NIGERIAN AGRICULTURAL JOURNAL
ISSN: 0300-368X
Volume 55 Number 1, April 2024 Pg. 66-73
Available online at: http://www.ajol.info/index.php/naj
https://www.naj.asn.org.ng

Determinants of Farmers' Utilization of Post-Harvest Management Practices in Rice-Producing Areas of Abia State, Nigeria

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Abstract

The socio-economic determinants of farmers' utilization of post-harvest management practices in rice producing areas (Ikwuano and Unuahia North Local Government Areas) of Abia State, Nigeria was studied and analysed in 2023. The study adopted a multistage random sampling procedure to select 90 rice farmers for the study. Data for the study were collected with the aid of a structured questionnaire and analysed using both descriptive and multiple regression analysis. Result revealed that 72.22% of the rice farmers were males, 62.22% acquired secondary education having a mean household size is 6 persons with mean annual farm income of ₦853, 978.00 and annual non-farm income (₦515, 224) as against 5,33 years membership of social organization. Result showed that farmers had high utilization and constraints to rice post-harvest management practices, with mean scores of 2.7. Multiple regression result showed that the coefficients for sex (β=0.0157), education (β=0.0126), social organization (β=0.0173) and farm income (β=0.0165) were determinants of utilization of post-harvest management practices by farmers. The study concluded that farmers had high utilization of post-harvest management practices. The study recommended that rice farmers should belong to cooperative groups, engage in literacy and training programmes in order to benefit from the use of appropriate post-harvest management practices involved in rice production in the study area.

Keywords: ***Utilization, post-harvest, management, practices, rice farmers***

Introduction

In developing countries, more than 30% of the food produced for human consumption in Sub-Saharan Africa is being lost because of inadequate postharvest management (Musa-Gambo, 2020). The cultivation of rice in all the agroecological zones in Nigeria is relatively carried out by small-scale farmers (Ubeh *et al*., 2020). Studies revealed that as the consumption level of rice increases, it directly affects production because of post-harvest losses experienced by farmers during harvesting, which has resulted in the need to develop post-harvest and value chain sectors in the country to reduce these losses incurred during the production process (National Agricultural Extension and Research Liaison Services (NAERLS) 2022; Nwaobiala and Ubeh, 2020; Oyaniran, 2022).

West African Rice Development Association (2021) asserted that lack of storage and agro-processing facilities pose great impediments to Nigeria's rice value chain, which is a major staple food and mostly cultivated crop and sustains the livelihoods of millions of people thereby resulting in a chain of losses and huge wastage. Rice post-harvest losses are largely caused by field insect pests, fungal and bacterial diseases, poor management practices unavailability of storage facilities, and mechanical damage during harvesting.

Egwuonwu, (2020) in a study attributed a proper post-harvest management system as a means of reducing the quantity and quality of rice losses which leads to higher income and food security for the farmer. Post-harvest operations in rice are regarded as the stage involving production by which harvesting follows when the panicle is separated from the rice plant at harvest, which is considered the starting point of the post-harvest management process. This process is divided into two groups namely technical activities (harvesting, field drying, threshing, cleaning, additional drying, storage, processing) and economic activities (transporting, marketing, quality control, information and communication, administration and management) (Food and Agriculture Organization (FAO), 2021). Moreover, it has been reported that the Federal Government of Nigeria's total cost of post-harvest losses has risen to over $3.5 trillion annually which translates to about 50

percent of the foods produced, which has resulted in a negative effect on the agricultural Gross Domestic Product (GDP) (Federal Ministry of Agriculture and Rural Development (FMA&RD), 2022).

The International Food Policy Research Institute (IFPRI) (2023), reported that the causes of food losses especially rice in developing countries may not be unconnected with; inadequate extension services that are required to train farmers in handling and application of recommended storage technologies of rice and poor market access. Given the above assertion, it seems there is a paucity of information on the socio-economic factors of farmers that determine their utilization of rice post-harvest management practices in the area of study.

