

PERCEPTIONS OF ENVIRONMENTAL FOOTPRINTS OF OIL AND GAS EXTRACTION IN SOUTHERN NIGERIA

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ABSTRACT

Southern Nigeria is the base of Nigeria's crude oil and gas. The activities of oil and gas (O&G) extraction orchestrated by mainly multinational companies have left most rural communities in the region vulnerable to environmental imbalances. These environmental impacts have resulted in debatable cases of socioeconomic and livelihood issues particularly agricultural problems and heightened cases of insecurity which have become recurrent topics of national and international debates.

This paper evaluates people's perceptions of the environmental impacts of O&G extraction in Southern Nigeria with a specific focus on the Niger delta region. The region is adjudged an agrarian society with most of its population almost solely dependent on the natural ecosystem as a source of their economic survival and livelihood. The results indicate that people are significantly different in their perceptions of the impact of the O&G industry based on socioeconomic differences. Yet, there seems to be a widespread dissatisfaction over the negative impacts of O&G extraction compared to its appreciative benefits.

The results specifically indicate high vulnerability to the negative environmental impacts of O&G extraction especially among farmers and fishermen in the region. The results thus, suggest a wide gap of income inequality which might be due to high rate of unemployment, and loss of livelihood as a result of the various negative impacts of O&G extraction on the environment. Hence, there is a need for improved and sustainable mitigation measures with high priority to empowering the youths, women, farmers and fishermen who seem to be the most vulnerable groups in the region.

Key words: *Agricultural Economics, Environmental Economics, Environmental Footprints, sustainable, Ecosystem, Oil and gas industry.*

JEL Classification: *Q2, Q3, Q4, O1, F6*

I.INTRODUCTION

Nigeria is one of Africa's major producers and exporters of crude oil. The bulk of Nigeria's oil and gas (O&G)¹ is extracted in the Niger Delta which situates within the southern region of the country. The region sits along the coastal trenches of the Atlantic Ocean geographically within the gulf of Guinea. Oil and gas in the region is extracted by mainly multinational companies owned by foreign investors who employ the services of a large number of local workers and foreign expatriates mostly from France, America, Germany, Britain, Russia, India and the Netherlands.

Southern Nigeria, mainly the Niger delta region is adjudged an agrarian society with most of its population almost solely dependent on the natural environment as a source of their economic survival and livelihood (Ekpebu & Ukpog, 2012). Among the major economic activities of the rural population include farming, fishing, and forestry activities such as hunting and lumbering. Thus, the operations of O&G extraction directly influence the sequence of economic and social wellbeing of the people.

There are recurrent national and international debates, and concerns among environmentalists over the deteriorating state of the region's ecosystem, coupled with public outcry against evident negative environmental and socioeconomic impacts of O&G extraction in the region (Azaiki, 2009; Eregha & Irughe, 2009). However, despite potential positive contributions of the oil and gas industry to national economy, crude oil extraction has been an issue of great concern in terms of its threat to the natural environment (Ogri, 2001; Ukpog, 2012). These negative impacts thus justify the need for guided policies on sustainable development and environmental sustainability. In other words, there is a need for environmental valuation, where people's perceptions of these impacts are assessed to guide fact based policy recommendations. Stakeholders in the oil industry need to be more committed to a constant monitoring and management of risk prone areas in order to avert further oil spills and explosions, and to ensure that obsolete pipelines are replaced or properly maintained.

This paper evaluates people's perceptions of environmental impacts of O&G extraction in the Niger delta region of Southern Nigeria. The emphasis is based on the fact that while crude petroleum remains a potential economic wealth, the processes of its extraction often come with various negative impacts ranging from environmental resource degradation to socioeconomic imbalances, as already discussed above. Our interest in the Niger Delta follows numerous literary reports and observable evidence of environmental impacts of the O&G industry in the region. The study also seeks to identify major areas of focus and offer a reference background to help policy makers and stakeholders in the industry in the quest to finding suitable mitigation measures. A brief review of environmental impacts of oil and gas extraction is presented below.

II.LITERATURE REVIEW

Environmental Impact of Oil and Gas extraction

Oil extraction pose undeniable damage to environmental resources such as vegetation, soil, water and air thus jeopardizing economic survival and livelihood of the people, especially in rural oil-producing areas where

¹ *African Economic Outlook (2013) Nigeria 2012. Issy les Moulineaux, France: African Development Bank Group.*

majority of the people are largely dependent on the natural environment for their livelihood (Ekpebu & Ukpong, 2012; Uyigue & Agho, 2007).

