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Full Length Research Paper

Econometric evaluation of rice profitability determinants in Kogi State, Nigeria

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The study was designed to determine the level of profitability of rice and factors influencing rice profitability in Kogi State, Nigeria. Primary data was randomly collected from 120 rice farmers with the aid of a set of structured questionnaire and interview schedule. The data were analyzed using descriptive statistics and regression analyses models applying four functional forms. The lead equation, semi-log model, was chosen using appropriate theoretical and econometric criteria after diagnostic tests including tests for heteroscedasticity and multicollinearity. Results indicated that rice farming in the state was profitable, with an average farm posting a profit of at least US$788.30 (₦122, 974.40K) annually. Rice profitability in the area was largely influenced by farmers' socio-economic attributes as well as production factors including farmers' age, farming experience and years of formal education recorded by the farmers. The resource inputs that significantly influenced rice profitability in the area of study was volume of farm credit accessed, value of fertilizer applied and water/irrigation expenses. Consequently it was recommended that policies that will make farm credit available at affordable rates to the farmers, promotion of rice as a means of livelihood, enhanced access of farmers to educational facilities and removal of subsidy/government interference in fertilizer which increases the market price of fertilizer in the country be put in place in Nigeria. Government should however invest more in irrigation facilities to reduce the cost of fertilizer production in the study area.

Key words: Rice profitability, econometric evaluation, costs and returns, profitability determinants, Kogi State, Nigeria.

INTRODUCTION

Roughly 50% of the world population is wholly dependent on rice as a staple food; 95% of the world's rice crop is eaten by humans. Microsoft student (2007) maintained that Asian countries produced about 90% of the 576 million tons of rice grown worldwide in 2002. According to West Africa Rice Development Association (WARDA) (2003), rice (*Oryzae* Spp.) generates the largest contribution to household income in Nigeria. Rice is produced in Nigeria using a variety of rice production systems and technological levels coexisting together. WARDA (2003), Horna et al. (2005) maintained that lowlands without water control are the main ecology followed by upland and irrigated rice. Rice production can be found in each of the large geopolitical zones of the nation (for example Middle Belt) based on ecology and ethnic traditions. These extend from the northern to southern zones with most rice grown in the eastern states (Enugu, Cross River, and Ebonyi States) and middle belt (Benue, Kaduna, Niger, Kogi and Taraba States) of the country. Daramola (2005) observed that the middle belt of the country (where Kogi State is located) enjoyed a comparative advantage in production over the other parts of the country. Reports by WARDA (2003) and Horna et al. (2005) indicated that Kogi State produced at least five percent (5%) of the total rice production in Nigeria. In 2000, Kogi's total output and yield mainly from wet season rice farming stood at 1,025,000 tons and 2.28 tons /ha (PCU, 2003).

The demand for rice has been increasing at a much faster rate (5 million tons/annum) than domestic production (3 million tons/annum) and more than any other African country since mid 1970 (FAO, 2001). Domestic

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supply has not kept pace with demand as imports have steadily increased faster than domestic supply by accounting for close to 60% of total supply and leaving the huge gap of about 2 million metric tons annually, a situation, which has continued to encourage dependence on importation thus draining the hard earned foreign exchange (WARDA, 2003; Momoh, 2007). Inability to fill in the demand and supply gap of rice has been alluded to erratic policies (WARDA, 2003). Unfortunately, average yield of upland and lowland rain fed rice in Nigeria is 1.8 ton/ha, while that of irrigation system is 3.0 ton/ha Project Coordinating Unit (PCU, 2003). This is very low when compared with 3.0 ton/ha from upland and lowland system and 7.0 ton/ha from irrigation system in places like Côte d'Ivoire and Senegal. Therefore, it appears that rice farmers in Nigeria are not getting maximum return from the resources committed to the enterprise (FAO, 2004; Mbah, 2006). It is not certain whether there are sufficient studies in the area of rice profitability determinants in Kogi State, Nigeria. There is therefore a need to improve the knowledge gap in rice productivity studies in Nigeria, especially in Kogi State to allow for more evidence based policy making in rice production and food security in Nigeria. The above scenario underlies the need for this study.