This necessitated the researchers to undertake the study to analyse socio-economic determinants of utilization of post-harvest management practices among farmers in rice-producing areas (Ikwuano and Umuahia North Local Government Areas) of Abia State, Nigeria.

The specific objectives of this paper were to;

i. Describe the socioeconomic characteristics of farmers;
ii. Ascertain levels of farmers' utilization of rice post-harvest management practices; and
iii. Examine constraints to farmers' utilization of rice post-harvest management practices in the study area.

Hypothesis tested;

$H0_1$: Rice farmers' socio-economic factors such as; age, education, marital status, household size, farming experience, farm income, access to credit, and cooperative membership do not determine their utilization of post-harvest management practices in the study area

Methodology

Study Area

The study was conducted in the rice-producing areas of Abia State, Nigeria. The Local Government are; Ikwuano Local Government and Umuahia North Local Government Areas.

Description of Ikwuano Local Government Area

Ikwuano Local Government Area is located in Abia State, Southeast Nigeria which was created on the 27th day of August 1991 from the defunct Ikwuano/Umuahia Local Government Area. The Local Government (LGA) has its headquarters in the town of Isiala Oboro and is bordered by Umuahia North 5º 24'N and by parts of Akwa Ibom State. Towns and Usaka villages that make Ikwuano 5º 24'N include; Omuegwu, Afaranta, Nkwoachara, Ameke, Ariam, Uba- kala, Oloko, Oboro, and Ibere. The Local Government Area lies between the Latitudes 5º 24'N and 5º 30'N and between the Longitudes of 5º 32'N of the Equator and 5º 37'N of the Greenwich meridian. The LGA has borders with Umuahia North and Bende to the North, Umuahia South and Isiala-Ngwa North to its West, Ini to the East and Obot-Akara to the South. The Federal Republic of Nigeria reports that the projected population growth of Ikwuano at 2.6% from the 2006 population figure is 55,405 people (National Population Commission (NPC), 2022). Michael Okpara University of Agriculture Umudike and National Root Crops Research Institute Umudike are notable landmarks. The LGA occupies a total area of 281 square meters with an average temperature of 28ºC (National Root Crops Research Institute (NRCRI), (2021).

Description of Umuahia North Local Government Area

Umuahia North is a Local Government Area of Abia State, Nigeria. Its headquarters are in the city of Umuahia. The Local Government Area is made up of Umuahia- Ibeku, Umukabia, Umuawa Alaocha, Umuagu, Umuda Isngwu and Ohuhu. The Federal Republic of Nigeria projected the population growth of the LGA at 2.6% from the 2006 population figure totaling 10, 3157 people (National Population Commission (NPC), 2020). The Local Government Area lies between Latitude 5º31' 29.68'' N of the Equator and Longitude 7º 29' 40.60''E of the Greenwich Meridian. The temperature varies from 18.9^{O}C to 30.5^{O}C and is rarely before 15^{O}C above 32.2ºC. The climate is classified as tropical. During most months of the year, there is significant rainfall and typically receives about 273.49 mm of precipitation and has 263.53 rainy days (72.2 percent of the time) annually, with Relative Humidity of 75.46 percent (NRCRI, 2023)

Sampling Procedure and Sample Size

Ikwuano and Umuahia North Local Government Areas were selected out of the four (4) rice-producing areas of the State. A multistage random sampling procedure was used in the selection of three (3) circles each from the five (5) circles that make up the two (2) LGAs namely; Ikwuano: - Oro Ibere, Ugwu Ibere and Agbor Ibere: Umuahia North: – Ofeme, Erote-Isieke and Ubani Ibeku were randomly selected that gave a total of eighteen (18) circles. A simple random sampling procedure was employed in the selection of five (5) rice farmers from the selected circles to give a total of ninety (90) rice farmers. Descriptive statistics, such as frequency counts, percentages mean scores, and multiple regression analysis were adopted in the data analysis.

