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Socio-Economic Determinants of Adoption of Improved Rice Production Technologies among Rice Farmers in Ebonyi State, Nigeria: A Logit Regression Model Approach

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ABSTRACT

Adoption is a decision to make use of an innovation on a continuous basis. It is against this backdrop that this study investigated the socio-economic determinants of adoption of improved rice production technologies in Ebonyi State, Nigeria. The study employed multi-stage random sampling techniques in the selection of 420 rice farmers from the three agricultural zones of the state. Primary data were sourced through field survey with the aid of structured questionnaires and interview schedule. Both descriptive and inferential statistics were used in data analysis. The result of the socio-economic characteristics of the farmers shows that majority (66.67 percent) of the respondents were males whose age ranged between 41-50 years with mean age of 42 years. Most of them (62.50 percent) were married and had household size of between 6-10 persons with average household size of 8 persons. Majority (50.83 percent) were full-time farmers whose farm size ranged between 1.1-2.0 hectares. Most of the farmers (43.33 percent) had been involved in rice farming for 21-30 years and earned monthly income of between N31,000-N40,000. The result of logistic regression analysis showed a log likelihood ratio of -188. 40 and Chi-square value of 682.559 which was significant at (P= 0.01); implying that all the variables jointly determined the dependent variable. The Pseudo R2 (Nagelkerke) which was 76.6 percent implied that about 76.6 percent of the variation in the adoption of improved rice production technologies was explained by the farmers socio-economic characteristics. Most of the variables were significant and met a priori expectations. The result of factor analysis identified: technical, financial and institutional constraints as major bottlenecks limiting adoption of improved rice production technologies in the area. It was concluded that the socio-economic characteristics of the rural farmers significantly influenced their adoption of improved rice production technologies. Necessary recommendations such as: reviving youths' interest towards rice production; employing and training more extension workers; timely provision of subsidized agricultural inputs as well as incentives for the formation of cooperative societies; were made.

Introduction

Rice (*Oryza sativa L*) is quickly becoming a major staple food for urban and rural consumers' alike (Nwanze *et al*., 2006). Over the decades, it has occupied a prominent position as a strategic crop for food security and economic development of nations of the world. FAO (2000) classified the crop as the most important food depended upon by over 50 percent of the world population for about 80 percent of their food need. However, domestic consumption of rice in Africa is significantly greater than domestic production, necessitating increased imports that drain large amounts of scarce foreign exchange (Buah *et al*., 2011). Across Africa, local production has been unable to keep pace with the rate of increase in demand. In the past 50 years, rice production in Africa has increased to 14.60 million tons (from about 3.14 million metric tons), most of the increase in production has come from expansion in the area devoted to the crop rather than from increase in yields (Buah *et al*., 2011). During the same period, Asia has increased rice production on a much grander scale, to about 570 million tons (up from 200 million tons), with most of this coming from higher yields on existing farm land (Norman and Otoo, 2002; Africa Rice Centre, 2007).

In West African sub-region, Nigeria has witnessed a well established growing demand for rice as propelled by rising per caput consumption and consequently the insufficient domestic production had to be complemented with enormous import both in quantity and value at various times (Erenstein *et al*., 2004; Daramola, 2005) The average Nigerian consumes 24.8 kg of rice per year, representing 9 percent of annual calorie intake (IRR, 2001). Due to its increasing consumption to the per capita calorie consumption of Nigerians, the demand for rice has been increasing at a much faster rate than domestic production and more than in any other African countries since mid 1970s because consumption is broadening across all socio-economic classes (FAO, 2001).

As a result of the nations urbanization, rice constitutes a major portion of the expenditure of cereals based diets of most Nigerians (Bello *et al*.,2012). Over the years, rice production

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had been found to be inadequate to the extent of not being able to bridge the demand/supply gap thereby causing the country to resort to importation. Rice importation rose from 7,000 tonnes in the 1960s to 657,000 tonnes in the 1990s, which created a serious drain on the nation's foreign exchange reserve (IRRI, 1995). Akpokodje *et al*., (2001) reported that 34.4 million Naira was spent on rice imports between 1995 and 1999. This forced the Nigerian government to take several steps to redress the trend, including placing a total ban on the importation of rice and a government's initiative geared towards increasing domestic production. This is because the country has abundant potentials for rice production; both for dry land rain-fed and swamp lowland cultivations. The availability of a sustainable agricultural technology for Nigerian resource-poor rice farmers is imperative due to the country's effort at achieving food security (Ladebo, 2004). Generation of agricultural research technologies are meaningful when they are adopted at the farm level. Therefore, adoption of improved rice production technologies could provide a lasting solution to the much needed food security in Ebonyi State particularly and in Nigeria generally.

At present, there are improved rice varieties provided through Growth Enhancement Scheme of Federal Government of Nigeria on her Agricultural Transformation Agenda; as well as other associated complementary technologies disseminated by Ebonyi State Agricultural Development Programme, Non-Governmental Organizations, USAID MARKETS among others. But, the widespread adoption of these technologies have seem to be below expectation. This underscores the need and relevance of this study.