Most of the world's O&G are being transported through pipelines (Işeri, 2015; Zhiltsov, 2015). The entire pipeline construction process often brings about displacements of human settlements and loss of environmental resources including natural habitats; forest, water settlements, and farmlands. In Nigeria, a number of people have been left homeless and economically affected following numerous incidents related to pipeline network and explosions (Azaiki, 2009). There are a number of land and river O&G pipeline crossings in Nigeria, which are potential oil spill and explosion locations (Anifowose *et al.*, 2014).

Oil installations including pipelines used in transporting crude O&G across the region have also not only occupied and displaced potential farmlands and forest, but also pose explosion risks to environmental resources and human lives. It is evident that the O&G industry is prone to explosion risks which often affect environmental resources and humans (Anifowose *et al.*, 2012; Onuoha, 2007).

On the whole, environmental hazards have both present and long-term effects (Benka-Coker & Ekundayo, 1995; Osuji *et al.*, 2004), which occur physically and can easily be accounted for, and some long-term latent effects on human life and biodiversity, which occur in the future, and are often difficult to anticipate and incorporate in the costs-benefits analysis (Revesz, 1999; Ugochukwu & Ertel, 2008). The world thus risks increased incidents of climate change and global warming as demand for O&G increases (Valsson & Ulfarsson, 2011), while the O&G sector remains a potential threat to food security and human existence (Abii & Nwosu, 2009; Inoni *et al.*, 2006). Also, studies have shown that human population has been affected by O&G related hazards either by the limitations posed to the ecosystem or consumption of food items polluted by oil spill (Ordinioha & Brisibe, 2013; Peterson *et al.*, 2003).

Oil spillage is one of the most destructive of all hazards associated with O&G extraction, and its impact ranges from economic hardship to social misfortune, this is evident in the reported loss of massive arable lands, forests and water sources to oil spills in oil-producing areas (Birdsall & Subramanian, 2004). Oil spill also remains a threat to the environment in terms of natural resource loss and extinction of valuable species, with enormous wanton destruction of biodiversity, as reported in the Gulf of Mexico (Lin & Mendelsohn, 2012; Pezeshki *et al.*, 2001). In the event of oil spills especially within the marine environment, fish and other sea foods remain the most vulnerable (Hasle *et al.*, 2009; Votier *et al.*, 2005).

According to Peterson *et al.* (2003), environmental impacts of oil spillage also include persistent shoreline contamination and high mortality of wildlife species. Continuous exposure of aquatic habitat to crude oil makes it vulnerable to adverse health conditions of the organisms, poor growth and impact on reproduction, while also directly destroying incubating eggs of aquatic organism, especially those of fish (Heintz *et al.*, 2000).

In Nigeria, oil spillage has been a regular incidence with negative economic and environmental impacts. For instance, between 1976 and 1996, the country has recorded about 4,647 oil spills; with about 1,820,410.50 barrels of crude oil lost (unrecovered) to the environment with pending latent effects on environmental resources (Azaiki, 2009; Inoni *et al.*, 2006).

Gas Flaring is another controversial component of O&G extraction. Gas flaring is a routine practice of O&G companies carried out to flare-off unused gas from different installations and to reduce pipe pressure during

drilling. This activity heats up the atmosphere, produces extreme temperature and a lot of greenhouse gases accompanied by carbon flared into the environment; with detrimental effects on the ecosystem. Gas flaring is also a major cause of raised temperatures and acid rain, which affect human health and biodiversity (Ordinioha & Brisibe, 2013; Uyigue & Agho, 2007). Gas flaring has been another issue of concern in recent years, as the world is faced with serious challenge of climate change as a result of global warming (Galeotti *et al.*, 2006). The practice of gas flaring continuously heats up the atmosphere; promoting extreme temperature unsuitable for normal performance and survival of some valuable organisms (Elvidge *et al.*, 2009).

III.OBJECTIVES OF THE STUDY

The main objective of the study is to evaluate people's perceptions of the environmental footprints of O&G extraction in Southern Nigeria with specific focus on the Niger delta region. The study aimed to achieve three cardinal specific objectives including; to:

- 1) Evaluate people's perceptions of the environmental impacts of O&G extraction using structured debriefing statements.
- 2) Identify vulnerable occupational groups mostly affected by environmental impacts of O&G extraction in the region, with a view to enhancing appropriate mitigation measures targeted at vulnerable occupational groups within the population.
- 3) Evaluate the statistical relationship between socioeconomic characteristics of the rural population and their perceptions about the oil and gas industry in the region. The study thus aimed to assess the influence of socioeconomic characteristics of the people on their perceptions.

