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Research Paper

Causes of oil and gas pipeline vandalism in the Niger Delta Region of Nigeria

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Abstract
Despite the consequences of crude oil pollution, the Niger Delta Region has continued to witness high rate of pipeline vandalism. This study looked at the causes of crude oil pipeline vandalism in the region. The survey research design was deployed to pilot the study and primary data was generated using questionnaire to solicit information from residents and workers of oil companies in the study area. Weighted means and percentages were used to validate or invalidate constructs. It was found that the causes of pipeline vandalism based on company worker's perspective were sabotage (86%), mechanical failure (56%), and corrosion (60%). Similarly, community dwellers identified the causes of pipeline vandalism to be sabotage (87.5%), mechanical failure (74.9%), corrosion (75%), negligence from oil and gas operators (82.4%). The study recommended that, government partners with oil companies to improve social life of the locals, improve surveillance and create awareness about the dangers of crude oil theft in the area.
Keywords: Pipeline-Vandalism; oil-theft; Niger-Delta; Sabotage

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I. INTRODUCTION

The Niger delta region represent the crude oil producing country of Nigeria and a wetland that is the biggest in Africa. About 37b barrels of crude reserve and a large deposit of gas (Alawode & Ogunleye, 2011). The oil industry account for 90 percent of external earnings for the country. On the other hand, the region is considered as one of the most oil impacted region in the world because of poor application of the oil mining laws and vandalism (Albert, Amaratunga & Haigh, 2017). According to Aitsi-Selmi, Blanchard, Al-Khudhairy, Ammann, Basabe, Johnston, Ogallo, & Onishi, (2015), several factors contributes to the environmental degradation of the region; and includes gas flaring, pollution related to industries, oil spillage and so on. Efforts by government to develop and create a sustainable society in the area have proved abortive over the years due to fraud, embezzlements and anger of the locals because of years of neglect by government. Some establishments and programs of government saddled with the responsibility of ensuring that the region is sustainable include Niger delta Development Commission (NDDC), Oil Mineral Producing Areas Development Commission (OMPADEC), Ministry of Niger delta (MND), and Amnesty program for the militants; have all failed due to corruption. There has also been improvement remuneration for oil producing states in Nigeria from 1 to 13%, yet the area is still home to some of the poorest Nigerians.

Over the years, crude oil spillage through pipeline vandalism is considered one of the major problems in Niger Delta Region (Aitsi-Selmi, Egawa , Sasaki, Wannous & Murray 2015; Ajao & Anurigwo, 2002; Akachi, 2011). Rising cases of pipeline vandalism by militant groups have significantly affected sources of revenues of government and oil companies operating in the region (Alawode & Ogunleye, 2011; Albert, Amaratunga & Haigh, 2017; Alik, Irasema, Orhan Daniel, Sálvano & Panmao, 2015; Aroh, Ubong, Eze, Harry, Umo-Otong, & Gobo, 2010). The militants claimed to be fighting for the emancipation of the region from environmental neglect (Atubi, 2015; Daniel, 2016; Duru, 2013; Eboh, 2016; Egbe & Thompson, 2013). Statistics have shown that Nigeria is losing well over 300,000 barrels per day (bpd) as a result of crude oil pipeline vandalism (Adebayo & Dada, 2008; Adedoja, Adepoju, Adedoja & Alaga 2016; Adekola, Fischbacher Smith, Fischbacher-Smith, & Adekola, 2016; Adishi, & Hunga, 2017; Agbazie, 2004), which runs into billions of dollars in losses (Mernyi, 2014; Mmeje, Ayuba & Muhammed, 2017; Okere, 2013). This has resulted in significant negative socioeconomic and environmental problems in the region (Eiser, Bostrom, Burton, Johnston, McClure, Paton, van der Pligt, & White, 2012; Ekott, Akpabio & Etukudo, 2013), with serious effects

on human lives and farm lands (Ajao & Anurigwo, 2002; Akachi, 2011; Akpan, 2013; Akpoghomeh & Badejo, 2006). Although factors such as institutional weakness, lack of effective implementation of environmental laws were hypothesized as the causes of vandalism in the region (Aigberua, 2017; Aishatu, Chukwudi & Hauwa'u, 2016; Aitsi-Selmi, Blanchard, Al-Khudhairy, Ammann, Basabe, Johnston, Ogallo, & Onishi, 2015), they are considered neither exhaustive nor confirmed as no available empirical evidences can be found confirming the asserted causes of vandalism in the area (Aitsi-Selmi, Egawa , Sasaki, Wannous & Murray 2015; Enaruvbe, & Ozien, Atafo, 2014; Madueme, 2010; Okoli & Orinya, 2013).

