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Determinants of Sustainability of Paddy Rice Production in Niger Delta Region of Nigeria

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Abstract
This study examined the determinants of sustainability of paddy rice production in Niger Delta Region of Nigeria. Multistage sampling technique was used to select a sample of 300 rice farmers from three states out of the nine states in the region based on their strength in rice production Data were collected using structured and validated questionnaire. Both primary and secondary sources of data were used in the study. The field results showed that, only two variables, sex and age were inversely proportional to sustainability while others; total household size, farm size, seed input, hired labor and fertilizer application were directly proportional to sustainability which implied that the higher the values of these variables the higher the sustainability level of farmers production system in the study area, It was concluded that rice production is highly sustainable in the area and that farmers should be encouraged by extension agents to use more of internal inputs to improve their sustainability through constant visitation and evaluation of their farm activities.
Keywords: Sustainability, Determinants, Paddy Rice Production, Niger Delta.

1.0 Introduction

In Nigeria, agriculture is the main source of food and the main employer of labor, employing about 60-70% of the population (CBN, 2005). The dominant crops in the south are cassava, yam, palm produce, cocoa and rubber while cereals (notably millet and sorghum), groundnuts and beans dominate crop production in the northern part of the country. According to the Nigerian National Bureau of Statistic, agriculture contributed (42.2%) to GDP followed by Oil and gas (19.35%). Manufacturing was a mere (4.025%) and Solid minerals (0.29%) Nigerian National Bureau of Statistics(NBS)., 2008). These analogies suggest that agriculture occupies a very prominent position in the growth and development of Nigerian economy.The concern of policy makers is how to ensure sustainable increases in food production so as to achieve sustainable food security. Rice is cultivated in virtually all of Nigeria's agro-ecological zones(Akande,2003), from the mangrove and swampy ecologies of the River Niger in the coastal areas to the dry zones of the Sahel in the North. Nigeria has depended largely on intensification to improve production because yields are low, averaging 2.0 tonnes per hectare (National Bureau of Statistics, 2009). Rice is an increasingly important crop in Nigeria. It is relatively easy to produce and it is grown for sale and for home consumption. In some areas there is a long tradition of rice growing, but for many, it is considered a luxury food for special occasion only. With the increased availability of rice, it has become part of the everyday diet of many in Nigeria. There are many varieties of rice grown in Nigeria; some of these are traditional varieties while others have been introduced into the country. Nigeria has a land area of 923,768 million square kilometres with a total of 71.2 million hectares of cultivable land, an estimated 4.6 million hectares is suitable for rice production but only about 1.8 million hectares or 39% is currently developed for rice cultivation. (Federal Government of Nigeria,2009). However the question is how we sustain the production of rice in this area to enhance increased rice production in Nigeria

Sustainable agricultural production systems involve those approaches to food production that ensures constant increases in productivity without compromising the chances of future generations to provide for themselves. It involves production practices that ensure environmental conservation and no or minimal disturbance to the natural eco support system, hence protects the potentials of the natural regeneration of the flora and fauna.(Nwaiwu*et.al.*, 2013). The concept of Sustainability according to Brundland Report (1987) entitled *our common future*, of the World Commission on Environment and Development is 'Development that fulfils the needs of the present generation without compromising the needs of future generations'. Sustainable Development means that development should "keep going". It emphasizes the creation of sustainable improvements in the quality of life of all people through increases in real income per capita, improvements in education, health and general quality of life and improvements in quality of natural environmental resources. Thus, sustainable development is closely linked to economic development. Sustainable development according to Jhingan (2010) aims at the creation of sustainable improvements in the quality of life for all people as the principal goal of development policy. Sustainable development also aims at bettering people's health and education opportunities, giving everyone the chance to participate in public life, helping to ensure a clean environment, and promoting intergenerational equity. Furthermore, Sustainable development aims at maximizing the net benefit of economic development, subject to maintaining the stock of all environmental and natural resource assets (physical, human and natural). Also sustainable development aims at accelerating economic

development in order to conserve and enhance the stock of environmental, human and physical capital without making future generations worse off. When applied to agriculture, sustainability suggests that food production at present leaves enough nutrients in the soil that would produce food for the future generations. It also suggests that food and fibre, as well as animal products, will be produced, in adequate quantities and quality to meet, on regular and continuous bases, growing demands for agricultural products. Sustainable agriculture is that agriculture that will bring about, increase in agricultural production at both aggregate and per capita level increase in foreign exchange earnings through export promotion and import substitution, provision of gainful employment opportunities, self- sufficiency in food production, generate savings (capital) for investment in other sectors, and preserve and conserve the natural resource base, to enhance its productivity (Imoudu, 1999).