IV.HYPOTHESES

The study was based on the following hypotheses; that:

- 1) There is no disparity in people's perceptions of environmental impacts of oil and gas extraction in Southern Nigeria.
- 2) There is no occupational group that is distinctively vulnerable to environmental impacts of oil and gas extraction in Southern Nigeria.
- 3) There is no statistical relationship between socioeconomic characteristics of the people and their perceptions of the impact of oil and gas extraction in Southern Nigeria.

V.METHODS OF DATA COLLECTION

This study was carried out in oil producing communities in the Niger delta region of Southern Nigeria, where the bulk of Nigeria's crude oil and gas is extracted. Three major oil-producing States in the region; Akwa Ibom, Bayelsa and Rivers were selected for the study.

Data were collected through administration of survey questionnaires. A total of 446 questionnaires (an average of 30 respondents from each of the communities), were administered to respondents selected from fifteen oil producing communities, including: Akwa Ibom State: Edo, Iko, Mkpanak, Unyenge, Ukpenebang Bayelsa State:

Odi, Imiringi, Etiama, Okotiana-Gbarain, Ogoibiri; and Rivers State: Chokota community, Igbo-Etche, Alesa-Eleme, Obigbo, Biara. The study used basic statistical tools mainly tables indicating means, standard deviations and percentages to present results on people's perception of environmental impacts rated using a five-point Likert scale measurement. People's perceptions were assessed using debriefing statements as highlighted in Table 1.

The Ordinal logit regression analysis was used to determine the relationship between socioeconomic variables and people's perceptions assessed using debriefing statements. The ordinal logistic regression (orderedlogit) analysis is presented in Table 2, below.

VI.RESULTS

The Perceptions based on debriefing statements

Respondents' perceptions of the impacts of the O&G industry were assessed using a combination of statements and debriefing questions. The respondents were asked to rate their responses based on the respective statements, under a five-point Likert scale ranging from 'strongly disagree' to 'strongly agree'; the results are presented in Table 1 below.

Table 1 Distribution of respondents based on agreement to debriefing statements

Case	Statement	Levels of agreement in percentage				
		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1	Oil and gas extraction has caused environmental problems in my community	1.6	1.3	2.7	16.6	77.8
2	Environmental problems in my area (or community) do not affect me and my family	62.8	18.2	13.9	3.4	1.8
3	I will not benefit from any change that will mitigate the environmental impacts of O&G extraction	45.5	30.7	16.8	4.5	2.5

Note: Each statement is considered a case in the model for ease of analysis as applied in Table 3.

1) "Oil and gas extraction has caused environmental problems in my community"

The respondents were asked to rate their perceptions of the impact of the O&G industry on the environment, using the statement; "oil and gas extraction has caused environmental problems in my community". The result is presented in Table 1 above. The environment is defined in terms of its components, and comprises the air, land,

water resources, plants, animals and humans, therefore, a threat to any of these components is a direct threat to the environment. With reference to environmental resources (and ecosystem services), humans face a direct effect of changes in the environment. As previously noted, the environment has been vulnerable to both conscious and accidental damage as a result of human activities which has triggered increased global debates on environmental sustainability, protection and conservation (Kennedy & Cheong, 2013; Gastineau *et al.*, 2014; Halkos & Matsiori, 2014).

As indicated in Table 1, majority (77.8%) of the respondents strongly agreed that O&G extraction has caused environmental problems in their communities. There are reported cases of the degrading nature of the Niger Delta environment (including land and forests), as a result of O&G extraction, with negative implications on the people and their sources of livelihood (Idemudia, 2014; Kuenzer *et al.*, 2014; Lekwot *et al.*, 2014). The result also support the reports that poverty in the region may be connected with the impact of O&G extraction on the environment which has gross consequent effects on the livelihood of the people, who depend mainly on agriculture, fishing and forestry activities. These views are also shared by Aaron (2005); Nyananyo (2015) and Osaghae (2015).

2) “Environmental problems in my area (community) do not affect me and my family”

Respondents were asked to rate their agreement or disagreement based on the statement; “environmental problems in my area (or community) do not affect me and my family”. The result indicates that the majority (62.8%) of the respondents strongly disagreed with the statement. On the reverse, the result indicates that majority of the respondents perceive that they and their families are affected by environmental problems which are a part of the negative footprints of O&G extraction in the region. The question helped to assess perceptions of impact of the industry on individuals and their households.

