted in Enugu State, Nigeria. The population of Enugu State is 3,267,837 people, with a total land area of 8,022.95 sq kilometres, according to the National Population Commission (NPC, 2006; Enugu State Official Gazette, 2017). The majority of people (68%) engage in agriculture, such as crop farming, animal farming, and fishing, according to the National Agricultural Extension Research and Liaison Services (NAERLS and PCU, 2011). Rice is an important food crop grown in the State. Rainfed lowland and upland production systems are employed for rice farming in the area, and the land area used for rice cultivation is around 65,000 ha, according to the Ecosystem Development Organization (EDO, 2003). The area experiences maximum and minimum temperatures of 35° and 22°C, respectively on an annual basis (NIMET, 2019).

Sampling Technique and Size

Respondents were selected using a multi-stage sample technique from a list of 44,200 registered rice farmers reported by the Enugu State Agricultural Development Programme (ENADEP) in 2017. Enugu State is divided into six agricultural zones by 17 local government areas (LGAs). In the first stage, we randomly chose four zones viz Awgu, Nsukka, Agbani, and Enugu East. In the second stage, four LGAs (Aninri, Uzo-uwani, Nkanu East, and Isi-Uzo) notable for rice farming were purposively selected from each of the four zones. In the third stage, a total of 10 communities Oduma, Okpanku, Nenwe, Aninri, Adani, Asaba, Ugbawka, Amagunze, Eha-Amufu and Neke were purposively selected from the four LGAs due to lowland rice farming dominance in the areas. Finally, we used proportional to size sampling to randomly select a total of 300 persons (rice farmers) from the selected communities. A breakdown of the selection is given in Table 1.

Data Collection

Rice farmers' cross-sectional data were collected using structured quantitative questionnaires administered via face-to-face interview schedules. Pre-testing was done on the questionnaire to ensure that it accurately collects the variables it is intended to measure. Farmers' input and cost levels, output and pricing levels, as well as their socioeconomic factors, were all collected for the study.

Table 1: Distribution of lowland rice farmers in the study area

Zone	Communities	Number of rice farmers selected
Agwu	Oduma	40
	Okpanku	40
	Nenwe	20
Sub-total		100
Nsukka	Adani	80
	Asaba	20
Sub-total		100
Agbani	Ugbawka	30
	Amagunze	21
Sub-total		60
Enugu East	Eha-Amufu	30
	Neke	10
Sub-total		40
Grand total		300

Field Survey, 2017

Methods of Analysis

Gross margin analysis

(GM) is specified as follows:

$$GM = TR - TVC \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1);$$

where GM is gross margin (₦) per hectare, TR is total revenue (₦) per hectare, TVC is total variable cost (₦) per hectare. From the gross margin the net profit is derived as follows:

$$\text{Net Profit} = GM - FC \ldots\ldots\ldots\ldots\ldots (2);$$

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

MVP-MFC cost analysis approach

The MVP-MFC cost analysis approach was used to measure the rice farms' resource-use efficiency. Okoye *et al*. (2006), Dauda *et al*. (2014), Kadiri *et al*. (2014), Tijani and Bakari (2014), Amaechina and Eboh (2017), and Konja *et al*. (2019) employed this approach in their distinct studies, calculating MVPs for each item and comparing them to their corresponding purchasing costs, MFC. By multiplying the marginal physical product (MPP) by the unit price (P) per kg of rice output, the marginal value product (MVP) was calculated:

$$MVP = MPP.P_y\ (\beta_i.Y_i/X_i).\ P_{Yi} \ldots\ldots\ldots (3);$$

where Y_i is mean value of output, X_i is mean value of input employed in the production of a product, MPPx is marginal physical product of input *X,* and P_y is unit price of rice output. β_i is the output elasticity of input *X.* The resource-use efficiency (RUE) of each of the measurable inputs used in rice production was computed by the ratio of the MVP to that of the MFC. Thus;

$$RUE = \frac{MVP}{MFC} \ldots\ldots\ldots\ldots\ldots\ldots (4);$$

where RUE represents resource-use efficiency and MFC denotes the value of measurable factor inputs at their weighted means. RUE 1 implies that resources are used efficiently by rice farmers in the study area. RUE > 1 implies resources are under-utilized and increasing the rate of use of that resource will help increase productivity. RUE < 1 implies resources are over utilised and reducing the rate of use of that resource will help improve productivity.

