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Comparative Economic Analysis of Upland and Lowland Rice Production in Izzi Local Government Area of Ebonyi State.

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ABSTRACT

A study on comparative economic analysis of upland and lowland rice production in Izzi Local Government Area was carried out. A total of 112 rice farmers were interviewed (56 from upland rice and 56 from lowland rice) in the study area using multistage random sampling techniques. The result of gross-margin analysis revealed that upland rice is more profitable than lowland rice as justified by 75% and 51% respectively as was calculated from gross-margin. Linear and exponential forms of the four functional form of regression analysis were chosen as the lead equation for socio-economic factors and production factors respectively. From the findings, it was established that upland rice production is more profitable than lowland rice production. The study therefore recommended the provision of capital, input subsidy, market and weather information, strengthening of farmers by disseminating information and assisting them adopt improved packages for rice production as ways to enhance rice production in the area.

1.0 Introduction

1.1 Background to the Study

Rice has become a strategic food security crop in Nigeria today with the country being the largest producer and consumer in West Africa, producing an average of 3.4 million metric tons ((MT) of paddy rice, equivalent to 1.8 million metric tons of milled rice (Daramola 2005; UNEP 2005). Before independence, rice is been treated with benign neglect as the country was self sufficient in rice production, hence, the commodity failed to attract attention in the various schemes, programmes and policies designed to initiate rapid transformation of the economy (Akpokodje, Lancon and Olaf, 2001; Akande, 2002). However, this situation has since changed as status of rice in the average diet has been transformed from being a luxury food item that it was at independence to that of a staple, taking the place of cassava, yam among others, as both the rich and the urban poor now rely on it as a major source of calories (WARDA, 2003; 2004; Daramola 2005). Rice consumption has risen tremendously since 1970 (10.3 per cent per annum), a result of the accelerating population growth rate (2.8 per cent per annum) and increasing per capita consumption (7.3 per cent per annum) leading to an increase in domestic demand over domestic supply. In response to meeting the shortfall in the supply-demand gap, Nigerian government has continued to resort to importation of milled rice. This situation has made Nigeria to become the largest importer of rice in Africa (Daramola 2005).The consequence of this excessive importation is the huge drains on the country's foreign exchange earnings over time (Cho 2002). The shift from a self-sufficient nation to an importing nation made rice to become a strategic commodity in Nigerian economy (Nkang *et al* 2006). The desire by successive regimes to reverse this trend led to implementation of various policies and programmes. Frequently, the measures used include trade policies such as tariffs, quotas and subsidies on inputs designed for trade protection or enhancement, and price supports designed to increase farm income (Coy 2006). Some of the agricultural programmes such as Agricultural Development Project (ADP), Abakaliki Rice Project (ARP), and Presidential Initiative on rice (PI) etc were directed towards increasing the output of rice. In spite of government intervention aimed at achieving self-sufficiency, the supply-demand gap continues to widen (Odoemenem and Inakwu, 2011). In spite of the fact that rice is cultivated in virtually all the agro-ecological zones in Nigeria, area cultivated to rice is still small (1.8 million hectares out of 5 million hectares). Estimate of locally produced milled rice for year 2008 was 1.8 million MT against demand of 5 million MT (NRDS, 2009). Beyond the farm gate, there are other issues of concern particularly in the downstream activities which are also constraining local supply of the commodity. These include issues like the absence of standard measures in the marketing of rice, transportation and poor linkage to rice processing. All these combine with on-farm constraints to undermine the competitiveness rice production in Nigeria (Daramola, 2005; NPC, 2006). Given the plethora of policies and programmes aimed at enhancing local supply of rice, this study therefore, focuses on engaging the Policy Analysis Matrix (PAM) to examine the effectiveness of rice sector policies and their effects on the profitability and competitiveness of the enterprise in the country with specific focus on the upland, lowland

1.2 Aim and objectives of the Study

The aim of this study is to compare the economic of upland and lowland rice production in Izzi Local Government of Ebonyi State.
In order to achieve this aim, the following objectives will be pursued:

i. To explain the geological characteristics of izzi rice farmland.
ii. To determine the farmers rice cultivation practice-upland and lowland rice cultivation.
iii. Determine the effect of the production factors on the quantity of both upland and lowland rice produced.
vi. Analyze the constraints to upland and lowland rice production in the study area.
v. To proffer solutions to the identified constraints in the study area.

1.3 Hypotheses

The following null hypotheses were tested:

Ho_1: The socio-economic characteristics of the farmers have no significant effect on the quantity of rice produced in the area.

Ho_2: There is no significant difference between costs and returns of upland and lowland rice produced.

1.4 Study Area

The study area is in Izzi Local Government Area of Ebonyi State. It is located at the North sensational district of the state. Ecologically it falls within the tropical rainforest zone and it is suitable for the cultivation of many types of crops such as yams, cassava, rice, maize, plantain, banana, fruits, vegetables and tree crops. Both lowland and upland rice are cultivated however, majority of the farmers cultivate rice under lowland ecology of the available inland valleys in the area. The study area is made up to eight (8) communities namely: Igbeagu, Ndezeenyim, Ndezechi, Mabalupgu, Ndebo-Ezzainyimegu, Ndiechi-Ezzainyimegu, Ndiegu ezzainyimegu and Agbaja.