For the purpose of this work, the definition of sustainability according to Okigbo, (1991) was adopted.He maintained that sustainable rice production is one in which the farmer continually increases productivity at levels that are economically viable, ecologically sound and culturally perceptible through effective management of resources and orchestration of inputs in numbers, quantities and qualities, sequences and timing, with minimum damage to the environment and danger to human life.Liebhardt, (1987) defined agricultural sustainability to involve production activities that minimizes the use of external inputs and maximizes the use of internal inputs, which already exist in the farm. Agricultural sustainability suggests that food production at present leaves enough nutrients in the soil that would produce food for the future generations. It also suggests that food and fibre, as well as animal products, will be produced, in adequate quantities and quality to meet, on regular and continuous bases, growing demands for agricultural products.

The objectives of the study include to:

i. assess the socio-economic characteristics of rice farmers in the region;
ii measure the sustainability of rice production method used in the region and
iii. determine the factors influencing sustainability of rice production in the study area.

The hypothesis which stated that:Socio-economic variables like sex, household size, farm size, seed input, family labor, hired labor, fertilizer application and herbicide application positively and significantly affect sustainability of rice production systems while age negatively and significantly affect the sustainability of rice production systems in the study area was tested.

2.0 Materials and Methods

The study was carried out in the Niger Delta Region of Nigeria. This region is a densely populated region sometimes called the Oil Rivers because it was once a major producer of palm oil. The Niger Delta, as defined by the Nigerian Government, covers over 70,000km^2 and makes up 7.5% of Nigeria's land mass (Wikipedia, 2010). Historically and cartographically, it consists of present day Akwa-Ibom,Abia, Bayelsa, Cross-River, Delta, Edo, Imo Ondo and Rivers states. The South-South Niger Delta includes Akwa-Ibom,Bayelsa, Cross River, Delta, Edo and Rivers States; South-East includes Imo and Abia states while Ondo state constitutes the South West Niger Delta State.A representative sample was selected for the study using a multistage sampling technique. Three states, Abia, Ondo and Imo States were purposively selected because of their relative strength t in rice production. Two Local Government Areas from each of the state, Abia (Arochukwu and Bende LGAs), Imo (Okigwe and Ihitte-Uboma LGAs), Ondo (Akoko North and Odigbo LGAs) were purposively selected based on their rice production intensity making a total of six Local Government Areas (LGAs). In each LGA selected, a list of rice producing communities was compiled through the assistance of ADP staff. From this list, five communities were selected randomly giving a total of thirty communities. In each of the selected communities ten rice farming households were randomly selected giving a total of fifty (50) farmers per LGA and hence a total of three hundred rice farmers. This technique gave every rice farmer in each community an equal opportunity of being part of the study

Data for this study were collected from both primary and secondary sources.Primary sources include information that were obtained from oral interview, observations and interview schedule. Two sets of interview schedule were used: the village level andfarmer's household level.Structured interview schedule was utilized in gathering primary data while Secondary source of information include journals, text books, internet search, websites, published and unpublished materials relevant to the study.The type of data collected included those that bordered on the socio-economic characteristics of farmers like (age, sex, level of education and household size). Others were quantities and types of inputs used in rice production like (farm size, seed input, hired labor, family labor, fertilizer application and herbicide application). Data were analysed using appropriate descriptive statistical tools and the ordinary least square (OLS) multiple regression analytical tools. The socio-economic characteristics of farmers were analysed using mean, frequencies and percentages while the determinants of paddy rice sustainability were identified with use of Ordinary Least square Regression analysis with model:

Ss = f (Ag, Sx, Hs, Fs, Si, Fl, Hl, Fa, Ha, e)_____equ. 1

Ssis sustainability which is given by:

$$Ss = \frac{N_{\sin}}{T_{Nin}} \times 100 \quad \text{equ. 2}$$

(Liebhardt, (1987); Nwaiwu, *et. al*, (2010); Nwaiwu *et.al;* 2013)

Where Ss = sustainability index or sustainable system (%).

N_{sin} = number of sustainable inputs used by a farmer.

T_{Nin} = total number of inputs used by a farmer

Finally, the mean sustainability index or level for the study area was determined to conclude whether the system is unsustainable or sustainable as thus:

$$Ss = \frac{\frac{N_{\sin}}{T_{Nin}} \times \frac{100}{1}}{n} \quad \text{equ. 3}$$

The criteria of sustainability are:

≤ 40% Unsustainable Production system,

>40% ≤ 50% Sustainable Production system,

>50% Highly Sustainable Production system.