Measurement of variables

i. The levels of utilization of rice post-harvest management practices were measured and rated on a 3-point type rating scale of; always=3, occasionally = 2, and never = 1. Based on the thirteen (13) rice post-harvest management practices, The scores derived were computed for each of the practices by summing the weights of 3+2+1 = 6/3=2.0. The following decision rules were obtained thus: Mean scores between; 1.00–1.50 =low, 1.51–1.99 =moderate, 2.0 and above is high utilization of these practices.

ii. Constraints encountered during the utilization of rice post-harvest management practices by farmers were measured and rated on a 3- 3-point Likert rating scale, categorized as; Severe = 3, mild = 2, and not severe =1. The seven (7) constraint statements response scores on rice post-harvest management practices available to

the farmers were computed for each practice by adding the ratings of 3+2+1 which was divided by 6/3 to give 2.0. The following decision rules were adopted. Mean scores were categorized thus; 1.0 -1.49 = low constraint, 1.50 -1.99 = moderate constraint; and above 2.0= high constraint.

Model specification

The hypothesis for the study was tested using multiple regression analysis at a 95% confidence level. The four functional forms of regression model were explicitly stated thus: linear, semi-log, exponential, and Cobb-Douglas were tried. The best fit was chosen as the lead equation based on its conformity with econometric and statistical criteria such as the magnitude of R^2, F-ratio, and number of significant variables.

The four functional forms are expressed as follows:

i. Linear Function: $Y = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} + ei$

ii. Semi-log Function: $Y = L_n \beta_o + \beta_1 L_n X_1 + \beta_2 L_n X_2 + \beta_3 L_n X_3 + \beta_4 L_n X_4 + \beta_5 L_n X_5 + \beta_6 L_n X_6 + \beta_7 L_n X_7 + \beta_8 L_n X_8 + \beta_9 L_n X_9 + \beta_{10} L_n X_{10} + \beta_{11} L_n X_{11} + X_{12} + ei$

iii. Exponential Function: $L_n Y = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} + ei$

iv. Cobb-Douglas Function: $L_n Y = L_n \beta_o + \beta_1 L_n X_1 + \beta_2 L_n X_2 + \beta_3 L_n X_3 + \beta_4 L_n X_4 + \beta_5 L_n X_5 + \beta_6 L_n X_6 + \beta_7 L_n X_7 + \beta_8 L_n X_8 + \beta_9 L_n X_9 + \beta_{10} L_n X_{10} + \beta_{11} L_n X_{11} + X_{12} + ei$

Where;

Y = utilization of post-harvest management practices measured by mean scores

X_1 = sex (male – 1, female=0)

X_2 =age of respondents (years)

X_3 = marital status (married =1, otherwise = 0)

X_4 = household size (number of people in household)

X_5 = education level (years spent in school)

X_6 = farming experience (years)

X_7 = farm size (hectares)

X_8= occupational status (farming= 1, otherwise = 0)

X_9 = farm income (₦)

X_{10} = non-farm income (₦)

X_{10} = access to credit (access = 1, otherwise = 0)

X_{11} = membership of social organizations (numbers)

X_{12} = extension contact (numbers)

ei= error term

Results and Discussion

Selected Socio-Economic Characteristics of Rice Farmers

Table 1 shows the selected socio-economic characteristics of rice farmers in the study area. The result indicates that the majority (72.22%) of the rice farmers were males. The results suggest that male farmers were more involved in rice post-harvest management practices than their female counterparts. This result corroborates with the findings of Agada and Ijih, (2019) as they reported that male-rice farmers utilized rice post-harvest technologies more than their female counterparts in Benue State, Nigeria. The mean household size is 6 persons. The result implies that the majority of rice farmers involved in rice post-harvest management practices have a medium household, which could contribute to labour availability during rice post-harvest practices. This supports the findings of Agro Nigeria, (2019), as they reported that farm families which fell within the range of 6 to 10 persons could reduce the drudgery involved in rice production activities and lower the rate of losses encountered during harvest. However, most (62.22%) of them acquired secondary education, which suggests that rice farmers were literate in understanding, accepting, and utilizing rice post-harvest management practices. Amir, (2017) reported that educated farmers and households are better advantaged to engage in recommended rice post-harvest management practices that are productive. The mean annual farm income of rice farmers was N853, 978.00 and the non-farm income of rice farmers was N515,224. Coker and Ninalowo (2018) postulated that income realized from any rice enterprise is dependent on the post-harvest management practices adopted by the farmers. The results suggest that trading, civil service, and processing which are non-farming sources have proven to augment farmers' family needs as reported by the International Food Policy Research Institute (IFPRI) (2023). The mean years of social organization membership were 5.33 years. Nwaobiala *et al*., (2023), and Olatinwo *et al*., (2019) asserted that farmers' cooperatives enhance the advantages of the economics of scale and management of available resources for access to the best information on post-harvest management practices.