Geographically, it is located within longitude 80.20'E and latitude 60.30'N on the world map, with the population of 126893 (NPC 2006). It is bounded with Abakaliki Local Government in the West, Ebonyi and Ohaukwu Local Government Area in the South, as well as Ado Local Government Area of Benue State in the North and Yala Local Government Area of Cross River State in the East. Basically, the greater percentages of the study area are mostly farmers who practice mostly mixed type of cropping.

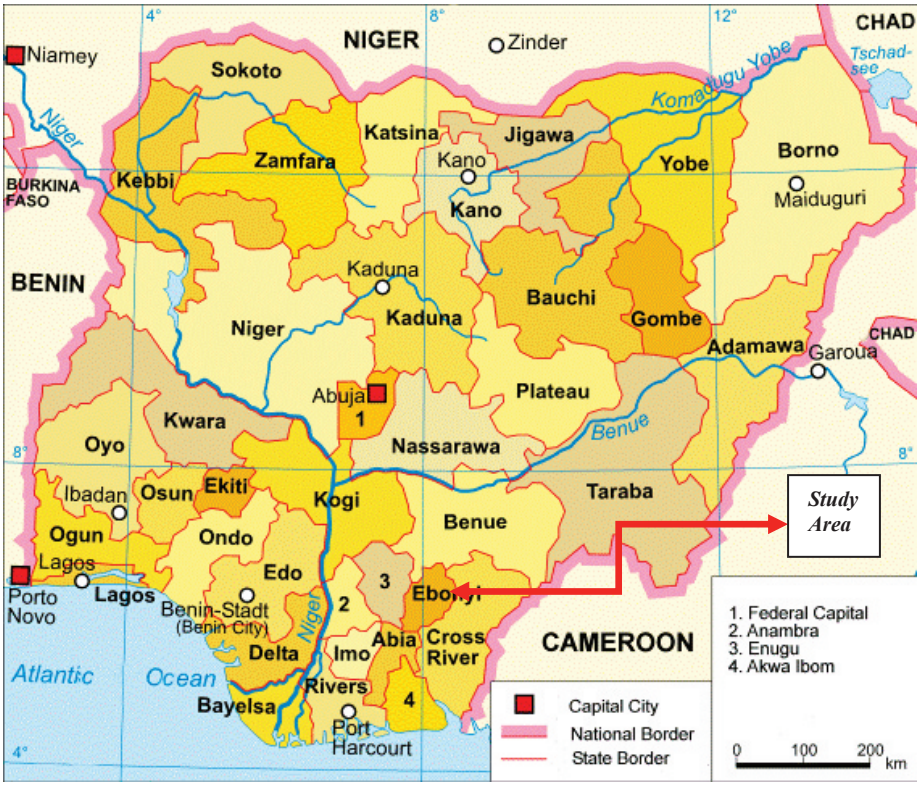

Fig.1: Map of Nigeria Showing the Study Area.

2.1 METHODOLOGY

The questionnaire Survey method was applied with Multistage random sampling techniques employed to select both the upland and swamp rice producers in the area. Stage one selected four communities randomly from eight communities that made up the study area. Stage two involved the selection of three (3) villages each from the selected communities. While the third stage will be the random selection five uplands and lowland of (rice farmers) randomly from each of the selected twelve villages. Thus a total of one hundred and twenty rice farmers' respondents was used as the sample size. Data for this study was analyzed using both descriptive and

inferential statistics. Descriptive statistics such as tables, percentage mean, average, frequency distribution was used to analyzed objective (I) and (II). Gross margin analysis was used in objective (III) objective (IV) and (V) were analyzed using a four functional forms of multiple regression analysis (multiple, regression analysis) while objective (VI) will be mean score.

GROSS MARGIN was used to determine the financial costs and returns of both the upland and lowland rice production in the study area, which will enable comparative economic analysis of the two types of rice production.

Gross margin is the summation of total revenue minus total variable cost. The net project model is mathematically shown below:

Net farm project = TR – TC

Where TC = TVC + TFC

NI = TR – TC

Where NI = Net project of both upland and swamp rice production

TR = Total Revenue

TC = Total Cost

FVC = Total Variable Cost

TFC = Total Fixed Cost

Regression Model

Objective V: The explicit stochastic form of the production function is specified as $Y=b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5$ etc (linear)

$Y = b_0 + b_1 + \log X_1 + \log X_2 + \log X_3 + \log X_4$ etc (semi-log)

$Log_y = b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5$ etc (Double log)

$Log_y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5$ etc (Exponential)

Y = Output of paddy rice in kg

X_1 = Farm size in hectares

X_2 = Labour in man days

X_3 = Seeds in kg

X_4 = Fertilizer in kg

X_5 = Capital in Naira

b_1 – b5 = coefficient to be estimated and

et = the error term

These were calculated on either sides of upland and lowland rice production in the study area.

