

# Preparedness and Mitigation Measures for Oil and Gas Pipeline Vandalization in the Niger Delta Region of Nigeria

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## Abstract

Owing to poor preparedness and mitigation measures for oil and gas pipeline vandalization in the Niger Delta Region of Nigeria, there have been series of spills that have now reached life threatening levels. This study set out to investigate factors that affect preparedness and mitigation measures for crude oil pipeline vandalism in the study area. The thrust of the study was to unravel the spatial variation in the preparedness and mitigation measures for crude oil pipeline in the region. The study used the survey research method and primary data was sort using questionnaire. The target population were heads of household and workers of multinational companies working in the area. Analysis of variance was used for hypotheses testing at the 0.05 level of significance. The study revealed that the companies' preparedness options were, use of hazard, risk and vulnerability assessment (76%). Both the community (42%) and companies (76%) respondents averred that the preparedness measure adopted in

the area were less effective for combating the menace of pipeline vandalism. The mitigation practices against pipeline vandalization adopted included awareness creation, promoting community participation, community policing, community-based pipeline surveillance, community by laws, right of way, punishment for offenders, and excommunication. Majority of the respondent whether community respondents (48%) or companies respondents (84%) suggested that, the adopted mitigation measures were not effective. The ANOVA model was significant at  $p < 0.05$  ( $F, 14$  sig 0.000) meaning that there is statistical significant variation in the level of preparedness for oil and gas pipeline vandalization in the study area. Similarly, the ANOVA model that measured the spatial variation in mitigation measures showed that the model is significant at  $p < 0.05$  ( $F, 16.83$ , sig 0.000), meaning there is statistical significant spatial variation in the level of disaster mitigation for oil and gas pipeline vandalization in the study area. The study recommends improvement in surveillance technology, creation of awareness of the dangers of pipeline vandalism to the locals, amongst others.

**Keywords:** Vandalism, Preparedness, Environmental-degradation, Niger-Delta

## 1. Introduction

The Niger delta region is the main area where oil is produced in Nigeria and a large proportion of the area are wet lands and represents the largest in sub-Saharan Africa (Achumba, Ighomereho, & Akpan-Robaro, 2013; Adekola, Fischbacher-Smith, Fischbacher-Smith, & Adekola, 2016). Data shows that around 40b barrels of crude oil reserves and a large amount of gas deposits (Adekola & Igwe, 2014). The oil sector account for over 90% of foreign exchange earnings for Nigeria and the bulk of it comes from the Niger delta region (Adishi & Hunga, 2017). However, the area is also the most polluted in Nigeria, and this is due to oil pipeline vandalism and poor response to crude oil spill disasters over the years (Ahmadu & Egbodion, 2013; Aigberua, 2017; Ameh, 2013). In the opinion of Atubi, (2015) several factors account for the degradation of the area, which include; gas flaring, industrial pollution, oil spillage, deforestation, coastal flooding (Dalby, 2014). Efforts of government to curb the menace of environmental degradation has met with corruption, fraud and dissatisfaction in the region (Daniel, 2016).

Over the years, crude oil spillage through pipeline vandalism is considered one of the major problems of the region (Okoli & Orinya, 2013). Rising cases of pipeline vandalism by militant groups have significantly affected sources of revenues of government and oil companies operating in the region (Okoli & Azom, 2017). There has been diverse opinion regarding the proliferation of militant groups in the area, where as some researchers claim that the militants started to destroy crude oil pipeline to show their anger towards government, for neglecting the area and allowing hunger and diseases to pervade the area (Okon, 2014), others claim that, the militants are mere greedy persons looking for an excuse to make quick wealth (Okonkwo, Kumar, & Tylor, 2015; Salau, 2016). Whichever way we chose to look at it, government presence in the area is minimal on one hand, and on the other hand, some of the locals are greedy and they want to make quick money (Wizor & Wali, 2020). The consequence of this is that the pipelines are continuously vandalised at the expense of the environment and sustainable national development.

