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DETERMINANTS OF FARMERS' USE OF LAND RECLAMATION PRACTICES IN OIL PRODUCING AREAS OF IMO STATE, NIGERIA: APPLICATION OF MULTIVARIATE LOGISTIC ANALYSIS

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ABSTRACT

This study analyzed the determinants of farmer's use of land reclamation practices in oil producing areas of Imo State, Nigeria. Data for the study were obtained with structured questionnaire from 172 food crop farmers selected through multistage sampling procedure. Descriptive statistics was used to determine the level of use of land reclamation practices, while inferential statistical technique (logit model) was used to estimate the determinants of farmers 'use of land reclamation practice. Results showed low level of use of land reclamation practices (x =1.5) among the farmers, and land filling was better practiced than other land reclamation practices. Determinants of farmers 'use of land reclamation practices were level of education, farm size, extension contact, annual farm income, social organization membership, availability of land reclamation technology, and access to information. In order for land reclamation practices to mitigate the land degradation and soil fertility loss experienced in the oil producing areas of Imo State, government should adequately motivate the extension personnel to follow-up the use of the introduced land reclamation practices by the farmers.

Contribution/ Originality: This study contributes in the existing literature on determinants of farmers' use of land reclamation practices using multivariate logistics analysis. The paper's primary contribution is finding that education, farm size, extension, farm income, social organization membership, availability of technology and access to information significantly determined farmers' use of land reclamation practices.

1. INTRODUCTION

Agriculture is the mainstry of Nigerian economy, contributing about 40% of Gross Domestic Product (GDP) [1, 2] however, Nigeria's economy is heavily dependent on earnings from the oil sector, which provides 20% of GDP, 95% of foreign exchange earnings, and about 65% of budgetary revenues [3, 4].

Increased oil exploration activities in the oil producing areas and the resultant effects of pollution due to spillages has become a great menace to the farm land and environment and pose a great threat to economic development as it results to land degradation, air and water pollution, crops destruction, and soil infertility [5, 6].

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In order to mitigate the negative consequences of oil exploration on the oil producing areas, the extension service through the mass media embarked on the dissemination of innovations developed through research on land reclamation practices to the oil producing areas. The land reclamation practices include; fertilizer application, re-vegetation, removal of wastes, land filling, use of organic soil amendments, planting deep rooted perennial grasses and trees [7, 8]. These land reclamation practices have been disseminated to farmers in the oil producing areas for several years using the extension innovations delivery Mechanism but the pace of use of the land reclamation practices by farmers appear quite slow and the analytical studies to identify the main factors affecting the use of the land reclamation practices are very scanty and far between.

This study is therefore designed to provide empirical information on the level of use of the land reclamation practices, and the determinants of use of such practices by farmers in oil producing areas of Imo State, Nigeria.

Related studies available were those on land use and soil management situation in Nigeria [9] and factors influencing the knowledge and adoption of land reclamation practices [8].

2. METHODOLOGY

This study was conducted in the oil producing areas of Imo State, Nigeria, comprising the two Local Government Areas (LGAs), Ohaji/Egbema and Ogunta where oil exploration takes place. The LGAs lie between latitudes 5^{o} 56'N and $7^{0}06'$ N and longitudes $6^{0}53^{0E}$ and 7^{o} 45^{I}E.

There is abundant oil deposits in the areas resulting to oil exploration and exploitation with resultant environmental degradation and soil fertility loss.

Multistage sampling techniques were employed to select respondents for the study. Food crop farmers in two communities of each LGA with the highest oil wells and highest oil exploration activities formed the sampling frame for selection of respondents.

From the sampling frame of 302 food crop farmers, a sample size of 172 farmers was determined, using the sample size model;

$$n = \frac{N}{1+N(e2^{2})} \quad ; \qquad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where, n =sample size for the study, N=total sampling frame, and e= tolerable error level of 0.05.

Proportionate sampling technique was applied to select 99 and 73 farmers from Ohaji/Egbema and Oguta LGAs respectively from their sampling frames of 173 and 129 food crop farmers respectively. The proportionate sampling model employed was;

$$n_h = N_h \left(\frac{n}{N}\right) \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where, n_a=sample size selected from each LGA, N_h= sampling frame in each LGA, N= total sampling frame in the two LGAs, and n=sample size for the study.

Random sampling was finally employed to selected the 172 food crop farmers for the study. Data for the study were obtained mainly from primary sources, using validated questionnaire. The researchers were assisted in the process of data collection by field enumerators who were trained for that purpose.