Regression model for objective IV

$Y = F (X_1, X_2, X_3, X_4, X_5, X_6 X_7 X_8)$ implicit non stochastic

$Y = b_0 + b_1 X_1 + b_2 + X_2 + b_3 X_3 + b_4 + X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8$ + etc …. (Linear)

$Y = b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + b_8 \log X_8$ + etc… (Semi-log)

$Log_y = b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + b_8 \log X_8$ + etc… (Double log)

$Log_y = b_0 + b_1 X_1 + b_2 + X_2 + b_3 X_3 + b_4 + X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8$ + etc …. (Exponential)

Where Y = quantity of rice produced

X_1 = Age of the farmers (in years)

X_2 =Gender

X_3 = Educational Status

X_4 = Marital Status

X_5 = Annual Income (N)

X_6 = Farming Experience

X_7 = Farm Size

X_8 = Household Size

b_o – b_8 = Regression coefficient

et = stochastic error term

Linkert Model – 4 points (mean score)

$05 = \frac{\sum fr}{Nr}$

Where 05 = mean score

$\sum$ = Summation

Nr = No of respondents a problem factors

Decision rule (DR) = 2.5

2.2 TEST OF HYPOTHESES

Hypothesis 1 and 2 were tested using F – test at 0.05 level of significance.

$$F\ cal = \frac{R^2 (N-K)}{(1-R^2)(K-1)}$$

Hypothesis 3 was tested using difference in mean at 0.05 L.S.F.
This is stated as

$$z = \frac{X_1 - X_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

Where z = mean score
0_1 = Mean returns if the rice produced
0_2 = Mean cost of the rice produced
σ_1^2 =Std deviation of return of rice produced
σ_2^2 = Std deviation of cost of rice produced
n_1 No of respondents
n_2 = No of respondents

3.0 RESULT AND DISCUSSION

The areas analyzed and discussed are. The socio-economic characteristics of both lowland and upland rice farmers, farming experiences; cost and return estimates; effect of the socio-economic characteristics of farmers on output; and problems and solutions in lowland and upland rice production.

3.1 Socio-Economic Characteristics of the Respondents

The socio-economic characteristics considered in the study includes; gender, age, mantel status, family sizes, educational background, annual incomes farming experience and famer size. Data was collected and result presented in table 1.

Table 1: Percentage distribution of farmers according to socio-economic characteristics

Variable	**Category**	**Frequency (n=112)**	**Percentage %**
Gender	Male	88	78.6
	Female	24	21.4
	15 -20	8	7.1
Age			
	21 – 30	20	17.9
	31 – 40	28	25
	40 and above	56	50
	Single	10	8.8
Marital status			
	Married	78	69.6
	Widowed	14	12.4
	Divorced	4	3.8
	Separated	6	5.7
Education Qualification	**Non-formal Education**	**Frequency**	**Percentage %**
	F.S.L.C	56	50
	WASC/GCE	12	10.8
	NCE, ND, OND	10	8.8
	HND, B.Sc	2	1.8
	M.Sc, PhD	2	1.8
Family size	1 – 3 members	15	13.4
	4 – 6 members	17	15.2
	7 – 9 members	30	26.8
	10 – 12 members	50	44.6
Annual income	Below N60,000	14	12.4
	N60,000 – N120,000	78	69.6
	N120,000 – N160,000	10	8.8
	N160,000 – N200,000	6	5.4
	N200,000 and above	4	3.8
Farming experience	1 – 4 yrs	12	10.7
	5 – 10 yrs	16	14.3
	11 – 20 yrs	32	28.6
	20 and above	52	48.4

Source: Field survey 2013

Gender: From table 1 it was found that 78.6% were male, while 21.4% were female. This implies that rice production in the area was greatly done by males. This is justified as males in the area have total control of land and allocates portions to women based on their need.
Age: According to the table, 7.1% were of the age 15 – 20, 17.9% of the age 21 – 30, 25% of the age 31.40 and 50% of the age 40 and above. The result implies that rice production is mostly done by the aged. This result conforms to the findings of Ike and Idong (2006), who opinioned that farming is mostly for old people probably because of quest for white collar job by youth and the middle aged.
Married Status: This was considered to verify its influence in rice production enterprise. The data on this was presented in table 1. Here it was confirmed that 69.6% of the farmers were married, 8.8% were single, 12.4% were widowed 3.3%, 5.4% were divorced and separated respectively. Thus rice production is mostly undertaken by married people. The essence of marriage in most farming communities is to use the offspring in carrying out some farm activities.
Family Size: From the analysis, it was revealed that the farmers range of 10 -12 was the majority (44.6%), 7 -9 members 26.8%, 4 – 6 members, 15.2% and 1 – 3 members 13.4%. this is still in conformity with the common household size of farmers in Ebonyi State based on survey data, Ike and Idong (2006). The higher the family members, the lower the lived labour and the lower the cost of production.
Education Qualification: The result obtained shows that 50% of the respondents have F.S.L.C, 26.8% have non-formal education white others ranging from WASC to Ph.D shared the remaining parentage. This conform with the finding of Banue and Amujoyegbe (2005) quoted by Nwankwo Patrick who opinioned that farmers in South Western zone of Nigeria were moderately literate; a condition that helped them to understand innovation on rice production such as use of modern land improvement techniques.
Annual Income: Analysis on annual income from Table indicate that majority of the respondents 69.6% earn between 60.000,-120,000, 88% 120,000-160.000, 5.4% 160-000-200,000 while only 3.8% earns above 200,000, the income level of the respondents is very low and may not encourage high savings among farmers, and majority of the higher income earners usually invest on non-farm business probably because of high risk of farm-business.