The rate of pipeline vandalization in the study today is alarming and points to the fact that the preparedness level of the oil companies and government to protect the oil pipelines is weak (Sanusi, Onovo, & Isa, 2016). There continues to be sales of locally refined products in the area, which are by products of stolen crude oil. The mitigation mechanisms in the area are also very weak, so that the environmental consequence of crude oil pipeline vandalism in the area is so costly for humans and the environment. This study therefore investigates the spatial variation in preparedness and mitigation measures for oil and gas pipeline vandalization in the Niger Delta Region.

## 2. Materials and Methods

This study was carried out in the Niger Delta region, which spreads from Aboh (5°33'49" N & 6°31'38" E) in the North to palm point (4°16'22" N & 6°05'27" E) in the South. The East-West limit is between Benin River estuary (5°44'11" N & 5°3'49" E) in the West and Imo River estuary (4°27'16" N & 7°35'27" E) (see Figure 1) extending towards Guinea gulf of West Africa (Shittu, 2014).

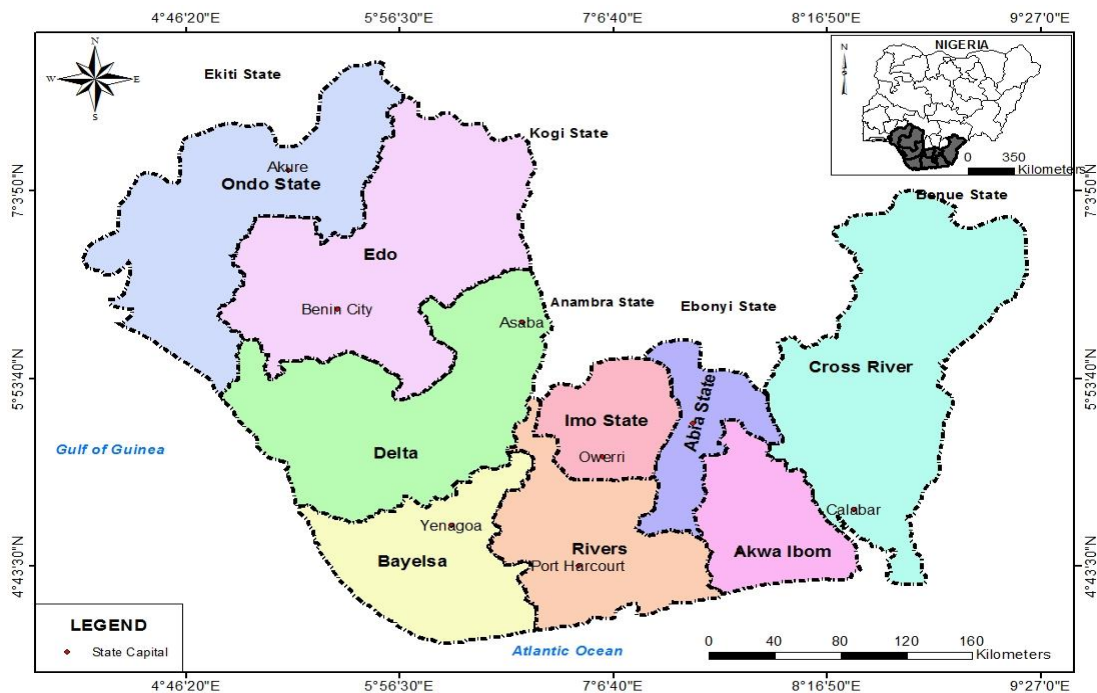


Figure 1. Niger Delta Region

(Source: Cartography and GIS Unit, Dept. of Geography and Env. Mgt. UNIPOINT, 2020).

The states domicile in the region include Abia, Akwa- Ibom, Bayelsa, Cross-River, Delta, Edo, Imo, Ondo, and Rivers states. The climate is classed the topical type based on the koppens classification. Rainfall thus ranges from 1950mm in the north sections to 2850mm in the south and coastal sections of the area. Mean temperature appears to be slightly uniform across the region and ranges 31 degrees in the dry season to 26 degrees in the wet periods. The area was initially agrarian, and it was common to see people engaged in farming or

animal rearing. More recently, after the discovery of oil and the consequent environmental pollution, the area has become remarkable for environmental pollution and not suitable for agriculture. The ability of the environment to self-regulate is no more possible as spills continue to occur in the area due to vandalism. Albeit, locals continue to fish in the very polluted rivers and consume same fishes and sea foods, thus it is common to see local manifest diseases common with persons that have consumed excess of heavy metals and hydrocarbons (Sanusi et al., 2016).

