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Socioeconomic Determinant of Rice Husk Utilization among Households in Ebonyi State, Nigeria.

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ABSTRACT

Most of the agricultural by-products are not used economically. The most prominent of this is the rice husk. The Rice husk as the most appropriate representative of the high ash biomass waste, is currently obtaining sufficient attraction, owning to its wide usefulness and potentiality. This study assessed the socioeconomic determinant of rice husk utilization among households in Ebonyi State, Nigeria. Findings indicate that the level of rice husk utilization in the study area is still at rudimentary stage, with the highest average utilization of 2.1as fuel for domestic cooking. The co-efficient of multiple determination pseudo R^2 was found to be 87% implying that the variations in rice husk utilization was due to the stated socio-economic characteristics. The study also identified some constraints to utilization such as lack of awareness and cost of transportation and therefore, recommends among others that through the help of extension agents, the general public should be informed on the need for waste recycling and the need for attitudinal change towards recycled product. Environmental Protection Agency and other related agencies should adequately sensitize the public on the long term implications of indiscriminate burning of rice husk as a disposal strategy on the socio-economic wellbeing of households in the concerned communities.

Keywords: Rice husk, Utilization, Households, Ebonyi State, Nigeria

INTRODUCTION

Rice husk is one of the most widely available agricultural wastes in many rice producing countries around the world [1]. Globally, Rice husk removal during rice processing, creates disposal problem due to less commercial interest. Rice husk ash (RHA) is a great environmental threat, causing damage to land and surrounding areas where it is dumped [2]. Therefore, intensive use of rice husk and its ash in farms, for both commercial and domestic purposes are the alternative solution to disposal problem. The rice husk is the hard protecting covering of rice grain that protect the seed during the growing season [3]. It is one of the co-products of rice processing in the rice mills. It is unique within nature; very tough, bulky and abrasive packaging material that forms a thermal barrier that compares well with that of excellent insulating materials [4].

This abundant agricultural waste has all of the properties one could ever expect of some of the best insulating materials. Compared with other agricultural residues, rice husk has distinctive features, such as a relatively high heating value and low moisture content. This indicates that rice husk is a potential good fuel. It has a higher content of ash as compared to other agricultural residues [5]. However, when compared with other fuels such as low quality coal (lignite), rice husk has a lower ash content [6].

Nigerian agriculture and farming pattern have been described as being

characterized by low waste recycling, because primitive techniques of production are still being used by the farmers [7]. After making the sales, the by-product of the rice processing are never cared for and this turns to pollutant in our environment, thus affecting the profit margins of the farmers [8].

Effective utilization of rice husk can be affected by socioeconomic factors such as level of education, level of income, distance to source, transportation difficulty etc. Though rice husk utilization can be affected by so many factors, it has a lot of socioeconomic benefits such as creation of market for rice husks (and possibly rice husk briquettes), including collection, transport, and supply. Other socioeconomic benefits of rice husk include access to clean electricity supply, animal feed, creation of employment opportunities for the local labour, additional revenue from selling rice husk ash for use in cement kilns or as high crystalline.

Presently, the utilization of rice husk in Ebonyi State is still at rudimentary stage. Sometimes, the husk is collected, burned and the ashes used for cleaning utensils, it may be used as food for chickens and pigs together with broken rice or as a litter material in poultry house, as fuel for domestic cooking using rice husk stove by very few households who are educated. Other major uses of rice husk such as for moisture retention in farms, weed growth inhibitor, fuel in power plant, concrete production, protection of soybean seed from bruchid beetles, ingredient in ruminant and poultry feeds (Integrated Review Group, 2008), fertilizer to improved yields by addition of rice-husk ash in fertilizer etc is not yet practiced in the study area. Generally speaking, rice husk ash is more useful for farmers than rice itself [9]. In view of the actual rising food prices, high population growth rate, and higher energy prices; efficiency and improvement of the whole production chain process becomes more important. In this context, the beneficial reuse of rice husk will be economically profitable for both the farmers and the industries. By doing so, it will add to the income of the farmers. Also, improving the position of small farmers in the use of rice husk is expected to contribute to social stability in the communities. So many works have been done on utilization of rice husk: for instance, [10], studied the utilization of rice husk ash as novel adsorbent: a judicious recycling of the colloidal agricultural waste; [11], worked on the utilization of rice husk and their ash. Similarly, [12], researched on utilization of waste agriculture byproduct to enhance the economy of farmers and [13] studied the utilization of rice husk ash. However, analysis of the studies showed a seeming gap in socioeconomic determinant of rice husk utilization among households in Ebonyi State, Nigeria.