Farming Experience: This was considered to determine how farmers' experiences have contributed to productivity level in the area. Table 1 show that 46.4% of the farmers have above 20yrs of experience 28.6% have 10-20yrs, 14.3% have 5-10yrs and 10.7% have 1-4yrs of farming experience.

Farm Size: It was observed that 50% of the rice farmers in the area have access to only one plot of land for their rice fragmentation in the area. Furthermore, 25% have access to 2-splots, 17.9% to 4-5plots white only 7.1% have access to five plots and above this reveals why majority of the rice farmers area mainly substance farmers and productions are mostly in small quantity.

3.2 Farming Practices used by Farmers

Items discussed in this section include, labour use, sale of farm produce, source of planting materials and quantity of rice cultivated by lowland rice farmers and upland rice farmers.

3.2.1 Type of Labour used by Farmers

This was considered to determine the type of labour used by farmers in the area and low it has affected their rice production.

Table 2: Frequency distribution of farmers based on the type of labour used.

Type of labour used	Frequency	Percentage
Hired labour	17	15.2
Family labour	30	26.8
Hired and family labour	52	46.4
Co-operative labour	13	11.6
Total	112	100

Source: Filed survey, 2013

Table 2 shows that rice farmers in the area mostly uses both haired and family labour for their rice farming. This was confirmed by 46.4% of the respondents while co-operation labour is 11.6% being least. Most of the time, labour is hired conformed with the time children we back to school on during vacation, children help in farm work, thus hiring of labour is being minimized.

3.2.2 Sale of Farm Produce

This is considered to determine the condition of selling their farm produce which sometimes determiner price to their sale and income made by the farmers.

Table 3: Frequency distribution of respondents according to how they sell their farm produce.

Condition/time	Frequency	Percentage
Store the rice	32	28.6
Sell at farm gate	40	35.7
Sell from time to time	40	35.7
Total	112	100

Source: field survey 2013

From the result it was observed that farmers sell their harvested products at farm gate (35.7%) and intermediate selling (35.7%). This result is not properly organized and basically it lacks market information, thus making farmers to sell at farm gate price which forms no incentive for the producers.

3.2.3 Source of Planting Materials by Rice Farmers

This was considered to determine how farmers in the study area source their planting materials which may affect their productive and will also determine how effective a resource have been used.

Table 4: Percentage Distribution of Respondents

According to sources of planting materials

Plating materials	Frequency	Percentage %
Buy from market	40	35.7
Old stock from farm	60	53.6
From extension agents	12	10.7
Total	112	100

Source: field survey 2013

From table 4, it was observed that 10.7% of the respondents get plant material from extension agents, 53.6% got from their old stock and 35.7% got from the market. This shows that majority of the farmers in the area uses their old stock as a source of planting.

3.2.4 Quantity of Rice Planted by Lowland and Upland Rice Farmers in the Study Area

The item was considered to ascertain how quantity rice cultivated by both lowland and upland rice farmers has affected the productivity in the area. The quantity of rice cultivated is a determinant of how large or small the next harvest should be when other factors are kept constant.

Table 5: Frequency distribution of both lowland and upland rice farmer according to this quantity of rice cultivated.

Quantity of rice	Lowland	Upland
10-25kg	7(12.5%)	8(14.2%)
26-50kg	27(48.3%)	28(50%)
51-100g	16(28.5%)	15(26.8%)
Above 100kg	6(10.7%)	5(8.9%)
Total	56(100)	56.(100)

Source: Filed survey, 2013

From table 5: It was observed that 48.3% of the respondent plant 26-50kg of rice, 12.5% plant 10-25kg, 28.5% plant 51-100kg and 10.7% for above 100kg. The table further shows that this distribution may have resulted from land fragmentation issue which allows only very few farmers to have access to land that will accommodate more than 200kg bag of rice this is for the lowland rice.

On the upland rice side, table 5: also shows that 50% of the respondents' plant between 26-50kg, 26.8% is 51-100kg, 14.2% is for 10-25kg and 8.9% of the farmers cultivates above 100kg of upland rice. This further shows that majority of the rice farmers in the area farms for mainly his household and very little for sale.

3.3 Cost and Returns of Lowland Rice Production

Cost and returns analysis was carried out to determine the profitability of lowland rice business in the study area, using gross margin formula.

Table 7: Shows costs and returns of rice enterprise

A: variable cost

Item	mandays	Unit cost (N)	Total cost (N)
Land clearing	20	350	7000
Tilling	30	600	18000
Nursery preparation	5	300	1500
Transplanting	50	150	7500
Gap filling	15	150	2250
First weeding	30	200	6000
Second weeding	20	200	4000
Fertilizer app	10	100	1000
Bird scaring	20	100	2000
Harvesting	15	250	3750
Threshing	10	200	2000
Miscellaneous	10	300	3000
Subtotal			**58,000**

B: Capital Inputs

Item	**Unit**	**Qty**	**Unit Cost (N)**	**Total Cost (N)**
Pesticide	Liters	2	1050	210
Fertilizer	Bags	8	4000	32,000
Subtotal				34100