Allocative efficiency

The allocative efficiency (AE) of lowland rice farmers was calculated using the stochastic frontier cost function, a model expressed implicitly as:

$$1_nCa = f(P_a, Y_a{:}\ \beta) + (V_i + U_i) \ldots\ldots\ldots (5);$$

where Ca is total cost of production of the i^{th} farmer, P_a is input prices, Y_a is output of the i^{th} farmer, β is parameters to be estimated, V_i is systematic component which represents random disturbance cost due to factors outside the scope of the farmer, U_i is one sided disturbance term used to represent cost inefficiency and independent of V_i. An individual farmer's cost efficiency (CE) is defined as the ratio of observed cost (Cb) to corresponding minimum cost (Cmin) for a specific technology.

$$CE = \exp(U) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6);$$

where CE is cost efficiency, Cb is the observed cost and represents the actual total production costs, Cmin is the minimum cost and represents the frontier total production cost. The stochastic frontier cost function is empirically specified as follows:

$$\log Ci = \beta0 + \beta1IoP1 + \beta21ogP2 = 3\log P3 + \beta51ogP4 + \beta51oP5 + IogYi + Ui \ldots (7);$$

where Ci is total production cost for i^{th} farmer (₦), β_1–β_5 is unknown parameters to be estimated, β_0 is intercept/constant, P_1 is cost of seed (₦), P_2 is total cost of labour (₦), P_3 is cost of fertilizer (₦), P_4 is cost of agro-chemicals (₦), P_5 is cost of transport (₦), Y_i is output of rice (kg), V_i is random variables that are considered to be normally distributed N (0, óV^2) and independent of the U_i, which are non-negative random variables that are half normally distributed [N(0,óU^2)] and account for production cost inefficiencies. The cost inefficiency model is specified as follows:

$$CE_i = b_0 + b_1Z_1 + b_2Z_2 + b_3Z_3 + b_4Z_4 + b_5Z_5 + b_6Z_6 \ldots\ldots\ldots\ldots\ldots\ldots (8);$$

where CE_i is cost inefficiency effect of the i^{th} farmer, Z_1 is age of the farmer (years), Z_2 is years of education (years), Z_3 is farming experience (years), Z_4 is extension contact (dummy; 1 indicates that the extension has been contacted, 0 indicates that it has not been contacted), Z_5 is family size (total number of persons in the household), Z_6 is access to credit (dummy: 1 indicates accessed while 0 denotes not accessed), *b* is estimated parameters, U_i tells you how efficient the i^{th} farm is in allocating resources. The ratio of a farmer's expected minimal cost (C1*) to the observed cost is the AE of that farmer (C1) (Aboki *et al.*, 2013; Tijani and Bakari, 2014).

RESULTS AND DISCUSSION

The socioeconomic and farm-specific characteristics of rice producers in the research region are shown in Table 2. The average age of the sampled respondents was 45 years old, according to the results. This indicates that the bulk of the responders were still youthful, energetic, and productive, which is advantageous for Nigeria's labour-intensive agriculture. This finding is consistent with those of Matanmi *et al*. (2011), Mustapha *et al*. (2012), Osayinlusi and Adenegan (2016), and Konja *et al*. (2019) who reported that the majority of young farmers involved in agriculture. The bulk of the farmers (90.7%) were males, while 9.3% were females. The strenuous and time-consuming operations associated with rice farming have resulted in male dominance in the area and the result agrees with Osayinlusi and Adenegan (2016), Kadiri *et al*. (2014), and Amaechina and Eboh (2017). In addition, the bulk of the farmers (84%) were married, with only 16% being single. This means that married people are more involved in rice production than single people. This backs up the finding of Osayinlusi and Adenegan (2016), who claimed that the majority of respondents have a stable family, which could help them make better decisions, particularly in agricultural production and home obligations. Rice farmers had an average of 13 years of education, thus, over half of the farmers had completed their secondary school education. Data show that the mean extension contact is 0.85. The ability to comprehend and evaluate information on new technologies and methods thar are passed through extension services (Konja *et al*., 2019; Ndubueze-Ogaraku and Ogbonna, 2016). The farmers had an average of 15 years of farming experience. Agriculture is a risky business, necessitating the use of experience to improve production (Ellis, 2003; Ndubueze-Ogaraku and Ogbonna, 2016; Amechina and Eboh, 2017). The majority of rice farmers (74%) were members of a cooperative association, while the remaining 26% were not. Farmers that join cooperatives have the opportunity to share information on modern agricultural technologies and to benefit from agricultural business advice and group marketing, resource pooling, and profit maximization (Opata *et al*., 2019). The majority of farmers (84%) had no access to credit to finance their rice-producing activities, whereas only 16% had access to credit. Farmers' profitability is reduced due to a lack of finance (Umoh, 2016).