This study adopted the cross-sectional research design. The target population were locals and MNOC/IOCs. The study used simple random sampling technique. The total population of the area is as presented in table 1. The Taro Yamane equation was used to determine the sample size and 400 respondents were determined for each of the states. This made the total respondents for the locals 1600. On the other hand, 50 MNOC and IOCs staff selected based on staff strength were 50 persons. The total sample size for the study therefore became 1650, albeit 1560 of the questionnaire administer to the locals were returned.

Table 1. Projected Population of the Study

States	LGAs	Population	Taro Yamane Sample Size	Percentage in Projected Population	Questionnaire Proportion (Target Population)
Akwa Ibom	Ibena	113,450	400	54.2	217
	Esit Eket	96,044		45.8	183
Total		209,494			
Rivers	Eleme	288,315	400	50.2	201
	Ikwerre	286,399		49.8	199
Total		574,714			
Delta	Isoko South	356,459	400	66.1	264
	Ethiope East	182,499		33.9	136
Total		538,958			
Bayelsa	Kolokuma/Opokuma	120,159	400	29.8	119
	Sagbama	283,275		70.2	281
Total		403,434			
Total (Communities Respondents)					1,600
MNOC Staff					50
<b>Total Respondents</b>					<b>1,650</b>

Source: National Population Commission (2006), Researcher's field work, 2020

The study considered arrays of constructs used in disaster management strategies to arrive at the final output of instrument which was a questionnaire. The reliability of the instrument was achieved using the test re-test method. Two surveys were done in two weeks using 20% of the sample size (330), on same respondents. After this the Pearson's Product moment correlation was used for the comparisons of both surveys and an r value of 0.91 was realized. The retrieved questionnaire was coded in micro soft excel environment for proper analysis.

Weighted mean and percentages were used for validating each construct. Analysis of variance was (ANOVA) was used for testing the hypotheses ‘there is no statistical significant spatial difference in level of preparedness for oil and gas pipeline vandalization in the study area’ and ‘there is no statistical significant spatial variation in the level of disaster mitigation for oil and gas pipeline vandalization in the study area’ at the 0.05 level of significance. The analyses were performed in the IBM/SPSS software environment.

### 3. Results

Table 2. Preparedness practices adopted by communities and MNOC/IOCs against pipeline vandalization

Perceptions	Communities		Companies	
	Frequency	Percent	Frequency	Percent
Hazard, risk and vulnerability assessment	289	18.5	38	76.0
Response mechanism and strategies	238	15.3	4	8.0
Coordination of other agencies	323	20.7	2	4.0
Information management	201	12.9	06	12
Early warning system	104	6.7		
Resource mobilization	139	8.9		
Public education, training and rehearsals	108	6.9		
None	158	10.1		
Total	1560	100.0	50	100.0

Source: Researchers field work (2020)

Table 2, presents preparedness practices adopted by communities and MNOC/IOCs against pipeline vandalization in the selected states. Apparently for the companies four preparedness options are in use and hazard, risk and vulnerability assessment (76%) is mostly subscribed to by the companies. This means that, the mostly applied preparedness option by the companies may not be effective, as it is at best paper work (Umo-Otong & Gobo, 2010). Also, looking at the communities, seven preparedness options were purported to be in use, with coordination of other agencies (20.7%) being the most identified by the respondents. Sadly, as high as 10.1% of the respondents adduced that no preparedness whatsoever was unground to handle pipeline vandalism cum disaster when it happens, this finding is consistent with that of Okoli, (2013), Ameh, (2013), Dalby, (2014).