Planting Materials

Item	**Qty**	**Unit Cost (N)**	**Total Cost (N)**
Rice seed	100kg (bag)	4000	4000
Subtotal			4000
Grand total			96,100

Fixed Cost

Depreciation on hoes and matches 240

Cost of land 3000

Total fixed cost 3240

Revenue

Item	**Unit**	**Qty**	**Unit Cost (N)**	**Total Cost (N)**
Lowland rice	Bag	37	4000	148,000
Total				148,000

Source: field survey, 2013

Total variable cost (TVC) = N96, 100

Total revenue (TR) = N148, 000

Gross margin (GM) = TR-TVC

= N148, 000-96,100 = 51,900

Profit (N) = GM-TFC (Total fixed cost)

= N51, 900 – N3240

= N48, 670

Percentage profit = 51%

Table 8: Cost and return of upland rice variable cost

Item		mandays	Unit cost (N)	Total cost (N)
Land clearing	10	300		3000
Tilling	20	400		8000
Planting	25	120		3000
Supplying	16	100		1600
First weeding	12	200		2400
Second weeding	12	200		2400
Fertilizer app	5	100		500
Bird scaring	20	100		2000
Harvesting	8	300		2400
Threshing	8	300		2400
Miscellaneous	10	300		3000
Subtotal				**30,700**

B: Capital Inputs

Item	**Qty**	**Unit Cost (N)**	**Total Cost (N)**
Pesticide Liters	2	1050	2100
Fertilizer Bags	5	4000	20,000
Subtotal			22,100

C: Planting Materials

Item	**Qty**	**Unit Cost (N)**	**Total Cost (N)**
Rice seed	100kg (bag)	300	3000
Subtotal			3000
Grand total			55,800

Fixed Cost (N)

Depreciation on hoes and matches 240

Cost of land 2000

Total fixed cost 2240

Revenue

Item	Unit	Qty	Unit Cost (N)	Total Cost (N)
Lowland rice	Bag	27	3000	81,000
Total revenue				81,000

Source: field survey, 2013

Total variable cost (TVC) = N55, 800

Total revenue (TR) = N81, 000

Gross margin (GM) = TR-TVC = N81, 000 – N55, 800 = N25, 200

Profit = GM (gross margin) – TVC (Total variable cost)

= N25, 200 – N2240= 22960

Percentage profit = 75%

From the gross margin analysis it was observed that in each hectare of hectare of land (lowland) cultivated, the return in low land is 37 bags of 100kg rice sold at N4000 each to generate N148,000 from it while total variable cost (TVC) was at N96,100 and a gross margin of 51900. Then the profit was calculated, to be N48670 after removing fixed cost of N324 and percentage profit of (51%).
From the upland rice, the total revenue generated was N81,000, TVC N55800 and gross margin of N25200. Then the TFC stands at N2240 and the profit of N22960 was made in every hectare cultivated and percentage profit of (75%).
From the observation, it was discovered that upland rice is more profitable than the lowland rice considering the percentage profit of the venture at (75%) which is higher than (51%) from lowland rice side. The percentage was from gross margin analysis conducted on the two types of rice cultivation.
Upland rice is more profitable because it needs lower initial capital t0 establish and cost of labour according to the gross margin analysis is also smaller compared to that if lowland where not everybody can work on it, because it is very much harder to work on.

3.4 Effects of Socio-Economic Characteristics of Farmers on the Quantity of Upland and Lowland Rice Produced in the Area

A multiple regression analysis was carried out on the lead equation the dependent variable was output of rice in kg while independent variables were socio-economic characteristics of the respondents status (X_4), annual income (X_5), farming experience (X_3), marital status size (X_7) and household size (X_8), result obtained was summarized and presented in table 9.

Table 9: Multiple regression result

Variable	Linear	Semi log	Double log	Exponential
Constant	-2155 (0.399)	-5.456 (2.052)	-1.790 (1.506)	-0.935 (0.527)
Age	0.000 -0.004 0.008 0.610	0.010 0.003 (0.658) 0.996	0.241 -0.408 (0.396) 0.309	0.081 0.010 (0.007) 0.191
Gender	0.018 (0.011) 0.102	0.170 (0.212) 0.426	-0.024 (0.119) 0.842	-0.002 (0.007) 0.821
Educational Status	0.005 (0.007) 0.473	0.013 (0.157) 0.936	-0.025 (0.091) 0.787	-0.002 (0.008) 0.757
Marital Status	0.435 (0.053) 0.000	2.837 (0.529) 0.000	1.866 (0.322) 0.000	0.294 (0.039) 0.000
Annual Income	-0.007 (0.000) 0.805	0.002 (0.078) 0.976	0.016 (0.043) 0.718	0.007 (0.000) 0.705
Farming Experience	0.014	0.333	0.171	0.004

	(0.009) 0.151	(0.207) 0.114	(0.119) 0.158	(0.007) 0.544
Farm Size	-0.16 (0.122) 0.385	0.131 (0.358) 0.716	-0.555 (0.465) 0.239	-0.197 (0.158) 0.218
Household	0.474 (0.087) 0.000	- - -	- - -	0.095 (0.73) 0.201
R2 = AdjR2 = D. W = F – Ratio =	0.744 0.756 2.240 44.091	0.671 0.625 2.015 14.570	0.671 0.617 2.131 12.505	0.714 0.674 2.105 17.805

Source: field survey, 2013

Linear form of multiple regressions was chosen as the lead equation and used in the discussion of the result. This was done due to the following criteria: goodness of fit of the functional form, based or the value of the coefficient of multiple determination (R2) signs of regression coefficients, significance of t-values, low standard error of estimates, and magnitude of F-ratio as well as the conformity of the signs borne by the coefficient to a priori expectations.