In order to find possible solution to the problem, the study described the socio-economic characteristics of households in Ebonyi State; determined the effects of socio-economic characteristics of the households on rice husk utilization; assessed the extent of rice husk utilization in the study area; determined the constraints to rice husk utilization among households in Ebonyi State.

THEORETICAL FRAMEWORK

This study is based on the theory of externality and public goods as adopted by [14]. Scholarly knowledge related to externality and public good, the capacity to adapt to change in environment and adaptation as a result of externality is still limited, and the vague and inconsistent definitions of terminology and concepts used in this academic field have frequently been criticized [15]; [16]. Meanwhile, the externalities or external effects are goods that have an impact on welfare (positive or negative) that is not taken into account by the agent producing them [17]. It arise whenever the actions of one economic agent make another economic agent worse or better off, yet the first agent neither bears the cost nor receives the benefits of doing so. A feedback mechanism (e.g., market)

between those affected and those causing the externality is thus missing; reasons are "transaction costs", or, in other words lack of "codification", absence of (a) reliable and measurable cause-response relations, (b) stable and well-defined preferences and (c) non-exclusiveness; link to public goods. When social costs differ from private costs, external cost exist and are, in fact, equal to the difference between the social and private cost; that is, External costs = social costs-private costs.

Many externalities in environmental economics have a structure that is similar to that of public goods. Public goods by definition are goods that are at least partially non-rival and non-exclusive. Non-rival means multiple people can simultaneously enjoy the services of the good; non-exclusive means that none of these people can be prevented from enjoying the services of the good. [18]. The theory of externalities hinges on overcoming the information barrier concerning the value of social costs. Several strategies exist:

i. Direct evaluation of private costs in absence of compensation mechanisms; effect on houses, bridges etc. (limited appeal because measuring private damages that have not been internalized due to transaction costs);
ii. Indirect evaluation of public goods (use rights only): these includes; Productivity method (ecosystem services, self-explanatory), Travel cost method and Hedonic pricing.

Direct evaluation of public goods (willingness to pay, contingent valuation), is relevant to the present study because it has to do in this context with the external effects of rice husk generated by rice milling industries in Ebonyi State which has is persisted and, has become a center of attention which led to relocation of the industry by the state government, since the environment is polluted for the dwellers without any recourse or even compensation. The need for further utilization of this resource will eliminate this negative externality, optimize rice production and enhance sustainable development.

METHODOLOGY

The study was conducted in Ebonyi State, Nigeria; which lies approximately within longitudes 7°30' and 8°30'E and latitudes 5°40' and 6°45'N and located in the eastern part of Nigeria. The State is made up of thirteen Local Government Areas, which are divided into three (3) agricultural zones, namely: Ebonyi North, Ebonyi Central and Ebonyi South.

A Multi-stage sampling technique was employed in the selection of 160 respondents for the study. The three agricultural zones were studied because they are all involved in rice production and milling. Purposive sampling was used to select one LGA each from the central and south agricultural zones and two LGAs from the North. In that order, Ikwo LGA was selected from Ebonyi central as Afikpo south was selected from Ebonyi South and Abakaliki and Izzi LGAs were selected from Ebonyi North agricultural zone based on available rice milling centers. A total of four LGAs were used for the study. Furthermore, there was a selection of one autonomous community from each of the selected LGAs giving a total of four autonomous communities. Again, four villages were selected from each community making a total of sixteen villages. This was followed by a random selection of 10 households from each of the villages, giving a total of 160 respondents that were used for the study. Data for this study were collected from primary sources using a well-structured questionnaire augmented with an interview schedule.

