International Journal of Management and Commerce Innovations ISSN 2348-7585 (Online)
Vol. 6, Issue 2, pp: (799-807), Month: October 2018 - March 2019, Available at: www.researchpublish.com

DETERMINANTS OF THE ADOPTION OF IMPROVED RICE VARIETY AMONG FARMERS IN GWAGWALADA, ABUJA

[1]Professor P.O. Idisi, [2]Dr. (Mrs) I. J Ogwu, [3]Ademoluti, A. E.

Department of Agricultural Economics, Faculty of Agriculture, University of Abuja, PMB 117, Abuja, FCT, Nigeria.
Corresponding Author: Ademoluti, A.E. ademolutiesther@yahoo.com_Tel: +2347066728972

Abstract: **The use of improved rice technology is being promoted by Nigeria government in order to increase productivity of upland rice farming. This study was carried out to investigate the determinant of adoption of improved rice variety in Gwagwalada area council, FCT. The specific objectives of this study were to identify the socio-economic characteristic of the sampled farmers, the profitability differentials between adopters and non-adopters and the determinant of adoption. A multi-stage sampling technique was used to select 120 rice farmers from four wards. Data were collected through a well-structured questionnaire. The data were analyzed using descriptive statistics such as frequency, percentages, ratios and maximum likelihood estimator such as probit model. The result shows that 33.3% of the farmers were between the ages 31-40. Most of the farmers were male (85%), who were married (90%). About (23.3%) of the farmers had a household size of 4-6 and 10-12 respectively, (36.7%) attained a tertiary education while (80%) had a farming experience of 12 and above. The profit differentials between the adopters and non-adopters show that the adopters had a profitability ratio of 1.3 while the non-adopters had a profitability ratio of 1.1. The Probit analysis result shows that educational status and the farming experience had a significant effect on adoption of this improved rice variety. Since most of the farmers were educated, training and educational empowerment should be organized by Government for older farmers, also social infrastructure and basic amenities should be provided.**

Keywords: **improved rice technology, farmers.**

1. INTRODUCTION

Background to the Study:

Agricultural growth is essential for fostering economic development and feeding growing populations in most less developed countries. Area expansion and irrigation have already become a minimal source of output growth at a world scale. Agricultural growth will depend more and more on yield-increasing technological change (Datt and Ravallion, 1996; Hossain, 1989). It is believed that, the adoption of new agricultural technology, such as the High Yielding Varieties (HYV), that led to the Green Revolution in Asia could lead to significant increases in agricultural productivity in Africa and stimulate the transition from low productivity subsistence agriculture to a high productivity agro-industrial economy (World Bank, 2008). In this regard, Mendola (2007) observes that the adoption of HYV has had a positive effect on household well-being in Bangladesh. In addition, empirical studies show that gains from new agricultural technology influenced the poor directly, by raising incomes of farm households, and indirectly, by raising employment and wage rates of functionally landless laborers, and by lowering the price of food staples (Pinstrup-Andersen *et al*., 1976; Hossain *et al*., 1994; Winters *et al*., 1998; de Janvry and Sadoulet, 1992, 2002; Irz *et al*., 2002; Bellon *et al*., 2006; Binswanger and von Braun, 1991; Evenson and Gollin, 2003; Just and Zilberman, 1988; Diagne *et. al*., 2009). In recent years, rice production has been expanding at the rate of 6 percent per annum in Nigeria, with 70 percent of the production increase due mainly to land expansion and only 30 percent being attributed to an increase in productivity (Fagade, 2000; Falusi, 1997; Africa Rice (WARDA), 2007 and 2008; Okoruwa *et. al*., 2007). Notwithstanding, the demand for rice is growing faster than production in the country, thus making the country depend on imported rice to meet the high demand. Several factors have been attributed to the slow bridge in the demand and supply gap. Prominent among which are the fact that nearly half of Nigeria's 140 million people live below the poverty line (World Development Indicators, 2004; NBS, 2008); the lack of high yielding varieties with good grain qualities, competition with imported rice, and inadequate post-harvest processing. Other factors are land degradation and inadequate land preparation, unreliable and uneven rainfall distribution, problems of weeds, insect pests, diseases, birds, and lack of training for key stakeholders.