The results in table 9 revealed that age (X), had a coefficient estimate of -0.004. This means that the age of the farmers have a negative relationship with output (y). This is a departure from the a priori expectation since all the independent variables were expected to bear positive sign. It can also be stated that the quantity of rice (kg) produced by farmers is not a function of their age. Also gender (X_2), educational status (X_3), and marital status (X_4) had a coefficient of 0.018, 0.005 and 0.435 respectively. This shows that gender educational status and marital status are positively related to the dependent variables (y) conform to the apriority expectation as the output is highly dependent on them. It could also be that higher educational status of the farmer contributed immensely since educated farmers apply more skill in their production processes. Gender also contributed positively since the male farmers have more production potentials than female farmers; furthermore, annual income had a coefficient of -0.007. This implies that annual income had an inverse relationship with output (y). This is a deviation from a priori expectation because it is expected that increase in annual income leads to increase in output bus this was not 50. The reason could be that as the farmers annual income increase, farmers reduce their investment and production level in rice production. In the same way, they increased production at low annual income. This seems to be abnormal, thus, annual income bore a negative sign from the table. The result further indicated that farming experience (X_6) and household size (X_8) with prior expectation since both of them have a direct or positive relationship with output (y). This implies that increase in farmers experience lead to a corresponding increase in their output. This is because experienced farmers learn from their past mistakes and improve more on their farming skills.

Also, farmers with large household size have the tendency of having an increased output. This is because they employ family labour which reduces the cost of labour and increased output. Farm size (X) had a coefficient of -0.106. This indicates that increase in farm size of the farmers does not lead to increase in output (quantity) of rice produced). This is a departure from a priori expectation since increase in farm size does not lead to a corresponding increase on output.

Finally, the result revealed that the R^2 is 0.774 white the adjusted R^2 is 0.756 (75%). This shows that 75% of the variation in the quantity of rice produced (kg) was explained by the combined effects of the independent variables included in the regression model. Also, the F-ratio was 44.091 and tested highly significant at 1% level. These indicated that the overall regression was a good fit.

The final regression estimate model is shown below:

$$Y = 2.155 - 0.004X_1 + 0.018X_2 + 1005X_3 + 0.435X_4$$
$$(0.399)\quad (0.008)\quad (0.011)\quad (0.007)\quad (0.053)$$

$$-0.007X_5 + .014X_6 + 0.106X_7 + 0.474X_8 + et$$
$$(0.000)\quad (0.009)\quad (0.122)\quad (0.087)$$

$R^2 = 0.774$
Adjusted $R^2 = 0.756$ (75%)
DW = 2.240
SEE = 0.37139
F – Ratio = 44.091
= significant at 1% level
$X_1 – X_8$ = independent variables
Y = Dependent variables (output)

The figures in brackets are standard error of estimate

3.5 Effect of the Production Factors on the Quantity of Rice Produced in the Area

It is necessary to determine the effects of production factors on the quantity of rice produced in the study are. Four functional forms of multiple regression analysis were done to choose the best fit model. The dependent variable was output while independent variables were production factors. The study considered the following production factors farm size (X_1), labour/manday (X_2), seeds (kg) X_3, fertilizer, kg (X_4) capital (Naira) X_5. Results obtained were summarized and presented in table 10.

Table 10: result of multiple regressions

Variable	Linear	Semi log	Double log	Exponential
Constant	-868.801 (492.463) 0.082	365.061 (67.125) 0.000	5.155 (0.388) 0.000	6.194 (0.065) 0.000
Farm size	250.899 (103.359) 0.018	175.592 (35.749) 0.000	0.221 (0.81) 0.000	0.182 (0.035) 0.000
Labour	70.639 (78.573)Ns 0.372	55.110 (30.866) 0.77	0.080 (0.062)Ns 0.202	0.059 (0.030) 0.052
Seeds	218.682 (126.604) 0.089	0.578 (0.214) 0.008	0.220 (0.100) 0.030	0.001 (0.000) 0.015
Fertilizer	208.806 (85.842) 0.018	84.014 (24.632) 0.001	0.202 (0.68) 0.030	0.093 (0.024) 0.000
Capital	109.730 (106.689)Ns 0.307	0.256 (0.250)Ns 0.318	0.72 (0.084)Ns 0.393	0.000 (0.000)Ns 0.257
R2 = AdjR2 = D. W = F – Ratio = SEE =	0.476 0.436 1.368 11.984 246.7903	0.579 0.559 1.625 29.196 231.07376	0.555 0.521 1.366 16.435 0.19434	0.608 0.589 1.587 32.839 0.22377

Source: field survey, 2013

The multiple regression result above shows exponential form as the lead equation. This is due to the following criteria, highest R_2, highest number of significant variable lowest standard error, the magnitude of F-ratio as well as conformity of the signs borne by the coefficients to a priori expectation. These conformity statistically significance of regression coefficient result shows coefficient of multiple determination R2 has 60.8% of the variable in the variation in the dependent variable (output of Paddy rice (kg) was caused by the combined effects of independent variables (production components) used to build the regression model.