(Liebhardt, (1987); Nwaiwu, *et. al*, (2010); Nwaiwu *et.al;* 2013)

Where: n = sample size of farmers

Ag = Age of farmers (years)

Sx = Sex of farmers (dummy variable,1 = male, 0 = female)

Hs = Household size (Number)

Fs = Farm size (Hectares)

Si = Seed input (Kg)

Fl = Family labor (Mandays)

Hl = Hired labor (Mandays)

Fa = Fertilizer application (Kg)

Ha = Herbicide application (Kg)

The a priori expectation is that, $b_1 < 0$, while $b_2 - b_7 > 0$.

3.0 Results and Discussion

Table 1 The socio-economic characteristics of the respondents

Table 1 shows the mean of the socio economic characteristics of rice farmers in the study area who formed the basis of this study

Characteristics of respondents		**Percentage (%)**	**Mean**
Age:			
	25 – 35	10.33%	49years
	36 – 45	27.67%	
	46 – 55	35.00%	
	56 – 65	17.33%	
	66 – 75	9.69%	
Marital Status:			
	Single	9.33%	
	Married	70.00%	
	Divorced	10.00%	
	Separated	1.00%	
	Widowed	9.67%	
Gender:			
	Male	64.33%	
	Female	33.67%	
Participation:			
	Part time farming	61.00%	
	Full time farming	39.00%	
Educational attainment			8 years
Years of experience in rice farming			17 years
Farm size			2.32 (ha)
Farmers household size			6

Source: Field Survey Data, 2012.

The Table 1 showed that most of the respondents fell within the age group 36 – 55years which was about 62.66% of the total sample, with a mean of 49years. This implied that rice farming is being practised by middle aged farmers who are still very active and are still able to cope with the stress of rice farming.This finding is consistent with the findings of Ibitoye *et.al*. (2012), who found that the mean age of rice farmers in their study area was 45years. This showed that rice farmers belong to the middle age class, who are physically fit to withstand the stress and risks involved in rice production, and are more mentally alert to embrace new techniques of rice production. Also, rice production in the study area was dominated by male farmers who comprised of 64.33% of sampled farmers.This is in contrast with Ibitoye, *et al* (2012) who found that there were more female rice farmers than males in their study area. The results also showed that 69% of rice farmers were part time farmers and 70.00% were married. This implied that rice farmers were people with high responsibility who needed income from other sources to meet up with their financial obligations. The table also showed that rice farming has been a long time practice amongst the farmers in the study area, which on the average was 17 years. The level of education attained was (8 years) on the average and the experience attained over the years will assist the farmers to be able to adopt new technologies. Lastly, the result showed that farmers in the study area weresmall – scalefarmers (2.32 hectare) and this small farm size make mechanization difficult thereby limiting output of rice to subsistence level leaving little for commercial. Also,Ibitoye *et.al.,* (2012) confirmed that (53.00%) of rice farmers in Ibaji cultivated between 1-3 hectares.

Table 2 Thedistribution of rice farming according to categories of inputs used.

Table 2 indicated that two categories of inputs were used in rice production in the study area, namely; internal inputs and external inputs.

Inputs	**Frequency**	**Percentage (%)**
Internal	197	65.67
External	103	34.33
Total	**300**	**100.00**

Source: FieldSurvey Data, (2012).

The Table also that 65.67% of total inputs used in rice production in the study area were internal inputs, which were owned land, rain fed water, both family and communal labor, organic manure and natural soil nutrient, owned capital, manual weeding and owned seed input while 34.33% were external inputs, which were purchased land, irrigated water source, hired labor, fertilizer purchase, borrowed capital, herbicide purchase and purchase of seed input. This analysis implied that paddy rice production in the study area was sustainable. This is in line with Liebhardt (1987) and Nwaiwu *et al.*, (2010) who posited that sustainable agriculture is that which involves the use of internal inputs (inputs not purchased, naturally endowed etc.) and unsustainable agriculture involves the use of external inputs (purchased, artificially manufactured and not readily affordable by poor farmers etc.).

Table 3 The distribution of respondents according to the level of sustainability in the study area.

Table 3 Distribution of Respondents according to sustainability level

Sustainability level (%)	**Frequency**	**Percentage (%)**
1.00 – 40.00	62	20.67
41.00 – 80.00	151	50.33
81.00 – 120.00	66	22.00
121.00 – 160.00	18	6.00
161.00 – 200.00	3	1.00
Total	**300**	**100.00**

Mean = 65.59%

Source: Field Survey Data: April –December, 2012.