Current situation manifests low output per area which no doubt limits achievement of desirable increase in agricultural productivity and self-sufficiency in food production desired by the Nigerian Government. The rice farmers are expected to use improved cultural practices to enhance their production. However, contemporary observations show that while some use improved practices, a reasonable proportion still use traditional methods thereby subjecting the rice farmers to low yield in the state. The situation on ground creates doubts on the variables that constitute determinants of rice farmers' adoption of improved rice production technologies in Ebonyi State.

This study therefore aims at examining the socio-economic determinants of rice farmers' adoption of improved rice production technologies in Ebonyi State; in order to give focus to extension service delivery targeted at assisting rice farmers to adopt improved production technologies. Based on the foregoing, the following research questions were asked:

- What are the socioeconomic characteristics of rice farmers in Ebonyi State?
- What are the effects of socio-economic characteristics of rice farmers' on the adoption of improved rice production technologies; and
- What are constraints to rice farmers' adoption of Improved Rice Production Technologies in Ebonyi State?

Objectives of the Study

The broad objective of this study is to investigate the socio-economic determinants of rice farmers' adoption of improved rice production technologies in Ebonyi State. The specific objectives include to:

i) describe the socio-economic characteristics of rice farmers in Ebonyi State;

ii)ascertain the effects of socio-economic characteristics of rice farmers' on adoption of improved rice production technologies; and

iii) identify constraints limiting adoption of improved rice production technologies in the study area.

Hypothesis

A null hypothesis was tested in this study.

Ho_1: There is no significant relationship between the socio-economic characteristics of rice farmers and adoption of improved rice production technologies in the study area.

Methodology

This study was conducted in Ebonyi State of Nigeria, which lies appropriately on latitude $7^0$3'N and longitude 5^0 4'E and $6^0$4'E in the South East geopolitical zone of Nigeria. A multi-stage random sampling techniques were used to draw samples for the study. Firstly, two Local Government Areas were randomly selected from each of the (3) three agricultural zones of the State. Secondly, random selection of 4 (four) autonomous communities from each local government area was made. Thirdly, 10 (ten) rice farmers were systematically selected from each autonomous community. This gave a total of 80 (eighty) rice farmers in each agricultural zone and 240 (two hundred and fourty) rice farmers as the total sample size. A well-structured questionnaire and interview schedule were used to collect primary data for the study. Both descriptive and inferential statistics were employed in data analysis. Objective 1 was analyzed using descriptive statistics such as frequency distribution tables, percentages and means. Objective II was analyzed with logistic regression analysis; while factor analysis was used to analyze objective III. The null hypothesis was tested with logistic regression analysis at 5% level of significance.

Measurement of Variables

Dependent variable

Adoption is regarded as the decision of a farmer to make use of an innovation or technology as the best course of action available on continuous basis. The dependent variable was adoption of improved rice production technologies. The respondents were asked whether they have adopted improved rice production technologies or not. Those who have adopted were assigned 1 while those who have not adopted were assigned 0. Others were assigned between 0.25 -0.75 according to the number of technologies they have adopted.

Independent Variables

These include socio-economic/personal characteristics of the rice farmers. The selected personal characteristics of the rice farmers were measured as follows:

Age

Respondents were asked to indicate their actual age at the time of study

Sex

Respondents' sex was noted on the basis of Male/Female

Marital status

Respondents were asked to indicate if: Married, Single, Widowed, Divorced or Separated.

Level of Education

Education refers to ability to read and write. Respondents were asked to indicate if they had: No formal education, Adult literacy, Primary, Secondary, Tertiary institutions e.t.c. This was scored and measured by the category of education attained in terms of adult education = 1, primary education = 2, secondary education = 3, tertiary education = 4 and tertiary education = 5. No formal education = 0.

Rice Farming Experience

This was measured as number of years spent by each respondent in rice cultivation. Respondents were requested to state the number of years they have spent in rice production.

Farm size

This is the total number of land cultivated by a particular farmer. This was measured by the number of heaps that can be made on respondents' rice farms. For the purpose of data analysis, the number of heaps was converted into hectares. According to Philips (1977), 10,000 heaps make 1.0 hectare.

Household size

This is the total number of people in a household. Respondents were requested to state the number of their household members thus: no. of wives, no. of male children, no. of female' children, no. of dependents. The total number living and feeding from the same pot was used as the household size of the respondents.

Occupation

Respondents were asked to indicate their secondary occupation apart from farming.

Annual Farm Income

This refers to the total amount of money earned by a rice farmer from rice production. The respondents were asked to estimate the total amount of income they earned from rice production in naira per year. This was used as their annual income.

Extension contact

This refers to the level of personal contact a particular farmer had with extension agents in their locality. The respondents were asked to indicate how often they are visited by extension agents in their community. Numerical value was assigned to the frequency of extension visits in order to obtain the level of extension contact of a particular respondent.

Membership of cooperative society

The respondents were asked whether they belonged to cooperative societies or not.

