

Linkages between Crude-oil Exploration and Agricultural Development in Nigeria: Implications for relevant qualitative data collection and analysis to improve rural economy.

By

Apata, T.G.

***Department of Agricultural Economics and Extension, Joseph Ayo Babalola University, Ikeji-Arakeji, Nigeria e-mail: davoapata@yahoo.com**

Abstract

Crude oil exploration has led to environmental problems in the producing communities. This has adversely affected livelihood activities in agriculture leading to low income. For survival and sustenance, people in this area tend to rely on multiple choices of non-farm rural activities to improve household's income. In this study, livelihood diversification strategies of farming households in crude oil-polluted areas of Nigeria were examined. Based upon the available information of the population size, the sampling procedure employed was Multi-stage random sampling. This technique helped to identify 150 polluted communities with 600 farming households covered. A total of 590-sample sizes were retained for subsequent analysis. Information was collected on household size, farming enterprise, different livelihood diversification strategies, costs of inputs, volume of outputs sold, revenue and household expenditure. Data were subjected to descriptive statistical, budgetary, regression and Foster-Greer-Thorbecke (FGT) poverty procedure. The average age of household head was 48.0 ± 8.2 years. The household size of 9.6 ± 5.3 members and average farm size of 2.8 ± 0.8 ha were obtained. Major farm income activities were fisheries (65.0 %) and crop production (35.0 %). The livelihood diversification index of 0.4 (CV 42) showed that majority of the household heads undertook one form of livelihood diversification strategy or another. Eighty-nine percent of the respondents diversified into non-farm activities. Livelihood diversification has significant effect on household income at $p < 0.05$. A 1.0 % increase in livelihood diversification will lead to 1.4% increase in income signifying an elastic relationship. The poverty status showed that 85.2% of the household heads that relied only on farm income were unable to meet household basic needs compared with 32.3% for those that diversified into non-farm activities. Farming activities related livelihood strategies have low net income compared with non-farm activities. Livelihood diversification strategy is related to improved household income and reduced poverty status. Thus, there is dire need for comprehensive qualitative data collection to support critical research on the linkages between agricultural development and the rural economy.

Keywords: Crude oil-pollution, Livelihood Diversification, Non-Farm Rural Activities, Poverty gap, Ondo State, Nigeria.

Introduction

The petroleum industry in Nigeria has brought exceptional changes to the Nigerian economy, particularly in the past five decades when it replaced agriculture as the basis of the Nigeria economy. The oil industry has risen to the unassailable loftiness of the Nigerian economy, contributing the lion share to gross domestic product and accounting for the bulk of federal government revenue and foreign exchange earnings since early 1970. However, Nigeria's considerable bequest in fossil fuel has not translated into a

desirable economic performance; rather, the nation's mono-cultural has assumed a wobbly dimension in the past decades predisposed to the vagaries of the international oil markets.

Before the advent of Crude-Oil exploration and exploitation in the crude-oil producing zones of Nigeria the people in the area had a thriving economy with about 90% of the population engaged productively in economic activities, such as artisan, fishing, mat weaving, local gin production, boat building, palm wine tapping among others (Ebisemiju, 1966, Omofonmwan & Odia, 2009). At this period agricultural growth is related to flourishing rural economy. People travelled far and near to transact businesses in these areas particularly fish marketing. The discovery of petroleum in commercial quantities in Oloibiri in Rivers states in 1956 and the exploitation in 1958, affected the ecosystem and the once thriving economy of the host communities. The consequence of this intervention in the local economy had resulted in decreasing economic activities (particularly agricultural) leading to decreasing outputs of fish catch and crop, declining rural economy (World Bank, 1993, Maduagwu 2000, Ibaba & Olumati, 2009).

Moreover, insight into poverty incidences in Nigeria revealed poverty is on the increase in crude-oil producing States. The poverty incidence on Table 1 show that poverty in Nigeria increased by 11.2% between 1985 and 2002, while about 55% of these incidences occurred in the crude-oil producing zones of Nigeria (Niger-Delta Development Commissions NDDC, 2002,). Analysis on Table 1 indicates that Ondo State (an oil-producing State) has the highest number of the poorest in that group. Poverty incidence has been on the increase in the State, as it rose from 5.94% in 1997 to 12.25% in 2006 (Ondo State poverty study, 1995, Ondo state Economic Summit, 2001, Opukri & Ibaba 2008).

Table 1: Incidence of Poverty in Nigeria and Ondo state in selected years (1985-2006)

| | 1985 | 1992 | 1997 | *2002 | 2006* ¹ |
|--|------|------|------|-------|--------------------|
| Percentage of poor people in total population | 43 | 34 | 48.5 | 54.2 | 54.4 |
| Percentage of extreme poor in total population | 28 | 40 | 45 | 52 | 53 |
| Percentage of poor people in oil-producing states ** | 15.4 | 16.5 | 24.8 | 28.6 | 30.1 |
| Percentage of poor people in Ondo state areas *** | 3.85 | --- | 5.94 | 11.73 | 12.25 |
| Poverty line for all poor (N) | 395 | 395 | 658 | 825 | 846 |
| Poverty line for **extreme poor (N) | 253 | 164 | 320 | 523 | 531 |

Source: F.O.S.: Poverty and welfare in Nigeria National Consumer Survey

: * U.N.D.P. (Human Development Report) 1998 & 2003

: * *The poorest among the poor

: *** NDDC 2002, assessment of NDDC project in the Niger-Delta areas

: *¹ National Bureau of Statistics, 2009 (www.nigerianstat.gov.ng)

Evidence from Table1 shows that from 1992 to 2006, poverty increased in the country with a high prevalence in the oil-producing areas. Past studies attributed this poverty increase to oil pollution in the host communities that deprived the communities' profitable livelihood activities, particularly farming and fishing enterprises (Ojo, 2002, Chikanda, 2009). In various parts of Nigeria where there are activities of mineral resources explorations, such as Tin mining in Jos, Plateau State, Gold mining in Ipinrindo, Osun State, Crude-oil exploitation in Niger-Delta areas. These are established evidences of pollution from mineral resources explorations destroying sources of livelihood of the host communities (Ojameruaye, 2004, Robalino 2007). These interferences have led to failing rural economy, misery and conflicts between the host communities and the mineral resources exploration companies; an example is the case of Niger-Delta areas of Nigeria (Ibeanu, 1999, Aaron, 2006). This poverty assessment result has provided some illuminating and explicit relationship between loss and decrease in agricultural livelihood and poverty status of farmers.

Literature has also revealed that there exists a link between loss/decrease in livelihood in agriculture due to disruptions of the ecosystem and weakening rural economy. Hence, there is an empirical evidence of a link between livelihood in agriculture on the one hand and food security and poverty on the other hand (Fei *et al*, 1978, Ohlsson, 2000; Pender *et al*, 2002). Poverty assessment report on Nigeria by the UNDP (1998) and Bureau of Statistics (1999) reported a similar trend between declining agricultural production and deteriorating rural economy in the oil producing areas of Nigeria. Literature has shown 80 percent of those who are involved in agricultural production in the environmentally degraded areas of Latin America are poor, 60 percent in Asia and 81 percent in Africa (Bifani, 1995, Iglesias & Quiroga 2007). There also established coincidence of poverty with areas seriously affected by deforestation, erosion, desertification and mineral resource exploitation (World Bank, 1997). Example of this coincidence can be found in Brazilian Nor'easter, part of the India where deforestation has being a major problem.

From the foregoing, it is shown that there exist a relationship between decreases/ loss in agricultural livelihood, income and poverty status of the host communities of mineral resources

exploitation. Therefore, this assertion requires empirical quantification. An examination of the effects of oil-pollution on income generating activities and household income, poverty status and livelihood diversification in this setting is considered to be of research relevance. The linkage among these variables is conceptualized within the oil exploration – oil-pollution – income generation – household poverty and livelihood diversification nexus of the rural economy and within the context of the host communities. As the intervention of crude oil-pollution resulted to declining outputs and revenue, farming/fishing households diversified into non-farm and non-fish income sources to improve household income. Does this diversification to non-farm have a significant effect on household income, improving rural economy and agricultural growth?