The result of Table 3 showed that, farmer's sustainability level 41.00 – 80.00 came first (50.33%), followed by 81.00 – 120.00 (22.00%), 1.00 – 40.00 (20.67%) came third while 121.00 – 160.00 (6.00%) came fourth. The mean sustainability level of respondents is 65.59%. This implied that farmers in the study area practice sustainable rice production system. This indicated that farmers use more of internal inputs (rain-fed agriculture, use of organic manure, crude implements like hoes and cutlasses, manual weeding, more of family and communal labor, owned capital, owned seed and owned land) than external inputs like (fertilizers tractors and

other heavy equipment) that further degrade the soil. It has been observed that farmers who practice sustainable agriculture are mainly small holder farmer and in this study we reported that small holder farmers are those who farm on marginal lands of between 0.1 – 6.0 hectares and highly dependent on rudimentary capital, rain-fed cropping, crude implements and mostly on family supplied labor. Nwaiwu, (2013) reported a similar observation in his study of cassava farmers in Imo State.

This sustainability of rice system encourages the farmers to invest more in rice production which could fetch them more income yearly. This yearly accrued income which the farmer ploughed back into the community and invested on his family, would ultimately lead to a sustainable rural development.

Table 4 The multiple regression result of the sustainability of (paddy) riceproduction in the study area.

Table 4Multiple regression results showing the determinants of sustainability of rice production in the study area.

Variables	Linear Form	Semi Log Form	Double Log form	Exponential Form
Constant (a)	20.96	-155.96	0.43	3.20
	(4.028)**	(-7.07)**	(1.35)	(22.22)**
Age (X_1)	-0.341	2.750	-0.112	-0.008
	(-3.401)**	(0.630)	(-1.784)	(-2.907)**
Sex (X_2)	0.026	7.551	-0.063	-0.136
	(0.012)	(3.007)**	(-1.784)	(-2.207)*
H/H size (X_3)	0.767	-3.241	0.061	0.027
	(2.452)*	(-2.007)*	(2.714)**	(3.121)**
Farm size (X_4)	-1.011	-0.372	0.213	0.056
	(-0.735)	(-0.187)	(7.428)**	(1.470)
Seed Input (X_5)	0.227	2.085	0.225	0.004
	(11.086)**	(1.010)	(7.553)**	(7.187)**
F/Labor (X_6)	0.241	20.592	0.046	0.003
	(3.646)**	(2.968)**	(0.459)	(1.524)
H/labor (X_7)	-0.018	-13.401	0.367	0.004
	(-0.168)	(-2.314)*	(4.400)**	(1.331)
F/Application (X_8)	-0.037	29.352	0.226	-0.002
	(-0.562)	(4.428)**	(2.369)*	(-0.846)
H/Application (X_9)	0.662	17.689	0.027	-0.002
	(0.52)	(3.894)**	(0.419)	(-0.071)
R^2	0.776	0.858	0.933	0.606
f-ratio	110.605**	194.286**	443.649**	49.240**

Source: Field Survey Data, (2012).

Figures in parenthesis are t values,

** means significant at 1%, * means significant at 5%:

Table 4 showed that out of the four functional forms analysed, the double log form best explained the regression relationship between the explained variable sustainability and the explanatory variables with R^2 value of 0.933. This implies that 93.30% of the variations in sustainability level of farmers production system were caused by age, (X_1), sex (X_2), total number of household (X_3), farm size (X_4), seed input (X_5), family labor (X_6), hired labor (X_7), fertilizer application (X_8) and herbicide application (X_9) while the remaining 6.70% was caused by error. The influence of the independent variables on the dependent variable was also found to be statistically significant at 1%. Out of all the nine explanatory variables, five were found to be statistically significant at both 1% and 5% levels of significance, these are household size (X_3), farm size (X_4), seed input (X_5), hired labor (X_7) and fertilizer application (X_8). The table also showed that, only two variables sex and age were inversely proportional to sustainability while others; total household size (X_3), farm size (X_4), seed input (X_5), hired labor (X_7) and fertilizer application (X_8) were directly proportional to sustainability. This implies that the higher the values of these variables the higher the sustainability level of rice farmer's production system and vice versa. For instance, the larger the farm size (internal input), the more the total number of farm household required to work on the farm, the higher the tendency of farmers to use organic manure and natural soil regeneration nutrients instead of buying inorganic fertilizer, manual weeding with hoes and cutlasses instead of tractors and herbicides etc. As opined by Nwaiwu (2010), the use of more internal inputs is sustainable production practice. The inverse proportionality of age showed that, the higher the age of farmers, the more he or she tends to use more of external inputs like inorganic fertilizer, tractors, purchase of seed, purchase of herbicides instead of manual weeding with hoes and cutlasses as a result of weakness of the body resulting from old age.