Objectives of the study

This research is geared towards uncovering the level of profitability of rice among rice farmers in the state with and the likely factors influencing their returns on farm investments. Specifically the study aimed at: 1 ascertaining the profit levels of rice farms in the state; 2 identifying the socio-economic attributes of farmers and other production factors influencing rice profitability in the study area.

LITERATURE REVIEW

Socioeconomic characteristics of rice farmers in Nigeria and rice output

According to Amaza and Maurice (2005) and Okoruwa and Ogundele (2006) most of the rice farmers in Nigeria are of small to medium scale categories. The average farm size among the traditional rice farmers was 1.259 ha while that of improved technology farmers was 6.52 ha. Okoruwa and Ogundele (2006) further noted that the average age of traditional technology rice farmers was estimated to be 42 years while that of the improved technology was 45 years. Average year of schooling for the traditional technology rice farmers was 7 years while that of the improved technology was 8 years (Okoruwa and Ogundele, 2006). Mbah (2006) showed that most of the rice farmers (69%) were either illiterates or semi-illiterates, with farm size between 0.1 to 0.3 ha, a situation that could be best described as small-scaled. This was why, according to the report, two explanatory variables, level of education and farm size had no significant effect on the output of rice in the study area. Instead he discovered that greater number (77.5%) of rice farmers in the area had long years of experience of about 10 to 30 years; and large family size of about 10 to 25 members; with many wives and children (including their extended families), all served as family labour. However, the variable, age, despite having a negative coefficient, was found to be statistically significant at 5% because productivity declined with advancement in age.

According to Horna et al. (2006), lowland rice production was more profitable than upland rice production in the state although upland rice is an alternative for small farmers with limited access to good quality land. They identified the following farmer characteristics that could affect aspects of rice cultivation: age, gender, years in school, marital status, experience in rice production, the size of the household, income from rice production, and whether or not the farmer sells rice. Age, gender and marital status characterize rice producers, and affect variety preferences. Years of school and experience in rice production express farmer knowledge. In West Africa, household size is also an indicator of better economic status. Households in the sites surveyed were often organized around a male household head with several wives. Except for Kogi, in the other two states in Nigeria, (Ogun and Ebonyi) farmers sell processed rice both parboiled and milled (Horna et al., 2006).

Inputs used in rice production in Nigeria

Many research reports on rice production in Nigeria (Okoruwa and Ogundele, 2006; Urama and Hodge, 2005) identified the following major inputs used in rice production: labour (hired or family labour), land (upland, swamp or irrigated), fertilizers, rice seedlings and herbicides. However other inputs identified by a few of them (Urama and Hodge, 2005) included water, hired machines as well as insecticides/herbicides. These inputs constitute the major cost components of rice production in Nigeria.

Determinants of rice output and profitability in Nigeria

Mbah (2006) revealed that capital investment and labour used had greater influence on rice output than other variables. Fertilizer used had little or no impact. However, it could be deduced that the quantity applied per hectare on the average fell short of the recommended rate and that farmers could not meet up with that rate because of its high cost. The result of the costs and return analysis

showed that rice production enterprise was a lucrative (profitable) business. In a similar study, but with bias for rice marketing, Anuegbunwa (2006) observed that rice marketing was economically viable. A return of N1.17 and N1.09 for every N1.00 invested at the wholesale and retail levels respectively were recorded in Ebonyi State. In their own study, Okoruwa and Ogundele (2006) discovered that farm size, hired labour, herbicide and seed contributed significantly to the technical efficiency of the farmers. For the improved technology rice farmers, only three of the variables, farm size, hired labour and herbicides were significant. This indicated that the quality of seed planted was more important than the absolute quantity. Farm size was found to be significant, and even though the use of hired labour and herbicides were found to contribute significantly to technical efficiency among the traditional rice variety farmers, their corresponding elasticities did not suggest that increased use of these input will yield more than proportionate increase in output.