Irrigated lowland rice is grown on around 10 percent of the 1.77million ha planted to rice in Nigeria. In August 1996, the National Crop Variety Release Committee in Nigeria released two semi dwarf varieties, FARO 44 for this ecosystem. They are suitable for all the Zones except Southern Eastern Nigeria, where African Rice Gall Midge (ARGM) is a major problem.

FARO 44 is a varietal name given to the line SI-692033. It was bred at the Chiyai Agricultural Experiment Station, Kaohsiung. Taiwan introduced through International Rice Testing Program Nurseries in 1981, and further evaluated by the International Network for Genetic Evaluation of Rice-Africa and in Multilocational Coordinated Rice Evaluation Trials (CRET) in Nigeria. After 3yrs in CRET, the line was further evaluated in farmers' field by the National Accelerated Food Production Programme (NAFPP). FARO 44 is resistant to leaf blast and leaf scald, but are susceptible to iron toxicity AGRM, and rice yellow mottle virus. They have long, slender grains and high amylase content. Both are popular in irrigated rice areas of North and Central Zones of Nigeria.

Nigeria is one of the many countries in the world with suitable ecologies for different rice varieties which can be harnessed to boost rice production to meet domestic demands and even to produce a surplus for export (Anon, 1997a). The country has a potential land area for rice production of between 4.6million and 4.9million ha. However, only 1.7 million ha, or 35 percent of Nigeria's total land mass, is cropped to rice. The cultivated land to rice is spread over five major ecologies- upland, inland or shallow swamp, irrigated rice, deep water or floating rice and tidal mangrove or swamp. The latter is not fully developed because there is a lack of appropriate technology (Singh *et al,* 1997). In spite of the presence of suitable environments, however, Nigeria is not among the leading world rice producers. The development of these improved rice varieties are aimed at increasing food production as well as alleviate poverty. Despite all the efforts made by the government and research institutes rice production still remains very low. Research has shown that farmers have not adequately adopted improved rice varieties but rather they still depend largely on the local varieties which give low yield and thus low productivity, hence the need for an empirical study on the subject matter.

Objectives of the Study:

The broad objective of this study is to examine farmer's adoption of improved rice variety in Gwagwalada Area Council FCT. The specific objectives of this study are to:

(i) identify the socio-economic characteristics of rice farmers in the study area;

(ii) identify the profit differentials between adopters of improved variety of rice and non-adopters; and

(iii) identify determinants of adoption of improved rice variety relative to local variety in the study area, with a view to proffering some policy recommendations based on the findings of this investigations.

Hypothesis:

The hypothesis to be tested in this study is stated as follows:

H_0: There is no difference in the profit level of adopters of improved rice variety and non-adopters of the improved rice variety in Gwagwalada Abuja.

2. METHODOLOGY

The study area was Gwagwalada Area Council of the Federal Capital Territory (FCT) Abuja. Gwagwalada is a populated place in the region of Abuja Federal Capital Territory, Nigeria. Gwagwalada Area Council is divided into ten wards namely: Kutunku ward, Ikwa ward, Ibwa ward, Tungamaje ward, Gwako ward, Central ward, Quarters ward, Dobi ward, Paiko ward and Zuba ward.

Multi-stage sampling technique was used to select the locations and farmers for the study. In the stage one, Four wards were purposively selected from the list of all (sampling frame) the rice growing villages where the improved rice variety seed were disseminated and was obtained from the Agricultural Development Project (ADP). In stage two Stratified sampling technique was used to select the villages from the ward. In stage three, the farmers were selected using random sampling technique from the villages. Thirty farmers were selected from each village for a total sample size of 120 rice farmers.

Primary data was obtained for the study. The primary data were obtained from a field survey on the socio-economic variables; adoption level and awareness level of the farmers were collected. For this purpose a structured questionnaire was administered on the respondent in the study area. Farm management data were restricted to the improved rice variety, because it's a widely grown food and an industrial crop.