3) “I will not benefit from any change that will mitigate the environmental impacts of O&G extraction”

To assess people’s perceptions of the benefits of a policy to mitigate the environmental impacts of O&G extraction in the region, respondents were asked to rate their perceptions based on the statement; “I will not benefit from any change that will mitigate the impacts of O&G extraction”. The result indicates that the majority (76.2%: 45.5% strongly agreed and 30.7% agreed) of the respondents indicated disagreement with the statement, which suggests that the respondents perceived that they would benefit from a change that would bring about mitigation of negative impacts of O&G extraction in the region. Therefore, instead of strategies targeted at post hazard remediation, where only affected people or communities are often compensated, the government and oil firms could design a master plan towards achieving a change(s) that would ensure sustainable mitigation measures to achieve environmental sustainability and improved livelihood for the people. Such plan might include a sustainable programme for employment, skill acquisition/job creation and rural development, which should cut across communities (not only host oil-producing communities) in the region.

Overall, the results in Table 1, shows how people differ in their assessments or perceptions of the O&G industry, which might have affected individual or collective relationship with oil firms. Such disparity could be as a result of differences in the location or distance from the impact zone, or influence of socioeconomic differences. To investigate this, although distance effect was not captured in this study, we employed the

ordered logit model to enable determination of the influence of the socioeconomic profiles of the respondents on their perceptions. The ordered logistic regression (ordered logit) analysis is discussed below.

VII.ORDERED LOGIT ANALYSIS

Three debriefing statements (cases) were used to evaluate the respondents' perceptions of the impact of O&G extraction in the region. The different levels of agreements were designated as 'thresholds' in the ordered logit model such as strongly disagree: threshold 1, disagree: threshold 2, neither agree nor disagree: threshold 3, agree: threshold 4 and strongly agree: threshold 5. The choice of the ordered logit model was mainly because of the ordinal nature of the dependent variables. The ordered logit model helped to estimate probabilities of the independent variables which provide an interpretation of the statistical influence of the independent variables on the dependent variables (levels of agreement) with reference to the p-values. Variables such as age, income and family size, were labelled as continuous and covariates in the model unlike gender (dummy variable), occupation (categorical variable) and educational levels (dummy variable) labelled as factors in the model. For occupation in particular, the variable, fishing (OCC = 8) was set as a reference variable in the model. The summary of ordered logit analysis is presented in Table 2 below.

Table 2 Descriptive Statistics of Variables used in the Ordered Logit Analysis

Variable	Label	Description and coding	Mean	Standard Deviation
Gender	GEN	Gender specifications of the respondents 1 = Male 0 = Female	0.65	0.48
Educational Levels	EDU	Educational status of the respondent 1 = Formal education 0 = Non-formal education	0.86	0.35
Age	AGE	Age of the respondent ranging from 18 – 64 years, labelled as a continuous variable.	40.04	11.01
Family size	FSI	Family size of respondent ranging from 1 to 10 people, labelled as a continuous variable	4.08	2.25
Income	INC	Monthly income of respondents ranging from N750 to N150000, labelled as a continuous variable	23952.30	26678.78
Occupation	OCC	Occupational status of the respondents 1 = Farming; 2 = Government worker; 3 = Oil company worker 4 = Other company worker; 5 = self-employed; 6 = Unemployed; 7 = Student; 8 = Fishing	4.20	2.14
Thresholds		Levels of agreement (ordinal data form)		

	1 = strongly disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; 5 = strongly agree		
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Note: Occupation labelled as OCC has the following component variables as applied in Table 3 below: OCC=1: Farming, OCC=2: Government worker, OCC=3: Oil company worker, OCC=4: Other company worker, OCC=5: Self-employed, OCC=6: Unemployed, OCC=7: Student, OCC=8: Fishing.