The hypothesis tested stated that, Socio-economic variables like age, sex, household size, farm size, seed input, family labor, hired labor, fertilizer application and herbicide application positively and significantly affect sustainability of rice production systems while age negatively and significantly affect the sustainability of rice production systems in the study area. Since there were significant variables at both 1% and 5% levels of significance from the adopted functional form (Double Log Form), the null hypothesis is hereby rejected and the alternative hypothesis accepted since socio-economic characteristics of rice farmers significantly affected the sustainability of rice farming systems in the study area.

4.0 Conclusion and Recommendations

The analysis of sustainability of farming system in the study area showed that 66% of internal inputs and 34% of external inputs were used in rice production, the mean sustainability level of rice farmers was 65.67%,and this implied that production system of rice farmers is sustainable in the study area.Also, the resultof the factors influencing sustainability of rice production in the area showed that R^2 value was 0.933 (93.30%) which implied that 93.30% of the variations in sustainability level of farmers production system were caused by all the variables used in the model while the remaining 6.70% was caused by error. However, this sustainability level can be improved if the education attained, age and experience of rice farmers which were all in favour of rice production is well annexed. Also, farmers should be encouraged by extension agents to use more of internal inputs to improve their sustainability through constant visitation and evaluation of their farm activities.

References

Akande, T. (2003): "An Overview of Nigerian Rice Economy" Monograph published by the Nigerian Institution of Social and Economic Research (NISER), Ibadan.

Central Bank of Nigeria (2006): CBN Statistical Bulletin (*http:/www.cenbank.org/out/publications/statbulletin/rd/2008/statbull-2006, pdf. 10th, July 2010)*

Federal Republic of Nigeria (2009): "National Rice Development strategy" (NRDS). For the Coalition of African Rice Development (CARD).

Ibitoye, S.J., Orebiyi, J.S. and Shaibu, U. M (2012) Economic Effect of Inorganic Pesticide Use on Fadama II Rice Farming in Ibaji Local Government Area, Kogi State, Nigeria. International Journal of Agric. and Rural Development, SAAT, FUTO. Vol 15 (2): Pg. 1063 – 1070.

Imoudu, P.B. (1999): "Sustainable Agriculture and Poverty Alleviation, Reality or Illusion''? 17th inaugural Lectures series, Federal University of Technology, Akure.

Jhingan, J.L. (2010): The Economics of Development and Planning. Vrinda Publications (P) LTD. MayurVihar, Phase 1, Delhi - 110 091.

Liebhardt, W.C. (1987): Low Input Sustainable Agricultural Production Systems, Paper Prepared For NAS, CSAN Joint Workshop On Agricultural Development And Environmental Research Ceske Budejoric, Czecgoslovakia, 6-16th April.

National Bureau of Statistics (2009): Rice Data Systems in Nigeria.

Nwaiwu, I.U; D.O Ohajianya; U.C. Ibekwe; E.C.C. Amaechi; C.A. Emenyonu; C.S. Onyemanwa; A. Henri-Ukoha; And F.A Kadiri (2010): Comparative Analysis Of The Allocative Efficiency Of Cassava Producers That Use External And Internal Inputs In Imo State, Nigeria. Academic Arena Vol. 2, No.11, Pp 96-108. Marstand Press, Richmond Hill, New York 11218, USA. Http://Www.Science Pub.Net/Academic

Nwaiwu, I.U; D.O Ohajianya, J.S. Orebiyi and C.C. Eze (2013): Determinants of Agricultural sustainability in South Eastern Nigeria. The Climate Change Debacle.Global Journal of Agricultural research, Vol. 1 No. 2, European American Journal.Pp 1- 13. (www.ea-journals.org).

Okigbo, B. N. (1991): Cited in Ugwu, B. (1991): Policy Imperative for Sustainable production of Roots and Crops in Nigeria in Nwosu, A.C., Nwajiuba, C. U. and Mbanasor, J.A. "Agricultural Transformation in Nigeria" Cited in Ebirim, N. (2008): Labour Utilization and Productivity Amongst rice Farmers in Ideato North LGA. Imo State. B. Tech Project Report submitted to AgricEcons. Dept, Federal University of Technology, Owerri.

United Nations Environmental Programme (2005): "Integrated Assessment of the Impact of trade liberalization". A case study of the Nigerian Rice sector. ISBN: 92-807-2450-0.

Wikipedia, (2010): Niger Delta (www.en.wikipedia.org/wiki/Niger-Delta)

World Commission on Environment and Development (WCED), (1987): Our Common Future, Oxford, U.K; New York: Oxford University Press.

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