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ASSESSMENT OF IMPACT SIGNIFICANCE OF OIL SPILL IN THE NIGER DELTA, NIGERIA

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ABSTRACT

Oil pollution is a serious threat to the bio-physical environment and consequently the socio-economic life of the people living within the oil bearing environment. This paper examined the significance of oil contamination on the socio-economic life of the people of Mgbede in Rivers State, Ekakpamre and Kwale in Delta State, with a view to determining the need for mitigation. Survey was conducted on the communities and with a well-structured questionnaire the data for the study were generated. Twelve (12) very simple and direct questions that constituted the impact indicators in the key areas of impact were rated against the impact dimensions of *Frequency, Magnitude, Significance, Risk and Extent *using the five-level Likert scale as follows: very Low (1); minimal (2); moderate (3); high (4); very high (5). The mean, which is the test value was calculated and used to test the hypothesis. The null hypothesis formulated was to determine the severity of impact on the host communities under study. One sample t-test (OST) was used to test the significance of the perceptions of the respondents on the degree of damages resulting from oil spill in the study locations. The p-values for all the five impact dimensions were found to be less than 0.05 ($p<0.05$), and so, the null hypothesis was rejected while the alternative, which is the research hypothesis, which hitherto stated that the damages resulting from oil spill are significant to warrant mitigation was accepted. Mitigation was therefore needful and hereby recommended.

INTRODUCTION

Assessment of overall impact significance of oil spill provides an indication of the extent to which the impacts of oil spill are felt by the target community. Depending on the degree, it might necessitate mitigative or adaptive measures or even call for total eradication of the problem source where possible. Oil spill incidents have been going on, unabated, in Nigeria's oil bearing communities since commercial production commenced in 1958 - a clear indication that it is an inevitable consequence of oil production activities. Spilled oil could result in impacts of great significance and high residual intensity, especially in cases of large scale spill or oil with extremely high toxicity. The severity of environmental damages caused by oil spill depends on the quantity of spill, type of oil, viscosity, toxicity, location, among other factors. Crude oil contamination and oil spillage are ways in which human activities have affected our natural ecosystem and the continuous release of contaminated oil effluents and untreated domestic oil waste-products have also been reported as threats to the integrity of the environment (Omaka *et al.*, 2011). Human beings get affected by the devastating impacts of spills. The Niger Delta region is dominated by rural communities that depend solely on the natural environment for sustenance, living and non-living livelihood (UNDP Report, 2006). They are richly endowed with natural resources and subsistent fishing and farming are their major occupations before the discovery of oil in their land. Intensive oil activities in this region are accompanied by huge environmental damages of all sorts. The world today recognises the significance of environmental sustainability to the development of the nations (Egbe and Thompson, 2010). This will remain a mere dream if the spate of oil spill incidents is not addressed. Environmental impact significance can be expressed in a matrix of the value (or sensitivity) of a receptor and the magnitude of the impact. The method brings structure to complex interactions and takes a range of factors into account, including extent, duration and severity of impact, whether it is a positive or negative, direct or indirect impact (Coffey Natural Systems, 2009). This paper examines the significance of impact of oil spill on the host communities.

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The assessment of the impact will be based on selected impact indicators rated against some impact dimensions using the five-level Likert scale to determine the extent of damages resulting from oil spill on the environment.

Statement of The Problem

Oil spill in Nigeria has created serious environmental problems which readily translated into social disequilibrium. The quest for hydrocarbon exploitation in Nigeria is a notable venture but the recklessness and apparent disregard to the environment with which this is pursued leaves much to be desired. In less than two decades of oil exploitation in the country, the environment has been inflicted with irredeemable damage due to oil spill. Oku (2011), quoting from Shell International Petroleum Company Report (1995) reported that in the nation's hydrocarbon history, the 1980 oil spill, is the largest so far when 400,000 barrels (64,000m^3) of Texaco oil spilled and the Shell Petroleum Development Company terminal tank failed at Forcados spilling about 580,000 barrels (92,000m^3) of oil into the host environment. According to Zabbey (2009), available records indicate that, the Niger Delta region of Nigeria experienced on the average, 273 oil spills resulting in about 115,000 barrels of crude oil worth US $ 5.64 million (valid with the current rate of US $49 per barrel) spilled annually from 1976 - 2001, making the region the most vulnerable to oil spill than anywhere else in the world. Steiner (2008), once stated that oil spills in the Niger Delta have been extensive, difficult to assess and often under reported.