Problem statement

There is increasing global concern about the implications of environmental degradation on the sustainability of livelihood security especially on the rural crop farmers and fishermen. Vosti and Reardon (1997) argued that agricultural production cannot sustain people's livelihood while at the same time the natural resources that agricultural production depends on is destroyed or polluted. The effect of crude-oil resource extraction on the Nigerian agriculture especially on the environment of the oil-producing areas of Ondo State (part of Niger-Delta areas) has been very glaring in terms of its negative effect on the region. This meddling has impacted disastrously on the socio-physical environment of the Niger Delta oil-bearing communities, massively threatening the subsistent peasant agricultural economy. Oil extraction has caused negative socio-economic and environmental problems in the Niger Delta, where as the Nigerian State has benefited immensely from petroleum since it was discovered in commercial quantities in 1956.

As a result of low income earned in agricultural and fishing livelihood in oil producing area, farming households have to diversify to non-farm sources to improve household income. Evidence in the literature over the last decade suggests that the share of household income from non-farm sources is growing (Reardon *et al*, 1998; Ellis, 1998). It was found out that non-farm sources account for 40-45 percent of average rural household income in Sub-Saharan Africa (SSA) and Latin America and 30-40 percent in South Asia coming from local sources rather than urban migration. Such pattern of

diversification has the potential to transform the structure of rural economies and societies (Barret *et al*, 2001 and Negatu, 2004).

Therefore, the following questions are of empirical significance. What is the relationship between oil-pollution and farming/fishing activities of the farming/fishing households in the area of study? What is its effect on income generation and household income? Is oil-pollution as form of environmental degradation the basis for livelihood diversifications by the households? What is the index of livelihood diversification strategy of the people? What is the significance of diversifications on household income? Is diversification related to improve household income and rural economy in the area of study?

How can empirical findings in the areas aid policy response to ameliorate these problems in the areas, most importantly the development of agricultural and fishing activities? Answers to these questions can be obtained through an understanding of the dynamics of rural economy and its effects on household income.

Objectives of the study

1. To measure the income generated from farming enterprises in crude oil-polluted area.
2. To quantify the level of livelihood diversification employed by the household heads.
3. To estimate the effects of livelihood diversification on households' income..

Hypothesis:

H₀: That income from livelihood diversification to non-farm has had a significant effect on household income and improve rural economy in Nigeria.

The relationships between poverty, livelihood and agriculture have driven major policy initiatives in both the agriculture and the environment sectors during the last century (Ravallion and Bidani, Walle & Cratty, 2003, Jayne *et al*, 2003, Ehui and Isigas 2006). Yet the assumptions prompting the initiatives are often not empirically supported. The quantification of the link between livelihood activities loss and environmental degradation can provide a structural handle for policy makers in making relevant policies. The benefits are implicit in the fact that if diversification can boost income, poverty can be reduced among the households in the affected areas (Etteng 1997, Ssewanyana 2002).

Conceptual Framework

Linkages between Agricultural Livelihood, Agricultural Growth and Rural Economy

In most developing countries agricultural livelihood has played the dominant livelihood in rural economy. Literature has identified agricultural growth to flourishing rural economy. For growth and sustainable rural economy, agricultural development must be the fore-runner, improving the quality of human life through sustenance of carrying capacity of supporting ecosystem (Thurlow, 2008).

This conceptual approach of linkages between agricultural growth and rural economy is that livelihood security in agriculture must be secured. This perspective provides a framework to assess critically sustainable livelihood through looking at the adequate stocks of flows of food and income to meet basic needs of all the household members (Chambers 1995). In other words, livelihood is said to be sustainable when it can cope or recover from stresses and shocks, maintain or enhance its capabilities and asset, while not undermining the natural resource base. Supporting this assertion Brundtland (1984) deduced that people's livelihood security is based more or less exclusively on the use of natural resources. Therefore, management of natural resources for the present use, while not undermining the future use of such resources becomes very important and critical.

Understanding livelihood concept is to understand all aspects of sustainable livelihood in a given area. A rural farmer is faced with a set of livelihood resources that can influence its outcome. These include:

1. Human resources e.g. skills, knowledge and ability to labour for successful different livelihood strategies.
2. Financial resources e.g. cash, credit and other economic assets such as farming and fishing equipment that are essential for pursuit of any livelihood strategy.
3. Natural resources e.g. land, wetlands, forests and water from which resource and services useful for viable livelihoods flow.
4. Social resources e.g. social networks upon which farmers draw when pursuing different livelihood strategies.

When these resources are abundant, attainment of livelihood security is assured. The combination of strategies would depend on different livelihood strategies (such as agricultural intensification, livelihood diversification from farm to non-farm) for which the farmer has access to and control over. Understanding the threats and challenges to the livelihood is important for policy directions.

Focus on Ondo state

The economy of the host communities of crude-oil producing areas of Ondo State, Nigeria before the Crude-oil exploitation experienced a thriving economy with about 90% of the population engaged productively in economic activities of agriculture and fishing. The setting up of Crude-oil exploitation have created a shock in the economic activities of people and destabilized the ecosystem. The economic activities of the people are now vulnerable to these shocks causing a significant decrease in agricultural/fishing outputs and increasing poverty.

Supporting this hypothesis, is the report carried out by Federal government in conjunction with UNDP (1998) on the assessment of poverty in selected six states of the country- Sokoto, Bauchi, Cross-river, Enugu, Kaduna, and Ondo. From the result of this assessment, Ondo state was ranked 3rd poorest and 7th poorest among the 36 states in Nigeria among the states considered.

Furthermore, in the poverty profile of the crude-oil producing zones conducted in 2002 and 2007 by NDDC, Ondo state was ranked the least, some of the indicators used were functional industries, post-secondary schools, level of infrastructures among others-the state recorded the least and ranked the poorest.

On the quantitative analysis of poverty in the state by Ondo state poverty study (1995), based on income poverty index, shows that about 45% of the households are in extreme poverty, while 85% were poor. Surprisingly, out of these 45% poor households, 55% are from the riverine areas (crude-oil producing zone). In other words, out of an estimated population 2.6 million in the state, 1.2 million could be said to be poor. Hence, in the riverine areas, 660,000 people are poor, while 44,252 people are non-poor (Ondo state environmental action plan, 1998).

Consequently, it becomes pertinent to critically look into the problem of this intervention and what can be done to reduce poverty in the riverine areas of the state in particular and other crude-oil producing areas of Nigeria in general.

Most of the inhabitants of the oil producing areas in Ondo State are the Ilajes. The Ilajes are a distinguished, distinct linguistic group of the Yoruba stalk made up of four geo-political entities namely Ugbo, Mahin, Etikan and Aheri. They were said to have left ILE-IFE their original ancestral home/settlement in the 10th century. They mainly occupy the Atlantic coastline of Ondo State of Nigeria while a large population of them settles on land in the hinterland. The area they occupy today remains the Ondo State of Nigeria only outlet to the sea. Ilajeland is bounded by the Ijebus to the West, the Ikale to the North, and the Itsekiri to the East, while the Atlantic Ocean formed the southern boundary. The Ilajes are one of the most dynamic and enterprising people in Nigeria. Their aquatic skill, coupled with their high adaptation ability enable them to conquer their harsh geographical environment and turn it to a big advantage. Consequently, they were able to build large communities like Ugbonla, Aiyetoro, Zion PePe and Orioke. Aiyetoro for example in its hey-days had the highest per capital income in the whole of Africa and attracted visitors, tourists and researchers from all over the world especially Europe, Canada, and America.

Apart from petroleum which is largely found in the area for which Ondo State today is recognized as an oil producing State. The occupational activities of the Ilajes include fishing, canoe making, lumbering net making, mat making, Launch building, farming and trading.

Methodology

Area of Study

The study was carried out in Ondo State, located in Southern Western Nigeria. The 2006 National population estimated the state population as 3,441,024. The state lies between longitudes 4.00 E and 6.00E and latitudes 5.45 N and 8.15 N. The state covers an area of over 14,595 square kilometres and divided into 18 Local Government areas (Ondo State Demographic Statistics, 2000).