Both descriptive and inferential statistics were employed in data analysis. Descriptively, Objectives i, iii and iv were achieved while objective ii was actualized with binomial logistic regression. The null hypothesis was tested at 5% alpha level using F-test.

Model specification

Binary logit regression model

In order to ascertain the socioeconomic factors that influences utilization of rice husk among households in the study area, the study adopted the logit model. Although, households from the treatment group, that is, households from major rice producing areas will be used for the logit model. A similar approach and parameters was adopted by [19] in accessing the determinants for adoption of ICT-based market information services by smallholder farmers and traders in Mayuge District, Uganda.

The model is explicitly stated as:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_9 X_9 + e_i \quad (1)$$

Where: Yi = dependent variable, utilization of rice husk (1 if the household utilize rice husks, 0 otherwise) use of rice husk means productive use of rice husks.

Where:

α = intercept,

$\beta_1 \ldots \beta_9$ = parameters to be estimated,

e_i = error terms,

$X_1 \ldots X_{10}$ = vectors of explanatory variables,

Where:

X_1 = Age of the farmer (years)

X_2 = Level of education of the farmer (years)

X_3 = Marital status (dummy, 1 = married, 0 if otherwise)

X_4 = Farming experience (years)

X_5 = Household size (number of persons)

X_6 = Occupation (dummy, 1 = farming, 0 if otherwise)

X_7 = Farm size (hectare)

X_8 = Annual income (naira)

X_9 = Distance from rice milling center (km).

Test of Hypotheses

The null hypothesis was tested with F-test at 5% level of significance. This was expressed thus:

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

Where:

R^2 = coefficient of multiple determination

N = Sample size

K = Number of variables

Decision Rule: if F-cal > F-tab, reject the null hypothesis, otherwise accept.

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Households

The socio-economic attributes of the households which includes; age, gender, level of education, marital status, farming experience, household size, occupation, farm size, annual income, the farm/home distance from rice milling center, participation in environmental sanitation were examined in this section. Results of the analysis were presented in Table 1.

Table 1: Descriptive Statistics of the Socio-Economic Characteristics of Households in Ebonyi State, Nigeria (N=160)

Socio-economic variable	Frequency (N= 160)	Percentage	Mean
Age of the households (years)			
≤40	63	39.4	
41-60	**67**	**41.9**	
>60	**30**	**18.7**	
			46.8
Gender			
Female	64	40	
Male	96	60	
Years of formal education			
0	54	33.8	
1-6	46	28.8	
7-13	**49**	**30.6**	
>14	**11**	**6.9**	
			6.7
Marital status			
Single	13	8.1	
Married	123	76.9	
Divorced	1	0.6	
Widowed	22	13.8	
Household size			
1-5	71	44.4	
6-10	76	47.5	
11-15	**13**	**8.1**	6.14
Farming experience			
≤20	96	60	
21-40	54	33.8	
≥ 60	10	6.3	
			19.1
Farm size			
≤5	130	81.3	
6-10	20	12.5	
11-15	6	3.8	
>15	4	2.5	
			3.8
Annual income (₦)			
≤ 200000	68	42.5	
201000-400000	53	33.1	
401000-600000	24	15.0	
>600000	15	9.4	
			305825
Household occupation			
Farming	147	91.9	
Civil servant	**8**	**5.0**	
Business/petty trading	**5**	**3.1**	
Distances of homes / farms from RMC			
≤ 1.0	91	56.9	

1.1-2.0	51	31.9	
2.1-3.0	**12**	**7.5**	
3.1-4.0	**6**	**3.8**	
			1.8
Households participation in environ. Sanitation			
No	2	1.3	
Yes	158	98.8	
Source field survey 2018			

From the result in Table 1, the mean age of the sampled households was 47 years. This implied that most of the sampled households were in their active age of productivity. This finding thus corroborated [20] who opined that age has significant influence on decision making process of respondents with respect to adoption of improved technology and other production related decision. The result further showed that 60% of the household heads were males as against 40% that were females. This imbalance in sex can be attributed as part of the cause of low rate of rice husk utilization as most uses like source of fuel for cooking, litter material in poultry houses, moisture retention in farm amongst others are mostly done by women. Thus the finding here conforms with the findings of [21] who discovered that 92% of the household heads he sampled in his study of the Analysis of Environmental Risk Factors Affecting Rice Farming in Ebonyi State Nigeria were male.