Amaza and Maurice (2005) showed that land, seeds and other costs were significant at 1% level; while fertilizer and water were significant at 5% level in determining rice productivity. The estimated coefficients for land, fertilizer, family labour, seeds, water and other costs were all positive, which conform to *a priori* expectation.

Theoretical and analytical framework

Economists agree that profit maximization is one of the major objectives of firms (Samuelson and Nordhaus, 2005). For firms to make profit (an indicator of productivity) they need to consider their costs when making pricing decisions (Crawford, 1997). Production costs and efficiency are primarily determined by the prices of inputs including time, labour, capital and technological advances (Samuelson and Nordhaus, 2005). Costs can be broadly categorized as fixed and variable. Fixed costs do not vary with the level of production. Rents, insurances, the salaries of administrative staff and depreciation on capital equipment are all examples of expenditures which do not directly vary with the level of production. If the production of an organization in a given time period were zero, these costs still have to be met. In contrast, variable costs are those expenditures which vary in direct relation to volumes of production. Examples of this class of cost include raw material costs, hourly labour rates and packaging costs.

This work benefits from Yotopoulos and Lau (1979) and other economic theorists who applied and recommended the use of unit output profit model and a Cobb-Douglass production function to test for productivity of firms. Yotopoulos and Lau specifically tested for equal technical and pricing efficiency; equal economic efficiency, and absolute pricing efficiency for each type of firm using the profit model. Their model uses data readily accessible from firms such as input prices, output prices and fixed capital service flow. Tests can be run to determine if the firms are profit maximizers and if technological progress is neutral.

Net farm income (NFI) and gross margin (GM): Johnson (1982) and Kay (1986) recommended the use of net farm income in ascertaining the profitability of farmers. NFI, according to them is derived after obtaining the gross margin (GM). GM is the amount of money realized after deducting variable expenses or costs from total sales or income. NFI is obtained by adjusting net cash farm income for total depreciation, net inventory changes and value of products consumed at home. NFI, according to Kay (1986) is the only true measure of profit for the accounting period since it includes the above adjustment which could be quite large. NFI is the profit from the year's operation and represents the return to the rice farm owner for personal and family labour, management and equity capital used in the rice farm.

Gross margin= Total income (TI) – Total variable costs (TVC). NFI = GM – Total fixed cost (TFC).

Regression analysis: According to Gujarati (2006) and Greene (2008) the primary objective of regression analysis is to determine the various factors which cause variations of the dependent variable. SPSS software defined it as the estimation of the linear relationship between a dependent variable and one or more independent variables or covariates.

METHODOLOGY

Sample frame, method of collection and data structure

Kogi State is bordered by nine other States and is the most centrally located State in Nigeria. Kogi State has an average maximum temperature of 33.2℃ and average minimum of 22.8℃. (Kogi State Government, 2007). The State has two distinct weathers – dry season, which lasts from November to February and the raining season that lasts from March to October. Annual rainfall ranges from 1016 to 1524 mm. The study was undertaken in three local government areas chosen purposively from three agricultural zones producing rice in Kogi State. A total of 120 respondents were selected using stratified random sampling technique out of which 40 each were drafted from each local government area (LGA) (Bassa, Lokoja and Idah LGAs) each representing an agricultural zone. For collecting relevant data from the respondents, an interview schedule was prepared considering the objectives in view. Personal Interview was conducted with all the 120 respondents using interview schedule.