Model Specification

Logit Regression Model

The logit model was based on cumulative logistic probability. Logistic probability functions was used. Logit model assumes that the underlying stimulus is a probability of technology adoption. The behavioural model is Yi= g [1i], where yi is the observed response for the ith observation. That is binary variable yi = 1 for adoption and yi = 0 for non-adoption. The probability of technology adoption model is implicitly specified as follows;

$Y = F (X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10})$ and explicitly as follows

$Y = b0 + b_1X_1 + b_2X_2 + b_3X_3 \ldots b_{10}X_{10} + et$

Where;

Y = Probability/Rate of Adoption

X_1 = Gender (Dummy, Male = 1, Female = 0)

X_2 = Age (years)

X_3 = Marital Status (Dummy, married = 1, single = 0)

X_4 = Household Size (Number)

X_5 = Educational Status (years)

X_6 = Farm Size (hectares)

X_7 = Farming Expericne (years)

X_8= Annual Income (Naria)

X_9 = Membership of FMCS (Dummy, Member = 1, Non-Member = 0)

X_{10} = Extension contacts (Dummy Frequent = 3, not frequent = 2, not all = 1)

$X_1 – X_{10}$ = estimated parameters

b0 = Constant

In this study, the dependent variable is the proportion of improved farm techniques which range from zero to one. The adoption categories are: 0, if none of the techniques is adopted; 0.25, if 1-3 technologies are adopted; 0.50 if 4-6 technologies are adopted; 0.75 if 7-9 technologies are adopted; and 1 if above 9 or all of the technologies are adopted. The advantages of proportional data in a probit framework over a normal probit model in this way are (1) we have a continuous, as opposed to a discrete (zero, one) dependent variable. In this case we are able to cater for partial adopters and (II) since the dependent variable is observed the coefficients of the variables are useful in that they measure the direct effects of the explanatory variables on the dependent variable.

Factor Analysis

Exploratory factor analysis procedure using the principal factor model with varimax rotation was employed in grouping the constraint variables into major constraint factors. In factor analysis, the factor loading under each constraint (beta weight) represent a correlation of variables (constant area) to the identified constraint factor and has the same interpretation as any correlation coefficient. However, only variables with loading of 0.40 and above (10 percent) overlapping variance (Camrey, in Chukwuone, Agwu and Ozor, 2006) were used in naming the factors. Based on the factors considered the Principal Component Analysis (PCA) or factor loading was adopted for the study.

The basic assumptions of factor analysis are as follows:

i. The error term ei are independent of one another, such that $E(ei) = 0$, and $var(ei) = \delta i^2$. Hence, each ei is an outcome of a random draw with replacement from a population of ei values having mean of 0 and certain variance, $\delta i^{2.}$

ii. The observable factors, Fj are independent of one another and the error terms, and such that $E (Fj) = 0$ and $var (Fj) = 1$. Therefore, each observable variable or factor Yi is linear function of independent factors, Fi and error terms, ei.

Factor analysis can then be expressed mathematically as:

$Yi = \beta i_0 + \beta i_1F_1 + \beta i_2F_2 + \beta i_3F_{3+} \ldots\ldots\ldots + \beta i_nF_{n+ei}$

Where,

Bi = Parmeters or loadings. Hence, B1=Bn is the loading of variable Yi on factors, Fn.

The factors that loaded higher than the other were isolated using Kaiser's rule of thumb. Kaiser developed a rule of thumb of 0.4 as a minimum loading weight which a factor can have before it can be isolated as being positive to the attribute in question.

Results and Discussion

The results of field survey were presented according to the specific objectives of the study as follows:

Socio-economic Characteristics of the Respondents

The socio–economic characteristics of the respondents such as their: gender, age, marital status, household size, educational attainment, occupation, farm size, farming experience, annual income, membership of farmers' cooperative society, access to credit and extension contacts were considered. Result obtained was presented in Table 1.

The result of the socio-economic characteristics of the respondents presented in Table 1 showed that majority (66.67 percent) were males; while few (33.33 percent) were females. This implies that most of the rice farmers in Ebonyi State are males. This is because rice production is dominated by men in the study area due to its tedious nature that made many women to abandon it. This is also closely related to the work of *Bawa et al*., (2009) who noted that males are major decision takers when it comes to such issues like adoption of new technologies.

Table 1. Percentage Distribution of the Socio-economic Characteristics of the Respondents