Data collection and Sampling Procedure

Primary and secondary data were collected for the study. The primary data were obtained through structured questionnaires and were administered on farming households in both polluted and non-polluted areas. Secondary data were obtained from Central Bank of Nigeria (CBN), Bureau of Statistics (BOS), Oil companies' office in Ondo and Lagos State, Department of fisheries of Ondo state and local governments respectively. Focus Group Discussions FGDs that cut across age and sex on the perception of pollution and its effects on their livelihood and environment were also conducted.

Based upon the available information of the population size, the sampling procedure employed was Multi-stage random sampling. The first stage was the purposive selection of the petroleum exploitation areas and also the affected areas of the State (4 local Governments are known). The second stage was the stratification of the areas into two groups polluted and non-polluted. The third stage was the selection of the farming households from a list of farming households obtained from Agricultural Development Projects (ADPs) office, Local governments offices and key informants. The fourth stage was the random selection of 300 farming households taken from a compiled list of about 3400 farming households in polluted areas. Similarly, 290 farming households were also taken from a compiled list of about 3200 farming households from non-polluted areas. In the selection of the sample size, population at each location was considered (Tables 2). A total of 590-sample sizes were retained for subsequent analysis. The study therefore, covered farming households that are into cropping activity, fishing activity and non-farm activities.

Table 2: Stratification of sample areas to polluted and non-polluted

| Polluted | | | Non- Polluted | | |
|------------|-------------|------------|---------------|---------------|------------|
| Town | Local Govt. | Population | Town | Local Govt. | Population |
| Ayetoro | Ilaje (1) | 18,146 | Igbodigo | Okitipupa (3) | 3848 |
| Awoye | Ilaje | 2301 | Isale Ebute | Okitipupa | 2750 |
| Molutehim | Ilaje | 1597 | Igbobini | Ese-odo | 6960 |
| Arogbo | Ese-odo (2) | 10,362 | Ebute | Irele (4) | 1235 |
| Igbekebo | Ese-odo | 2299 | Mahintedo | Ilaje | 2909 |
| Iju – Osun | Irele | 2383 | Igbokoda | Ilaje | 12,803 |

Source: Ondo state Demographic Variables Statistics 2000

Analytical Tools and Models

Budgetary Analysis

This method of analysis for objective one was used to measure the profitability accrues from livelihood in and fishing activities in polluted and non-polluted areas.

$$GM = \sum P_i Y_i - C_i \quad (i = 1, 2, \dots, n) \quad \dots\dots\dots(1)$$

Where GM = Gross Margin

P_i = the market price of the i th output (₦/unit) in the activity

Y_i = the annual yield of the i th output (unit/ha)

C_i = the imputed cost in producing the i th output (₦/ha)

Further analysis was required to measure the relationship of the intervention of crude-oil exploitation on natural resource use based livelihood activities like crop farming and fishing and income derived from it. Index of Oil Exploitation was computed to measure this relationship (Chichilnisky, 1997):

$$IOE = \sum K_i \log K_i^{-1} \quad \dots\dots\dots(2)$$

$$K_i = y_i / x_i \quad i = 1, 2, 3, \dots, n$$

Where IOE = Index of Oil Exploitation

K_i = proportion of income from fishing/ crop farming

y_i = income derived from the sales of output i (#)

x_i = imputed cost of producing output i (#)

IOE was computed for both polluted and non-polluted areas.

Computation of Livelihood Diversification Index

Composite Entropy Index (CEI) was used to compare diversification across situations having different and large number of activities since it gives due weight to the number of activities (Anna, 2002; Daniel & Johnson, 2004). This index possesses desirable properties that impart uniformity and fixity to the scale used as norm to examine the extent of diversification.

It is expressed as

$$LDI_j = \left[\sum_{i=1}^n P_i \log_N P_i \right] \left[1 - \left(\frac{I}{N} \right) \right] \quad (3)$$

Where $P_i = \frac{A_i}{\sum Y_i}$

P_i = Proportion of the income of i^{th} activity relative to all activities

A_i = Net income received from activity i

Y_i = Net income from all livelihood activities

i = 1, 2, ..., N

The C.E.I. has two components, viz., distribution and number of crops, or diversity. The value of Composite Entropy Index increases with the decrease in concentration and rises with the number of crops/activities. These components of index are bounded between zero and one and thus the value of C.E.I. ranges between zero and one. Since the index uses $-\log_N P$ as weights, it assigns more weight to lower quantity and less weight to higher quantity.

Determinants of Livelihood Diversification

In order to examine the determinants of livelihood diversification, the index of livelihood diversification was regressed against selected variables. The variables used borrow from the works of Chand (1995), Shiyani and Pandya (1998).

The Livelihood Diversification Model is expressed as:

$$LDI = f(X_1, X_2, X_3, \dots, X_{13}, \mu_i) \tag{4}$$

The estimating equation is represented as:

$$LDI_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots, \beta_{13} X_{13} + \mu \dots \tag{5}$$

Where LDI = Livelihood Diversification Index

β_0 = Constant term

$X_1 - X_{15}$ = Independent variables.

U = Error term assumed to have normal distribution with zero mean, and constant variance i.e $U \sim N(0, \sigma^2)$ and $E(U_i, U_j) = 0$ if $i \neq j$.

The following variables are hypothesized as having significant influence on the livelihood diversification index: Household size (X_1), level of education (X_2), age (X_3), cropping/fishing experience (X_4), hired labour (X_5), cropping/fishing input (X_6), expenses on food (X_7), opportunity cost of own labour (X_8), cropping/fishing income (X_9), number of non-farm rural activities (X_{10}), market facilities (X_{11}), access to extension facilities (X_{12}) and cost of credit facilities (X_{13})

The selection of these variables is based on economic theory and suggestions of previous/similar studies. The OLS technique was used to estimate the model.

Effect of livelihood diversification index and other factors on income.

The effect of Livelihood Diversification index and other variables on Household income were examined by regression analysis. A two-stage methodology is adapted. This is necessary because

Livelihood Diversification Index and Household income are jointly depended on similar household socio-economic variables (Barret 2001, David *et al.* 2002 and Negatu 2004). Moreover, Livelihood Diversification Index has been used previously as dependent variable in equation (5). The use of 2SLS has the advantage of estimating all parameters of the structural equation in the model simultaneously (Olayemi, 1998).

The objective of using 2SLS is to facilitate the use of Ordinary Least Square (OLS) method to each equation of the structural model (Olayemi, 1998).

Model specification

$$Y_i = d'_0 + d'_1 X_1 + d'_2 X_2 + \dots + d'_{20} X_{20} + \epsilon_i \quad (6)$$

Where one of the X's is LDI

$$LDI = b_0 + b_1 + b_2 X_2 + \dots + b_{13} X_{13} + v_i \quad (7)$$

Where Y_i = the income

$X_1 - X_{20}$ = Explanatory variables.

\overline{LDI} is an endogenous explanatory variable in eqn (7), hence its estimated value from equation (6) is used in equation (7) as an explanatory variable. According to Olayemi, (1998), an endogenous independent/explanatory variable has two components a systematic component \overline{LDI} and a random component V. Hence,

$$\text{That is } LDI_i = \overline{LDI} + V \quad (8)$$

Substituting LD eqn (8) with eqn (6) we have

$$Y_i = d_0 + d_1(\overline{LDI}_i + V_i) + d_2(X_2) + \dots + d_{20}X_{20} + \epsilon_i$$

It becomes

$$Y_i = d_0 + d_1 \overline{LDI}_i + d_2 X_2 + \dots + d_{20} X_{20} + (\epsilon_i + d_1 V) \quad (9)$$

OLS method can then be used to estimate equation (9)

The following variables are hypothesized as having significant influence on the livelihood diversification index model: Household size (X_1), level of education (X_2), age (X_3), cropping/fishing experience (X_4), hired labour (X_5), cropping/fishing input (X_6), expenses on food (X_7), opportunity cost of own labour (X_8), cropping/fishing income (X_9), number of non-farm rural activities (X_{10}), market facilities (X_{11}), access to extension facilities (X_{12}) and cost of credit facilities (X_{13})

