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Full Length Research Paper

Resource use efficiency of fadama III small-scale rice farmers in Nasarawa State, Nigeria

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This study examined the utilization of farm resources among fadama III small scale rice farmers in Nasarawa state. Data were collected from a random sample of 1200 farmers (600 participating and 600 non participating farmers) from seven local government areas of Nasarawa state. These were analyzed using regression analysis, farm budget, t-test and efficiency measures. The result revealed that the coefficient of labour, fertilizer, seed were statistically significant at (P<0.01) and farm size (P<0.05) and herbicide (P<0.1) for participants, while the non participants fertilizer was found to be (P<0.01), labour, seed and herbicide (P<0.05) and farm size (P<0.1). The overall production elasticity of the inputs used was 1.045 and 1.356 for participants and non participants. Participants used all the resources more efficiently than the non participants with a ratio of 6.40 as against 9.04 for labour, 6.71 as against 7.60 for fertilizer, 3.74 as against 7.11 for seed, 7.00 as against 10.92 for herbicide and 3.25 as against 5.27 for farm size. The result for MVP adjustment reveal 84.38% adjustment is required for optimum utilization in labour for participants as against 88.94% for non participants. 85.10% adjustment is required for optimum utilization in fertilizer for participants as against 88.85% for non participants. 73.22% adjustment is required for optimum utilization in seed for participants as against 85.93% for non participants. 83.30% adjustment is required for optimum utilization in herbicide as against 90.84% for non participants. 67.23% adjustment is needed for optimum utilization in farm size as against 81.03% for non participants. Production resources in the study area were found not to be efficiently utilized for both groups, hence, not to optimum economic advantage. It therefore goes that urgent attention is needed through provision of agricultural inputs to bridge the gap for optimum use of the resources in the study area and technical efficiency in rice production in Nasarawa state could be increase through better use of farm inputs; as such there should be provision of such enabling policies (such as making available all agricultural inputs required at the right time and affordable prices). There is also need for fadama III participants to have access to credit, as financial assistance from fadama project cannot meet their demand for inputs.

Keywords: Optimum economic advantage, Percentage MVP Adjustment, Production elasticity Resources use.

INTRODUCTION

The status of development assistance by respective development partners gives insights on the nature and potentials of funding and assistance by the respective multilateral and bilateral agencies in the country. The World Bank country assistance strategy focuses on expanding community driven development approaches and supporting infrastructure as means of easing bottlenecks to private sector activity in agriculture and other economic sectors. The World Bank provides part financing for the fadama III projects (FGN, 2009).

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Successive governments have always acknowledged the eminent role of agriculture in the national economy. Somehow, they have never been able to position agriculture on the proper scheme of national priorities through its investment decisions. Agriculture has been neglected in terms of quantity and quality of investments. Adoption of rice production has been considered as a pride among small scale farmers in Nigeria because rice is considered as a high value crop. Production resources are seldom combined in proper manner by small scale farmers (Abdulsalam et al.,1998). Taking production status of rice cultivation and ecological endowment, Nigeria could be said to have an undoubted comparative advantage for the expansion of its production as food and raw materials thereby becoming self sufficient and indeed becoming an exporter of the commodity (Idi. S. 2003). Most of the rice produce in Nigeria is accredited to small scale farmers. The small scale farmers operate in small distantly fragmented farm land with technical and allocative inefficiencies in the use of available farm resources (Hamidu, 2000).

On the other hand, maintenance of productivity in agricultural production which is a component of efficiency (Lingard,1975) is equally a fundamental component of sustainability (Santacoloma, 2000). Thus it is expected that if Fadama farmers improve the efficiency of their use of inputs, they simultaneously achieve economic and environmental objectives which are considered a prerequisite for increase sustainability (De Koeijer et al., 2002). In this way, the goal of Fadama to reduce poverty by improving the living condition of the rural poor and to contribute to food security and increased access to rural infrastructure, and specifically the Fadama project will enhance agricultural productivity and value addition for small holders and rural entrepreneurs on a sustainable basis (Msuya, 2003). This, therefore raises the question of the farming inputs that could be supply by the Fadama project in order to enhance the level of efficiency of Fadama farmers, hence, improve the productivity of rice production in Nasarawa state and Nigeria as a whole.

The broad objective of the study is to assess the relative economic efficiency among participating and non participating Fadama III small scale rice farmers in Nasarawa state, Nigeria.