Socio-economic Characteristics	Frequency	Percentage	Mean (x)
Gender	160	66.67	
Male	80	33.33	
Female			
Age			
< 20	18	7.58	
21-30	23	9.58	
31-40	49	20.42	42
41-50	109	45.42	
51-60	28	11.67	
> 61	13	5.42	
Marital status			
Single	60	25.00	
Married	150	62.50	
Widow	10	4.17	
Widower	11	4.58	
Separated/Divorced	9	3.75	
Household size			
1-5	64	26.67	
6-10	129	53.75	
11-15	26	10.83	8
16- 20	16	6.66	
Above 21	5	2.08	
Educational Attainment			
No formal education	60	30.83	
Adult education	24	10.00	
Primary education	99	41.25	6
Secondary education	43	17.92	
Tertiary education	14	5.83	
Occupation			
Full-time Farming	122	50.83	
Farming and Civil service	31	12.92	
Farming and Trading	32	13.33	
Farming and Hunting	24	10.00	
Farming and Fishing	21	8.75	
Farming and Carpentry	10	4.16	
Farm size (hectares)			
0.1-1.0	25	10.42	
1.1-2.0	111	46.25	
2.1- 3.0	63	26.25	2
3.1- 4.0	22	9.17	
Above 4.1	19	7.92	
Rice farming experience			
1 – 10	21	8.75	
11 – 20	40	16.67	
21 – 30	104	43.33	26
31 – 40	56	23.33	
Above 41	19	7.92	
Monthly Income (₦)			
₦11,000- ₦ 20, 000	56	23.33	
₦ 21, 000- ₦ 30,000	114	47.50	
₦ 31, 000- ₦ 40, 000	47	19.58	
₦ 41, 000- ₦ 50, 000	13	5.42	₦ 27, 270
Above ₦ 51,000	10	4.17	
Membership of rice			
Farmers' cooperative society			
Members	169	70.42	
Non-members	71	29. 58	
Access to credit			
No Access	195	81.25	
Had Access	45	18.75	
Extension Contact			
Frequent	24	10.00	
Not Frequent	119	49.58	
Not at all	97	40.42	
Total		**240**	**100**

Source: Field Survey, 2014.

The result on age showed that most of the rice farmers (45.42 percent) aged between 41-50 years; while few 5.42 percent were above 61 years. This shows that most of the farmers are average aged men and women who are still capable of carrying out agricultural activities with the adoption of IRPTs recommended by ADPs and other agencies in the state. The mean age of the respondents was 42 years. This indicates an ageing farming population which is consistent with the assertions of Ekong (2003) who opined that farming in rural areas of Nigeria is dominated by older farmers because of the outmigration of youths to urban centres in serach of white collar jobs.

The result of marital status of the respondents had shown that most of the respondents (62.50 percent) were married; while few (3.75 percent) were separated or divorced. This implies that most married men and women were involved in rice production in the study area as a means of providing food and other requisites for their family members. Dikito-Watchmeiser, (2001), opined that marital status is an important factor in rural participation and acceptance.

The result of the household size of the farmers showed that greater proportion (53.75 percent) of the rice farmers lived with 6-10 persons in their household; while 2.08 percent lived with more than 21 persons in their household. This shows that the household size of the respondents is relatively large. The mean household size of the respondents is 8 persons. According to Njoku (1991), households with larger size tend to attach greater importance to food security than those that were small in number.

Analysis of the educational attainment of the respondents indicates that most of the rice farmers (45.42 percent) completed primary education; while few (5.83 percent) attained tertiary education. This shows that most of the respondents had low level of educational attainment. However, majority can read and write. The mean number of years spent in formal education was 6 years. Obasi (2005) reported that the level of educational attainment by a farmer would not only increase his farm productivity but also enhance his ability to understand and evaluate new production technologies.

Further analysis revealed that most of the rice farmers (50.83 percent) were involved in full time farming; while minority (8.75 percent) were both farmers and artisanal fish farmers. Other occupations engaged by the respondents are carpentry, trading, hunting and civil service. This conformed to the work of Alimba (1995) who observed that rural people engage in arts, crafts and handcrafts, however, their major occupation is farming.

The result in Table 1 shows that most of the farmers (46.25 percent) had farm size within the range of 1.1 – 2.0 hectares; while only 7.92 percent possessed farm size above 4 hectares. This implies that the farm size of most of the respondents is relatively small due to high level of land fragmentation which characterizes land ownership in the study area. The mean farm size of the respondents was 2 hectares. Edeh (2008) however, reported average farm size of 0.91 hectares for rice farmers in Ebonyi State.

Analysis on rice farming experience showed that majority (43.33 percent) of the rice farmers had been involved in rice farming for 21-30 years; while only few (7.92 percent) had rice farming experience of above 41 years. This shows that most of the rice farmers are actually experienced in rice farming, since they have high level of farming experience. The mean number of years spent in rice farming among the respondents was 26 years. The number of years a farmer had spent in the farming business according to Nwaru and Ekumakama (2002) may give an indication of the practical knowledge he/she had acquired on how to overcome certain inherent farming problems.

Credit availability could determine the extent of production capacity. The result of access to credit shows that most of the rice farmers (81.25 percent) did not have access to credit while very few (18.75 percent) had access to credit. This implies that there is low access to credit among rice farmers in the study area. FAO (1997) noted that credit is a very strong important factor needed to acquire or develop farm enterprises.

The result of the analysis on monthly income of the respondents indicated that most of the respondents (47.50 percent) earned between N21,000 – N30,000 per month; while very few (4.17 percent) earned above N 51,000. This shows that most of the respondents are low income earners whose income distributions are very low. The average monthly income earned by the respondents was N 27, 270. The result indicates that there is a weak earning power among the respondents. This poses a great threat to innovation adoptions. This is because increase in incomes would enable poor households save more financial resources and consequently gain required financial capacity to invest in technology adoption.