The objectives of the study were analyzed using the descriptive statistics such as, the profitability ratio, frequency distribution, percentage and the MLE which employs the probit model. Objective one was analyzed using frequency distribution and percentages, Objective two was analyzed using the Profitability Ratio while objective three was analyzed using the Maximum Likelihood Estimator.

The profitability ratio measures the farmer's ability to generate earnings relative to some metric, often the amount invested in this improved rice variety. Profitability ratios are useful in fundamental analysis which investigates the financial health of the farmer. The profitability ratio of the farmer is measured by ;

$$\text{Profitability ratio} = \frac{\text{Revenue}}{\text{Cost}}$$

The ratio measures an important dimension of a farmer's profitability. It indicates the portion of each Naira of revenue that is available to cover expenses. It offers a measure of the farmer's ability to withstand either higher expenses or lower revenues.

The probit model which is a quantitative response model, enables us predict the likelihood of adoption decisions of farmers not included in the original sample if we have data on their personal attribute (Amemiya, 1981).

Model Specification:

The Maximum Likelihood Estimator is adopted which employs the probit analytical tool. In this model, the probability of a farmer adopting the 'innovation' is defined in terms of index or stimulus which is unobservable. And, the cumulative normal distribution with zero mean and unit variance is used to transform the index to the probability range as given by:

$$P = 1/\sqrt{2\pi} \int_{\infty}^{y^*} \exp\left(-\frac{u}{2}\right) du$$

Where,

Y^* is the level of the stimulus

P is the probability of observing response (adoption).

The unobserved Y^* is defined as a linear combination of observable explanatory variables. It can be represented in the explicit form algebraically for the ith farmer as,

$$Y_i = \beta_0 + \beta_1X_{1i} + \beta_2X_{2i} + \beta_3X_{3i} + \beta_4X_{4i} + \beta_5X_{5i} + \beta_6X_{6i} + \beta_7X_{7i} + U_i$$

$$i = 1, 2, 3, 4, 5, 6, 7$$

The Y can also be referred to as the adoption equation in the context of the study. The dependent variable is whether or not the particular farmer adopts (which is observable), using the adoption score method.

The Probit procedure calculates maximum likelihood estimates of regression parameters and the natural (or threshold) response rate for quantal response data from biological assays or other discrete event data. This includes probit, logit, ordinal logistic, and extreme value (or gompit) regression models.

Probit analysis developed from the need to analyze qualitative (dichotomous or polytomous) dependent variables within the regression framework. Many response variables are binary by nature (yes/no), while others are measured ordinarily rather than continuously (degree of severity). Ordinary least squares (OLS) regression has been shown to be inadequate when the dependent variable is discrete (Collett, 1991 and Agresti, 1990). Probit or logit analyses are more appropriate in this case.

The model is specified in the implicit form as follows:

Where $Y = F(X_1, X_2, X_3, X_4, X_5, X_6, X_7)$ is the implicit form of the model: and

Y = Adoption Index (Adoption = 1, non = 0)

X_1 = Age of farmers (in years)

X_2 = Sex (Male = 1, Female = 0)

X_3 = Marital status (Married =1, Not married =0)

X_4 = Household size (No of people feeding from the same pot)

X_5 = Educational status (in years)

X_6 = Level of income (in Naira)

X_7 = Farming experience (in years)

U_i = Error term

3. RESULTS AND DISCUSSION

Profit Differentials of Adopters and Non-Adopters:

The profitability ratio is used to measure the profit differentials of both the adopters and the non-adopters. The Sum total revenue and the cost of all the adopters and non adopters are used to get the profit ratio.

$$\text{Profitability ratio (Adopters)} = \frac{\sum \text{Income}}{\sum \text{Cost}}$$

$$\text{Profitability ratio} = \frac{33{,}976{,}000}{26{,}225{,}000}$$

$$\text{Profitability ratio} = 1.3$$

While for the non-adopters,

$$\text{Profitability Ratio} = \frac{15{,}720{,}000}{14{,}027{,}250}$$

$$\text{Profitability Ratio} = 1.1$$

This shows that the profitability ratio of the adopters is 1.3 while the profitability ratio of the non-adopters is 1.1. This result implies that the profitability ratio of the adopters is greater than that of the non-adopters. It shows that the revenue generated is greater than the cost incurred. If the value of the profitability ratio continues to increase per unit cost of input, it gives more revenue. The value of the ratio is increasing i.e., the cost doesn't increase but the revenue increases. Therefore, the adopters are efficient in their production.