Table 2: Socio-economic characteristics of lowland rice farmers

Variable	Minimum	Maximum	Mean
Age	21.00	65	45.00
Gender	0.00	1.00	0.90
Marital status	0.00	1.00	0.78
Family size	5.00	11.0	33.0
Educational level	6.00	12.0	11.0
Farming experience	2.00	31.0	15.00
Extension contact	0.00	1.00	0.85
Credit access	0.00	1.00	0.79
Cooperative membership	0.00	1.00	0.80

Source: Field Survey, 2017

Costs and Returns of Lowland Rice Production in the Study Area

According to rice farmers, the planting times for (paddy) rice were 102-120 days. For the 2017 cropping season, Table 3 shows the production costs and revenue per hectare of rice farms in the research region. From 2234.10 kg of rice, the average total value of rice produced was ₦493,735. It reveals that the average quantity of rice seed per hectare was 64 kilograms per hectare, with an average market price of ₦221 kg^{-1}, accounting for 7.92% of total production costs. The fertilizer quantity was 224 kg ha^{-1}, with an average market price of ₦124 kg^{-1} accounting for 15.55% of the overall production cost. Land clearing, tillage, planting, fertilizer application, weeding, agrochemical application, harvesting, packaging, and shipping were all part of the labour costs. The opportunity cost in man-days was used to calculate the family labour. The wage rate was different based on the activity. The average salary rate in the study region was ₦795 per man-day, resulting in an average labour cost per hectare of ₦108,120 (60.3%) of the total cost of production in the study area. The entire cost of fixed inputs for rice production, which includes the cost of renting land and depreciation of instruments, was ₦11,866 accounting for 6.64% of total expenses.

Table 3 also shows that the total revenue (TR) was ₦493,735 ha^{-1}, while the total cost (TVC + TFC) was ₦178,606 ha^{-1}. As a result, the net farm income was ₦315,129 ha^{-1}. The average rate of return on investment (ROI) was 2.80, which means that for every ₦1 invested in rice production in the study area, a profit of ₦1.80 was made. As a result, rice farming in the research area appeared to be economically viable. This result is consistent with Okoye *et al*. (2006) and Hassan (2015) who found average rates of return on investment of ₦1.80 and ₦1.29 in their respective investigations.

Resource-Use Efficiency (RUE)

Seed, labour, fertilizer, and agrochemical resource-use efficiency estimations are shown in Table 4. The ratio of MVP of each input utilized to its corresponding factor prices was used to measure rice farmers' resource-use efficiency in this study. MVP is a metric for determining how well resources are allocated. When there is no difference between MVP and unit price, inputs are considered to be efficiently allocated in pure competitive conditions. The seed has an AE value of 0.0383, indicating that farmers are overusing the seed. This suggests that by reducing the amount of seed used in production, rice yield in the study area will increase. This finding agrees with Ogundari and Georg-August (2008), Kadiri *et al*. (2014), and Konja *et al*. (2019) but differs with Dauda *et al*. (2014) and Amaechina and Eboh (2017), who found seed input to be under-utilized in their study region. Also, fertilizer had a RUE value of 0.131, indicating that fertilizer was overused in production. To boost rice output, the rice

Table 3: Average costs and returns per hectare of rice production

Variable		Quantity (kg ha^{-1})	Price per unit (₦ ha^{-1})	Value (₦ ha^{-1})	Total cost (%)
Rice revenue		2234.10	221	493,735	
Variable costs	Seed (kg)	64	221	14,144	7.92
	Fertilizer	224	124	27.776	15.55
	Agrochemicals (litres)	10	1670	16,700	9.35
	Labour (man-days)	136	795	108,120	60.34
	Total variable cost			166,740	93.36
Fixed costs	Cost of renting land			6000	3.36
	*Depreciation of tools			5866	3.28
	Total fixed costs			11,866	6.64
	Total cost			178,606	100
	Total revenue			493,735	
	Net farm income			315,129	
	Return on investment			2.80	

Source: Field Data, 2017. *Depreciation of tools like hoe, cutlass, knapsack, barrows, sickle, basin, motorcycle, etc.

Table 4: RUE estimates of resources

Variable	MPP	MV = MPP×P$_y$	MFC (₦)	AE = MVP/MFC	Remark
Seed	0.4519	99.86	2605.31	0.0383	overutilised
Labour	0.1962	43.36	1226.03	0.0354	overutilised
Fertilizer	0.4403	97.31	744.38	0.131	overutilised
Agro-chemical	0.3576	79.03	16674	0.0473	overutilised

Source: Field Survey, 2017

producers should lower the amount of fertilizer used. The results are consistent with Opata *et al*. (2019) and Kadiri *et al*. (2014) also contradict the finding of Biam *et al*. (2016) and Nimoh *et al*. (2012). Also, the RUE values for labour and agrochemicals are both < unity, 0.0354 and 0.00473, respectively.

This means that farmers were overusing both components and that reducing their use would enhance rice farmers' RUE and consequently rice production. This result contradicts Amechina and Eboh's (2017) findings but agrees with that of Ishiaku *et al*. (2017).