Level of Farmers' Utilization of Rice Post-Harvest Management Practices

Table 2 shows the mean frequency distribution of utilization of rice post-harvest management practices among farmers in the study area. The result indicates that rice farmers utilized processing, reaping of panicles, and threshing, with mean scores of 2.9, cutting of stalk, laying of paddy on the stalk, stacking to dry, cleaning, milling, packing, and storage. Cutting of rice stalk with a mean rating of 2.8, threshing (=2.6), drying, and incorporation of green manure (=2.5) as post-harvest management practices. The grand mean, of 2.7, indicates that rice farmers had high utilization of these practices. The high utilization of these practices may be attributed to rice farmers' longer years of engagement in the business, had enhanced the management of rice grains after harvest that is targeted to reducing losses. The result corroborates with the findings of James *et al*., (2017), and Mtui (2017) as they found that the utilization of any technology by farmers is related to experience and risk-averse encountered during any production and post-harvest management practices.

Constraints to Rice Post-Harvest Management Practices

Table 3 shows the mean frequency distribution of the constraints encountered by farmers in rice post-harvest

management practices in the study area. The result indicates that farmers encountered high constraints to rice post-harvest management practices. Furthermore, the result revealed pest and disease infestation (.0), lack of funds (=2.8), non-access to credit (=2.9), poor extension support, and inadequate machines with mean ratings of 2.5 each. Complicated technologies and lack of technical know-how on the application of these practices, with mean ratings of 2.4 were identified as major constraints. The result revealed that rice farmers had very serious (=2.7) constraints to rice post-harvest management practices in the study area. The result affirms the study of the Department of International Development (DFID) (2019) as they report that these constraints responses also affected rice post-harvest management practices of most rice farmers in Nigeria.

Socio-economic Determinants of Farmers' Utilization of Post-Harvest Management Practices among Farmers

The result in Table 4 showed the regression estimates of socio-economic factors influencing rice post-harvest management practices in Abia State, Nigeria. The double log function was chosen among the four functional forms as the lead equation based on a high R^2 value, number of significant factors, conformity, and agreement with a priori expectations. The F-value was highly significant at the 1.0% level, which indicates a regression of best fit. The R^2 value of 0.5167 implied that 51.67% of the variability in post-harvest management was explained by the independent variables. The coefficient for sex (0.0157) was positive and significant at a 5.0% level of probability. This implied that an increase in male rice farmers would lead to an increase in post-harvest management practices in the study area. This result was expected as men play an outsized role in the post-harvest handling and processing stage, where considerable food loss occurs as technologies used for post-harvest management are mostly tedious and are handled and adopted by men (Nordhagen, 2021; International Food Policy Research Institute (IFPRI) (2023). The coefficient for education (0.0126) was positive and highly significant at a 1.0% level of probability with rice post-harvest management practices in the study area. The result indicates that with an increase in the level of education, post-harvest management practices of rice farmers will also increase in the same proportion. This was also expected as these management practices in rice involve handling, packaging, and rice grain processing, which was expected to increase with the increase in the farmers' level of education. In corroboration with the findings, Egwuonwu (2020) in his study found that farmer's exposure to higher levels of education positively and significantly influences the practice of better post-harvest management. In support of the findings, Peleo *et al*., (2019) also are of the view that the eagerness to adopt post-harvest management practices by farmers increases their quest for enhanced literacy level. The coefficient for membership in social organization (0.0173) was also positive and significantly related to post-harvest management practices at a 10.0% level of probability, which is in agreement with a prior expectation. Rice farmers who are members of cooperative farmers' associations were expected and likely to increase their post-harvest management practices as a result of access to information available to them. Oyaniran, (2020) reported that being a member of cooperative groups will generally help the farmers access agricultural information on rice processing methods such as; harvesting, storage, by-products, drying, and milling which are easily done through mechanical processes and the facilities best accessed through cooperation. The coefficient for farm income (0.0165) was positive and significant at a 1.0% level of probability. This implied that any increase in farm income would lead to a corresponding increase in post-harvest management practices by the rice farmers. This result was expected as the farmers would make a conscious effort to employ all post-harvest management measures as they engage in rice production activities. If there was an impressive income derived to enhance their economic status as reported by Coker and Ninalowo. (2018).