Probit Model Showing the Determinant of Adoption:

Table 1: PROBIT RESULT

$$Y = -3.624018 - 0.344180 + 0.058541 + 0.859517 - 0.028075 + 0.096764 - 0.113806 + 0.086379$$

McFaadden R-squared= 0.135098 Schwarz criterion= 1.517935

LR statistics (7df) = 22.46978 probability (LR stat) = 0.002107

From the result in table 4.3, most of the independent variables conform to apriori expectation except X_1 (Gender), X_4 (Household size), X_6 (Farming Experience) which have a negative sign. X_2 (Age), X_3 (Marital status), X_5 (Educational level), X_8 (Income) were significant in explaining the probability of the farmers in adopting the improved rice variety.

Holding other variable constant, X_5 (Educational status) has a probability of 0.096764 and it has a significant effect on adoption at 5% level. X_6 (Farming Experience) has a probability of -0.113806 and it has a significant effect on adoption at 5% level.

From the result in table 1, using the based domain which is the probability that the farmer adopted is 1 or otherwise. The negative coefficient of X_1 shows that less female farmers adopted the improved rice variety. The positive coefficient of X_2 implies that the younger the farmer, the more the adopters. The positive coefficient of X_3 implies that the married farmers adopt more than the rest. The negative coefficient of X_4 shows that farmers with a less household size will adopt less. The positive coefficient of X_5 indicates that farmers who attained tertiary education adopt more than the rest. The negative coefficient of X_6 indicates that the less the farming experience of the famers, the less the adoption of the improved rice variety. The positive coefficient of X_8 indicates that farmers with a higher income adopts more or otherwise.

4. SUMMARY, CONCLUSION AND RECOMMENDATION

4.1 Summary of Findings

The major findings in the socio-economic characteristics of the farmers showed that of the improved rice farmers where within the economically productive age, they were mainly male and were married. The findings also showed that the farmers had a longer farming experience and a large household size and majority of the rice farmers attained tertiary education.

More so, findings showed that the adopters of the improved rice variety were more profitable than the non-adopters. Furthermore, findings also shows that the positive coefficient of the age, marital status, Income, educational status and the negative coefficient of the gender, household size and farming experience of the farmers were important in explaining the probability of the farmers in adopting the improved rice variety. While Educational status and Farming experience were statistically significant.

4.2 Conclusion

Younger farmers especially male will tend to adopt this improved variety more than the older farmers. Married with a large household size will adopt this improved rice variety more than the rest. Farmers that are highly educated, with a longer farming experience and have a high income will adopt this improved rice variety more because it will be more profitable and they will also adopt because of its high yield and it's resistant to pest and diseases compared to other existing rice varieties.

4.3 Recommendations

Firstly, since most of the farmers that adopted were male and the female farmers adopted less, I recommend that government should organize empowerment for the women and they should be well trained in the aspect of processing and marketing of the farm produce.

Secondly, since the older farmers adopted less than the younger farmers but are involved more in farming than the younger farmers, and since most of the farmers that adopted attained tertiary educational level than the rest, and they have a longer farming experience, I recommend that government should provide educational empowerment and training for this farmers and also a better extension services to farmers in order to intimate them with new developments in agricultural production.

Thirdly, since most of the farmers that adopted had a large household size, Government should provide farm machineries, infrastructure and basic amenities to the other farmers so as to assist them in improving production and also adopting new innovations.

Fourthly, since most of the farmers that adopted had a high income than the rest, I recommend that Government should provide farmers with necessary funds needed to assist, good marketing network, improved seeds, fertilizer and herbicides to enable them make more production and profit.

REFERENCES

[1] Africa Rice Center (WARDA) (2007). African Rice Trends: Overview of Recent Development in the Sub-Saharan Africa Rice Sector. *Africa Rice Center Brief. Cotonou, Benin: WARDA*. 8pp.