Empirical data estimation method

Simple descriptive statistics like percentage, mean, range etc were calculated and at the same time gross margin was used to determine the profitability of the rice farms. Multiple regression analyses were conducted to ascertain the determinants of rice profitability in the study area. Four functional forms, (linear, semi-log, Cobb-Douglas and exponential functions) were used out of which the best model was selected based on its performance with

respect to its estimated F-Ratio, Akaike Information Criteria and conformity of most of the coefficients' signs to theoretical expectations. Before the lead equation was used for empirical analysis it was subjected to econometric diagnostic tests, particularly, tests for heteroscedasticity (Table 3) and presence of severe multicollinearity in the model. Using Breusch-Pagan-Godfrey test in Eviews 7 econometric software which is based on Breusch and Pagan (1979) theory, an F-statistic of 1.693 was obtained. It was significant at 10 percent alpha level of significance, implying that heteroscedasticity was present in the model. In order to correct for heteroscedasticity therefore, all further analyses were done using White heteroskedasticity-consistent standard errors and covariance approach to remedy the problem following Gujarati and Sangeetha (2007); this way, heteroscedasticity was no longer detected in the model. The test for presence of severe multicollinearity in the model was done using variance inflation factor (VIF) which was computed using Stata 11 econometric package. According to Gujarati and Sangeetha (2007) any VIF of above 10 indicates a problem of severe multicollinearity for the particular variable in the model. In this analysis, only a single variable out of nine (9) explanatory variables had VIF greater than 10 (and it had a VIF of 12). We therefore tolerated that variable since the number was negligible and considered the model to be free from the trouble of severe multicollinearity. The implicit form of the multiple regression models was:

$\Pi = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, + \mu)$.

The explicit form of the models is as follows:

a) $\Pi = \beta o + \beta_1 X_1, + \beta_2 X_2, + \beta_3 X_3, + \beta_4 X_4, + \beta_5 X_5 + \beta_6 X_6, + \beta_7 X_7, + \beta_8 X_8, + \beta_9 X_9, + \beta_{10} X_{10}, + \mu)$

… Linear model

b) $\ln\Pi = \beta o + \beta_1 X_1, + \beta_2 X_2, + \beta_3 X_3, + \beta_4 X_4, + \beta_5 X_5 + \beta_6 X_6, + \beta_7 X_7, + \beta_8 X_8, + \beta_9 X_9, + \beta_{10} X_{10}, + \mu)$

…Semi-log model

c) $\ln\Pi = \beta o + \beta_1 \ln X_1, + \beta_2 \ln X_2, + \beta_3 \ln X_3, + \beta_4 \ln X_4, + \beta_5 \ln X_5 + \beta_6 \ln X_6, + \beta_7 \ln X_7, + \beta_8 \ln X_8, + \beta_9 \ln X_9, + \beta_{10} \ln X_{10}, + \mu)$

…Double log model

d) $\Pi = \beta o + \beta_1 \ln X_1, + \beta_2 \ln X_2, + \beta_3 \ln X_3, + \beta_4 \ln X_4, + \beta_5 \ln X_5 + \beta_6 \ln X_6, + \beta_7 \ln X_7, + \beta_8 \ln X_8, + \beta_9 \ln X_9, + \beta_{10} \ln X_{10}, + \mu)$

… Exponential model

Where

Π = Farm profit in Naira; X_1 = Age of farmers in years; X_2 = Volume of farm credit accessed in Naira; X_3 = Years spent on formal education; X_4 = Quantity of fertilizer applied in kilogrammes per hectare; X_5 = Years of rice farming experience; X_6 = Irrigation and Water expenses in Naira per farm; X_7 = Value of labour input expenses in Naira per farm; X_8 = Total Marketing expenses (including packaging, transport and storage); X_9 = Value of Seedlings applied in Naira; ln = natural log to base e ; βo = intercept of the model; β_1 - β_1 = coefficients of the respective explanatory variables and μ = stochastic error term.