Conclusion

In conclusion, rice farmers had high utilization and high constraints to rice post-harvest management practices. The coefficients for sex, education, membership of cooperatives, and farm income were determinants of farmers' utilization of rice post-harvest management practices in the study area. It is therefore recommended that rice farmers should take advantage of cooperative membership, with the view of benefitting from the economies of scale emanating from group ownership. There is also a need to employ efficient processing and viable marketing systems geared toward increased farm income through the purchase of production and post-harvest tools to minimize rice losses. Finally, an educational policy that would encourage rice farmers in the country to undergo literacy and training programmes on recommended post-harvest strategies is hereby advocated.

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Table 1: Selected socio-economic characteristics of respondents in the study area

Variables	Frequency (n=90)	Percentage
Sex		
Male	65	72.22
Female	25	27.78
Household Size (numbers)		
1-4	19	21.11
5-8	51	56.67
9-11	20	22.22
Mean ($\bar{x}$)		**6.0**
Education (years)		
No formal	7	7.78
Primary	56	62.22
Secondary	27	30.00
Tertiary	7	7.78
Annual Farm income (₦)		
50,000-100,000	2	2.22
101,000-150,000	4	4.44
151,000-200,000	9	10.00
201,000-250,000	7	7.78
251,000-300,000	13	14.44
301,000-400,000	55	61.11
401,000-500,000	2	2.22
Mean ($\bar{x}$)		**853,978**
Non-farm income (₦)		
50,000-100,000	24	26.67
101,000-150,000	8	8.87
151,000-200,000	8	8.87
201,000-250,000	4	4.44
251,000-300,000	3	3.33
301,000-400,000	5	5.56
401,000-500,000	27	30.00
None	11	12.22
Mean ($\bar{x}$)		**518,124**
Membership of Social organization (years)		
1-5	22	24.44
6-10	29	32.22
11-15	10	11.12
None	29	32.22
Mean ($\bar{x}$)		**5.33**

Source: *Field Survey Data, 2023*

Table 2: Mean frequency distribution of level of utilization of rice post-harvest management practices among farmers in the study area

Rice Post-Harvest Management Practices	Always	Rarely	Never	Total	Mean	Decision
Cutting of rice stalk	72(216)	14(28)	4(4)	**248**	**2.8**	**High**
Laying rice paddy on stalk	71(213)	19(38)	0(0)	**231**	**2.8**	**High**
Stacking it to dry	73(219)	14(28)	3(3)	**250**	**2.8**	**High**
Bundling for transport	38(76)	41(82)	11(11)	**169**	**1.9**	**Moderate**
Threshing	72(216)	18(36)	0(0)	**234**	**2.6**	**High**
Drying	82(246)	8(16)	0(0)	**232**	**2.5**	**High**
Cleaning	76(228)	10(20)	4(4)	**252**	**2.8**	**High**
Milling	79(237)	10(20)	1(1)	**249**	**2.8**	**High**
Packing	77(231)	11(22)	2(2)	**255**	**2.8**	**High**
Storage	77(231)	12(24)	1(1)	**256**	**2.8**	**High**
Processing	80(240)	10(20)	0(0)	**260**	**2.9**	**High**
Reaping of panicles	74(222)	10(20)	6(6)	**266**	**2.9**	**High**
Threshing	79(237)	11(22)	0(0)	**259**	**2.9**	**High**
Total mean ($\bar{x}$)					**34.7**	
Grand mean ($\bar{x}$)					**2.7**	**High**

Source: *Field Survey Data, 2023*
Values in parentheses are nominal Likert values multiplied by frequencies.