[2] Africa Rice Center (WARDA)/FAO/SAA. (2008). NERICA: the New Rice for Africa – a Compendium. EA Somado, RG Guei and SO Keya (eds.). Cotonou, Benin: Africa Rice Center (WARDA); Rome, Italy: FAO; Tokyo, Japan: Sasakawa Africa Association. 210 Pp.

[3] Agresti, A. (1990), *Categorical Data Analysis*, New York: John Wiley & Sons. Pp 1-27.

[4] Amemiya, .T. (1981)"Qualitative Response Models: A Survey," *Journal of Economic Literature, 19: 1483-1536.*

[5] Bellon, M. R., Adato, M., Becerril, J., & Mindek, D. (2006). Poor farmers' perceived benefits from different types of maize germplasm: The case of creolization in lowland tropical Mexico. *World Development, 34(1),* 113–129.

[6] Besely, T. and A. Case (1993). "Modeling Technology Adoption in developing countries". *American Economic Review 83: 396-402.*

[7] Binswanger, H. P., and von Braun, J. (1991). Technological change and commercialization in agriculture: The effect on the poor. *World Bank Research Observer, 6(1),* 57–80.

[8] Collett, D. (1991), *Modelling Binary Data*, London: Chapman and Hall.

[9] Datt, G., and M. Ravallion, (1996). How Important to India's Poor is the Sectoral composition of Growth? World Bank Economic Review 10(1), 1-26.

[10] Evenson, R. E., & Gollin, D. (2003). Crop variety improvement and its effect on productivity: *The impact of international agricultural research. Oxon: CABI.*

[11] Fagade, S.O. (2000). Yield Gaps and Productivity Decline in Rice Production in Nigeria. *Paper Presented at the Expert Consultation on Yield Gap and Production Decline in Rice, 5-7 September, 2000. FAO, Rome, Italy. 15 pp.*

[12] Falusi, A.O. (1997). Agricultural Development and Food Production in Nigeria: Problems and Prospects. In: B., Shaid, N.O., Adedipe, M. Aliyu and Jir, M. (eds.) Integrated Agricultural Production in Nigeria: Strategies and Mechanism (NARP) Monograph No. 5. pp. 151-170.

[13] Hossain, M., (1989). Green Revolution in Bangladesh: Impact on Growth and Distribution of Income. University Press Ltd, Dhaka.

[14] Hossain, S.M.A. and Chamala, S., (1994). Patterns and intensity of adoption of the HYVs of boro rice in Bangladesh. *Bangladesh journal of agricultural economics 17* (1/2), 45–60.

[15] Irz, X., Thirtle, C., Lin, L. and Wiggins, S., (2002). Agricultural productivity growth and poverty alleviation. *Development Policy Review 19* (4), 449–466.

[16] Mendola, .M. (2007). Agricultural Technology Adoption and Poverty Reduction: A Propensity Score Matching Analysis for Rural Bangladesh. Food Policy 32(2007): 372-393.

[17] Okoruwa V. O.; M. A. Y, Rahji and O., Ajani, (2007). Rice and Maize Stratification Project in Nigeria. *Draft Report*.

[18] Pinstrup-Andersen, P., de London, N.R.; Hoover, E., (1976). The impact of increasing food supply on human nutrition: implications for commodity priorities in agricultural research and policy. *American Journal of Agricultural Economics* (May), 131–142.

[19] Singh, B. N. Fagbebe, S., Nkwungwu, M.N. Williams C. Jagtap, S.S. Oladimeji, O., Efsye, A and Okhidierbie, O. (1997).Rice Growing Environment and Biophysical Constraints in Different Agro ecological Zones of Nigeria Met. *Journal 2 (1): 35-44.*

[20] Winters, P., de Janvry, A., Saudolet, E., Stamoulis, K., (1998). The role of agriculture in economic development: visible and invisible surplus transfers. *Journal of Development Studies* 345, 71–97.

[21] West Africa Rice Development Centers (WARDA) (2003). Annual Report.

[22] West Africa Rice Development Centers (WARDA) (2004). Annual Report.