Specifically the study intends to;

Determined the socio-economic characteristics and its effect on Fadama III farm output and income in the study area.
Determine the cost and returns associated with rice production in the study area.
Determine the extent of farm resource use for both participating and non participating rice farmers in the study area.

MATERIAL AND METHOD

Study Area

The study was conducted in Nasarawa state; the state is located in the middle belt zone of the country. It lies between latitude 7^o and 9^o North and longitude 7^o and 10^o East, and shares common boundaries with Benue state to the South, Kogi state to the West, the federal capital territory (FCT), Abuja, to the North West, Kaduna and plateau states to the North East, and Taraba state to the south East. The state has a climate typical of the tropical zone, because of its location. Its climate is quite pleasant: A mean temperature of 60^o F and 80^o F maximum have been recorded while rainfall varies from 313.73cm in some places to 145cm in other areas. The month of December, January and February are cold (sometimes quite cold) due to the very dry harmattan winds blowing across the state from the North-East. It is characterized by two distinct seasons: dry and wet. The dry season start from November to February, while the rainy season is from March to October. Average daily sunshine in the state is 6.2 hours and average daily vapour pressure is 26hpg.
The physical features of the study area are largely mountainous. It covers very large area of the state, much of which are rocky and of undulating highlands to average height of about 1,400m above sea level. The coastline of river Benue and its trough created alluvial fertile soil, which is very good for crop production. Other smaller rivers cover most parts of the state and empty into the river Benue. The sediments are generally comprised of sandstones, siltstones and subordinate inter-bedded clays all of cretaceous age. Alluvial soils are found along the Benue trough and their flood plains. These are always swampy in nature due to availability of water all year round. The forest soil, which are rich in humus, and laterite soils are found in most parts of the state.
The 1991 census put the state's population at 1.2 million. The state's population by 2003, estimated at the national average growth rate of 2.83% per annum, is projected to 2.0 million. However, with the influx of people particularly into Karu and Keffi LGAs, due to their proximity to the federal capital territory, Abuja, as well as into Lafia, being the state capital, places the current estimated population of the state at 2,040,097 (NPC, 2006). Males constitute 51% and females 49% of the population. Over 80% of the people of the state are subsistence farmers and live in rural areas. Major crops suitable to the state ecological conditions are rice, sesame, soya beans, groundnut, cassava, yam, maize, cashew, sorghum, melon, mangoes, citrus and vegetables. There is an estimated water surface area of over 5,645 square kilometer and favourable climatic conditions for the fish industry.

Population and Sampling Procedure

The target population for the study is the Fadama III participating and non-participating rice farmers in

Table 1. Number of participating Fadama rice farmers to be sampled.

LGA	Number of Registered FUG into Rice Production.	Number of Registered members into Rice Production.	Number of Fadama Rice Farmers to be Sampled.
Lafia	20	321	141
Awe	26	638	281
NasarawaEggon	9	172	76
Kokona	10	188	83
Karu	3	56	24
Toto	8	181	80
Doma	2	33	15
Total	**78**	**1589**	**700**

Source: preliminary Survey, 2016.

Nasarawa state, the state was stratified according to the three agricultural zones (south, north and west). The sampling procedure comprise of a two stage sampling procedure.

The first stage involve random selection of two local government areas from each agricultural zones noted for intensive production of rice from the thirteen local government areas participating in the Fadama III project, for sample reliability one more local was selected giving a total number of seven local government areas. The seven local government areas noted for intensive production of rice sampled during preliminary survey were southern zone (Lafia, Doma and Awe), Northern zone (Nasarawa Eggon and Kokona) and Western zone (Karu and Toto). Stage two; from the 100 registered Fadama III rice farmers group (see appendex) in the seven local government areas with 1589 participating rice farmers, 700 participating Fadama III rice farmers were selected for the study by simple random sampling technique. A proportionality factor was use to determine the number of participating rice farmers from each local government area. As in table 1, the proportionality factor is specified as;

$n = nL / NL * 700$ ---------- (1)

Where

n = Sample size per local government area.

nL = Number of Fadama users group members per local government that are into rice farming.

NL = Total number of Fadama users group members that are into rice farming.

From the 1400 questionnaires distributed for participating and non participating rice farmers 1200 were returned, 600 for participating and 600 for none participating.