Table 3. The effectiveness of preparedness practice adopted by MNOC/IOCs and communities in the study area

Perceptions	Companies		Communities	
	Frequency	Percent	Frequency	Percent
Very Effective	4	8.0	258	16.5
Effective	6	12.0	282	18.1
less effective	38	76.0	662	42.4
Ineffective	2	4.0	358	22.9
Total	50	100.0	1560	100.0

Source: Researchers field work (2020)

The effectiveness of preparedness practice adopted by MNOC/IOCs and communities in the study area is presented in table 3. the scale for inquiry in the table is designed from very effective to ineffective. In the table most of the respondents identified that preparedness options applied in the area are ineffective whether at the community levels (42%) or the companies level (76%). This thus explains the level of pollution that is lucid in the study area as one traverse from the east to the west of the region and has been corroborated by Okon, (2014), and Wizer and Weli, (2020).

Table 4. Mitigation practices against pipeline vandalization adopted by MNOC/IOCs and communities in the study area

Opinions	Communities		Companies	
	Frequency	Percent	Frequency	Percent
Awareness creation	432	27.7	26	52
Promoting community participation	279	17.9	14	28
Community policing	318	20.4		
Community-based pipeline surveillance	323	20.7	10	20.0
Community by laws	62	4.0		
Right of way (ROW) implementation	113	7.2		
Others (punishment for offenders, excommunication, etc)	33	2.1		
Total	1560	100.0	50	100

Source: Researchers field work (2020)

The mitigation practices against pipeline vandalization adopted by MNOC/IOCs and communities in the study area are presented in table 4. The mitigation options therein are awareness creation, promoting community participation, Community policing, community-based pipeline surveillance, community by laws, right of way (ROW) implementation and others (punishment for offenders, excommunication, etc). Awareness creation was the most identified mitigation option by both the community (27.7%) or the company (52%) respondents.

Table 5. The effectiveness of mitigation options adopted against pipeline vandalization in the study area

perceptions	Communities		Companies	
	Frequency	Percent	Frequency	Percent
Very Effective	260	16.7		
Effective	229	14.7	8	16.0
Less Effective	749	48.0	42	84.0
Ineffective	322	20.6		
Total	1560	100.0	50	100.0

Source: Researchers field work (2020)

The effectiveness of mitigation options adopted by MNOC/IOCs and communities in the study area is presented in table 5. The scale for inquiry in the table is designed from very effective to ineffective. In the table most of the respondents identified that mitigation options

applied in the area are less effective whether at the community levels (48%) or the companies level (84%). This thus explains the level of loss and environmental damage taking place in the study area (Okon, 2014; Wizer & Wali, 2020).

Table 6. Agencies collaborating with communities and companies on disaster preparedness and mitigation in the study area

Options	Communities		Companies	
	Frequency	Percent	Frequency	Percent
Federal Government	295	18.9	11	22.0
MNOC/IOCs	523	33.5		
NGOs	162	10.4	9	18.0
National Emergency Management Agency (NEMA)	244	15.6	8	16.0
National Oil Spill Detection & Response Agency (NOSDRA)	234	15.0	22	44.0
Red Cross Society of Nigeria	102	6.5		
Total	1560	100.0	50	100.0

Source: Researchers field work (2020)

Table 6 presents the perception of the respondents about the agencies they collaborate with on disaster preparedness and mitigation of oil pipeline vandalism in the study area. Six agencies were identified by the respondents as bodies that collaborate to mitigate oil pipeline vandalism in the study area. For the communities the federal government (18.9%) and MNOC/IOCs (33.5%) were the most cooperating agencies, while red cross (6.5%) was the least identified agency by respondents as a body that involves in disaster preparedness and mitigation of oil and gas pipeline vandalism in the study area. As for the companies, the National Oil Spill Detection & Response Agency (NOSDRA) (44%), and the federal government (22%) collaborated more, according to the respondents.