Several studies have been conducted on pipeline vandalism in Nigeria and elsewhere (Ahmadu & Egbodion, 2013; Okon, 2014; konkwo, Kumar & Tylor 2015; Okoye & Okunrobo, 2014; Onuoha, 2009; Oyegun, 2003; Sanusi, Onovo, & Isa, 2016), yet the problem of pipeline vandalism persist, with serious impacts on agriculture and other sources of livelihoods in the area. This study is thus carried out to holistically evaluate the causes of pipeline vandalism in the study area.

II. MATERIALS AND METHODS

The study area is the Niger Delta region of Nigeria. The region extends from Aboh (5°33′49″ N and 6°31′38″ E) in the North to palm point (4°16′22″ N and 6°05′27″ E) in the South. The East-West limit is between Benin River estuary (5°44′11″ N and 5°3′49″ E) in the West and Imo River estuary (4°27′16″ N and 7°35′27″ E) (Figure 1) protruding towards the Gulf of Guinea on the Atlantic coast of West Africa (Shittu, 2014). The Niger Delta region is a densely populated area in Nigeria. Its population is about 31 million people. The land mass extends over about 70,000 km2, and make up 7.5 percent of Nigeria's landmass.

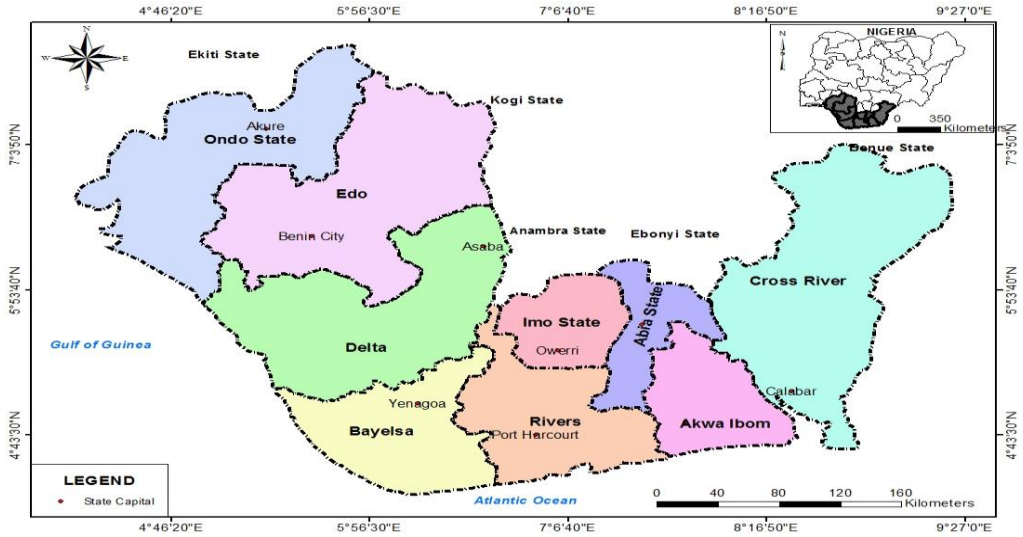

Figure 1: Niger Delta Region
(Source: Cartography and GIS Unit, Dept. of Geography and Env. Mgt. UNIPORT, 2020).

The region consists of the present day Abia, Akwa- Ibom, Bayelsa, Cross- River, Delta, Edo, Imo, Ondo, and Rivers states.

The Niger Delta region of Nigeria features within a tropical monsoon climate of transitional zone of Koppen Af climatic types that varies from the hot equatorial forest type in the southern lowlands to the humid tropics in the northern highlands and the cool montane type in the Obudu plateau area with prolonged and heavy rainy season and very short dry season months in the region. Only the months of December and January truly qualifies as dry season months in the region. During the dry season, the northeast trade wind blowing over the Sahara Desert extends its dehydrating influence progressively towards the equator, reaching the southern coast of Nigeria in late December or early January. The period is known as the "Harmattan", which is more noticeable in some years than others. The harmattan, which climatically influences many cities in West Africa, is less pronounced in the Niger Delta. The heaviest precipitation in the region occurs between March and October (Oyegun & Adeyemo, 1999). The mean annual rainfall is put at 2,000mm (Ayoade, 1993). But also ranges from over 4,000mm in the coastal towns of Bonny and Brass in Rivers and Bayelsa States respectively, and decreases inland to 3,000mm in the mid-delta around Ahoada in Rivers State, Yenagoa in Bayelsa State, and Warri in Delta States, respectively; and slightly less than 2,400mm in the northern parts of the region.