Data Collection Techniques

Primary data were collected with the aid of questionnaires which was administered by the researcher as well as trained enumerators (seven facilitators of the Nasarawa state Fadama III project). The pre- test of the questionnaires and actual data collection was done in the dry season, that is, between November and December; and between January to April respectively. The data collected covered farmers' socio economic and crop production variables.

Variable and Model Specification.

The differences of means in income, output and farm size of the participating and non-participating rice farmers were computed to test for significant difference.

The Model

$$Z = \frac{\mu_1 - \mu_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} \quad \text{---------- (2)}$$

Variables' Measurement

μ_1= Mean parameters of participating fadama rice farmers in the study area.

μ_2= Mean parameters of non-participating fadama rice farmers in the study area.

σ_1^2= Variance of parameters of participating fadama rice farmers in the study area.

σ_2^2= Variance of parameters of non-participating fadama rice farmers in the study area.

n_1= Number of participating fadama III rice farmers sampled in the study area.

n_2= Number of non-participating fadama rice farmers sampled in the study area.

Z= Test statistics to be used for the study.

To determine the extent of farm resource use for both participating and non participating rice farmers in the study area, various tools were employed; these include regression analysis for farm production and efficiency measures.

Analytical tools

To determine the cost and return of participating and non participating fadama III rice farmers in the study area,

various tools such as gross margin, net farm income, farm financial analysis and sensitivity analysis was use.

The models

Gross Margin Analysis

The gross margin, the return over variable cost is an appropriate measure of profitability used for comparing enterprises for short run annual planning decision. It is a very useful planning tool in farming enterprises in the case of subsistence agriculture (Olukosi, J. O and Erhabor, P.O. 1998). It forms the basis of most analysis and planning procedure and enables a practicing farmer to understand his business better. The gross margin will be calculated as follows:

GM = TR – TVC ---------- (3)

Where

GM = Gross margin

TR = Total revenue

TVC = Total variable cost.

This research used gross margin to determine the return over variable costs per hectare for rice farm in the study area. The gross margin model used is expressed as;

$$GM/Ha = \frac{TR - TVC}{\text{Total area of production (Ha)}} \quad \text{---------- (4)}$$

Net Farm Income

Net farm income is the profit from the farmer's operation and represents the return to the owner for personal labour, management and equity capital used in the farm business. Net farm income is sometimes called net income or net profit. It is the income from the business that pays for the farmers and his family's physical and managerial effort and interest on his own capital invested in the business. It includes the farm products consumed by him and his family, so therefore it is not necessarily cash incomes (Johnson, D.T. 1982). Net farm income can be calculated using the following formula;

NFI = GM – FC ---------- (5)

Where

NFI = Net farm income

GM = Gross margin

FC = Fixed cost

This study used net farm income to determine the return on capital invested the wage for farmers' physical labour and reward for management per hectare. The net farm income model use for the study is;

$$\text{Net farm income/Ha} = \frac{\text{Gross margin} - \text{Total fixed cost}}{\text{Total area of production (Ha)}} \quad \text{-- (6)}$$

Farm Financial Analysis

Farm financial ratios used to determine the strength of Fadama III rice farmers in the study area, these ratios were gross, operating and fixed.

Gross Ratio

The gross ratio is the total farm expenses divided by the gross income. Where the total farm expenses figures is obtained by summing the operating and fixed cost figures. The gross ratio measures the ultimate solvency and success of the farm business. It is a long run planning tool for determining the performance of entire farm business. A less than one ratio is desirable for farm business (Olukosi and Erhabor, 1998). The gross ratio shows the proportion of gross income that goes to pay for the expenses. The gross ratio formula for this study is;

$$\text{Gross ratio} = \frac{\text{Total cost of production}}{\text{Total revenue}} \quad \text{---------- (7)}$$

Operating Ratio

The operating ratio is the total operating cost divided by the gross income. The operating ratio shows the proportion of the gross income that goes to pay for the operating cost. The operating cost which is directly related to the variable resources is the decision making tool with regards to factor adjustment during a production period. In traditional farm setting, the operating ratio is more important than fixed ratio in that most of the resources used are variables, while fixed items are almost negligible (Olukosi and Erhabor, 1998). The operating ratio formula to be used for this study is;

$$\text{Operating ratio} = \frac{\text{Total variable cost}}{\text{Total Revenue}} \quad \text{---------- (8)}$$

Fixed Ratio

The fixed ratio is the total fixed cost divided by gross income. It is an indication of the percentage of the gross income accruing to the fixed resources. It is also ex ante decision tool: (Olukosi and Erhabor, 1998). The fixed ratio formula for this study is;

$$\text{Fixed ratio} = \frac{\text{Total fixed cost of production}}{\text{Total Revenue}} \quad \text{---------- (9)}$$

Farm financial ratio was used by many workers Sani, R.M. (1996), Milton, S. (1997), Saleh, D.G (1997), Suleiman, H.R (2008) to measure the financial success of farms in Nigeria.