Result obtained in Table 1 showed that majority (70.42 percent) did not belong to any cooperative society; whereas few (29.58 percent) were members of cooperative society. This is in consonance with the findings of Chikezie *et al*., (2012) who observed that majority (80 percent) of his respondents were non-cooperative members.

The result equally showed that majority (49.58 percent) of the respondents could not have frequent access to extension services; whereas few (10 percent) had frequent access to extension service. This implies that there is low level of access to extension service in the study area; despite extension agents deployed and sent to various communities by the State Government. This could invariably affect the rate of dissemination as well as level of adoption of Improved Rice Production Technologies among rice farmers in the study area.

Effects of Socio-economic Characteristics of Rice Farmers on the Adoption of Improved Rice Production Technologies in Ebonyi State

The effects of socio-economic characteristics of the rice farmers on the adoption of Improved Rice Production Technologies was ascertained using a logistic regression analysis. The result obtained is shown in Table 2.

Table 2. Co-efficient Estimates of Logit Regression Model of the Effect of Socio-economic characteristics on Adoption of Improved Rice Production Technologies

Variables	Parameter	Coefficients	Standard Error	Z-value
Constant	b_0	-3.769	0.189	-0.102^{NS}
Gender	b_1	0.019	0.016	-1.132^{NS}
Age	b_2	-0.019	0.074	0.244*
Marital Status	b_3	-0.018	0.022	1.084**
Household Size	b_4	0/023	0.019	0.271**
Educational Status	b_5	0.005	0.136	-0.619**
Farm Size	b_6	0.084	0.012	0.798**
Farming Experience	b_7	0.009	0.000	6.310*
Annual income	b_8	0.000	0.203	-0.715*

Membership of cooperative society	b_9	0.145	0.241	0.362*
Contact with Extension Agents	b_{10}	0.087	0.965	-3.904*

Source: Data Analysis, 2013.
** = Significant at 5 percent
* = Significant at 1 percent
Pearson Goodness of Fit = 682.559
N = 240
Probability (LR stat) = 0.0000
Pseudo R^2 = 0.766 = 76.6 percent

The result of logit regression in Table 6 showed that the log likelihood ratio was – 188.40 and the Chi-square value was 682.559. This implies that the model as a whole is statistically significant at 1 percent level of significance. The Chi-square value is also significant at 1%, implying that all the variables jointly determine the dependent variable. The pseudo R-square (Nagelkerke) which represents the multiple determination has a value of 0.766 (76.6 percent); implying that the explanatory variables jointly explained 76.6 percent of the variation in adoption of IRPTs. Consequently, the interpretation of the logit analysis indicates the following:

Gender (X_1) was positively signed and was not statistically significant. This shows that there was gender discrimination in relation to technology adoption. Both male and women farmers adopted improved rice production technologies. This shows that gender played a role in decision making when it comes to adoption of new technologies as confirmed by Adesina *et al*. (2001) and Iwueke (2006).

Age (X_2) had a negative coefficient and was not statistically significant. This negative coefficient indicates negative relationship which implies that as the age of the rice farmers increases, their level of adoption decreased. The a priori expectation was met. This implies that younger rice farmers are more likely to adopt innovations than their older counterparts. This is agreement with the study of Lemchi *et al.* (2003) who asserted that younger farmers are more likely to adopt farm innovations than their older farmers being more willing to take risk.

Marital Status (X_3) bore a negative coefficient and was statistically significant at 1 percent. This means that there was a great difference between married farmers and non-married farmers in terms of technology adoption. It could be that married rice farmers adopted IRPTs more than unmarried ones. This could be true because married farmers have large household size who can supply family labour needed in technology adoption because most of the improved technologies are labour intensive. In support of the above findings, Tshuna *et al*. (1999) opined that married farmers were more likely to adopt and extend innovation to others through support from their spouses and other household members.

The household size (X_4) was positively signed and statistically significant at 1 percent level of significance. This shows that the higher the household size of the respondents, the higher their level of adoption of IRPTs. The a priori expectation was actually met as it has a positive coefficient which implied that rice farmers with higher number of household size do adopt IRPTs in Ebonyi State more than those with few household members. This is true because the more the number of household, the higher the adoption of new practices and vice versa. The result corroborated with the report of Ekwe (2004) which indicated that most farmers in Abia State of Nigeria of Nigeria which readily provided labour for on-farm and off-farm activities and facilitated innovations adoptions.

Educational status (X_5) was positively signed and statistically significant at 5 percent level of significance. The a priori expectation was actually met as it has a positive coefficient which implied that rice farmers with higher educational qualification do adopt IRPTs in Ebonyi State than less educated farmers. This conforms to the work of Idris *et al*. (2006) who identified low level of formal education to be associated with less likelihood of respondents to understand scientific basis of agriculture and superiority of improved practices over traditional practices.