Rice Farmers' Estimated Allocating Efficiency

Table 5 shows the calculated maximum likelihood (ML) estimates of stochastic frontier cost parameters for rice. The sigma-squared (δ^2 = 0.2640) for the cost function is quite high and significant at the 1% level of probability, indicating that the provided assumption of the composite error term distribution is true (Idiong, 2007). The gamma (γ = 0.002) indicates that allocative inefficiency accounts for 0.2% of the variability in rice farmers' output that is not explained by the function.

The estimated coefficients of all the parameters of cost function are positive. The cost of labour, fertilizer, agro chemical and transport are significant at 1% level while the cost of seed is not significant. The estimated coefficient of the variable output was positive and significant at 1% level indicating that an increase in rice output will lead to increase in total cost of production. This shows that the cost of production is influenced by the quantity of output realized. The result of this study is in tandem with the findings of Ogundari and Georg-August (2008), Biam *et al.* (2016) and Hassan (2015) which in their separate studies reported a direct relationship between cost of production and output quantity.

The estimated coefficients of seed (0.0452) were positive and not significant. The cost of labour (0.1962) both hired and family indicated a positive and significant effect on total cost of rice production at 1% level. This implies that farmers' total cost of producing rice is increased as more labour is put into use. These show the importance of these variables in the allocation of costs in rice production.

Cost of agro-chemical (0.3576) and transport cost (0.1524) are positively signed and are significant at 1% level respectively. The positive relationships of the cost of these variable inputs in the cost allocation of the rice production system indicated that an increase in any of these variables would increase the total cost of production for rice in the area. Also estimated coefficient of fertilizer implied that if there is a unit increase in the cost of fertilizer the total cost of production would increase by a magnitude of 0.4403.

Table 5: Allocative efficiency of the rice farmers in the area

Variable	Parameters	Coefficients	t-value
Constant	β_0	-4.2654	-5.332***
Output	β_1	0.0531	3.5203**
Cost of seed	β_2	0.4519	0.8125
Cost of labour	β_3	0.1962	3.5203***
Cost of fertilizer	β_4	0.4403	7.6244***
Cost of agro-chemical	β_5	0.3576	6.0037***
Cost of transport	β_6	0.1524	3.1968***
Inefficiency model			
Constant	Z_0	0.1524	0.8275
Age	Z_1	-0.1524	-2.0851**
Educational status	Z_2	0.0207	1.6042*
Farming experience	Z_3	0.0137	1.0596
Extension contact	Z_4	0.0016	0.4104
Family size	Z_5	-0.0439	-0.4125
Credit access	Z_6	0.0967	0.6689
Sigma-squared	(δ^2)	0.2640	11.6213***
Gamma	(γ)	0.0020	0.2874
Log likelihood function		-225.7539	
LR test		13.8245	
Total number of observations		300	
Mean efficiency		0.62	

Source: Computed from field data
***Significant at 1% , **Significant at 5%, *Significant at 10%

The socio-economic factors influencing the allocative efficiency of rice farmers in Enugu State were age and educational status which are significant at 5 and 10% level respectively as shown in Table 5. The results reveal that the coefficients of age (–0.0075). The negative influence of age on allocative efficiency agrees with the opinion of Idiong (2007) that the older a farmer becomes the more he or she is unable to combine resources efficiently given the available technology. Although family size is not significant, its coefficient is negative, the negative relationship of family size with allocative efficiency implies that an increase in family size increases the efficiency of the farmer although not significantly. The sign of the coefficient agrees with the findings of Okorie (2012). The positive and statistically significant relationship of education with allocative efficiency agrees with the findings of Amaza and Olayemi (2000) and Biam *et al.* (2016) that increasing years of formal education increases farmers' level of allocative and technical efficiency.

CONCLUSION

The drivers of resource-use efficiency among lowland rice farmers, as well as the gross margin and marginal value product-marginal factor cost (MVP-MFC), were explored in this research, contributing to inefficient rice studies. Rice farmers' allocative efficiency is influenced by their age and education. The results from the GM show that rice production is profitable with an average rate of returns on investment (ROI) of 2.80. The MVP-MFC analysis shows that all the input factors hypothesized were over utilised indicating the existence of large-scale resource-use inefficiency among lowland rice farmers of the state. The empirical results also show that the socio-economic variables that affect the allocative efficiency of rice farmers were only education and age. It can be concluded from this study that, while rice farming in the area is income-generating and profitable, there is widespread resource-use inefficiency among rice farmers in Enugu State, Nigeria. Almost all of the hypothesized input components were overused by the farmers. This could be due to the government's recent engagement in the rice business, which included subsidizing most inputs for farmers. Since input intensification has not resulted in the anticipated yield for rice in the state, efforts should be directed toward investment in extension education and the dissemination of new technologies. Finally, the study recommends a farm-level policy directed towards the encouragement of younger adults since they are more likely to adopt innovation and boost efficiency and investment in extension education for advisory services to facilitate resource-use efficiencies.

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