The terrestrial and the aquatic environments act as receptors to this toxic material. The same soil and water are the major livelihood assets of the host communities as they generally depend solely on farming and fishing to earn their living. These assets are fast being degraded, devastated and devalued, so much so, that they no longer function as originally destined. Oil pollution starves the soil of relevant nutrients. Anoliefo and Vwioko (1994), Agbaogodo, Erudorad Akparobo (2006), Gill, Nyawuame and Enikhametalor (1992), Emeyan, Akpoborie and Akpohonor (2008), Essaghah (2008), Legborsi (2007), Nwogwugwu, Aloa and Egwuonwu (2012), Ikpatt and Scoth (2013), Ikelegbe (2006), are among notable authors who have identified the monumental socio-economic, socio-cultural and socio-political implications of oil spill on the environment of the host communities. Their fundamental rights to existence are threatened consequent upon the fact that their normal sources of livelihood are continually disrupted with little or no legislative protection against these environmental destruction. Leakages and fire incidents are also associated with gas production and transportation (Collins *et al.*, 2009). The problem of the current study is therefore encapsulated in the following research questions.

- To what extent does the crude oil spill affect the host communities.
- How significant is the impact of oil spill to warrant mitigation.

The answers to the above research questions would address the strategic objective of the present study which seeks to examine the extent of damages resulting from oil spill on the soil and whether the damages are statistically significant to warrant mitigation.

Hypothesis

Drawing from the research questions, and to achieve the set objective, the following null hypothesis was formulated.

Ho: The damages resulting from oil spill are not significant to warrant mitigation.

The goal of the hypothesis is to determine the severity of impact of oil spill on the host communities under study.

MATERIALS AND METHODS

Study Area

Nigeria has a coastal line of approximately 85km towards the Atlantic Ocean, lying between latitudes 4^o 15'N to 4^o 50'N and longitudes 5^o 25'E to 7^o 37'E, with a land mass of about 28,000sqkm within the coastal region, Adati (2012). This coastal area consists of freshwater swamp, mangrove swamp, dry lands interlaced with meandering channels and creeks. The Niger Delta is located within the Atlantic coast line of Southern Nigeria. It is the world's second largest delta, Awosika (1995). Mgbede in Ogba/Egbema/Ndoni Local Government Area of Rivers State, Ekakpamre in Ughelli South Local Government Area and Kwale in Ndokwa West Local Government Area in Delta State, all within the Niger Delta region, shall constitute the study locations. According to the 2006 national census figures, the Niger Delta has a population of about twenty five million people (National Bureau of Statistics, 2006). Rivers State has an estimated population of 5,185,400 while Delta State is estimated to have about 4,112,445 people according to the same source.

Methodology

This study basically adopts the survey research method. The survey conducted on the communities was used to generate the data with a well structured questionnaire. The relevant personal characteristics of the respondents, population and information on the problems due to oil spill form the basic structure of the questionnaire. The essence of this survey is to ascertain the extent to which the incidence of oil spill has affected their source of livelihood and the sustainable use of their land resource as well as the cumulative consequences on their social, economic and even spiritual needs. The questionnaire comprised very simple items or questions strictly falling within the scope of the study so that the respondents don't deviate from the study focus. It is in two sections. Section A addressed the background and personal characteristics of the respondents while the responses on the impact of oil spill on the community made up section B. This section has 12 very simple and direct questions that constituted the impact indicators which were the key areas of impact. These were rated against the impact dimensions of *Frequency, Magnitude, Significance, Risk and Extent* using the five-level Likert scale as follows: very Low (1); minimal (2); moderate (3); high (4); very high (5). The mean, which is the test value was calculated thus, and used to test the hypothesis:

$$\frac{5+4-3+2+1}{5} = \frac{15}{5} = 3.0$$

This was equally used to evaluate the respondents' opinion of the questionnaire items listed in section B.