RESULTS AND DISCUSSION

Profitability of rice in Kogi State

Results of profitability analyses are presented in Table 1. The average profit obtained by rice farmers in the study area was one hundred and twenty two thousand nine hundred and seventy four Naira thirty Kobo (₦122, 974.30). This is equivalent to about seven hundred and eighty eight thousand US dollars ($788.30) per farm assuming an exchange rate of N156.00 to a dollar. An average farm in the area is about 1 ha. The findings show that rice farming is a very profitable business in Kogi State, Nigeria. This corroborates earlier studies in other parts of Nigeria which held that rice farming is a very profitable enterprise (Anuegbunwa, 2006; Okoruwa and Ogundele, 2006). There are therefore great potentials in rice farming as a source of livelihood especially in the area of poverty alleviation and household food security in Nigeria with respect to Kogi State.

Determinants of rice farming profitability in Kogi State

After comparing the performance of the four regression models tried, the researchers finally selected the semi-log model as the lead equation (Table 2). The choice was based on the high number of coefficients' agreement with theoretical expectation in the model compared to the rest in addition to other econometric model selection criteria fulfilled such as the Akaike Information Criterion (AIC) and Schwarz criterion. According to Greene (2008) and Gujarati and Sangeetha (2007) when models that are similar are being compared, the ones with the lowest AIC or Schwarz criterion should be chosen especially if the coefficients' signs are in consonance with *a priori* expectation. They advised that models should not be selected based on R-square performance alone but based on theoretical as well as these econometric criteria. The F-ratio of the semi-log model was significant at 1 percent alpha level. The R-square 0.34 recorded by the model implied that 34% of the variation in profit levels recorded on the sample rice farms were explained by the variation of the independent variables used in the model.

Age, volume of farm credit accessed, monetary value of fertilizer applied on the farm and farming experience level all returned positive signs which were in agreement with theoretical expectations. Their signs imply that marginal increase in these input variables lead to increase in the profit level posted by the rice farms surveyed. They were statistically significant at 10, 1, 5 and 5% alpha levels respectively. The slope coefficient of the variable representing age which was 513.23 means that, in absolute terms, a relative change in the age of the farmers resulted in profit increase of N513.23K on the farms studied. The findings was in agreement with Mbah (2006)'s earlier finding that age was a significant determinant of rice profitability.

The low p value (0.000) of the estimated F-statistic of the model means that at alpha = 1%, we reject the null hypothesis that the joint effects of all the explanatory variables included in the model are equal to zero.

Credit accessed had a slope coefficient of 4.03E-06 which implied that 0.0004% of change in profit level (very marginal anyway) was as a result of volume of credit

Table 1. Mean costs and returns in rice farming in Kogi State farms.

Parameter	Cost item	Amount in naira (₦)	Amount in (us$)
Total revenue		220760	1415.13
	Variable costs		
	Labour cost	75420	483.462
	Maintenance of machines/tools	3550.42	22.7591
	Cost of pesticides	3362.88	21.5569
	Cost of seedlings	4178.33	26.7842
	Marketing (Packaging/transport/miscellaneous) expenses	4386.83	28.1207
	Fertilizer expenses	2347.5	15.0481
	Water/irrigation expenses	4539.77	29.1011
Total variable cost (tvc)		97785.7	626.832
Gross margin		122974	788.297

Source: Field Survey, 2009.