[23] World Bank (2008). World Development Report. Agricultural for Development World Development Indicators, (2004).

APPENDIX 1:

Profit Differentials for Adopters (Income and Cost)

Nos	INCOME(N)	COST (N)
1	320000	254000
2	400000	317500
3	640000	508000
4	640000	508000
5	160000	127000
6	480000	381000
7	352000	254000
8	800000	635000
9	1280000	1016000
10	800000	635000
11	1280000	1016000
12	672000	508000
13	520000	381000
14	256000	190500
15	200000	127000
16	320000	254000
17	496000	381000
18	520000	381000
19	360000	254000
20	656000	508000
21	336000	254000
22	352000	254000
23	336000	254000
24	432000	317000
25	368000	254000
26	960000	762000
27	320000	254000
28	80000	63500
29	320000	254000
30	344000	254000
31	1280000	1016000
32	800000	635000
33	192000	127000
34	504000	381000
35	480000	381000
36	360000	254000
37	160000	127000
38	672000	508000
39	496000	381000
40	520000	381000
41	1600000	1270000
42	960000	762000
43	200000	127000
44	1000000	762000
45	416000	317500
46	800000	635000
47	336000	254000
48	560000	444500
49	656000	508000

50	336000	254000
51	1600000	1270000
52	488000	381000
53	504000	381000
54	672000	508000
55	984000	762000
56	480000	381000
57	648000	508000
58	352000	254000
59	320000	254000
60	240000	190500
61	360000	254000
Total	33,976,000	26,225,000

Profit Differentials for Non-adopters (Income and Cost).

Nos	Income(N)	Cost (N)
1	320000	286000
2	240000	214500
3	560000	500500
4	128000	107250
5	88000	71500
6	160000	143000
7	560000	500500
8	560000	500500
9	240000	214500
10	480000	429000
11	160000	160000
12	320000	286000
13	128000	107250
14	160000	143000
15	240000	214500
16	480000	429000
17	160000	107250
18	320000	286000
19	360000	321750
20	400000	357500
21	320000	286000
22	240000	214500
23	320000	286000
24	400000	357000
25	400000	357000
26	240000	214500
27	320000	286000
28	160000	143000
29	160000	143000
30	160000	143000
31	80000	71500
32	160000	143000
33	120000	107000
34	400000	357000
35	400000	357000
36	160000	143000
37	240000	214500
38	320000	286000
39	240000	214500
40	240000	214500
41	160000	143000
42	480000	429000
43	200000	178750

44	80000	71500
45	160000	143000
46	400000	357000
47	400000	357000
48	240000	214500
49	320000	286000
50	240000	214500
51	320000	286000
52	240000	214500
53	480000	429000
54	160000	143000
55	128000	107250
56	240000	214500
57	400000	357500
58	320000	286000
59	40000	35750
Total	15,720,000	14,027,250

Probit Analysis

Dependent Variable: Y
Method: ML - Binary Probit
Date: 05/29/14 Time: 08:08
Sample: 1 120
Included observations: 120
Convergence achieved after 6 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.
X1	-0.344180	0.522164	-0.659141	0.5098
X2	0.058541	0.048667	1.202904	0.2290
X3	0.859517	0.553295	1.553453	0.1203
X4	-0.028075	0.047793	-0.587429	0.5569
X5	0.096764	0.041784	2.315845	0.0206
X6	-0.113806	0.046061	-2.470751	0.0135
X8	0.086379	0.016033	5.387544	0.0000
C	-3.624018	1.356638	-2.671322	0.0076

Mean dependent var	0.508333	S.D. dependent var	0.502027
S.E. of regression	0.326783	Akaike info criterion	0.756550
Sum squared resid	11.96014	Schwarz criterion	0.942382
Log likelihood	-37.39298	Hannan-Quinn criter.	0.832017
Restr. log likelihood	-83.16099	Avg. log likelihood	-0.311608
LR statistic (7 df)	91.53604	McFadden R-squared	0.550354
Probability(LR stat)	1.11E-16		
Obs with Dep=0	59	Total obs	120
Obs with Dep=1	61		