The level of education of the household heads as presented in Table 1 showed an average years of 7yearswhich implied completion of basic primary education. This also point at the reason for low level of utilization of rice husk as some level of education and exposure is required of the household to expose him to various way in which rice husk can be used after milling. The result here was expected considering the low level of education usually associated with households in rural areas since is only one rice mill center that was cited at the urban area and others at the rural areas.

Meanwhile, the result of the analysis further showed that about 77% of the households were married as others were single, widowed or divorced.

The result here is somewhat unexpected as households who are married are expected to use more rice husk for cooking and other uses but the use is still very rudimentary in the study area. Hence, the finding here agrees with the findings of [22] study on Economic Analysis of Limestone Exploitation on Crop Production in Ebonyi State which discovered that (100%) of the farmers/household heads (respondents) were married but never increased the use of limestone as expected in his study.

However, the sampled households had a mean household size of six persons. The household of six connotes a large family size needed for household labour.

The result in Table 1 also showed that the mean farming/working experience was 19.10 and by approximation it remains 19 years. The implication of this results is that most of the households have farmed/worked for 19 years and below. This implies that the households will have the knowledge of the quantity of rice husk generated annually and some level of utilization and would be willing to be guided on the best utilization strategies as a way of removing rice husks from the environment. According to [23], experience affects and influences the rate of adoption of new technology.

The result on farm size showed that 81.3% of the sampled households in Ebonyi State have farm sizes of 5 and below hectares. This implies that most of the households in the state have farm sizes of 5 and below hectares. Specifically, the mean farm size of the household was 3.8 which implies that the average farm size

of the households in the state was about 4 hectares. This probably could be as a result of land tenure system coupled with the teeming population of the farmers, thereby heightening the cause of ever-increasing land fragmentation. The findings here could also be affected by the farm size of mega firms in the state such as State rice farms, FADAMA 111 rice projects etc., in the study area who have farm sizes in thousands of hectares.

The result on annual income showed that most of the households in the state have annual income of ₦200000 and below. Specifically, the average annual income of the households was ₦305825.

The result on occupation show that majority (91.9%) of the sampled households in Ebonyi State have their occupation as farming. Implying that agriculture is the major employer of labour in the study area. This will give an idea of the quantity of rice husk generated in the area.

Farm and home distances from the milling centers within the study area (fixed distance of four kilometers) is a measure of access to rice husk and safety from environmental pollution caused by rice husk on environmental quality such as lands, air, water and on humans including their crops and livestock. The result in Table 1 showed that both farm and home distances were relatively far from the milling centers. However, it is observed that home distance is farther than farm distance. It further showed an average distance of 1.8625km approximately 2kms away from the milling centers.

Result on environmental sanitation showed that majority (98.8%) of the respondents participated in environmental sanitation while 1.3% of the respondents does not.

Effects of the Socio-economic Characteristics of the Households on Rice Husk Utilization

From data analysis on effects of the socio-economic characteristics of the households on rice husk utilization, the result showed that some variables significantly influenced rice husk utilization in the study area as shown in Table 2.

Table 2: Logistic Regression Result for Socio-economic Determinants of rice Husk Utilization in the Study Area.

Explanatory variables	Co-efficient	Standard error	Z value
Age	.1468134	.0937533	1.57
Distance from RMC's	-1.257635	1.169112	1.08***
Exp. of farm/wk.	.1590586	.0633246	2.51**
formal education	.7072975	1.28005	0.55
Farm size	.2222142	.1692858	1.31
Household size	.564971	.2981448	1.89*
Income	-3.09e-07	3.47e-06	-0.09
Occupation	1.818092	1.832103	0.99***
Marital status	-6.135841	1522.691	-0.00**
Constant	3.123649	1522.698	0.00
Log likelihood ratio	-25.129707		
Chi-square	0.0014		
Pseudo R^2	0.8734		

*** = significant at 1%; ** = significant at 5%; * = significant at 10% levels respectively.
Source: Field survey data, 2018.