Farm size (X_6) was positively and significantly related to the dependent variable at 5 percent level of significance. This means that rice farmers whose farm size are large adopted IRPTs unlike those without sufficient farm. This is true and conforms to the a priori expectations because ownership of land can be an advantage to innovation adoption. They can easily test the technologies on their farm when there is enough land for them to practice the technology.

The farming experience (X_7) was positively signed and statistically significant at 1 percent level of significance. This means that the higher the farming experience of the respondents, the higher their level of adoption of innovations on improved rice production technologies. This is contrary to the study carried out by Onemolease (2005) who obtained a significant negative relationship between farming experience and adoption of improved technologies.

Further analysis shows that the annual income of the respondents (X_8) was statistically significant at 1 percent and bore a positive coefficient. This implies that positive relationship exist between the farmers' annual income and their level of adoption of IRPTs. The a priori expectation was met because farmers with increased annual income are expected to adopt innovations more than those with lower annual income.

Membership of Cooperative Society (X_9) was positively signed and statistically significant at 1 percent level. This implies that cooperative membership enhanced access to information for members on improved technology and many other inputs of the technology. This disagrees with the findings of Ojo (2009) who discovered that belonging to a cooperative society was not significant with adoption of recommended cassava production practices. But, agrees with the work of Deji (2005), who found membership of cooperative societies as a predictive factor of adoption behaviour of farmers.

Contacts with Extension Agents (X_{10}) was positively signed and statistically significant at 1 percent level of significance. This shows that rice farmers' who had frequent contact with Extension Agents had better knowledge on Improved Rice Production Technologies and adopted innovations more readily than their counterparts. Imolehin and Wada (2000) made similar observations. They concluded that active extension service is a key to passing information on improved agricultural practices on rice farmers who are the end users.

The overall fit of the logit model was explained by the Pearson Goodness of fit which was 682.559 and statstistically significant at P = 0.01. The logit model estimate is shown as:

$Y = -3.769 + 0.019b_1 – 0.019b_2 – 0.018b_3 + 0.023b_4 + 0.005b_5 + 0.08b_6 + 0.09b_7 + 0.000b_8 + 0.145b_9 + 0.087b_{10}$

(0.189) (0.016) (0.074) (0.022) (0.019) (0.136) (0.012) (0.000) (0.203) (0.241) (0.965)

Constraints limiting Adoption of Improved Rice Production Technologies in Ebonyi State

Exploratory factor analysis was used to group the variables into possible constraint factors. The result of the rotated component matrix showing the extracted factors, based on the response of the farmers is presented in Table 3.

Table 3. Varimax Rotated Factor Matrix on Constraints to Adoption of Improved Rice Production Technologies in Ebonyi State.

Variables Code	Variables Names	Constraint I Technical	Constraint II Financial	Constraint III Institutional
$V0_1$	Scarify of improved seeds	0.147	0.121	0.741
$V0_2$	Inadequate finance	0.013	0.917	0.051
$V0_3$	Inefficient Extension service delivery	0.279	0.021	0.435
$V0_4$	Poor government support	0.055	-0.261	0.401
$V0_5$	Low level of knowledge and Awareness	0.671	0.013	-0.129
$V0_6$	Poor marketing of products	0.004	0.012	1.535
$V0_7$	Tediousness of the technology	0.446	-0.035	-0.034
$V0_8$	High cost/scarcity of labour	0.112	0.817	0.015
$V0_9$	Lack of interest among youths	-0.055	0.001	0.563
$V0_{10}$	Lack of adequate knowledge improved practices	0.401	-0.347	-0.251
$V0_{11}$	High cost of Agrochemicals	0.213	0.327	0.061
$V0_{12}$	Lack/high cost of fertilizers	0.111	0.423	-0.029
$V0_{13}$	High cost of farm tools	0.038	0.591	0.051

Source: Data Analysis, 2014.

From the data obtained from field survey, four (4) major constraints were extracted based on the responses of the respondents. Only variables with constraint loading of 0.30 and above at 10% overlapping variance (Ashley *et al.*, 2006, Madukwe, 2004) were used in naming the factors. Variables that loaded in more than one constraint and those lower than 0.3 were not considered. The next thing to do as reported by Kessler (2006) was given each constraint a denomination that best describes or characterizes the set of variables contained in it. In this regards, the variables were grouped into four (3) major constraints as constraint I (Technical constraint), Constraint II (Financial constraint) and Constraint III (Institutional constraints).

Constraint I was considered and named technical constraint due to the factors that loaded high under it. These are: $V0_5$- low level of knowledge and awareness (0.671), $V0_7$- Tediousness of the technology and $V0_{10}$- lack of adequate knowledge of improved practices (0.401). This corresponds to the study of Umeh (2009) who identified complexity of technology as a constraint to adoption of agro forestry recommendations among farmers in Ebonyi State Nigeria.