accessed for the farm business. The marginal contribution of credit to the farms' profits could be as a result of low volume of credit accessed by the farmers who were privileged to access credit. The positive sign of credit input underlies the need for improved farm credit access as emphasized by so many policy advocates in the developing countries like Nigeria where farmers find it very difficult to raise start up capital for their farm business. Even though, education's slope coefficient was negative, it was significant, statistically. It shows that education was a significant determinant of profitability among rice farmers. Educated farmers are more likely to apply modern technologies and information that can raise the farm value addition process which can result in higher profitability. However it was not very clear why the negative sign was returned. On the other hand, farming experience was positively signed and had a slope coefficient 1.49E-02, meaning that a unit change in years of farming experience attained by a rice farmer could bring about increased profit of about 0.05%. This findings agree with Horna et al. (2006) who observed that years of formal education and rice production experience had significant influence on rice profitability (or productivity) in Kogi State. The elasticity of fertilizer input (in terms of expenses on the input) was 0.00252 meaning that about 0.00252% change in profit was brought about by an extra naira spent on fertilizer that was used in rice farming in the study area. It also implied that fertilizer was an important factor of production among rice farmers in the study area. This is in harmony with Okoruwa and Ogundele (2006), and Urama and Hodge (2006)'s findings who earlier noted that fertilizer application and other inputs increased yield on rice farms. The slope coefficient of the variable, irrigation and water expenses on rice farms was 6.87E-05 and significant at 10% alpha level. This represents a low profit elasticity of 0.0000687% (almost inelastic) with respect to the variable, water and irrigation expenses. Even though this result does not show high response of profit to these inputs usage, its positive sign buttressed the significant role water and irrigation services play on rice farms. If these inputs are efficiently utilized, they can boost the potentials of rice productivity in the study area. Rice requires a lot of water both at the nursery and growing stage. Where irrigation and water facilities are absent it means high profit can hardly be expected from such farms.

Conclusion

Through the use of appropriate econometric techniques, this study has been able to uncover the major determinants of rice profitability in Kogi State, one of the important rice producing states in Nigeria. The study confirmed that rice is a profitable business hence an important enterprise that should not be ignored but promoted since it can help in income generation, poverty reduction and food security at household and national level. The study proved this point when it noted that a typical rice farm in Kogi State could post a profit of at least US$788.30 in a year. It is hereby recommended that government should promote rice farming in the State as it is capable of enhancing food security and generating gainful opportunity for farmers, irrespective of educational attainment. The study further found that both socio-economic and production factors were significant determinants of rice profitability in Kogi State. The major socio-economic factors that significantly determined profit levels posted by Kogi State rice farmers included age, farming experience and years of formal education recorded by the farmers. Young, energetic farmers who could cope with the labour requirements of rice farming appeared to be dominating rice farming in Kogi State. There

Table 2. Results of regression analyses (OLS) using four functional forms.

Variable	Linear model		Exponential model		Double log model		Semi-log model	
	Coefficient	**p value**	**Coefficient**	**p value**	**Coefficient**	**p value**	**Coefficient**	**p value**
Age	513.2283	0.218	14399.45	0.4361	0.231781	0.1799	0.007569	0.0659
(t values in parentheses)	(1.2389)NS		(0.7816)NS		(1.3496)NS		(1.8573)*	
Volume of farm credit accessed	0.5574	0.0005	1000.829	0.0053	0.007979	0.0217	4.03E-06	0.0038
(t values in parentheses)	(3.6164)***		(2.8439)***		(2.3281)**		(2.9563)***	
Years of formal education	-591.694	0.1002	-291.2519	0.6484	-0.005084	0.3711	-5.92E-03	0.0882
(t values in parentheses)	(-1.6578)*		(-0.4573)NS		(-0.8980)NS		(-1.7201)*	
Fertilizer applied	2.7187	0.0745	415.429	0.4074	0.004919	0.2512	2.52E-05	0.0531
(t values in parentheses)	(1.8008)*		(0.8317)NS		(1.1534)NS		(1.9554)*	
Farming experience in years	1217.171	0.0954	13695.43	0.1369	0.193921	0.0378	1.49E-02	0.0338
(t values in parentheses)	(1.6822)*		(1.4984)NS		(2.1018)**		(2.1498)**	
Irrigation and water cost	11.7627	0.0057	67406.2	0.0028	0.431621	0.0328	6.87E-05	0.0824
(t values in parentheses)	(2.8188)***		(3.0564)***		(2.1618)**		(1.7532)*	
Labour costs	0.127665	0.2647	20402.3	0.0282	0.088777	0.28	2.98E-07	0.7663
(t values in parentheses)	(1.1299)NS		(2.2242)**		(1.0857)NS		(0.2980)NS	
Marketing expenses	-1.892834	0.5582	-2572.202	0.8353	-0.048981	0.6603	-2.13E-05	0.4798
(t values in parentheses)	(-0.5873)NS		(-0.2084)NS		(-0.4408)NS		(-0.7090)NS	
Value of seedlings planted	-1.771193	0.499	-13535.43	0.2565	-0.111626	0.2628	-1.78E-05	0.4371
(t values in parentheses)	(-0.6777)NS		(-1.1406)NS		(-1.1256)NS		(-0.7799)NS	
Intercept	16434.81	0.5798	626462.1	0.0158	6.976805	0.0046	1.08E+01	0.0000
(t values in parentheses)	(0.5553)NS		(-2.452208)		(2.8942)***		(39.3836)***	
R-Square	0.424058		0.332785		0.305309		0.34363	
Adjusted R-squared	0.376935		0.278195		0.248471		0.289927	
F-Ratio	8.999038	0.000	6.096042	0.0001	5.371542	0.00004	6.3987	0.0000
Akaike Information criteria	24.16492		24.31203		1.030085		0.973344	
Schwarz criterion	24.39721		24.54432		1.262376		1.205635	