Farm size (X_1) was positively signed and statistically significant at 1% level of significance. This implies that the higher the farm sizes of the respondents, the higher their output. This agrees with a priori expectation. Likewise labour (mandays) was also positively related to the respondents output. This means that the farmers obtained higher output by employing move labour in their rice farming activities.

Moreover, quantity of seeds used (kg) was positively signed, showing that it increased with increase/in output of the rice farmers. This could be as a result of use of improved varieties of rice and proper management of labour among the farmers. This did not deviate from the priori expectation. It was discovered that the quantity of fertilizer used (kg) lead to a corresponding increase in the quantity of rice produced. This implies that fertilizer was properly applied in a right proportion in the study area.

Finally, capital (X_5) showed a positive relationship and was not statistically significant. This implies that farmers who employed more capital in their productive activities obtained higher output of rice (kg).

Therefore, the final estimated regression model is shown below.

$$\text{Logy} = 6.194 + 0.182X_1 + 0.059X_2 + 0.001X_3 + 0.093X_4 + 0.000X_5 + et$$
$$(0.065)\quad (0.035)\quad (0.030)\quad (0.000)\quad (0.024)\quad (0.000)$$

Where Y = dependent variable (output)

$X_1 – X_5$ = Production factors

et = Error term

3.6 Constraints to Upland and Lowland Rice Production

Various factors that hinder rice production in the area which result to low production output were identified and shown in table 11.

Table 11: Mean distribution of the respondents based on the constraints militating against rice production in the study area.

Items	Mean Score (Xs)	Decision
Lack of finance	4.3	Accept
Lack of labour force	3.1	Accept
Lack of farm land	2.9	Reject
Effect of climate	3.8	Accept
Pest and disease	3.9	Accept
Distance to farm	2.8	Reject
Marketing problems	3.7	Accept
Bad road network	3.7	Accept
Storage facilities	3.9	Accept
Back of access of new rice varieties	3.8	Accept

Source: field survey, 2013

In analysis, the table 11 above is a mean scores derived from a five pint linker scale were employed to identify the constraints. This implies that any items below 3.0 were rejected while items that are above or equal to decision rule were accepted as a major problems taking producers of low and upland rice in the study area. Then the result further to reveal that lack finance (0s = 4.3), lack of labour force (0s = 3.1), lack of variable farm input (0s = 3.8), bad road network (0s = 3.7) and lack of access to new rice varieties (0s = 3.8) were all accepted by the low land and upland rice producers as the major problems that had contributed to their low level of production while only lack of land (0s = 2.9) and distance to the farm (0s = 2.8) were rejected as never be a problem to rice production by the farmers in the study area.

Test of Hypothesis 1

A null hypothesis was tested on the socio-economic characteristics of the farmers which have no significant effect on the quantity of rice produced using F-test at 0.05 level of significance as shown below:

$$F - \frac{Cal = R^2 (N-K)}{1 - R^2 (K-1)}$$

Where R^2 = coefficient of determinants
N = Sample Size
K = Number of Variables

$$F - \frac{Cal = 0.774 (112-8)}{1 - 0.774 (8-1)} = \frac{0.774 \times 104}{0.226 \times 7}$$

$$= \frac{80.496}{1.582} = 50.8$$

F – Tab at 0.05 level of significant
F critical ($V_2 = 112 - 8 = 104$ and $V_1 = 8 - 1 = 7$

Decision Rule

If F cal > F tab reject the null hypothesis otherwise accept.

Therefore F cal > F tab, null hypothesis was rejected which means that the socio-economic characteristics of farmers have a significant effect on the quantity of rice produced in the study area.

Test of Hypothesis II

A null hypothesis which states that there is no significant effect of production factor on the quantity of rice produced was tested using F – test at 0.05 level of significance shown below.

$$F - \frac{Cal = R^2 (N-K)}{1R^2 (K-1)}$$

Where R^2 = coefficient of determinants
N = Sample Size
K = Number of Variables

$$F - \frac{Cal = 0.608 (112-5)}{1 - 0.608 (5-1)} = \frac{0.608 \times 107}{0.399 \times 4}$$

$= \frac{65.056}{1.568} = 41.48$

F – Tab at 0.05 level of significant 2.24
F critical ($V_2 = 112 – 5 = 107$ and $V_1 = 5 – 1 = 4$)

Decision Rule

If F cal > F tab; reject the null hypothesis otherwise accept.
Therefore, since F - cal > F - tab, the null hypothesis was rejected which means that there is significant effect of production factors on the quantity of rice produced in the study area.