Return per Naira Invested

Return per Naira invested is given as the net income realized on each naira invested in the rice enterprise.

RNI = NFI/TC ---------- (10)

Where;

RNI = Return on naira invested.

NFI = Net farm income

TC = Total cost of production.

Regression Analysis Model Specification for Farm Production in crop Farm.

A rice production function was estimated using regression analysis. Three functional forms were derived to estimate the rice production function for beneficiaries and non beneficiaries; these functional forms are modeled in linear, semi logarithm and double logarithm. The production function are specify as follows;

Linear functional form:

$TFO = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \mu$ ------ (11)

Semi – logarithm functional form

$TFO = \log a + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + b_5\log X_5 + \log\mu$--- (12)

Double – logarithm functional form

$\text{LogTFO} = \log a + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + b_5\log X_5 + \log\mu$-----(13)

Where
TFO = Total farm output (kilogram)
X_1 = Farm labour (Mandays)
X_2 = Quantity of fertilizer (Kilogram)
X_3 = quantity of seed (kilogram)
X_4 = Quantity of herbicide (litre)
X_5 = Farm size (Hectare)
μ = Random error term.

Resource – Use Efficiency

According to Adeniyi J.P. (1973) and Olukosi, J. O; Erhabor, P.O. (1998), a discussion of resource allocation efficiency generally starts with the assumptions regarding the motives of producers. The classical assumption is the motive of profit maximization, which is an ideal framework against which various forms of efficiencies of production can be adequately measured and tested.

To test the price or allocation efficiency of agricultural resources, Olukosi, J. O and Erhabor, P.O. (1998) suggests that we compare the value of marginal product of each resource (as work out at geometric mean) with its corresponding price and test the difference statistically for significance with the help of t – test.

For this study, the marginal physical product (MPP) of land, labour, seed and herbicide input in rice production will be calculated as follows;

$MPPi = bi/Xi$ ---------- (14)

Where
MPPi = the marginal physical product of inputs
bi = The estimated regression coefficient of input i
Xi = the geometric mean usage of inputs.

The marginal value product (MVP) for each input will be calculated by multiplying the MPP of each input by the geometric mean price of paddy rice. The calculation is express as follows;

$MVPi = MPPi \times PXi$ ---------- (15)

Where
MVPi = Marginal value product of multiple i
MPPi = Marginal physical product of input i
PXi = The geometric mean price of paddy rice.

The marginal factor cost (MFC) on the other hand is the addition to total cost resulting from using extra unit of input. It is calculated as follows;

$MFC = \delta TC / \delta X_1 = PXi$ ---------- (16)

Where
δ = Differentiation sign.
MFC = Marginal factor cost.
TC = Total cost.
Xi = i^{th} input
PXi = Price of i^{th}price.

Decision rule

Marginal value product will be estimated using the regression coefficient of each input and the price of the output as express in equation (15).

The resource is said to be efficient if:
r = 1, meaning resource is being efficiently utilized.
r< 1, it means the resource in question was over utilized hence decreasing the quantity used of that resource increases profit.
r> 1, it shows that the resource is being underutilized and increasing the rate of use will raise profit level.

The average physical product of land, labour, fertilizer, seed and herbicide inputs is calculated as follows;

$APPi = y/Xi$ ---------- (17)

Where
APPi = the average physical product of inputs.
y = the geometric mean of farm output.
Xi = the geometric mean usage of input i.

The elasticity of production with respect to land, labour, fertilizer, seed and herbicide are calculated as follows;

$EPi = MPPi \times APPi$ ---------- (18)

Where
MPPi = Marginal physical product of input i
APPi = Average physical product of input i
EPi = Elasticity of production with respect to input i.

Decision rule

If $\sum EP = 1$; constant return to scale
If $\sum EP < 1$; decreasing return to scale.
If $\sum EP > 1$; increasing return to scale.