The Niger Delta region consists of Deltaic plain soils which are found in wetland and upland areas. The remnant wetland deltaic plain soil has sand (75%) with low clay content which increases down the subsoil. Surface soil colors are brown or very dark grayish brown. Surface soils are well drained having no mottles. The

soils are strongly acid (pH 4.5). But acidity decreases down the profile. Organic matter content is low (2.5%). The carbon to nitrogen ratio is very high. The Niger Delta Region is an economic hub of Nigeria. Niger Delta Region has up to four important merchant port and, today, it is the centre of Nigerian's Oil Industry (NDES, 2000). Its major exports include petroleum and oil palm products. The Region is a major industrial center as it has many multinational companies as well as other industrial concerns, particularly businesses related to the petroleum industry.

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.

Table 1: Projected Population of the Study

State	LGAs	2006 Population (NPC)	Projected Population (2019)	Taro Yamane Sample Size	Percentage in Projected Population	Questionnaire Proportion (Target Population)
Akwa Ibom	Ibeno	74,840	113,450	400	54.2	217
	Esit Eket	63,358	96,044		45.8	183
Total			209,494			
Rivers	Eleme	190,194	288,315	400	50.2	201
	Ikwerre	188,930	286,399		49.8	199
Total			574,714			
Delta	Isoko South	235,147	356,459	400	66.1	264
	Ethiope East	120,390	182,499		33.9	136
Total			538,958			
Bayelsa	Kolokuma/Opokuma	79,266	120,159	400	29.8	119
	Sagbama	186,869	283,275		70.2	281
Total			403,434			
Total (Communities Respondents)						1,600
MNOC Staff						50
Total Respondents						**1,650**

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

The study considered numerous instrument items used by experts on the field of disaster management strategies to arrive at the final output of instrument (Questionnaire). The reliability of the instrument was achieved using the test re-test method. Two independent surveys were done in the space of three weeks using 10% of the sample size (165). A Pearson's Product moment correlation was used for the comparisons of both surveys and an r value of 0.89 was realized. The retrieved questionnaire was coded and subjected to Statistical Package for the Social Sciences (SPSS) for proper analysis. Weighted mean and percentages were used for validating each construct.

III. RESULTS

Table 2: Causes of Oil and Gas Pipeline Vandalization (Multinational Oil Company perception)

Questionnaire Item Code	SA (%)	A (%)	D (%)	SD (%)	UN (%)	Total (%)	Weighted mean
1	18 (36)	25 (50)	7 (14)	00 (00)	00 (00)	50 (100)	4.22
2	13 (26)	15 (30)	18 (36)	3 (6)	1 (2)	50 (100)	3.72
3	13 (26)	17 (34)	19 (38)	00 (00)	1 (2)	50 (100)	3.82
4	00 (00)	13 (26)	23 (46)	5 (10)	9 (18)	50 (100)	2.8
5	27 (54)	16 (32)	00 (0)	6 (12)	1 (2)	50 (100)	4.24
6	19 (38)	14 (28)	17 (34)	00 (00)	00 (00)	50 (100)	4.04

7	00 (00)	34 (68)	14 (28)	00 (00)	1 (4)	50 (100)	3.58
8	6 (12)	21 (42)	15 (30)	7 (14)	1 (2)	50 (100)	3.48
9	00 (00)	18 (36)	20 (40)	11 (22)	1 (2)	50 (100)	3.1
10	7 (14)	31 (62)	12 (24)	00 (00)	00 (00)	50 (100)	3.9
11	9 (18)	29 (58)	12 (24)	00 (00)	00 (00)	50 (100)	3.94
12	00 (00)	26 (52)	17 (34)	6 (12)	1 (2)	50 (100)	3.36
13	24 (48)	23 (46)	3 (6)	00 (00)	00 (00)	50 (100)	4.42

Source: Researchers field work (2020)