Constraint II was critically examined and named financial constraint due to the high loading variables under it. These are: $V0_2$ Inadequate finance (0.917), $V0_8$ High cost and scarcity of labour (0.817), $V0_{11}$-High cost of agrochemicals (0.327), $V0_{12}$ Lack/High cost of fertilizers (0.423) and $V0_{13}$ – High cost of farm tools (0.591). Nwike and Chidebelu (1991) identified lack of funds as a constraint to continuous adoption of innovations.

Also, after careful examination, constraint III was considered and named institutional constraints due to the variables which loaded high under it. These are: $V0_1$-Scarcity of improved seeds (0.741), $V0_3$-Inefficient extension service delivery (0.435), $V0_4$- poor government support (0.401), $V0_6$ - Poor marketing of products (1.535) and $V0_9$ – Lack of interest among the youths (1.535). Obeta and Nwagbo (1991) posited that adoption of innovations could be seriously hampered by poor distribution of technological inputs. They further argued that agricultural technologies that were not easily available at moderate prices were hardly adopted.

Test of Hypothesis

The null hypothesis was tested in this study:

Ho_1: There is no significant relationship between the socio-economic characteristics of rice farmers and the adoption of improved rice production technologies in the study area.

The omnibus tests of model coefficients and the likelihood ratio statistics was highly significant, P = 0.01, suggesting that the model has a strong explanatory power. The significance of this likelihood ratio statistics test rejected the null hypothesis of this study. Therefore, the alternative hypothesis was accepted. This implies that the socio-economic characteristics of the rice farmers significantly influence their adoption of IRPTs in the study area.

Conclusion and Recommendations

The study had shown that the socio-economic characteristics of rice farmers in Ebonyi State are strong determinants of their adoption potentials. The rice farmers were limited by technical, financial and institutional weaknesses as they strive to adopt improve rice production technologies in the study area. Therefore, efforts should be made to revive youths' interest towards rice production since they possess higher adoption potential and requisite strength for farm labour supply. Agricultural Extension workers should be employed, trained, equipped and monitored to ensure prompt dissemination of improved practices generated from research stations. There should be timely provision of subsidized agricultural inputs to enhance rice farmers' access to basic agricultural inputs. There is also need to support formation of cooperative societies among the rice farmers. This could avail government and non-governmental organizations support through the provision of inputs and services such as improved seeds and credit facilities in the study area.

References

[1] Adesina A, Zinnah M (1993). Technology Characteristics, Farmers' Perception and Adoption Decisions a Tobit Model Application in Sierra Leone. Agric. Econs 9: 297-311.

[2] African Rice Centre (Africa Rice) (2009). Annual Report (2009). Increasing Investment in Africa's rice sector. Cotonuo, Benin, P. 68.

[3] Akpokodje, G., Hamicon, F., and Erestein, O (2001). *Nigeria's rice economy: State of Act*. Proceeding of Annual meeting of Farm Management Association of Nigeria (FAMAN). Jos, Nigeria.

[4] Alimba, J.O (1995). Linkages Between Farm and Non-Farm Sectors of the Nigerian Rural Economy In: Eboh, E.C., Okoye, C.U and Ayichi, D (1995): Rural Development in Nigeria: Concepts, Processes and Prospects. Auto-Century Publishing Company, Enugu. Pp: 31-41.

[5] Ashley, B.S; Amber and F. Anthony (2006). Education by Nation: Multivariate analysis: Retrieved April 22, 2008, from http://www.users.muchio.edu/porterbm/sun/2006/starts.s.

[6] Bawa, D.B., Ani, A.O and Nuhu, H.S (2009). Perception of privatization and commercialization of Agricultural Extension Services in Adamawa State, Nigeria. American-Eurasian. *Journal of Sustainable Agriculture*, (3): Pp: 375-380.

[7] Buah, S.S.J., Nutsugah, R.A.L., Kanton, I.D.K., Atokple, W., Dogbe, Afia, S.,et al (2011). Enhancing farmers' access to technology for increased rice productivity in Ghana (2011). *African Journal of Agricultural Research* 6 (19): 4455-4466.

[8] Chukwuone, N.A, A.E Agwu and N. Ozor (2006). Constraints and Strategies Towards Effective Cost-Sharing of Agricultural Technology Delivery in Nigeria: Perception of Farmers and Agricutural Extension Personnel. *Journal of International Agriculture and Extension Education*, 13(1):Pp: 29-40.

[9] Deji, S.O (2005). Assessing Economic Advantages of cassava production in Nigeria. Paper presented at workshop organized by Cassava Producers Association of Nigeria, Abuja, Nigeria.

[10] Dikito-Watchtmeiser, M.S (2001). Empowering women in achieved food security, social capital. International Food Policy Research Institute, Washington DC. Focus 6, Policy Brief 9 of 12, August, 2001.

[11] Edeh, H.O (2008). Analysis of environmental risk factors affecting rice farming in Ebonyi State, Nigeria. An unpublished Msc. Thesis submitted to the Department of Agricultural Economics, University of Nigeria, Nsukka, P: 45-50.

[12] Ekong, E.E (2003). An introduction to rural sociology Uyo: Dove Educational Publications, Pp: 25-26, 270.