Distance from rice mill center-RMC; household size; occupation; marital status; working/farming experience and level of annual income were found to be significant. While age; formal education and farm size were not significant.

Age of the household head: Age has a positive relationship with rice husk utilization but not significant. This means that the higher ones age the higher the individual would like to use rice husk in the farm, poultry house and as fuel in the family etc.

Distance from the RMC: This was found to be inversely related to rice husk

utilization. This means that the probability of using rice husk in the farms and homes decreases as distance of the farms and homes increases from the rice milling center. Since rice husk transportation is costly and it occupies space.

Farming/Working Experience of the Household Head: Farming/working experience has positive relationship with rice husk utilization. This is because the more experienced a household is, the higher the knowledge on rice husk utilization both in the farm and other utilization strategies.

Formal Education: This has positive relationship to rice husk utilization. This means that the higher ones level of education is, the higher the probability of rice husk utilization. This is because the poultry farmers, piggery farmers and improved cook stove users are mainly the educated ones.

Farm Size: This has a positive relationship to rice husk utilization but not significant. Implying that the individuals with higher farm size may not afford fertilizer for all their farms but may use rice husk in some portions of the farm. Also it will encourage the use of this husk to parboil the paddy rice after which the burnt rice husk will now be applied in the farm as manure.

Household Size: This was found to be directly related to rice husk utilization and was significant. This means that rice husk utilization increases as household size increase. As consumption needs increase, household income reduces, thereby leaving little or none for buying of fertilizer, soil stabilization and aeration materials, electric cooker and stoves instead he goes for improved cook stove such as one that use rice husk as fuel and other expenses.

Occupation: This bore positive and significant. Implying that an increase in the number of farmers somehow increases the utilization of rice husk in the study area.

Household Income: This has a negative relationship to rice husk utilization, implying that the higher the income of the household the higher the probability of the individual using standard cooking equipment in the family, buying fertilizer for his farming activities and other more expensive materials as his litter materials in his animal farms. This makes sense because with increased income, individual farmers can afford to pay for improved and more costly materials to parboil his paddy such as firewood, use of gas, kerosene, electric cooker etc.

Marital Status: This is directly related to rice husk utilization. Married people are found to utilize rice husk more than the single. This is because more of the farmers and household heads are married and most married people use the husk in their farms as fuel in their local cook stove and since most land is owned by married people, soil maintenance such as supply of manure, soil aeration, soil structure and texture maintenance are done by the owners of the land.

The co-efficient of determination pseudo R^2 was found to be 87% implying that the variation in rice husk utilization was due to the stated socio-economic characteristics. The overall regression was significant with the probability Ch^2 value of 0.0014; this implies that socio economic variables are major determinant of rice husk utilization in the study area.

The F-statistics at 5% level showed that the socio-economic characteristics of households is a significant determinant of their rice husk utilization with F-cal. value of 85.37 and F-tab. value of 2.09. Therefore the null hypothesis which states that the socio-economic characteristics of households is not a significant determinant of rice husk utilization was rejected.

Extent of Rice Husk Utilization in the Study Area

During the field work component of this study, the respondents were asked whether they utilize rice husk and to indicate the extent to which they use it,

on a 4-point likert type rating scale. Their responses were graded thus; Strongly Agree (SA) =4, Agree (A) =3, Disagree (DA) =2, and Strongly Disagree (SD) =1. Result of an item statement is accepted if its mean value was 2.50 and above, otherwise, it is not accepted. The result showed that some utilization practices were practiced at a low extend while some were not practiced at all by the households. The result is presented in Table 3