Table 3: Mean frequency distribution of constraints encountered by farmers in rice post-harvest management practices in the study area

Constraints Encountered	Severe	Mild	Not Severe	Total	Mean	Decision
Complicated techniques	52(156)	25(50)	13(13)	**219**	**2.4**	**VS**
Poor extension support	54(162)	27(54)	9(9)	**225**	**2.5**	**VS**
Pest and disease problems	72(216)	15(30)	3(3)	**276**	**3.0**	**VS**
Inadequate machines	50(150)	37(74)	3(3)	**227**	**2.5**	**VS**
Lack of technical know how	47(141)	36(72)	7(7)	**219**	**2.4**	**VS**
Lack of funds	74(222)	28(56)	1(1)	**240**	**2.8**	**VS**
Non access to credit	61(183)	2(56)	1(1)	**240**	**2.7**	**VS**
Total mean ($\bar{x}$)					**18.3**	
Grand mean ($\bar{x}$)					**2.6**	

Source: *Field Survey, 2023*
VS = Very Serious
Values in Parentheses are Nominal Likert Values Multiplied by Frequencies

Table 4: Multiple regression of the socio-economic determinants of post-harvest management practices among rice farmers in Abia State, Nigeria

Variables	Linear	Exponential	Double Log +	Semi-Log
Constant (B_0)	53.4672	3.9792	3.7779	43.4619
	(38.63)***	(144.87)***	(27.59)***	(6.29)***
Sex (X_1)	0.9879	0.0198	0.0157	0.7858
	(2.32)*	(1.21)	(2.65)**	(3.86)***
Age (X_2)	-0.0003	-1.91e-06	-0.0093	-0.4789
	(-0.03)	(-0.01)	(-0.39)	(-0.39)
Marital status (X_3)	-0.3971	-0.0089	-0.0089	-0.3988
	(-0.47)	(-0.54)	(-0.53)	(-0.47)
Education (X_4)	0.0248	0.0005	0.0126	0.6461
	(2.22)*	(2.23)*	(3.76)***	(0.89)
Membership of Cooperative (X_5)	-0.1362	-0.0028	0.0173	-0.8472
	(-1.80)*	(-1.85)*	(2.33)*	(-2.25)*
Household size(X_6)	0.1078	0.0021	-0.0001	0.0255
	(3.11)**	(2.38)*	(-0.01)	(0.06)
Occupation (X_7)	0.0242	0.0009	-0.0036	-0.1987
	(0.03)	(0.06)	(-0.23)	(-0.25)
Farming Experience (X_8)	-0.0321	-0.0006	-0.0041	-0.2061
	(-0.99)	(-0.98)	(-0.39)	(-0.39)
Farm income(X_9)	1.74e-08	4.05e-10	0.0165	0.8175
	(0.12)	(0.14)	(3.27)***	(1.79)*
Non -farm income (X_{10})	2.59e-07	5.08e-09	0.0015	0.0785
	(0.12)	(2.88)**	(0.72)	(0.72)
Extension contact (X_{11})	0.0157	0.0004	0.0017	0.0844
	(0.06)	(0.06)	(0.31)	(0.30)
F-calculated	5.33	5.34	7.47	6.44
R-squared	0.4582	0.4593	0.5167	0.4685
Adjusted R-squared	0.4150	0.4170	0.4845	0.4512

Source: *Field Survey, 2023*

* $p \leq 0.10$, ** $p \leq 0.05$ and *** $p \leq 0.01$

+ = lead equation