Data collection took place between September and November, 2015.

2.1. Analytical Techniques

Descriptive statistics (percentage and mean) was used to determine the level of use of land reclamation practices, while inferential statistics (logit model) was used to estimate the determinants of farmers' use of land reclamation practices.

To determine the level of use of land reclamation practices disseminated to the farmers, the following 3-point likert type scaling procedure was adopted to quantity the variable, level of use; low level of use =1, moderate level of use=2, and high level of use=3. The values of the three responses were added and further divided by 3 to obtain 2.0 which was regarded as the mean or bench mark. Land reclamation practices with mean scores below 2.0 were regarded as having low level of use, while land reclamation practices with mean scores equal to 2,0 or above were regarded as having high levels of use by the farmers.

In assisting the factors that determine farmer's decisions to use land reclamation practices, we require a model that deals with the dichotomons dependent variable "use or not use". This behavioural dependent variable can be used to examine the relationship with the independent variables. Such models cannot be estimated by either multiple regression or the ordinary least square (OLS) techniques. Multiple regression technique results in invalid parameter estimates and wrong magnitude of the effects of the independent variables on the dependent variable. In the case of OLS, assumptions that the variances of the error terms are constant and not correlated with the level of independent variables are violated. Consequently, four commonly used approaches to estimate such models are; the linear probability model (LPM), logit model, probit model, and the tobit model [10]. Like the OLS technique, the LPM is also plagued by several problems and is not generally recommended. The LPM provides predicted values that may fall outside the 0-1 intervals, thus violating the assumption of probability.

The remaining model types give maximum likelihood estimators and overcome most of the shortcomings of linear probability model, by providing consistent and efficient estimates.

Among the three other techniques proposed, we opted for the logit model framework as described by Maddala [11] and Gujarati [10].

This model has been applied in a similar study [12-15] and has been found to be efficient in explaining such dichotomous decisions variables. In formulating the model, we assumed that Pi is the observed response of farmer i, (ie, Pi=1 for use, otherwise Pi=0), the decision to use the land reclamation by an ith farmer depends on Xi, which is a vector of factors representing the farmer specific economic, social, land reclamation attribute, and farmers' perceptions. The disturbance term is represented by (e) and assumed to have a mean equal to zero. Consequently, the decision model can be stated as follows;

$$P_i = \frac{\exp^{Z_i}}{1+\exp^{z_i}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

$$Z_i = \ln \frac{P_i}{1-P_i} = B_0 + \sum_{j=1}^{n} B_j X_{ji} + e \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

$$\frac{P_i}{1-P_i} = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + B_9X_9 + B_{10}X_{10} + e \ldots\ldots\ldots\ldots(5)$$

Where, X_1= household size (number of household members who work on the farm)

X_2= level of education (number of years spent in school)

X_3 =farm size (Hectare)

X_4=Extension contact (number of visits per annum)

X_5=Access to credit (Dummy Variable, 1 for access, O if otherwise)

X_6=Tenure (Dummy variable,1 for permanent land ownership, O if otherwise)

X_7=Annual farm income (Naira)

X_8= Social organization membership (Dummy variable, 1 for member, O fornon-member)

X_9= Availability of land reclamation technology (Dummy variable, 1 if technology is available, 0 if otherwise)

X_{10}=Access to information (Dummy variable, 1 for access to information, o if otherwise)

It is expected a priori that the coefficients of X_1, X_2, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, >0;$X_3<0$.

3. RESULTS AND DISCUSSION

3.1. Level of Use of Land Reclamation Practices

The various land reclamation practices disseminated to the farmers and their levels of use by the farmers are presented in Table 1.Data in the table show that land filling was better practiced than other land reclamation practices with moderate level of use of 2.3. This could be due to visible erosion sites, ditches and gullies that required immediate attention of land filling.

The other land reclamation practices of fertilizer application, use of organic soil amendments, revegetation, removal of wastes, and planting deep rooted perennial grasses and trees had low levels of use of 1.2, 1.1. 1,8, 1.7 and 1.1 respectively, which implies low level of use of the practices.

The mean level of use among the farmers was 1.5 which implies that there was low level of use of land reclamation practices by the farmers which could lead to poor farm output and reduced farm income among the farmers in the study area. This could be because of lack of follow-up delivery mechanisms by the extension personnel that were not adequately motivated to perform their expected roles in the filed.