Table 3: Extent of Rice Husk Utilization in the Study Area

Variable	Mean Score	Ranking	Remarks
Cleaning of utensils	1.1125	4th	VLE
Use as litter materials in poultry house	1.7000	2nd	LE
Use as fuel for domestic cooking	2.1125	1st	LE
Ingredient in ruminant and poultry feed	1.4438	3rd	LE
For moisture retention in farms	1.0250	5th	VLE
As weed growth inhibitor	.9813	7th	VLE
As a fuel in power plant	.9563	8th	VLE
For concrete production	.9500	9th	VLE
Protection of soybean seed from bruchid beetles	1.0000	6th	VLE

Source: Field survey, 2015

The result as contained in Table 3 indicated that the level of rice husk utilization in the study area is still at the rudimentary stage. Based on the result, few households' only use rice husk as fuel for domestic cooking, as litter materials in poultry house and as ingredient in livestock feed with the mean ratings of 2.1125, 1.7000, and 1.4438 respectively. While many other use like cleaning of utensil, moisture retention in the farms, protection of soybean seed from brunched beetles, weed inhibitor in the farm, fuel in power plants and concrete production with the mean ratings of 1.1125, 1.0250, 1.0000, 0.9813 and 0.9500 have not yet been explored thus the cause of accumulation of rice husk in the study area which now cause the high level of pollution experienced by households in the study area. This conforms with the statement of [13] that rice husk ash is more useful for farmers than the rice itself but its use is still at rudimentary stage.

Constraints to Rice Husk Utilization

The constraints faced by the households in rice husk utilization were considered and analysed as shown in Table 4.

Table 4: Constraints to Rice Husk Utilization in the Study Area

Variable	Mean Score	Ranking	Remarks
Lack of awareness	3.9313	1st	SA
Insufficient information about proper use	3.7563	4th	SA
Socio-economic problems	3.6750	8th	SA
Penetration of technology	2.6250	13th	A
Lack of interest	2.5563	14th	A
Lack of environmental concern	3.7813	3rd	SA
Insufficiency of information transfer	3.0063	12th	A
Government insensitivity	3.1875	9th	A
Lack of manpower	3.0250	11th	A
Subsidy	3.6875	7th	SA
Cost of transportation	3.7875	2nd	SA
Seasonal fluctuation in amount of production	3.0313	10th	A
Spatial fluctuation of the amount of production	3.7500	5th	SA
Limited amount of production	2.1000	15th	D
Consumers attitude to recycled product	3.7438	6th	SA

Source: Field survey, 2018

From the Table 4 all the constraints considered significantly affected rice husk utilization in the study area except limited amount of production. Lack of awareness, cost of transportation, lack of environmental concern, insufficient information about proper use, spatial fluctuation of the amount of production, consumers attitude to recycled product, subsidy, socio-economic problems, government insensitivity, seasonal fluctuation in amount of production, lack of manpower, insufficiency of information transfer, penetration of technology, lack of interest, limited amount of production had mean ratings of 3.9313, 3.7875, 3.7813, 3.7563, 3.7500, 3.7438, 3.6875, 3.6750, 3.1875, 3.0313, 3.0250, 3.0063, 2.6250, 2.5563 respectively. Limited amount of production had the least rating of 2.1000. These constraints limit the utilization of rice husk by the households and create high level of disposal problems which leads to environmental pollution in the study area. Households in Ebonyi state particularly those in Abakaliki capital territory have suffered from pollution caused by rice husk due to lack of awareness in the proper use as well as other constraints. Hence the persistence of these constraints will continue to increase environmental pollution and affect the health standard of the households. This confirms the view of [3] that the reasons associated with rice husk not been utilized effectively is lack of awareness of its potentials to farmers and industrial persons among others.

CONCLUSION AND RECOMMENDATION

Based on the result of this study, the study concludes that the socioeconomic characteristics of the households in the study area such as level of education, level of income, farm size etc, are the major determinant of rice husk utilization in the study area. The study also conclude that the level of rice husk utilization is still at the rudimentary stage in the study area and therefore recommends that the government should intensify their effort in creating awareness on different uses of rice husk in the study area. The extension agents should also encourage the households on the uses of rice husk.

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