RESULT AND DISCUSSION

Results of Socio-economics Characteristics of Respondents and its Effect on Fadama III Farm Income and Rice Output

Table 1 presents the regression results of the effects of Fadama III on farm income and rice output. Model 1

Table 1.OLS Regression Results of the Effect of Fadama III on Farm Income and Rice Output.

	Model 1			**Model 2**		
	Farm Income			**Rice Output**		
VARIABLES	Coefficient	t-statistic	p-value	Coefficient	t-statistic	p-value
Age	-0.0080508	-2.02	0.043**	-0.0445005	-1.14	0.256
	(0.0039829)			(0.0391374)		
Farming Experience	0.0001977	0.14	0.889	0.0254769	1.72	0.086*
	(0.0014193)			(0.0148137)		
Rice-farming Experience	0.0063122	0.76	0.446	0.061212	0.75	0.452
	(0.008277)			(0.0813336)		
Household size	-0.0187306	-3.21	0.001***	-0.1797395	-2.14	0.032**
	(0.0058413)			(0.0838343)		
Household in Rice-farming	0.0276655	2.37	0.018**	0.5174937	3.72	0.000***
	(0.011687)			(0.139036)		
Farm size	0.3764675	10.09	0.000***	7.527364	20.53	0.000***
	(0.0373066)			(0.3665925)		
Fadama	0.7203892	10.14	0.000***	8.962457	12.84	0.000***
	(0.0710292)			(0.6979673)		
Education	0.1801797	2.04	0.041**	0.3738758	0.43	0.666
	(0.0881435)			(0.8661413)		
Marital Status	0.0981669	0.96	0.338	-0.5847845	-0.58	0.561
	(0.1024365)			(1.006591)		
Land Acquisition	-0.0917	-1.28	0.199	0.0349628	0.05	0.960
	(0.0714261)			(0.701867)		
Labour	0.2141382	2.30	0.022**	4.414772	4.05	0.000***
	(0.0932882)			(1.091282)		
Constant	11.52809	57.12	0.000***	6.915325	3.49	0.001***
	(0.2018297)			(1.983276)		
Observations	1200			1200		
R-squared	0.4228			0.4938		
F-statistic	124.72			105.35		
p-value(F-statistic)	0.0000***			0.0000***		

Standard errors in parentheses
*** Significant at 1%, ** Significant at 5%, * Significant at 10%

presents the result of the effect of Fadama III and other socio-economic factors on farm income while model 2 presents the result of the effect of Fadama III and other socio-economic factors on rice output. Model 1 shows that age, household size, and type of land acquired have negative effect on farm income. This is shown by the negative sign on each of their coefficients. On the other hand, each of farming experience, rice-farming experience, household in rice-farming, farm size, Fadama, education, marital status, and labour have positive effect on farm income. This is shown by each of their positive signs. However, of all these effects, only those of age, household size, household in rice-farming, farm size, Fadama, education, and labour are statistically significant. This is evident from each of their probability values (p-value) being less than 1% and 5% significance level (i.e. 0.01 and 0.05) respectively. The significant negative effects of age and household size indicate that farm income decreases as each of age and household size increases. Their respective coefficient values of 0.0080508 and 0.0187306 indicate that a year increase in age decreases farm income by about 0.8% and an increase in household size by one person decreases farm income by about 1.9%. On the other hand, the significant positive effects of household in rice-farming, farm size, education, labour indicate that farm income increases has each of these variables increases. Their respective coefficient values of 0.0276655, 0.3764675, 0.1801797, and 0.2141382 indicate that an increase in the number of household in rice farming by an individual increases farm income by about 2.8%, an hectare increase in farm size increases farm income by about 37.6%, an additional increase in year of schooling increases farm income by about 18%, and an additional increase in labour increases farm income by about 21.4%. Since Fadama is dichotomous (i.e. has a value of one if a beneficiary of Fadama III and zero if otherwise) and has positive coefficient value, its coefficient value indicates that beneficiaries of Fadama III have higher farm income than non-beneficiaries by about 72%. The reported R-squared indicates that about 42% of variation in farm income is explained by Fadama III and these socio-economic factors. The reported F-statistic value of 124.72 and its probability value of 0.0000 indicate that all

Table 2. Cost and returns analysis of fadama rice farmers in Nasarawa state.

Cost/return	Amount (₦ per ha) Participants	Non Participants
Total variable cost	28,467.17	25,346.19
Total fixed cost	790.96	686.32
Total cost	**29,257.93**	**26,032.51**
Total revenue	223,091.73	145,911.80
Gross margin	194,624.53	120,565.61
Net farm income	193,833.77	119,879.29

these variables are jointly significant in explaining farm income.