[13] Ekwe, K.C (2004). Factors Associated with Utilization of Improved Gari Processing Technology in South eastern Nigeria. Unpublished Ph. D Thesis in the Department of Rural Sociology and Extension, Michael Okpara University of Agriculture, Umudike. P. 151.

[14] Food and Agricultural Organization (FAO) (2006). FAO Production Year Book, Rome.

[15] Food and Agricultural Organization (FAO) 2000. Agriculture towards 2015/30 Technical Interim Report. April, 2000. Rome.

[16] Food and Agricultural Organization (FAO) 2001. FAO rice Conference 2001. Rome

[17] Idrisa, Y.C., Gwacy, M.M., and Ibrahim, A (2006). Determination of Adoption of Cassava Farming. *Production Agriculture and Technology* (PAT), 2: 26-36

[18] Imolehin, E. D and Wada, A. C (2000). Meeting the rice production and consumption demands of Nigeria with improved technologies, International Rice Commission Newsletter 49 http:// www. Fao.org/DOCREP/X7164T/X716404. htm.

[19] JICA (2007). The Study on the Promotion of Domestic Rice in the Republic of Ghana

[20] National Development Planning Commission (NDPC) (2005). Growth and Poverty Reduction Strategy (GPRSII).

[21] International Rice Research Institute (IRRI), 2001. Rice Statistics

[22] International Rice Research Institute (IRRI). 1995. *World rice statistics*.

[23] International Rice Institute, Manila, Philippines. Pp: 32-42.

[24] Iwueke, R.O (2006). Gender and Resources Use Efficiency in Rice Production System in Abia State. An unpublished MSc. Thesis, Michael Okpara University of Agriculture Umudike, Nigeria. Pp: 2-30.

[25] Kessler, C.A (2006). Divisive Key-Factor Farm Households Soil and Water Conservation Investment. *Journal of Applied Geography* 26:40-60.

[26] Lemchi, J., Tshiunza, M and Tenkouano, A (2003). Factors driving the intensity and rate of cooking banana adoption in Nigeria. *Journal of Agriculture and Social Research*, 3 (2): 135-166.

[27] Madukwe, M.C (2004). Multivariate Analysis for Agricultural Extension Research. In Terry A.O (Ed) Research Methods in Agricultural Extension. Pp: 206-236.

[28] Mustapha , Bello., Salua, E.S and Ezra, L (2012). Analysis of Factors Influencing Discontinuance of Technology Adoption: The Situation with Some Nigerian Farmers. *Journal of Sustainable Agricultural Research* 1 (2): 292-293.

[29] Njoku, J.E (1991). Factors Influencing the Adoption of Improved Oil Palm Production Technologies by Small- Holders in Imo State, Nigeria. Proceedings of 4th National Conference of Farming Systems Research Network, Calabar Nigeria.

[30] Norman, J. C., Otto, E (2002). Sustainable rice production for food security. Proceedings of the 20th Session of the International Rice Commission, Bangkok, Thailand, 23-26 July 2002. International Rice Commission .

[31] Nwanze K.F., Mohapatra S, Komawa P, Shellemiah K, Bruce-Oliver S (2006). Rice Development in Sub-Saharan Africa. Journal of Science, Food and Agriculture., 68: 675-677.

[32] Nwaru, J.C and Ekumankama, O.O (2002). Economics of Resource Use by Women arable crop farmers in Abia State. Research report submitted to the senate grant committee, Michael Okpara University, Umudike. P. 40.

[33] Nwike, C.C. and Chidebelu, A.A (1991). Appraisal of yam minisette for farmers in South-Eastern Nigeria. Proceedings of 4th Conference of National Farming System Research Network, Calabar Nigeria.

[34] Obasi, L.N (2005). Innovation programme in rural development in Nigeria: An Evaluation of the better life programme using APBS framework. Published by Auto Century Publishing Company Enugu.

[35] Obeta, M.E and Nwagbo, F.C (1991). The Adoption of Agricultural Innovations in Anambra State, Nigeria: *A case study of improved IITA Cassava Technology Package. Proceedings of 4th Conference of National Farming Systems Network Calabar, Nigeria.*

[36] Ojo, H.I (2009). Analysis of Factors Influencing Women Adoption of Improved Cassava Production Technologies in Mopamuro Local Government Area, Kogi State. Unpublished

M.Sc Thesis, Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria.
[37] Onemolease E.A (2005). Impact of Agricultural Development Programme (ADP) activities in Arable Crop Production on Rural Poverty Alleviation in Edo State, Nigeria. An unpublished Ph.D Thesis of University of Benin, Benin City, Edo State, Nigeria. P 123.
[38] Tshiunza, M.J., Lemchi, A.I and Faturoli. B (2001). Economic Analysis of Plantain Hybrid Performance: Improving Plantain and Banana-Based System. Annual Report of IITA, Ibadan, Nigeria.
[39] Umeh, G.N (2009). Adoption of Agro forestry Recommendations among farmers in South east zone of Nigeria. *Journal of Research in Agriculture*, 6(1).P 112.