Test of Hypothesis III

The test of difference between cost and return of upland and lowland rice production was tested using Ƶ – test at 0.05 level of significance as shown

$$z = \frac{X_1 – X_2}{\sqrt{\frac{Q^2_1}{n_1} + \frac{Q^2_2}{n_2}}}$$

Where X_1 = mean return from upland and lowland rice

X_2 = Cost from upland and lowland rice produced

Q^2_1 = Standard deviation of the return from rice produced

Q^2_2 = Standard deviation of the cost of rice produced.

n_1 and n_2 sample size of the respondents

$$Ƶ = \frac{753214.29 – 493348.60}{\sqrt{(86241.9372)^2 + (297448.86)^2}}$$

$$= \frac{259865.69}{\sqrt{66408 + 789962}} = \frac{259865.69}{\sqrt{79062678.9}}$$

$$\frac{259865.69}{28118.08}$$

Ƶ - Cal = 9.24

Ƶ tab at 0.05 level of significance = 1.960

Decision Rule

If Ƶ cal > tab reject the null hypothesis otherwise accept.
Therefore, since Ƶ cal > Ƶ tab reject the null hypothesis. This implies that there is significant difference between the revenue and cost of upland and lowland rice production in the study area.

4.0 SUMMARY, CONCLUSION AND RECOMMENDATION

4.1 Summary

A study on comparative economic analysis of lowland and upland rice production in Izzi Local Government Area of Ebonyi State was carried out. The broad objectives of the study was to compare the economics of upland and lowland rice production in the study area, while specific objectives were to: Describe the socio-economic/personal characteristics of farmers who are engaged in rice production in the study area: identity types of farming parties used by the farmers; analyze the cost and returns, determine the effects of socio-economic characteristics of farmers on the quantity of upland and lowland rice produced and analyze the constraints to upland and lowland rice production in the study area.

A total of 112 rice farmers were chosen for the study using multistage random sampling technique. The instrument for data collection was questionnaires and interview schedule. Only primary data was used for the study. Appropriate statistical tools such as descriptive and inferential statistics were employed in data analysis. Descriptive statistics such as percentage distribution table, gross margin analysis and likes scales were used for data analysis while inferential statistics such as four functional form of Ols multiple regression analysis was also used.

Result obtained revealed that majority 78.6% of the farmers were make who were above 40 years (50%). Most (69.6%) were married and could read and write (50%) were the family size of greater proportion of the respondents ranged from 10-12 people (44.6%) while their annual income was between N60,000-N120,000 for 69.6% of the rice farmers. Further analysis indicated that the respondent had involved in rice farming over 20 years (48.4%) and this were highly experienced in both upland and lowland rice production with small farm size of 0.5 – 1 hectare (50%).

However, most of the rice farmers studied employed both hived and family labour in rice production (46.4%) while some employed only family labour 26.8%), they sell their rice at farm gale (35.7%) and some other from time (35.7%). Also rice producers in the area sourced their planting materials mostly from there old stock (53.6%) while only (35.7%) bought from market. The quantity of rice planted by lowland and upland rice farmers was between 26 -50kg (46.4%) of the respondents respectively.

Gross margin analysis was carried out to determine whether rice production was profitable and which is most profitable in the study area. A total of N48,670 was realized as a total profit earned by lowland rice farmers N22,960 was realized on upland rice production with the percentage profit for lowland and upland rice at 51% and 75% respectively meaning that considering profit percentage of upland it has more than that of lowland irrespective of the amount realized.

The effect of socio-economic characteristics of upland and lowland rice farmers on the quantity they produced was determined using four functional form of multiple regression analysis linear from indicated the highest R^2 of 77.4% meaning that 77.4% variation in the dependent variables was caused by the combined influence of independent variables used to build the regression model. This shows that the socio-economic characteristics of rice farmers had strong influence on quantity of rice produced in the area. Moreover, the effect of production factors on the quantity of rice produce (kg) was also determined; using four functional forms of multiple regression analysis, exponential from with R^2 60.8% was selected as the lead equation. This implies that up to 60.8% caused by combined effects of independent variables included in the regression model.

Finally, constraints to upland and lowland rice production were analyzed using mean score obtained from a five points linkers model major constraints identified in the study area were, lack of finance (4.3), lack of labour (3.1) lack of viable farm input (3.8), pest and diseases (3.9), marketing problem (3.7), bad road network (3.7), storage facilities (3.9), lack of access to new rice varieties (3.8). There null hypothesis were tested at 0.05 level of significance using F – test and Ƶ test respectively. Result obtained showed that socio-economic characteristics of rice farmers have significant effect on the quantity of rice produced; the production factors have significant effect on the quantity of rice produced; and that there is significant difference between the revenue and cost of upland and lowland rice production in the study area.

5.2 Conclusion

Rice production is a profitable and viable economic activity in the study area though like finance, lack of labour force lack of viable farm input pest and diseases, marketing problems, bad road networking, storage facilities and lack of access to new rice varieties. Small initial capital is needed for statement.

5.3 Recommendations

Based on the findings of this research work. The following recommendations were hereby made:

a. Provision of capital and improved varieties for farmers in the study area. By the state and local government encouraged.

b. Provision of subsidy in inputs used for rice production such as fertilizer, seeds and agro-chemicals to enable small scale farmers to procure them.

c. Training of farmers by extension agents on the adoption of modern rice production techniques, weather information and proper usage of agro-chemicals and fertilizers by rice producers in the area.

d. Provision of marketing on demand and supply trend of rice to enable farmers to know how to channel their produce for maximum profit.

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