The following variables are hypothesized as having significant influence on the income model: Livelihood Diversification index (Z_1), Household size (Z_2), level of education (Z_3), age (Z_4), cropping/fishing experience (Z_5), hired labour (Z_6), cropping/fishing input (Z_7), expenses on food (Z_8), opportunity cost of own labour (Z_9), farm size (Z_{10}) agricultural land (Z_{11}), expenses on fertilizer (Z_{12}), expenses on improved seed (Z_{13}), expenses on non-food item (Z_{14}) and expenses on chemicals (Z_{15}), number of non-farm rural activities (Z_{16}), outputs to own consumption (Z_{17}), market facilities (Z_{18}), access to extension facilities (Z_{19}) and cost of credit facilities (Z_{20})

The selection of these variables is based on economic theory, previous/similar studies and peculiar characteristics of the variables in the area of study

Elasticities were computed for significant variables in both the net income and LDI. Following Olayemi, (1998), Herath and Takeya (2003). Elasticities are calculated as

$$\text{Elasticity} = \frac{dY}{dX_i} \cdot \frac{\bar{X}_i}{\bar{Y}} \quad (10)$$

$$\text{O}_1 = b \frac{\bar{X}}{\bar{Y}}$$

Where O_1 = Elasticity estimate

b = Parameter estimate (marginal effect associated with each Independent variable)

X = Mean of independent variable

Y = Mean of dependent variable

Basis for the selection of these variables was adopted from the works and specification of Herath and Takeya (2003).

Foster-Greer-Thorbecke (FGT) poverty analysis

The Food Energy Intake FEI method is adopted in obtaining the food poverty line in this study. This is because of its amenability to data requirements and availability. FGT poverty procedure method utilized the household income generated in meeting the needs of the household and uses it to construct the poverty line. This burrows from the work of Greer and Thorbecke (1986) and Okurat *et al*; (2002).

The FEI poverty line is represented as

$$Z = e^{(a+bK)} \quad (11)$$

Where Z = Food Poverty Line

K = Recommended daily allowance of calories intake (World Bank)

2,350 Kcal is the daily per capita household food energy intake recommended by the World Bank for the study of poverty (see Schubert, 1994)

a and b are estimated parameters to be obtained from equation (3.16) below.

The parameters are obtained from the relationship

$$\ln E_i = a + bC_i \quad (12)$$

E_i = total food expenditure per adult equivalent by household i

C_i = total calorie consumption for different household per adult equivalent by household i

a and b are parameters to be estimated. a = intercept, b = coefficient

C_i is the calorie equivalents of the different types of foods consumed by the different households converted to calories.

Here few assumptions were made,

1. The quality of difference of each food item is ignored.
2. The food items under consideration were assumed to be homogenous for all households.
3. Local units were assumed to be fixed per community, although they may vary across communities.

Therefore, Foster, Greer and Thorbecke (FGT) index, P_α (Foster *et al*; 1984) was used to measure poverty status among the households.

The FGT index (P_α) is given as:

$$P_\alpha = \frac{I}{N} \sum_{i=1}^q \left(\frac{Z - Y_i}{Z} \right)^\alpha \quad (13)$$

Where Z = poverty line

Y_i = Income of the household i ($i = 1, 2, \dots, q$)

q = No of household below the poverty line

N = total number of sampled households

α = parameters of the FGT index (P_α). $\alpha \geq 0$ and it can take three values of 0,1 and 2. These values give different implications.

Implications

- If $\alpha = 0$, the FGT index P_0 measures poverty incidence. This represents the index of the households that are impoverished.
- If $\alpha = 1$, the FGT index P_1 measures the poverty depth of the households. This denotes the proportion of the poverty gap that the average poor will require to get to the poverty line.
- If $\alpha = 2$, the FGT index P_2 measures the severity of poverty. This gives more weight to the poorest of the household poverty.

Results and Discussions

The socio-economic characteristics of the respondents shows that 64.58% of the farmers are males with about 70% of them being married. The age distribution shows that those in the 41-50 years category are 35.54% while those above 50 years are 51.02% with the mean age of 48.01. The household size distribution revealed modal class of 7-9 household numbers with the mean of 9.6. Furthermore, 45.83% of the land used for agricultural activities are inherited land, this category had access to extension services and also, about 19.15% had access to credit facilities. Moreover, this finding show that 88.98% are

polluted areas is higher than Gross margin of fishing activity in polluted areas. Table 5 also, revealed the estimated farmer who made losses in polluted areas to be 14.1% higher than farmers who made losses in non-polluted areas. This decreasing revenue in fishing activity can therefore be attributed to direct causal relation of environmental degradation from crude-oil spills incursion into freshwater that led to depletion in captured fisheries.

Table 4: Estimated Average Gross Margin of cropping and fishing activities

| Regions | Farming activity | | # / Annum |
|--------------------|------------------------|------------------------|-------------|
| | Cropping | Fishing | |
| Polluted areas | ₦17,373.01 (17.88%) | ₦52,119.04 (72.33%) | ₦ 69,492.05 |
| Non-polluted areas | ₦ 9,773.94 (82.12%) | ₦19,943.48 (27.67%) | ₦ 99,717.42 |
| | ₦97,146.95 (100.00) | ₦72,065.52 (100.00) | |

Source: Field survey NOTE: ₦151.5 = \$1

Table 5: Distribution of Farmer's Revenue in Cropping and fishing activities

| Item | Polluted | Non-polluted |
|------------------------------|--------------|--------------|
| Major Occupation | | |
| Crop Farming | 105 (35.0%) | 155 (53.45%) |
| Captured Fisheries | 195 (65.0%) | 135 (46.55%) |
| Total | 300 | 290 |
| Revenue | # | # |
| Highest Average Revenue | 515,750 | 512.550 |
| Average Cost | 363,750 | 257.550 |
| Net Income / Loss | 152,000 | 255.000 |
| Least Average Revenue | 363,150 | 58.278 |
| Average Cost | 538,500 | 121.735 |
| Net Income / Loss | (175,350) | (63.457) |
| Estimated Profited Household | 207 (69.00%) | 241 (83.10%) |
| Estimated Loss Household | 93 (31.00%) | 49 (16.90%) |

Source: Field Survey

From the computation of Index of Oil Exploitation (IOE) for both areas, the results are presented in Table 6. The analysis indicated a negative relationship in polluted areas. IOE of -2.202 indicated that for every ₦1 derived from the sales of output *i*, ₦ 2.202 was used for the imputed cost of producing *i*. This revealed that crop farming and fishing is no longer a profitable business venture, as most outputs were directed to family consumption. Oftentimes production cost are being augmented from other sources

of income particularly non-farm source. However, in non-polluted areas, for every ₦1 invested in producing output I, ₦ 1.79 were derived from the sales of output i.

Table 6: Index Of Oil Exploitation IOE

| Areas | N | Minimum | Maximun | Mean | Std. Deviation |
|--------------|-----|---------|---------|--------|----------------|
| Polluted | 290 | -1.772 | -2.632 | -2.202 | -0.015 |
| Non-polluted | 300 | 0.866 | 2.714 | 1.790 | 0.158 |

Livelihood Diversification Strategies.

Due to low income earned from farming livelihood activities, household heads diversified into other sources of income generating activities to improve household income. Table 7 presents the results of the different livelihood activities engaged by household heads. The results revealed that about 11.33% households did not diversify and rely only on income from farming enterprise, while 88.67% households diversified. Findings from this study revealed that farming households employed multiple sets of non-farm livelihood portfolios to improve household income. Table 7 reveals that majority of the household heads were engaged in two non-farm livelihoods activities. These are Local Brewing (70.68%) and Mat Weaving (74.81%). The income from these two non-farm activities contributed significantly to household's income.