Table 3. Ordered Logit Model Estimation for Respondents' perceptions of the O&G Industry

Variable	Case 1	Case 2	Case 3
	Coefficient	Coefficient	Coefficient
AGE	0.039**	-0.005	-0.044*
FSI	-0.020	0.073	0.178*
INC	-3.07E-006	-7.621E-007	-5.141E-006
GEN = 0	0.113	0.113	-0.195
EDU = 0	-0.464	0.054	-0.308
OCC = 1	-15.917*	-2.288***	1.166
OCC = 2	-16.921*	1.688**	2.180*
OCC = 3	-17.347*	3.556*	2.324*
OCC = 4	-18.267*	2.229**	1.901**
OCC = 5	-17.253*	1.635**	2.286*
OCC = 6	-17.012*	1.067	2.665*
OCC = 7	-17.852*	1.744**	2.743*
Log Likelihood	579.929*	844.756*	1036.511*
Pseudo R ²			
Cox & Snell	0.108	0.201	0.153
Nagelkerke	0.143	0.229	0.166
McFadden	0.080	0.106	0.066
Observations	446		

*Note: Each debriefing statement was designated as a case in the model, such that the first statement in Table 1 was labelled as 'Case 1', and so on. Levels of significance: * $P \leq 0.01$; ** $P \leq 0.05$; *** $P \leq 0.10$. Threshold specifications: 1 = strongly disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; 5 = strongly agree.*

The result for Case 1, shows that higher age profile is associated with strong agreement to the statement, suggesting that perceptions of environmental impacts of O&G extraction could be subject to years an individual have experienced the various changes that occur within the environment. Also, fishermen more than others are found to indicate strong agreement to the statement, which suggests that fishermen may be more vulnerable or mostly affected by the negative changes in the environment as a result of oil and gas extraction.

The result for Case 2, shows that compared to fishermen, all other occupation groups, except farmers, agreed more to the statement that environmental problems in the region do not affect them and their families. This indicates that farmers and fishermen more than others disagree to this statement, suggesting perception of high impact of environmental problems on farmers and fishermen, as well as their households. This result corroborate the fact that in the event of an oil spill or oil and gas explosion, farmlands and the marine environment remains the most affected (Hasle *et al.*, 2009; Ekpebu & Ukpong, 2012; Votier *et al.*, 2005). It is obvious that environmental problems might include changes that affect the outputs and incomes of farmers and fishermen, thus affecting food security and general wellbeing of their dependant households.

The result for Case 3, shows that age has a negative relationship with people's agreement to the benefits of mitigating environmental problems in the region. This suggests that with the growing experience of environmental impacts, people who by reason of age have experienced the consecutive impacts of environmental problems perceive mitigation of these impacts would benefit them. On the other hand, the positive relationship of family size to agreement of the statement cannot be substantiated. However, the result shows that all occupation group except farming compared with fishing, has significantly positive relationship to people's agreement to the statement, suggesting that fishermen perceived they would benefit more than others from mitigation of environmental impacts of O&G extraction in the region.

An overall assessment of the ordered logit results indicates interesting similarities in the views of farmers and fishermen, suggesting a feeling of high vulnerability among them, to the negative impacts of the O&G extraction in the region. Thus, there is a need for improved mitigation measures, with high priority to young people, farmers (Most of whom are women) and fishermen who seem to be the most vulnerable groups in the region.

VIII.CONCLUSION AND RECOMMENDATIONS

The study evaluates people's perception of the oil and gas industry with respect to extraction, and has identified vulnerable groups mostly affected by environmental impacts of O&G extraction in Southern Nigeria ². The widespread negative perception of the O&G industry among the respondents suggests an obvious evidence of inequality in the distribution of oil wealth and benefits among different groups in the region. The negative impacts of O&G extraction may have triggered the seeming perception of the O&G industry as a resource curse, which has exacerbated increased protest and cases of insecurity in the region in recent years. It is thus important that

- 1) O&G companies improve upon their community relations and corporate social responsibilities across the region, to help mitigate the negative impacts of the industry. Such a gesture should also include non-oil-producing communities which may also be directly or indirectly affected by impacts of O&G extraction.
- 2) In addition, companies and other stakeholders in the oil industry should always comply to the conditions stipulated in the memorandum of understanding (MOU) normally signed with the respective communities.

² World Bank (2013) *Nigeria Economic Report (No. 1)*. Washington, DC: World Bank

- 3) Also, O&G companies in the region might have to promote programmes to support orientation and awareness campaign where the people would be properly informed of the benefits of the industry, as well as implications of O&G extraction with ways of coping with its impacts. Such programmes might involve collaborations with the media as well as educational and research institutions.
- 4) Above all, stakeholders in the industry should make sincere effort towards preventing avoidable negative environmental and socioeconomic impacts of O&G extraction.
- 5) In particular, there is a need for improved and sustainable mitigation measures with high priority to empowering the youth, women, farmers and fishermen who seem to be the most vulnerable groups in the region.

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