Table-1. Percentage Distribution of farmers by level of use of land reclamation practices

Level of use							
Land Reclamation	**Low**	**(1)**	**Moderate**	**(2)**	**High**	**(3)**	**Mean**
Practices	Freq	(%)	Freq	(%)	Freq	%	$(\bar{x})$
Fertilizer application	149	86.6	20	11.6	3	1.8	1.2
Re-vegetation	57	33.1	91	52.9	24	14.0	1.8
Removal of wastes	75	43.6	67	39.0	30	17.4	1.7
Land filling	28	16.3	63	36.6	81	47.1	2.3*
Use of organic soil amendments Planting deep rooted	135	78.5	32	18.6	5	2.9	1.1
perennial grasses and tress	106	61.6	59	34.3	7	4.1	1.1
Mean		53.3		32.2		14.5	1.5

*Land reclamation practice that had moderate level of use

3.2. Determinants of Use of Land Reclamation Practices

The Maximum Likelihood Estimate was used to estimate the empirical model. Estimate of the coefficients and significant levels are presented in Table 2.

The chi-square goodness of fit test statistics of the model was 79.63 and shows that the model fits the data with significant at 1% level. This shows that the independent variables are 80% relevant in explaining the farmers' decision to use the land reclamation practices. Z-values of the parameter estimates indicate that the decision to use land reclamation practices is mainly influenced by seven variables.

The coefficients of level of education (X_2) were positive and significant at 1% level, which implies that farmers who possess high levels of education used the land reclamation practices more than the illiterate farmers. This result.

The coefficient of farm size (X_3) was negative and significant at 1% level. This inverse relationship implies that small farmers, in comparison to large farmers use improved technologies at a faster rate if additional gains are substantial. This finding is in consonance with those of Shiyani, et al. [16] and Idrisa, et al. [13].

The coefficient of extension contact (X_4) was positive and significant at 5% level, implying that the positive influence of extension personnel lead to high use of land reclamation practices.

The coefficient of annual farm income (X_7) was positive and significant at 1% level, which implies that increase in farm income resulting from use of improved practices lead to more use of the practices.

Table-2. Parameter Estimates of the Logit Model of the Determinants of Farmers Use of Land Reclamation Practices agrees with those of Kormawa, et al. [14].

Explanatory variable	Coefficient	Z-value
Constant	0.8916	8.2037**
Household size (X_1)	0.1806	1.8728
Level of education (X_2)	0.2217	3.0942**
Farm size (X_3)	-0.1804	-2.9871**
Extension contact (X_4)	0.0615	2.5618*
Access to credit	0.0314	1.8226
Tenure (X_6)	0.0247	1.5708
Annual farm income (X_7)	0.3106	4.0397**
Social organization membership (X_8) Availability of land	0.0457	2.5529*
reclamation technology (X_9)	0.0665	3.0928**
Access to information (X_{10})	0.0387	2.8871**
Log likelihood function	-59.032	
Chi-square	79.63**	

*significant at 5%
**significant at 1%

The coefficient of social organization membership (X_8) was positive and significant at 5% level. This direct relationship implies that farmers who belonged to social organization use land reclamation practices more than farmers who did not belong to social organizations.

This could be because membership of social organization brings about cross-fertilization of ideas and sharing of experiences among the farmers on introduced technologies which leads to more use of the technologies if found profitable.

The coefficient of availability of technology (X_9) was positive and significant at 1% level, which implies that if the introduced technology packages are available, the farmers will use them as expected than when the technology packages or components are not available.

The coefficient of access to information (X_{10}) was positive and significant at 1% level, indicating that if information on introduced practices is available and accessible to the farmers, they will be highly used by the farmers than when the practices are introduced to the farmers and they are not available and accessible. These seven variables are therefore the determinants of farmers' use of land reclamation practices in the study area.

The coefficients of household size (X_1), access to credit (X_5), and tenure (X_6) were not significant at 5% level, implying that they are not important determinants of farmers' use of land reclamation practices in the study area.

4. CONCLUSION AND RECOMMENDATIONS

This paper showed that education, farm size, extension contact, farm income, social organization membership, availability of technology, and access to information are determinants of farmers' use of land reclamation practices. The results demonstrated further that there was low level of use of land reclamation practices, and for land reclamation, practices to mitigate the land degradation and soil fertility loss of the oil producing areas of Imo State, government should adequately motivate the extension personnel to follow-up the use of the introduced land reclamation practices by the farmers. Technical guidance in the form of regular extension training will enhance the use of land reclamation practices among the farmers in Imo State, Nigeria.

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