Table 7: Livelihood Diversification Strategies

| Activity (N=590) | Diversification Trend | Reason for Trend |
|---|-----------------------|--|
| Main Occupation | Livelihood activity | Oil pollution incursion into fresh-water and farming area reducing yield. Poor yield output. Increase income generation. |
| Farming 35.00% | 0. 11.33% | |
| Fishing 65.00% | 1. 35.67% | |
| Other Occupation | 2. 41.00% | |
| Fish Trading 28.57% | 3. 11.33% | |
| Trading (Manufactured goods) 33.08% | 4. 0.67% | |
| Artisans 25.19% | | |
| Boat Building 7.52% | | |
| Plank selling 5.26% | | |
| Paid employment 12.78% | | |
| Mat weaving 74.81% | | |
| Remittances (Local & Abroad) 10.15% | | |
| Palm wine Tapping 18.80% | | |
| Local Brewery (Local gin) 70.68% | | |
| Motorcycle <i>Okada</i> Operators 3.38% | | |
| Others 37 (13.91%) | | |

Table 8 explains the level of livelihood diversification pattern and estimated Composite Entropy Index which is the proxy for livelihood diversification. Table 8 reveals a 0.635 (CV 37) index for diversification into one activity and 0.255 (CV = 12) index for diversification in four enterprises. The result however, shows that as the number of livelihood diversification decreases the CE-Index increases and would become one for no livelihood diversification. This implies specialization into one enterprise. On the average, the CE-Index for the whole sample is 0.421 (CV 42). This suggests that livelihood diversification exists. The CEI-index shows that household undertook one form of livelihood diversification or another. However, majority of the household heads were into one or two livelihood diversification activities.

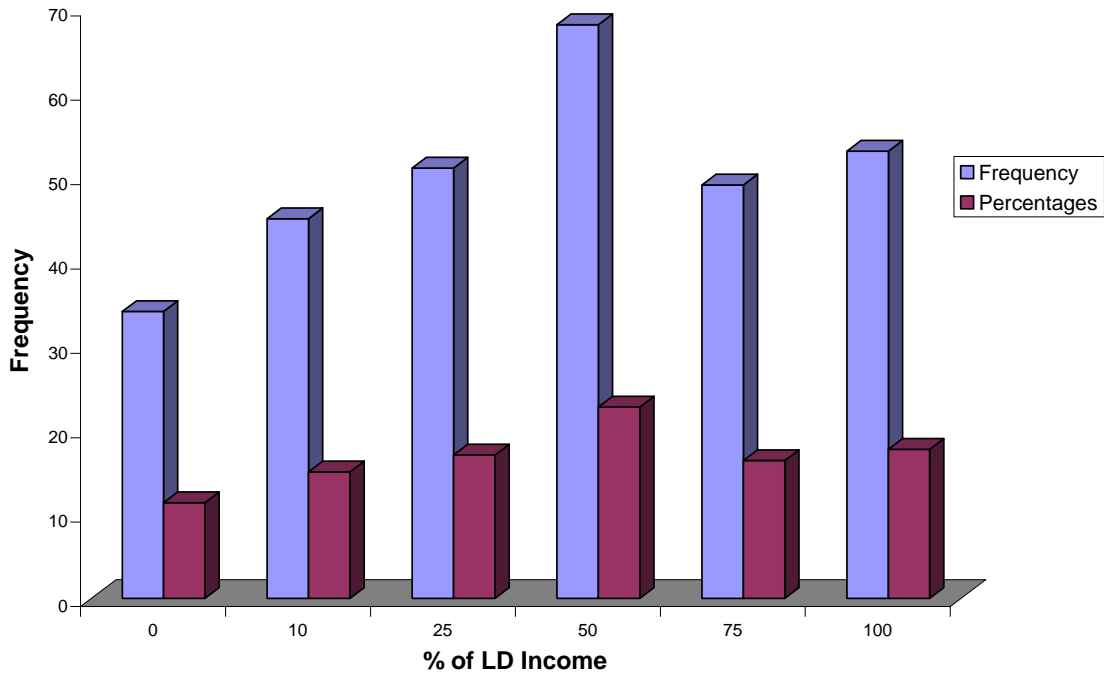
Table 8: Livelihood Diversification Indices Computed in the Study Area

| Composite Entropy Index | | | | | | |
|-------------------------|---------------|-------------|----------------|------------|------------|---------|
| Diversification Trend | Frequency (%) | Combination | Standard error | Min. Value | Max. Value | C.V (%) |
| 0 | 34 (11.3) | 1.0 | 1.0 | 1.0 | 1.0 | 100 |
| 1 | 107 (35.7) | 0.635 | 0.232 | 0.382 | 0.968 | 37 |
| 2 | 123 (41.0) | 0.458 | 0.113 | 0.314 | 0.679 | 25 |
| 3 | 34 (11.3) | 0.401 | 0.096 | 0.304 | 0.613 | 24 |
| 4 | 2 (0.7) | 0.255 | 0.031 | 0.215 | 0.526 | 12 |
| Total | 300 (100.0) | 0.441 | 0.185 | 0.304 | 1.0 | 42 |

Field- Survey

Figure 4.1 presents the proportion of income from livelihood diversification in the total income. The results from figure 4.1 reveal that 11.33% household heads did not diversify and rely only on income from farming/fishing sources. About 17.67% of the household heads derived 100% income from diversification activities. The results show that 39.00% household heads derived above 50% income from diversification activities and 32.00% households derived below 50% income from diversification activities. The implication of this result is that 85.2% of the household heads that relied only on farm income were unable to meet household basic needs compared with only 32.3% of those that diversified into non-farm activities. This finding suggests that livelihood diversification to non-farm sources are growing. Such patterns of diversification can transform the structure of rural economies if strengthened.

Fig. 4: Livelihood Diversification LD % Income in Total Income



Determinants of Livelihood Diversification

Table 9 presents the results of the Ordinary Least Squares for LDI Regression model. The R^2 of 74% and the Standard Error of 0.02514 indicated a good fit for the estimated equation. Results from the LDI equation indicate that diversification was affected negatively and significantly by age (X_3) and access to credit (X_{13}). Thus, the higher the age and access to credit used for production variables the lower the level of diversification. The results also indicated that farming/fishing income (X_6), education (X_2), number of non-farm rural activities (X_{10}), access to extension services (X_{12}) and access to market (X_{11}), all have significant positive effects on livelihood diversification (Table 9). The results reveal that farming/fishing income (X_6) was the most significant factor influencing livelihood diversification. This means that poor households struggle for additional income to meet household needs. Similarly, educations, NFRA, access to extension services and access to market facilities have positive significant effect on livelihood diversification (Table 9). Increases in these variables will lead to increase livelihood diversification. As households realize that they can make more money from non-farm sources they may gradually shift from farming livelihood activities and this may affect farming outputs. The implication is that interest in farming

will be gradually declining and can lead to scarcity of agricultural products or food shortages in the area of study.

Table 9: Ordinary Least Square for LDI Regression Analysis

| Variable | Estimate | t-value |
|---|--------------|-----------|
| Household size (X_1), | - 2.1481E-04 | -0.1345 |
| level of education (X_2), | 0.7251 | 2.4131* |
| Age (X_3), | -7.9135E-03 | - 2.2652* |
| Cropping/fishing experience (X_4), | -4.5821E-03 | -0.3546 |
| Hired labour (X_5), | -4.5482E-07 | -1.0523 |
| Cropping/fishing input (X_6), | 1.7245E-08 | 3.2543** |
| Expenses on food (X_7), | -2.4431E-07 | -0.2988 |
| Opportunity cost of own labour (X_8), | 2.335E-06 | 0.7654 |
| Cropping/fishing income (X_9), | -4.4652E-09 | -0.6635 |
| Number of non-farm rural activities (X_{10}), | 5.5134E-07 | 2.3852* |
| Market facilities (X_{11}), | 0.0185 | 2.5643* |
| Access to extension facilities (X_{12}) | 0.6453 | 2.4127* |
| Cost of credit facilities (X_{13}) | 0.00859 | -3.0048** |

Source: Computer Printout of Multiple Regression Analysis

DIAGNOSIS STATISTICS

*** = Significant at $p < 0.001$, ** = Significant at $p < 0.005$, * = Significant at $p < 0.01$

Multiple R = .8253, R Square = .7691, Adjusted R Square = .7432, Standard Error = .02514. Constant = - 0.0103

Table 9 presents the results of the estimated linear equation for the second stage of the two-stage least squares method. The R^2 of 75% and standard error of 0.8457 indicated a good fit for the equation.

Table 9 reveals that diversification has a statistical positive significant relationship with total income at 5 percent level of significance. This clearly indicates that diversification truly has an impact on total income. The result shows that access to credit (Z_{20}) and cost of farming inputs (Z_8) have significant negative effect on income. In other words, access to credit in the study area is found to have a negative impact.