Source: Results of econometric analyses based on Field Survey, 2009.

Table 3. Results of heteroskedasticity test: Breusch-Pagan-Godfrey.

F-statistic	1.69265	Prob. F(9,110)	0.0991
Obs*R-squared	14.5972	Prob. chi-square(9)	0.1026
Scaled explained SS	9.93758	Prob. chi-square(9)	0.3556

Source: Field data (2009) analysis results using E-Views 7 econometric programme.

is need for the State and Federal Government to encourage these young farmers whose rising age and experience are serving as veritable inputs to rice productivity in the state. Education of rice farmers can enhance their ability to adopt modern and innovative practices that can bring about increased profitability in rice farming in the state. Hence there is need for the government to promote adult and formal education programmes especially among rice farmers in Kogi State, Nigeria. Access to farm credit input, fertilizer expenses and water/irrigation expenses were some production factors that influenced rice productivity in the state. The fact that access to farm credit was influencing profitability in the study area implies that microfinance banks and commercial banks in the country should be charged by Central Bank of Nigeria and Federal Government to reduce the bureaucracies and rigidities that discourage rice farmers from having access to borrowed funds (credit) at affordable interest rates. Such policy can enable credit input contribute more meaningfully to rice profitability in the state in particular and in Nigeria at large. Nigerian Government still needs to invest in irrigation facilities especially in rice producing states like Kogi State so that farmers' expenses on irrigation could be reduced. Finally, it is recommended that government should make fertilizer available to rice farmers at affordable prices by removing middle men and other agencies who contribute to making fertilizer prices prohibitive to rice farmers in the state. The current subsidy on fertilizer can be removed to make market forces force down prices of fertilizer for the rice farmers. If these policies are adopted, these researchers believe that rice farming can become the best income earner for farmers in rice producing ecologies in Nigeria.

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Appendix 1. Descriptive statistics of resource inputs and socioeconomic variables evaluated.

Variable	Obs	Mean	Std. Dev	Min	Max
Profitability in Naira	120	122974.3	52064.91	28640	272900
Irrigation cost in Naira	120	4539.767	1048.788	2500	8000
Fertilizer cost in naira	120	2347.5	2909.213	1.00E-05	10000
Marketing cost in Naira	120	4386.825	1296.42	400	8000
Value of Seedlings used in Naira	120	4178.333	1542.789	1900	8500
Labour_Expenses in Naira	120	75420	42370.8	17700	181500
Credit accessed in Naira	120	34966.67	31653.04	0.00001	150000
Age of farmers	120	42.23333	9.375216	22	67
Extension contact (Count)	120	9.083337	10.42345	1.00E-05	40
Years of formal education	120	8.275003	5.984518	1.00E-05	25
Experience in years	120	14	7.050836	2	30

Source: Field Data, 2009.