Identification of Respondents

The respondents were selected through random varying internal variant of the systematic sampling technique (Berry and Baker, 1968; Aprioku, 1991), in Essaghah (2008), to ensure that those to be administered the questionnaire were relevant stakeholders in the community. These were made up of the *teachers, clergymen, youth leaders, traditional council members, oil/gas based workers, civil servants and farmers*. Samples were drawn from each of these group of respondents. Nnodu (2009) quoting Nwana (1981), stated that if a population is a few hundreds, a 40% or more sample will do, if many hundreds, a 20% sample will do, if a few thousands, a 10% sample will do, and if several thousands, a 5% or less sample will do. Using this as a basis, the researcher adopted a minimum of 50% to draw a sample from each unit that made up the seven groups of respondents.

Statistical Tool for Hypothesis Testing

To test the hypothesis, one sample t-test (OST) was used to test the significance of the perceptions of the respondents on the extent of damages resulting from oil spill on the study locations. This hypothesis, as earlier stated, sought to know whether the damages resulting from oil spill in the community are significant to warrant mitigation. This statistical tool tests if the mean of a variable is significantly greater than the posited or test value which in this study is 3.0, got from the ranking of the five-level Likert scale. The hypothesis was tested at 95% confidence level using the Statistical Package for Social Sciences (SPSS).

RESULTS AND DISCUSSION

From Table 1, the valid response returned for Ekakpare was 88.5% out of one hundred and thirteen questionnaires distributed to them, 87.0% was recorded for Kwale from the one hundred and fifteen distributed to them, while Mgebede recorded 87.72% out of the one hundred and fourteen questionnaires administered to them. The average valid response rate based on the total number of questionnaires distributed in the entire study area came to 87.74% leaving only 12.28% as invalid or unreturned.

The rating of the respondents was quite revealing on several environmental issues and questions relating to the impact of oil spill on the community. Most of the ratings fell within 'moderate' and 'very high' impact levels (3-5). For instance, on '*oil spill incidents'* impact indicator, the mean ratings for all the impact dimensions were between 'moderate' and 'very high'. The minimum score was 3.55 under 'importance' while the 'risk' dimension posted the highest with 4.47. In a similar way, under impact indicator, serial number 2 (loss of productive land), the 'frequency' dimension got 4.54 while 'magnitude' had 3.59 which was the lowest. The values for the rest of the impact indicators were as presented in Table 2. Out of the 60 mean rating scores recorded, only 9 (15%) fell between 3.0 and 3.99, and none was below 3.5. The other 51 scores (85%) were between 4.1 and 4.57. The 4.1 rating is equivalent to 82%, therefore the impact of oil spill on the socio-economic life of the communities under study had an overwhelming majority rating of 85% and puts the socio-economic damage caused by oil spill at 82%. This result is consistent with findings of Ikwuegbu (2007) which put the environmental damages of oil activities in the Niger Delta at 82%.

In Opukri and Ibaba (2008), environmental degradation arising from oil spills results in internal displacement of communities, diminished productivity of farming and fishing, mass relocation, occupation and income losses, poverty, induced voluntary and involuntary migration, loss in ancestral homes and familiar surroundings, loss in religions and cultural artefacts, youth restiveness and inter community clashes. All these socio-economic problems associated with oil spill very much agree with the findings of this study as presented in table 2. The damages are quite high judging by the rating results. Rural-urban migration of able-bodied young men and women as well as land resource degradation occasioned by incessant oil spills, were implicated for the relatively old age of the farmers (Inoni *et al,* 2006). Important production parameters such as crop yield, land productivity and farm income, measured in the study indicate that oil spill has a statistically significant effect on them. Similar findings were noted in Baker (1970b), Gbadegesin (1997) and Ihejiamaizu (1999). The negative impact of oil spill on the socio-economic life of the affected communities is further emphasised by the results of this study.

Test of Hypothesis

Null Hypothesis (H_o): *the damages resulting from oil spill are not significant to warrant mitigation.*

Table 1. Distribution of Questionnaires and Results

S/N	Respondents	Ekakpamre			Kwale			Mgbede			Average
		Distribution	Valid	% Valid	Distribution	Valid	% Valid	Distribution	Valid	% Valid	
1	Teachers	16	14	87.5	25	23	92	16	16	100	93.16
2	Clergy men	5	5	100	18	16	88.89	10	10	100	96.3
3	Youth Leaders	10	7	70	12	11	91.67	10	7	70	77.22
4	Traditional Council Members	20	17	85	15	12	80	30	24	80	81.67
5	Oil/Gas based workers	30	28	93.33	5	3	60	18	16	88.89	80.74
6	Civil Servants	12	10	83.33	25	24	96	15	13	86.67	88.67
7	Farmers	20	19	95.0	15	11	73.33	15	14	93.33	87.22
	Total	113	100	88.5	115	100	87.0	114	100	87.72	87.74