This suggests that most of the times, the amount received was small and often not timely to meet seasonal agricultural production, thereby leading to diversion for consumption and social obligations. Similarly, money spent on farming inputs most of the times could not be met by the outputs/yield from farming activities. The significant and positive variables are education (Z_2), agricultural land (Z_6), LDI (Z_7), opportunity cost of own labour (Z_{10}), expenses on chemical (Z_{14}), number of non-farm rural activities (Z_{17}) and market facilities (Z_{18}), all contribute significantly and positively to total income. This suggests that the more of these variables that are utilized the more is the income made.

Table 9 Results of Regression Estimates of Total Income

| Variable | Estimate | t-value |
|--|-----------|-----------|
| Livelihood Diversification index (Z ₁), | -4.3518 | -0.3542 |
| Household size (Z ₂), | 5.3642 | 3.6734** |
| Level of education (Z ₃), | -23.456 | -0.2546 |
| Age (Z ₄), | -3.5228 | -0.3522 |
| Cropping/fishing experience (Z ₅), Hired labour (Z ₆), | -0.3144 | -0.2855 |
| | 7.1058 | 2.4591** |
| Cropping/fishing input (Z ₇), | 0.8355 | 2.2517** |
| Expenses on food (Z ₈), | -0.9254 | -3.0281** |
| Opportunity cost of own labour (Z ₉), | -2.11E-03 | -0.0148 |
| Farm size (Z ₁₀) | 2.5568 | 2.4862* |
| Agricultural land (Z ₁₁), | -0.4128 | -0.0661 |
| Expenses on fertilizer (Z ₁₂), | -0.8225 | -0.0352 |
| Expenses on improved seed (Z ₁₃), | 6.8837 | 0.9014 |
| Expenses on non-food item (Z ₁₄) | 7.5761 | 2.3855** |
| Expenses on chemicals (Z ₁₅), | 0.4261 | 0.3158 |
| Number of non-farm rural activities (Z ₁₆) | 0.1108 | 0.2856 |
| Outputs to own consumption (Z ₁₇), | 9.4381 | 4.0025*** |
| Market facilities (Z ₁₈), | 0.5247 | 2.1548** |
| Access to extension facilities (Z ₁₉) | 1.4627 | 0.4115 |
| Cost of credit facilities (Z ₂₀) | -0.3846 | -2.4476** |

Source: Computer Printout of Multiple Regression Analysis

DIAGNOSIS STATISTICS

*** = Significant at $p < 0.001$, ** = Significant at $p < 0.005$, * = Significant at $p < 0.01$

$R^2 = .7962$, Adjusted $R^2 = .7461$, Standard Error = 0.8457 Constant = - 2.1185

Hausman Specification Test

To test whether income and livelihood diversification strategies are related in a simultaneous manner, the Hausman specification test is conducted. The procedure for this test is as follows. The endogenous variable in the model, such as compounded Household Income and LDI are analyzed independently in terms of the rest of the predetermined variable using Ordinary Least Square (OLS) method. The unstandardized predicted value and residuals are saved. Having done this, another endogenous variable is created from the residuals and included in the analysis as an explanatory variable. If the t-value for this variable is statistically significant greater or equal to 2, then it can be concluded that there is simultaneity (Mills and Zandvakili, 1997; and Andersen, 2004).

The following are the results after performing the Hausman Specification Test.

Hausman test Results for Equations 7 and 8.

$$\Delta \text{LDI} = 11.256 - 0.317 \Delta Y^* + 0.143 \varepsilon^* \quad (14)$$

$$\text{t-value} \quad \quad \quad -5.314 \quad \quad 2.14$$

$$\Delta Y = 28.146 - 1.583 \Delta \text{LDI}^* + 0.126 \varepsilon^* \quad (15)$$

t-value -5.101 2.46

Where, Δ LDI = estimated Livelihood Diversification Index

ΔY^* = estimated unstandardized predicted value of Household income from reduced-form equation by OLS

ε^* = saved residual value while estimating unstandardized predicted value of compounded LDI

ΔY = Computed Household Income

Δ LDI* = estimated unstandardized predicted value of compounded Δ LDI from the reduce-form equation by OLS

ε^* = saved residual value while estimating unstandardized predicted value of compounded Household income.

These estimates co-efficient for the ε^* variables are statistically significant in both equation; implying that there is simultaneity between compounded changes in LDI and Household income.

Equations 14 and 15 present the results from the reduced-form equation (as in ΔY^* and Δ LDI*) express endogenous variables as functions of exogenous or predetermine variables only. Their parameters measure both the direct and in direct influence of exogenous variables on endogenous variables. But these reduced-form parameters are composed entirely of structural parameters (Paudel, 2004). That is, this reduced-form parameter is a combination of some structural parameters (Anderseen, 2004). This suggests that policy that can influence livelihood diversification can also do same to income and *vice versa*. Thus, this finding suggests that livelihood diversification has a significant effect on income..

Elasticities were computed for only six continuous variables in the total income model. These included education (Z_2) for both income and LDI model, cost of farming/fishing inputs (Z_7) and non-farm rural activities (NFRA) income (Z_{16}). The others are age (Z_3), opportunity cost of own labour (Z_9) and expenses on chemicals (Z_{15})

Table 10: Elasticity Estimates from the Income and LDI Models

| Variable | Income Elasticity | LDI Elasticity |
|---|-------------------|----------------|
| Education (Z_2) | 0.2863 | 0.2771 |
| Age (Z_3) | ----- | -0.2254 |
| Farming / fishing inputs (Z_7) | 0.0768 | ----- |
| Opportunity cost of own labour (Z_9) | 0.0199 | ----- |
| Expenses on chemicals (Z_{15}) | 0.4837 | ----- |
| Non-farm rural activities income NFRA(Z_{16}) | 2.1857* | 2.3827* |

Source: Computed from Multiple Regression Analysis Print out

*= Elastic variable

Table 10 reveals that only NFRA income was elastic for both income and LDI models out of other variables whose elasticities were computed. The most important factors that significantly increase total income in order of importance included NFRA income, expenses on chemicals, education and LDI. While for LDI model, in order of importance are NFRA income, cost of farming/fishing inputs and education.

Moreover, results from Table 10 reveals that 10 percent increase in NFRA income would result in about 22 percent increase in household income. Similarly, an increase of the same magnitude in expenses on chemical, education and LDI would lead to 5 percent, 3 percent and 2 percent increase in total income model respectively. For LDI model, 10 percent increase in NFRA income would result in 24 percent increase in the level of diversification with 8 percent and 3 percent increases in LDI model respectively.

Poverty Profile of Household's Heads

Table 11 presents the results of the analysis of the FGT measures of poverty. The three measures of poverty, namely the level, the depth and the severity of poverty were computed. The headcount ratio (P_0) is the ratio of the number of poor individuals to the total population. While the (P_1) the depth and (P_2) is the severity of poverty.

The results from Table 11 revealed that Awoye has the highest headcount ratio (P_0) (66.67%) of the sampled households falling below the poverty line. Followed by Ayetoro with 63.3 percent and Igbekebo 62.2 percent. The poverty gap index, P_1 , also reflects that Awoye has the greatest depth of poverty 37.5 percent. The severity of poverty captured by P_2 also suggests that Awoye 19.4 percent, Ayetoro 17.3 percent and Igbekebo 18.8 percent have more severe poverty.