Table 7. Factor affecting the practice of preparedness/ mitigation of effects of oil pipeline vandalization in the study area

Options	Companies		Communities	
	Frequency	Percent	Frequency	Percent
Lack of Commitment from MNOC/IOCs personnel	12	24.0	352	22.6
Lack of Resources	6	12.0	315	20.2
Rely on Government	1	2.0	384	24.6
Rely on Community People	14	28.0		
Lack of Community Leadership towards Disaster Practice	9	18.0	166	10.6
None	6	12.0	59	3.8
Others	2	4.0	1	0.1
Reliance on oil company			283	18.1
Total	50	100.0	1560	100.0

Source: Researchers field work (2020)

Table 7 presented the factors that affect preparedness and mitigation of effects of oil pipeline vandalization in the study area. The factors listed by respondents in this regard include lack of

commitment from MNOC/IOCs personnel, lack of resources, reliance on government, reliance on community people, lack of community leadership towards disaster practice, reliance on oil company, none, and other factors (embezzlement of funds, insincerity of leaders, community efforts to thwart government revenue due to poor sharing of resources). However, for the respondents at the companies, lack of commitment from MNOC/IOCs personnel (24%) and reliance on community people (28%) were the major factors responsible for poor preparedness and mitigation. For the community respondents, lack of commitment from MNOC/IOCs personnel (22.6%), lack of resources (20.2%) and reliance on government (24.6%).

Table 8. Spatial variation in disaster preparedness levels in the study area

<b>ANOVA</b>					
Disaster preparedness levels					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	22.946	3	7.649	14.591	.000
Within Groups	815.698	1556	.524		
Total	838.644	1559			

Table 8 presents the spatial variation in pipeline disaster preparedness levels in the selected states where the study was carried out. The model is significant at  $p < 0.05$  (F, 14 sig 0.000). This means that the null hypothesis stating there is no statistical significant variation in the level of preparedness for oil and gas pipeline vandalization in the study area is rejected and the alternate hypothesis stating there is, is accepted. This means there is a significant spatial variation in the disaster preparedness measures against oil pipeline vandalism in the area.

Table 9. Duncan statistics showing spatial variation in disaster preparedness measures in the study area

<b>Disaster preparedness levels</b>				
Duncan <sup>a</sup>				
States	N	Subset for alpha = 0.05		
		1	2	3
Rivers	390	3.0354		
Bayelsa	390		3.4030	
Delta	390			3.6581
Akwa-Ibom	390			3.6703
Sig.		1.000	1.000	.814
Means for groups in homogeneous subsets are displayed.				
a. Uses Harmonic Mean Sample Size = 390.000.				

Table 9, reveals exactly where the difference in disaster preparedness measure lie in the study area. Lucid is that preparedness in Rivers and Bayelsa is below that of Delta and Akwa-Ibom States. In all the preparedness levels are very low across the States.



Table 10. Spatial variation in pipeline disaster mitigation levels in the study area

ANOVA					
Disaster mitigation preparedness					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	29.927	3	9.976	16.825	.000
Within Groups	922.563	1556	.593		
Total	952.491	1559			

Table 10 presents the spatial variation in pipeline disaster mitigation levels in the selected states where the study was carried out. The model is significant at  $p < 0.05$  (F, 16.83, sig 0.000). This means that the null hypothesis stating there is no statistical significant spatial variation in the level of disaster mitigation for oil and gas pipeline vandalization in the study area is rejected and the alternate hypothesis stating there is, is accepted. This means there is a significant spatial variation in the disaster mitigation measures against oil pipeline vandalism in the area.

Table 11. Duncan statistics showing spatial variation in disaster mitigation measures in the study area

Duncan <sup>a</sup>			
States	N	Subset for alpha = 0.05	
		1	2
Rivers	390	3.0142	
Bayelsa	390	3.0202	
Akwa-Ibom	390		3.5421
Delta	390		3.6485
Sig.		.296	.907
Means for groups in homogeneous subsets are displayed.			
a. Uses Harmonic Mean Sample Size = 390.000.			

Table 11, reveals exactly where the difference in disaster mitigation measure lie in the study area. Lucid is that mitigation in Rivers and Bayelsa is below that of Delta and Akwa-Ibom States. In all the mitigation levels are very low across the States.