Table 2. Mean Rating of Impact Indicators against Impact Dimensions. By the Respondents

S/N	SOCIO-ECONOMIC INDICATORS	IMPACT DIMENSIONS				
		Frequency	Magnitude	Importance	Risk	Ext.
1	Oil spill incidents	4.12	3.60	3.55	4.47	4.38
2	Loss of productive land	4.54	3.59	4.54	4.47	4.38
3	Reduction in Agricultural yield	4.57	3.60	4.54	4.47	4.38
4	Land despoliation/degradation	4.39	4.29	4.44	4.25	4.19
5	Oil spill fires	4.39	4.30	4.44	4.27	3.97
6	Loss in soil fertility/leaching of soil nutrients	4.70	4.31	4.54	4.26	3.95
7	Reduction in man power available for land cultivation	3.57	4.30	4.49	4.26	3.96
8	Loss of sacred forests	3.57	4.06	4.48	4.30	3.94
9	Loss in income	4.49	4.49	4.53	4.30	4.16
10	Exodus of Youths from the villages	4.49	4.50	4.46	4.19	4.16
11	Insecurity/Youth restiveness	4.49	4.50	4.49	4.20	4.13
12	Loss in ethical values	4.50	4.49	4.34	4.19	4.13

Table 3 (a-k). Statistical Analysis for Testing Hypothesis Two (One Sample T-Test)

(a) One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Impact Dimension A	300	4.3011	.19134	.01105

(b) One-Sample Test

	Test Value = 3.0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Impact Dimension A	117.775	299	.000	1.30106	1.2793	1.3228

(c) One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Impact Dimension B	300	4.0894	.30603	.01767

(d) One-Sample Test

	Test Value = 3.0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Impact Dimension B	61.658	299	.000	1.08941	1.0546	1.1242

(e) One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Impact Dimension C	299	4.0907	.16999	.00983

(f) One-Sample Test

	Test Value = 3.0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Impact Dimension C	110.945	298	.000	1.09068	1.0713	1.1100

(h) One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Impact Dimension D	300	4.32	.448	.026

(i) One-Sample Test

	Test Value = 3.0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Impact Dimension D	50.935	299	.000	1.316	1.27	1.37

(j) One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Impact Dimension E	300	4.2062	.40589	.02343

(k) One-Sample Test

	Test Value = 3.0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Impact Dimension E	51.472	299	.000	1.20621	1.1601	1.2523

The goal of the hypothesis, which was to determine the severity of impact, was achieved using the one sample t-test. For the impact dimensions, the calculated t-values and probability values, p-values, are shown in Tables 3 (a-k). Based on Tables 3 (a and b) the sample mean is 4.3011 while the test value (mean) is 3.0. The calculated t-value is 117.775 while the p-value is 0.000. Since the p-value is less than 0.05 which is the probability value of committing type one error, the conclusion therefore is that impact dimension A (frequency), is significant at 95% confidence limit. This applies to Tables 3 (c to k). for impact dimensions B to E (magnitude, importance, risk and extent).

Table 3. Summary of t and p- Values For all Impact Dimensions

S/No	Impact Dim	t	p	Remarks
1.	Frequency A	117.775	0.000	Significant
2.	Magnitude B	61.658	0.000	"
3.	Importance C	110.945	0.000	"
4.	Risk D	11.125	0.000	"
5.	Extent E	51.472	0.000	"

Source: Researcher's Computation

Table 3 presents the summary of the t and p - values for all the impact dimensions. The p-values were all less than the stated level of significance.

Decision Rule: If the p-value for any of the five impact dimensions is less than 0.05 ($p<0.05$) the null hypothesis is rejected while the alternative which is the research hypothesis is accepted. In this study, the alternative hypothesis, which states that the damages resulting from oil spill are significant to warrant mitigation, is therefore accepted.

Conclusion

The findings of this study indicate that crude oil has deleterious effects on the variables examined which invariably result in socio-economic and general environmental decay. Vast stretches of farmland are lost to spill, denying the communities of their main sources of livelihood. Arising from this are the social problems of youth restiveness, forced migration, psychological disorientation. The economic loses are evident too, as there is colossal loss of income and abject poverty.

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