The over-all poverty profile revealed that 60 percent of the households fell below the poverty line (Table 11), while poverty gap revealed 26.8 percent and 11 percent for severity of poverty. Results from the analysis of all the three FGT poverty measures suggest that poverty situation is worse in the study area. This implies that for household to move out of poverty, livelihood in farming activities must not be considered as a primary source of income generation

Table 11: Poverty Levels Estimates Based on Food Poverty Line for the Study Area

| Town | P ₀ | P ₁ | P ₂ |
|-----------|----------------|----------------|----------------|
| Iju- Osun | 0.5561 | 0.1358 | 0.0832 |
| Arogbo | 0.5328 | 0.1721 | 0.0974 |
| Igbekebo | 0.6222 | 0.3092 | 0.1878 |
| Ayetoro | 0.6331 | 0.3284 | 0.1730 |
| Molutehim | 0.5769 | 0.2869 | 0.1572 |
| Awoye | 0.6671 | 0.3750 | 0.1350 |
| Total | 0.6018 | 0.2678 | 0.1107 |

Source: Computed from Poverty Line Measures

Livelihood Diversification Strategies and Poverty Status

The rural population in developing countries derives an important share of its income from Rural Non-Farm Activities (NFRA). Ellis (2000) stated that 30%-50% of Rural Non-Farm Activities is common in Sub-Saharan Africa. While Reardon *et al* (1998) give a mean figure of 42% for Sub-Saharan Africa. In Asia and Latin America, FAO (1994) estimates the figures to be 32% and 40% respectively. Ellis (2000) gives an appreciably higher estimate for South-Asia to be 52%. This FAO (1994) study summarized data from over 100 studies undertaken for over three decades (1970-1990s) for Asia and Latin-America farm households.

Studies by (Reardon, 1997; Haggblade *et al*, 2002 and Daniel and Johnson, 2004) recognized that the development of the rural non-farm sector is a critical factor in providing employment in rural areas and can boost household income. This can influence poverty reduction. Hence, Figure 4.2 presents livelihood diversification strategies and poverty status in the study area.

Fig. 5: Livelihood Diversification Strategies and Poverty Status

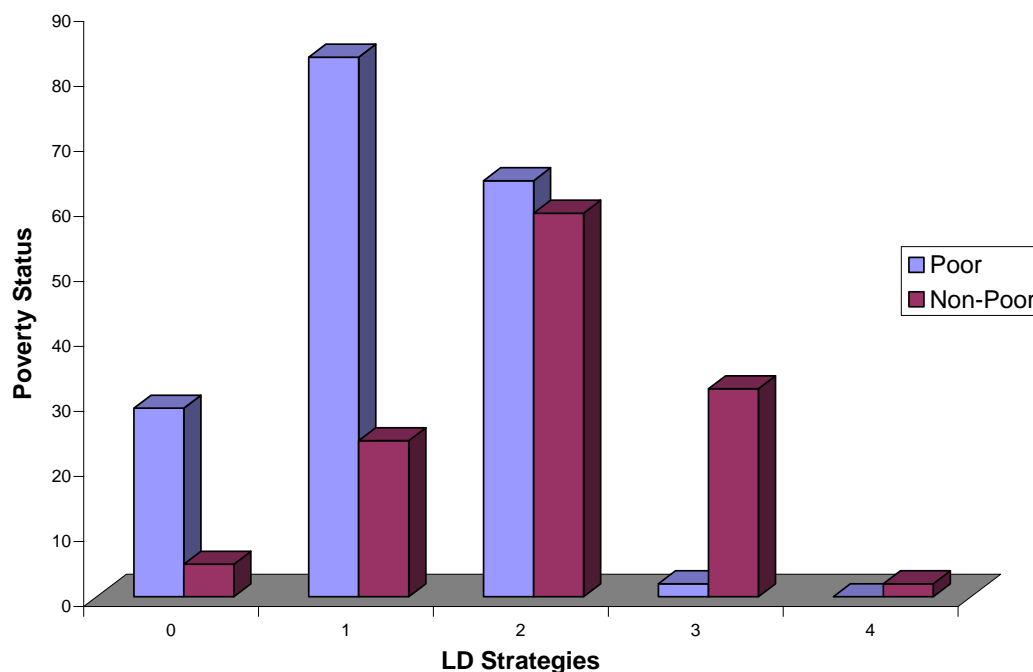


Figure 4.2 reveal that 88.67% households were into different strategies to boost household income. While 41.00% households were into 2 different Livelihood Diversifications mix. Household that did not diversify were 11.33%, and out of these figures 85.29% households were identified poor. Majority of the households that had multiple set of livelihood portfolios of non-farm rural activities (about 94.44% household heads in this category diversified into 3-4 Livelihood activities) were non-poor.

This finding suggests that households in the study area are shifting from farming activities to non-farm/non-fish income generating activities. Households that diversified more to non-farm/non-fish source fare better than those who do not.

Policy Implications of the results

The study revealed that there is a significant relationship in the Gross margin of major agricultural activities in the area of study. Also, there exists a significant difference in the income generation of farmers in both polluted and non-polluted areas with a lower income generation in polluted areas. The implication of this result is that low levels of income exist in the polluted areas as 80% of the farmers earned less than one dollar per day (N90 - N135). One way farmers improve income generation is through

livelihood diversification, as revealed by the study. The higher the diversifications the better off the farmers become.

Specific policy on boosting of rural income generation is necessary especially in hard-core severe poor income generation areas as indicated to be high in polluted areas. Derivation fund for oil producing state from federal government can be channel to the development of the community facilities like extension service center, health centers, building of school, technical institutes to improve skilled manpower and the promotion of labour-intensive job creation schemes, and the construction of cottage industries as identified in the study area. The primary beneficiaries of the anti-poor income measures should be those within the 30% severity poor income group as revealed by the study to be in the polluted areas.

Agriculture is the main source of livelihood for the people and form of thriving rural economy before Crude-oil exploitation. On inception of Crude-oil exploitation there exist a competition and conflicts of natural resource used. This has led to environmental degradation, thus affecting the host communities' natural resource use and livelihood in agriculture. Livelihood in agriculture is no longer a major source of income generation especially in the polluted areas. Those farmers that diversify to non-farm livelihood activities fare better than those who diversify less particularly in polluted areas. This tends to explain why agriculture is relegated and government on the other is not paying close attention to develop infrastructures that can aid the development of agricultural sector.

The study revealed vibrant non-farm rural activities in each location of the study areas; These non-farm rural activities is highly important because of its effect on employment, sources of additional income and help to meet basic needs within rural economies. Diversification has a significant effect on Household Income. Household income is link with welfare improvement. Welfare improvement can be argued to be an impetus to improved rural economy. While improve rural economy is therefore not related to agricultural growth, unlike in the 1950s and 1960s when agricultural growth is linked with flourishing rural economy. Thus, there is dire need for comprehensive qualitative data collection to support critical research on the linkages between agricultural development and the rural economy.

References

- Aaron, K. K. (2006). "Human Rights Violation and Environmental Degradation in the Niger Delta Region of Nigeria", in Elizabeth Porter and Baden Offord (eds), *Activating Human Rights*, Peter Long, Oxford, Borne, New York, Pp.193–215.
- Anderssen, C. J. 2004. "Making inferences about Polarizations, Welfare and Poverty. A study of 101 countries from 1970-1994". *Journal of Applied Econometrics*. 19.3: 537-550
- Anna, C.R. 2002. "Rural household strategies in southern Mali": Determinants and contribution of income diversification to income level and distribution. *World Bank working paper 2785:1-203* www.worldbank/anna October 2004
- Barret, C.B., T. Reardon and P. Webb 2001. "Non-farm income diversification and household Livelihood strategies in rural Africa" Concepts, Dynamics and Policy implications. *Food policy*. 26. 4:315-331
- Bifani,P.1995. Environmental degradation in rural areas, cited in *The Environment, Employment and Development Work edited by Bhalla, ILO office Geneva*. Chapter2:154-301
- Brundtland, T. (1984): Economics growth and environmental management. *World Industry*. Conference on environmental management. Marseilles, France *November 14-16*
- Central Bank of Nigeria (CBN), 2005. An appraisal of Federal governments on National poverty eradication programme by the research department. 27.1:8-18
- Chambers, R. (1995). Poverty and livelihoods: Whose reality counts? *IDS discussion Paper #347*
- Chand, R. 1995." A critique on the methods of measuring economic diversification" Paper presented for the training course on "Quantitative Techniques for Policy Analysis in Agricultural Economics" Conducted by the Division Agricultural Economics, Indian Agricultural Institute, New Delhi Nov. 27-Dec.9:214-242
- Chikanda, A (2009): Environmental Degradation in Sub-Saharan Africa in Environment and health in Sub-Saharan Africa eds Springer Netherlands: ISBN 978-1-4020-9381-4
- David, R.S., A. Gordon, K. Meadows and K. Zwick (2001): Livelihood options and Diversification in Uganda: Patterns and determinants of change across two rural districts. *Food policy* 26.2: 421-435
- Daniel, S. and C. Johnson 2004. Livelihood options? The Political Economy of Access, Opportunity and Diversification. *Overseas Development Institute (ODI) Working* , *Westminster, London UK*. 233:112-216
- Earth Action, (1994): Defend the Ogoni people in Nigeria: Alert publication in USA No.3
- Ehui, S. and M. Tsigas, 2006, "Identifying agricultural investment opportunities in sub-Saharan Africa: A global, economy-wide analysis," *African Journal of Agricultural and Resource Economics*, 1(1):1-19, December.