Model 2 shows that age, household size, and marital status have negative effect on rice output. This is shown by the negative sign on each of their coefficients. On the other hand, each of farming experience, rice-farming experience, household in rice-farming, farm size, Fadama, education, type of land acquired, and labour have positive effect on rice output. This is shown by each of their positive signs. However, of all these effects, only those of household size, household in rice-farming, farm size, Fadama, and labour are statistically significant. This is evident from each of their probability values (p-value) being less than 1% and 5% significance level (i.e. 0.01 and 0.05 respectively. However, farming experience is also seen to be statistically significant only at 10% significance level. The significant negative effect of household size indicates that rice output decreases has household size increases. Its coefficient value of 0.1797395 indicates that an increase in household size by one person decreases rice output by approximately 0.2 bags. On the other hand, the significant positive effects of household in rice-farming, farm size, and labour indicate that rice output increases has each of these variables increases. Their respective coefficient values of 0.5174937, 7.527364, and 4.414772 indicate that an increase in the number of household in rice farming by individual increases rice output by approximately 0.5 bags, an hectare increase in farm size increases rice output by approximately 7.5 bags, and an additional increase in labour increases rice output by approximately 4.4 bags. Since Fadama is dichotomous (i.e. has a value of one if a beneficiary of Fadama III and zero if otherwise) and has positive coefficient value, its coefficient value of 8.962457 indicates that beneficiaries of Fadama III have more rice output than non-beneficiaries by approximately 9 bags. The reported R-squared indicates that about 49% of variation in rice output is explained by Fadama III and these socio-economic factors. The reported F-statistic value of 105.35 and its probability value of 0.0000 indicate that all these variables are jointly significant in explaining rice output.

Cost and return analysis

The costs and returns of participants and non participants are presented in table 2. The variables cost constituted a major part of t he total cost of production with a mean of ₦28,467.17 and ₦25,346.19 per hectare for participants and non participants respectively. The fixed cost is made up of depreciation of tools and equipment. The per hectare total fixed cost for participant and non participants are ₦790.76 and ₦686.32 respectively. The total cost of production (variables and fixed) per hectare for participants and non participants were ₦29,257.93 and ₦26,032.51 respectively. The mean total revenue of ₦223,091.73 and ₦145,911..80 per hectare for participants and non participants were realized, while gross margin per hectare of participants and non participants were ₦194,624.53 and ₦120,565.59 respectively. The mean net farm income per hectare were ₦193,879.77 and ₦119,879.29 for participants and non participants respectively.

Indicating there is no much difference in the mean total cost of production between the two groups of farmers. The difference in total cost of production between the two groups is ₦3,225.42, indicating no much increase on the expenses incurred by the participating rice farmers. But the differences per hectare in the net farm income is ₦73,954.48, though both participating and non participating farmers realized a considerable profit per hectare, the absolute difference in profit level result from the financial assistance received from the project and also training in the use of inputs. This findings agrees with Adegbite et al. (2008) that to produce a hectare of vegetables in fadama communities, farmers may require assistance and also Ajao et al. (2005) observed that the income of farmers could be improved if resources were efficiently used at the existing technology.

Farm Financial Ratios

Table 3 revealed that the two groups of farmers in the study area expend a mean of 12.70% and 17.40% of the total revenue realized in paying for operating cost, while 0.60% and 0.40% of the mean total revenue realized goes to pay for fixed cost. The mean gross ratio per hectare of 0.131 and 0.178 showed that 13.10% and 17.80% of the mean total revenue per hectare realized by the farmers goes to pay for the total cost of production of participating and non participating rice farmers respectively. The figures were reasonable considering

Table 3. Farm financial ratio analysis of fadama rice farmers in Nasarawa state.

	Ratio per Ha	
Farm financial ratio	Participants	Non Participants
Operating	0.127	0.105
Fixed	0.006	0.004
Gross	0.131	0.178
Return in naira invested	6.62	4.60

Table 4. Estimated regression equation for total farm output (Kg) with production inputs of rice farmers in Nasarawa state.