#### 4. Discussion

Preparedness practices adopted by communities and MNOC/IOCs against pipeline vandalization in the selected states, shows apparently that of the preparedness options that are in use, hazard, risk and vulnerability assessment is mostly subscribed to by the companies. This means that, the mostly applied preparedness option by the companies is not effective, as it is at best paper work (Umo-Otong & Gobo, 2010). Also, looking at the communities, seven preparedness options were purported to be in use, with coordination of other agencies being the most identified by the respondents. Sadly, respondents adduced that no preparedness whatsoever was on ground to handle pipeline vandalism cum disaster when it happens, this finding is consistent with that of Okoli, (2013), Ameh, (2013), Dalby, (2014). Meanwhile, Ameh, (2013), asserted that the way the country is handling it oil pipeline installation,

particularly in the Niger Delta Region, not only put the locals at risk of food insecurity, but also puts plants and animals at the risk of extinction. More so, near nothing is done to mitigate or repel vandal, so that the vandals are having a field day (Wizor & Wali, 2020). In this study the respondents averred that, the preparedness practice is less effective, confirming the work of Okon, (2014). This thus explains the level of pollution that is lucid in the study area as one traverse from the east to the west of the region and has been corroborated by Okon, (2014), and Wizor and Wali, (2020).

The factors that affect preparedness and mitigation of oil pipeline vandalization in the study area include lack of commitment from MNOC/IOCs personnel, lack of resources, reliance on government, reliance on community people, lack of community leadership towards disaster practice, reliance on oil company, none, and other factors (embezzlement of funds, insincerity of leaders, community efforts to thwart government revenue due to poor sharing of resources). However, for the respondents at the companies, lack of commitment from MNOC/IOCs personnel and reliance on community people were the major factors responsible for poor preparedness and mitigation. For the community respondents, lack of commitment from MNOC/IOCs personnel, lack of resources and reliance on government were the main factors. This finding is in tandem with that of (Tamuno, 2011; Adishi & Hunga, 2017).

The spatial variation in pipeline disaster preparedness levels in the selected states presented significant model at  $p < 0.05$  (F, 14 sig 0.000), implying that there is a significant spatial variation in the disaster preparedness measures against oil pipeline vandalism in the area. Which showed that Rivers and Bayelsa were the least prepared when compared with Delta and Akwa-Ibom States. This finding is corroborated by that of Nwagbosa, (2012), who identified that most of the illegally produced petroleum products emanates from Rivers and Bayelsa states. Sadly, the sources of the crude oil from which the substandard fuel is produced are products of vandalism. According to Ezeoba (2011), the vandals have no regards for the environment and use crude methods in syphoning crude oil and consequently, the rate of pollution in the area is high and devastating for locals who must interact with the environment to survive (Tamuno, 2011; Adishi & Hunga, 2017).

Similarly, inquiry into the spatial variation in pipeline disaster mitigation levels in the selected states where the study was carried out, showed a significant model at  $p < 0.05$  (F, 16.83, sig 0.000), implying significant spatial variation in the disaster mitigation measures against oil pipeline vandalism in the area. Again, Rivers and Bayelsa were least on the chart in comparison with Delta and Akwa-Ibom States. This finding compares with that of (Duru, 2013).

## **5. Conclusion and Recommendation**

The factors that affect preparedness and mitigation against oil pipeline vandalization in the study area included lack of commitment from MNOC/IOCs personnel, lack of resources, reliance on government, reliance on community people, lack of community leadership towards disaster practice, reliance on oil company, other factors (embezzlement of funds, insincerity of leaders, community efforts to thwart government revenue due to poor sharing of resources), adequate re-evaluation of the preparedness and mitigation approaches will in

no small way improve the environmental health in the study area. Also, Rivers and Bayelsa States ranked lowest in preparedness and mitigation measure as compared to Akwa-Ibom and Delta States. The study thus concludes that more attention be paid to these areas in terms of preparedness and mitigation against oil pipeline vandalism, while not neglecting other areas. In this regard, the following recommendations are advanced:

- a) the government, in partnership with the communities should improve on social inclusion and integration of the youth in meaningful employments to reduce the quest for oil theft in the area
- b) the government and the MNOCs should improve on the surveillance gargets, so that when pipelines are tampered with, the after effects can be easily mitigated.
- c) the place of public orientation and re-orientation cannot be overemphasised. There is therefore, need for government to partner with the communities and MNOCs, to help improve the public perception of government installations in the area, particularly oil and gas pipelines.
- d) one of the easiest ways to control crime is to give the youth something to lose. The lip service of government and allied agencies over the years should stop and institutions and companies built in the study area.

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