- Ebisemiju, F.S. (1966) "The fishing economy of Ilaje District" an unpublished B.A. Thesis in the Department of Geography, University of Ibadan, Ibadan Nigeria
- Ellis, F. 1998. "Household strategies and Rural Livelihood Diversification". *Journal of Development studies* 35. 1:1-38.
- Etteng, I.A. 1997. "The Nigerian State, Oil exploration and Community interest, Issues and Perspectives". *Unpublished M.Sc. Thesis, Department of Agricultural economics University of Port-Harcourt, Nigeria.* ix + 216pp
- FAO 1994. Summarized data from 1970-1990s estimates of Asia and Latin America Farm households. www.fao./ data summary estimates Asia Latin-American farm households/htm November 2004.
- Federal Office of Statistics FOS (1999) "Poverty and Agricultural Sector": The Incidence of Poverty of Farmers in Nigeria. National Consumer Survey 1996/1997
- Fei, J.C., G. Ranis and S. Kuo (1978) "Growth and the family distribution of income" *Quarterly journal of economics, Vol. 92 1 (February) pages 17-53.*
- Foster, J., J. Greer and E. Thorbecke 1984. A class of Decomposable Poverty Measure, *Econometrical* 52.2: 761-766
- Greer, J. and E. Thorbecke 1986. "A methodology of measuring food poverty, applied to Kenya". *Journal of Development Economics, 24. 2: 59-74.*
- Haggblade, S., P. Hazell and T. Reardon 2002. "Strategies for stimulating poverty alleviating growth in the rural non-farm economy in developing countries". *International Food Policy Research Paper (IFPRI) Washington D.C. Research paper 32: 215-256*
- Herath, P.H. and H. Takeya 2003. Factors determining intercropping by rubber small holders in Sri-Lanka: A Logit Analysis. *Agricultural Economics* 29: 159-168
- Jayne, T.S., Y. Takashi, M.T. Weber, D. Tschirley, R. Benfica, A. Chapota and B. Zule 2003. Small holder income and land distribution in Africa: Implications for poverty reduction strategies. *Food policy* 28: 253-275
- Ibaba, I.S and Olumati, J.C., 2009. Sabotage Induced Oil Spillages and Human Rights Violation in Nigeria's Niger Delta. *Journal of Sustainable Development in Africa* (Volume 11, No.4, 2009)
- Ibeanu, O. (1999). "Oil resource flow and conflict in rural Nigeria" In Tilla Ritta Granfelt (ed) *Managing the globalized Environment, local strategies to secure livelihoods*, New York, IT publishers, Pp 9-13 B25.
- Iglesias, A., Quiroga, S. (2007). "Measuring the risk of climate variability to cereal production at Five sites in Spain". *Climate Research, 34, 47-57.*
- Maduagwu, A. (2000): Alleviating poverty in Nigeria: Africa economic analysis publication Vol.23 Number 2 Pages 34-41.

- Maxwell, S. (1998) "Agricultural Development and poverty in Africa". *CTA publications Annual Report 1998 pp1-12*
- Mills, J.A. and A. Zandvakili 1997 "Statistical Inference via Bootstrapping for measures of Inequality". *Journal of applied Econometrics*, 2: 133-150
- Negatu, W. 2004. Determinants of rural livelihood diversification. Evidence from Southern Ethiopia. *Quarterly journal of agriculture* 43.3:102-116
- Niger-Delta Development Commission NDDC (2002) Project assessment tour of all Oil-producing Areas in Nigeria
- Ohlsson, L. (2000) livelihood conflicts- linking poverty and environment as causes of conflict, Stockholm: SIDA. *Environment policy unit*.
- Ojameruaye, E. 2004. *Lessons from the Chadian Model for Distribution of Oil Wealth in Nigeria's Niger-Delta* 3: 1-34 www.niger-delta_urhobo_historical_society.org September 2003
- Ojo, J.B. 2002. The Niger Delta: Managing Resources and Conflicts. *Research Report, Development Policy Centre, Ibadan*, 49: 1-57
- Olayemi, J.K. (1995) The design of a poverty alleviation program for Nigeria working paper for Poverty alleviation program development committee National Planning commission, Lagos July 1995.
- Okurat, F.N., J.O. Odwee and A. Adesina 2002:" Determinants of regional poverty in Uganda: *African Economic Research Consortiums AERC RP* 122:1-87
- Omofonmwan, S.I and Odia, L.O., 2009 . Oil Exploitation and Conflict in the Niger-Delta Region of Nigeria, *J Hum Ecol*, 26(1): 25-30 (2009)
- Ondo State Economic Summit 2001.
- Ondo State Demographic Statistics 2000. Compiled by Ministry of information.
- Ondo State Environmental Action Plan 1998
- Ondo state poverty study group 1995
- Opukri, C.O. and Ibaba, I.B. (2008): Oil Induced Environmental Degradation and Internal Population Displacement in the Nigeria's Niger Delta. *Journal of Sustainable Development in Africa* (Volume 10, No.1, 2008)
- Paudel, L. 2004. "Analysis of the relationship between Poverty and Income inequality in Alabama, U.S.A. The use of Two-Stage Least Squares method. *Unpublished Master of Science Thesis, Department of Agricultural Business. Graduate School, Alabama University, U.S.A.* xiv + 169pp
- Pender, J.P., P.Hazell and J.L.Garret (2002)'Reducing poverty and protecting the Environment. The overlooked potential of less-favoured lands Unfinished Agenda IFPRI publication (2002) for IFPRI's 2020 vision initiatives.
- Ravallion, M. and B. Bidani 1994." How robust is a poverty profile?" *World Bank Economic Review*,

8. 1: 75-102

- Reardon, T 1997. "Using evidence of household income diversification to Inform study of the rural non-farm labour market in Africa". *World Development*, 25. 5: 735-747
- Reardon, T., K., Stamoulis, M.E., Cruz, A. Baliscan, J. Berdeque and B. Banks 1998. Rural Non-Farm Income in Developing countries. The state of food and Agriculture 1998: *Part III, Rome: Food And Agricultural Organizations (FAO) of the United Nations*.
- Robalino, J. (2007) Land conservation policies and income distribution: who bears the Burden Of Our environmental efforts? *Environment and Development Economics* 12(4).
- Ssewanyana, S.N. (2002). "Sustainability of livelihood security among rural households in Uganda" Issues in *African Development Monograph series #31 August, 2002*
- Shiyani, R.L., and H.R. Pandya 1998. Diversification of Agriculture in Gujarat: A spatio-temporal analysis. *Indian journal of agricultural economics* 53. 4: 627-639
- Thurlow, J. (2008) "Options for Agricultural Growth and Poverty Reduction in Mozambique." Working Paper 20, Regional Strategic Analysis and Knowledge Support System (www.resakss.org).
- United Nations Development Programme UNDP (1998&2003): *Human Development Reports Nigeria Oxford University Press Nigeria*
- Vosti, S.T. and E.D Reardon 1997. *Sustainability, Growth and Poverty Alleviation: A Policy and Agro ecological perspective*. Johns Hopkins University Press Baltimore, MD.
- Walle, S. and G. Cratty 2003. Is the emerging non-farm market economy, the route out of poverty in Vietnam? *World Bank Policy Research Working Paper January*. 2950: 16-25
- Wolfson, M.C. (1994). "When inequalities diverge" *American Economic Review* May Vol.84, No. 2 353-358.
- World Bank (1996) "Poverty assessment in the midst of plenty. The challenge of growth with inclusion in Nigeria". World Bank Poverty Assessment, May 31st Washington D.C
- World Bank (1993): Poverty reduction Handbook. The World Bank, Washington D.C