Functional forms	Constant	Labour	Fertilizer	Seed	Herbicide	Farm size	R^2
Linear							
PF	2.621	8.3611	0.8221***	5.201***	0.316^{NS}	5.216^{NS}	78.21
	(1.211)	(4.312)	(3.50)	(2.212)	(0.431)		
NPF	38.265	0.7671 *	0.3048NS	0.841**	0.310^{NS}	0.623*	49.87
	(4,220)	(1.16)	(4.416)	(0.212)	(2.112)		
Semi-Log							
PF	41.682	3.24***	12.271***	31.123*	22.501*	34.25^{NS}	48.21
	(7.363)	(3.57)	(3.710)	(3.712)	(1.981)		
NPF	-2543	-3.541	55.20***	2.311*	-3.210^{NS}	-0.59^{NS}	44.42
	(3.541)	(6.621)	(2.020)	(1.881)	(3.61)		
Double-Log							
PF	3.542	3.521*	3.621^{NS}	2.131**	2.311^{NS}	14.31**	69.11
	(2.610)	(1.241)	(4.020)	(0.168)	(3.65)		
NPF	2.561	3.361^{NS}	0.630*	0.914*	0.611**	0.071^{NS}	68.25
	(0.761)	(9.22)	(3.513)	(4 .316)	(1.11)		

Note: PF= Participating Farmer NPF= Non Participating farmers; NS= Non significant; *significant at P<0,5; **significant at P<0.1; ***Significant at P<0.01.

86.90% and 82.20% of the mean total revenue per hectare that were accrued by the farmers. The mean gross margin ratio was higher by 4.70% in non participating farms due to an improved management skills received from the project by participants. The returns per naira invested which gives the benefit accrued to every naira invested in the production is a better measure. The participants were found to obtained a higher ratio of 6.62 (₦6.62 to every naira invested) than the non participating farmers with a ratio of 4.60 (₦4.60 to every naira invested). Both groups of farmers have a considerable returns, which was due to an appreciable increase in the current market price of paddy rice.

Resource use efficiency among participants and non participants of fadama III rice farmers in Nasarawa state.

Three functional forms of regression models linear, semi-logarithm and double logarithm were used to determine the relationship existing between output (yield) and inputs used among participating and non participating fadama III rice farmers in Nasarawa state. The R^2 with respect to participants was found to be 88.21% and that of non participants was found to be 78.25%. This implies that the variables included in the model labour, fertilizer, seed, herbicide and farm size jointly explained 88.21% variation of the dependent variable (yield) of participants. And also a joint variation of the variables explained 78.25% of the yield of non participants. This is reasonably high considering other explanatory factors such as differences in soil fertility and farmers management abilities. The sign of the estimated parameters have increasing effect on total farm output. The coefficient of labour, fertilizer, seed were statistically significant at (P<0.01) and for farm size (P<0.05) and herbicide (P<0.1) for participants. The coefficient of variation for non participants fertilizer (P<0.01), labour, seed and herbicide (P<0.05) and farm size (P<0.1). This findings agree with Abdullahi et al. (2012); that the of estimated cob-Douglas regression analysis shows positive coefficient and significance of labour, seed, fertilizer and farm size in his study of economic of resource use in small scale rice production in Niger state table 4.

Production Elasticity

The overall production elasticity the inputs in table 16 reveal that the sum of elasticity (returns to scale) are 1.045 and 1.356 for participants and non participants

Table 5. Estimated production elasticity for small scale rice farmers in Nasarawa state.

Inputs	Participants	Non Participants
Labour	0.351	0.452
Fertilizer	0.059	0.095
Seed	0.046	0.086
Herbicide	0.084	0.098
Farm size	0.505	0.625
Return to scale	**1.045**	**1,356**

Table 6. Estimated marginal value product and marginal factor cost of inputs used by respondents.

	Marginal Value Product		Marginal Factor Cost		MVP/MFC	
Inputs	PF	NPF	PF	NPF	PF	NPF
Labour	32.00	49.00	54.10	5.43	6.40	9.04
Fertilizer	8.12	9.20	1.21	1.02	6.71	7.60
Seed	19.20	22.32	5.14	3.14	3.24	7.11
Herbicide	7.00	11.14	1.00	1.02	7.00	10.92
Farm size	26.00	28.20	8.00	5.53	3.25	5.27

Note: PF= Participating Farmer NPF= Non Participating farmers;
Field survey, 2016.

respectively which show an increasing return to scale for both groups of rice farmers. The farmers' elasticity of production with respect to inputs used by participants and non participants are all less than one (1) but not less than zero (0). This implies that both groups of farmers were using all the estimated production inputs in the rational production region. The higher value of return to scale in non participants indicate a better use of inputs by participants, this suggest that rice farmers in Nasarawa state can increase their rice output by employing more of these five resources. This findings is in line with Goni, M, Mohammed, S and Baba, B.A (2007) that the values of the sum of elasticity of production is 1.875 showing increasing return to scale and more resources be employed to increase output of rice table 5.

Estimated Marginal Value Product to Marginal Factor Cost Of Inputs

Table 6 shows estimated marginal value product to marginal factor cost of inputs used by participants and non participants in the study area. The results revealed that the ratio of marginal value product MVP to marginal factor cost MFC were greater than unity for all the inputs used by participants and non participants. Indicating a likely increase in output if more of such inputs seed, fertilizer, farm size, herbicide and labour had been properly utilized by both participants and non participants.The fact that both group of rice farmers underutilized their resources, however participants used all the resources more efficiently than the non participants with a ratio of 6.40 as against 9.04 for labour, 6.71 as against 7.60 for fertilizer, 3.74 as against 7.11 for seed, 7.00 as against 10.92 for herbicide and 3.25 as against 5.27 for farm size. The efficient use of resources by participants may be attributed to the fact that there is close monitoring of project fund that were disbursed fadama III rice farmers by the project facilitators and the advisory services training received. This finding agrees with Shehu, J.F (2007) who carried out a comparative economic analysis of small scale holder rain fed and irrigated rice production in selected local government areas of Adamawa state. The result revealed that labour, fertilizer and herbicide were underutilized.

Percentage Adjustment in Marginal Value Product for Optimum Utilization of Inputs

Table 7 shows the percentage adjustment in marginal value product for optimum utilization of inputs. Optimum utilization of inputs requires that the marginal value product be equal to inputs unit price. The result reveal 84.38% adjustment is required for optimum utilization in labour for participants as against 88.94% for non participants. 85.10% adjustment is required for optimum utilization in fertilizer for participants as against 88.85% for non participants. 73.22% adjustment is required for optimum utilization in seed for participants as against 85.93% for non participants. 83.30% adjustment is required for optimum utilization in herbicide as against 90.84% for non participants. 67.23% adjustment is needed for optimum utilization in farm size as against 81.03% for non participants. The results indicate that a lot need to be done by participants and non participants to bridge the gap for optimum use of the resources in the study area. This requires the effort of fadama III project to step up and provide more funds to the participants as the present fund disbursed is not sufficient enough for

Table 7. Estimated marginal value product (MVP) adjustment for small scale rice farmers in Nasarawa state.

Inputs	Participants	Non Participants
Labour	84.38	88.94
Fertilizer	85.10	88.85
Seed	73.22	85.93
Herbicide	83.30	90.84
Farm size	69.23	81.03

optimization of resources. Though both group of rice farmers need to bridge gap for optimum use of resources, the participants are more efficient in their use of resources. This may be attributed to the participants' access to the pilot assets acquisition, input support and the capacity building training opportunities offered by the project unlike the non participants. This findings agree with Sani et al. (2010) and Goni, M, Mohammed, S and Baba, B.A (2007) in their studies of rice production in the lake chad area of Borno state and Bakore local government of Kano state respectively. Both results reveal that resources were underutilized and a lot need to be done to bridge the gap for optimum use.

CONCLUSION AND RECOMMENDATION

The difference in total cost of production between the two groups is ₦3,225.42, indicating no much increase on the expenses incurred by the participating rice farmers. But the differences per hectare in the net farm income is ₦73,954.48, though both participating and non participating farmers realized a considerable profit per hectare, the absolute difference in profit level result from the financial assistance received from the project and also training in the use of inputs. Both groups of farmers have a considerable return, which was due to an appreciable increase in the current market price of paddy rice. Both groups of farmers have a considerable return, which was due to an appreciable increase in the current market price of paddy rice.

Production resources in the study area were found not to be efficiently utilized for both participants and non participants, hence, not to optimum economic advantage. It therefore, follows that increased rice production will be negatively affected. It therefore goes that urgent attention is needed through provision of agricultural inputs to bridge the gap for optimum use of the resources in the study area.

Technical efficiency in rice production in Nasarawa state could be increase through better use of farm inputs; as such there should be provision of such enabling policies (such as making available all agricultural inputs required at the right time and affordable prices).

There is also need for fadama III participants to have access to credit, as financial assistance from fadama project cannot meet their demand for inputs.

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