N:B SA strongly agree, A agree, D disagree, SD strongly disagree & UD undecided

1. Sabotage is the major cause of oil and gas pipeline vandalization; 2. Mechanical failure is the major causes of oil and gas pipeline vandalization; 3. Corrosion is the major causes of oil and gas pipeline vandalization; 4. Negligence from oil and gas operators is the major causes of oil and gas pipeline vandalization; 5. Oil and gas pipeline vandalism affect the revenue of the oil and gas companies; 6. Poor governance is responsible for frequent oil and gas pipelines vandalism; 7. Lack of sense of belonging is the major reason for frequent oil and gas pipelines vandalism; 8. Poor Resource Management is responsible for frequent oil and gas pipelines vandalism; 9. Inadequate Compensation is responsible for frequent oil and gas pipelines vandalism; 10. Adequate security and public education is the best way to curb the frequent oil and gas pipelines vandalism; 11. Adoption of community-based surveillance is the effective way of curbing the oil and gas pipeline vandalism; 12. Improved technology involvement by oil companies will stop oil and gas pipeline vandalism; 13. Empowerment and Improved Socio-economic Activities will put an end to oil and gas pipeline vandalism.

The causes of pipeline vandalism based on company worker's perspective is presented in table 2. respondents agreed that sabotage is the major cause of oil and gas pipeline vandalization (86%), while 14% disagreed. The respondents agreed that mechanical failure is a major cause of oil and gas pipeline vandalization (56%) while the respondents that disagree accounted for 46%. Respondents also agreed (60%) that corrosion is the major causes of oil and gas pipeline vandalization, while 40% disagreed. Respondents disagreed (51%) that negligence from oil and gas operators is the major causes of oil and gas pipeline vandalization, while 13% agree. The proportion being undecided (18%) here creates suspicion that the respondents are likely economical with truth here. Respondents adduces that they agreed (86%) that oil and gas pipeline vandalism affect the revenue of the oil and gas companies, while 12% disagreed. Also, Poor governance (66%) is responsible for frequent oil and gas pipelines vandalism, but 34% disagreed. Respondents also agreed (68%) that lack of sense of belonging is the major reason for frequent oil and gas pipelines vandalism, while 28% disagree. This confirms the earlier study of (Babatunde, et al, 2012), who averred that, dissatisfaction with the operations, control of resources and sharing of proceeds from oil mining in the area is one of the major motivating factor to vandalize oil pipe lines. Respondent agreed poor resource management (56%) is responsible for frequent oil and gas pipelines vandalism, 44% disagree and 2% is undecided. Also, documented is that respondents agreed (36%) that inadequate compensation is responsible for frequent oil and gas pipelines vandalism, while 51% disagreed. Inadequate security and lack of public education results in frequent oil and gas pipelines vandalism (76%) while 24% of the respondents disagreed. Most respondents agreed (76%) that lack of community-based surveillance is a cause of oil and gas pipeline vandalism, 24% of respondents disagreed. Respondents also agreed (52%) lack of improved technology involvement by oil companies is a cause of oil and gas pipeline vandalism, while 46% disagree and 2% of the respondents are undecided. Respondents agreed (94%) that lack of empowerment and improved socio-economic activities is a cause oil and gas pipeline vandalism. The weighted mean in table 4.2 gives insight into understanding the most important of causes of pipeline vandalism in the area. In this case lack of empowerment and improved socio-economic activities (4.42); sabotage (4.24) oil and gas pipeline environmental pollution (4.22) are the major causes of pipeline vandalism in the area, while the minor cause is negligence from oil and gas operators, with a weighted mean of 2.8.

Table 2: Causes of Oil and Gas Pipeline Vandalization (Community Dwellers Perspective)

Question Item code	SA (%)	A (%)	D (%)	SD (%)	UD (%)	Total (%)	Weighted mean
1	797(51.1)	568(36.4)	76 (4.9)	70(4.4)	49(3.1)	1560 (100)	4.28
2	424(27.1)	746(47.8)	215(13.8)	123(7.9)	52(3.3)	1560 (100)	3.88
3	416(26.7)	754(48.3)	236(15.1)	113(7.2)	41(2.6)	1560 (100)	3.89
4	574(36.8)	712(45.6)	138(8.8)	108(6.9)	28(1.8)	1560 (100)	4.09
5	623(39.9)	705(45.2)	135(8.7)	64(4.1)	33(2.1)	1560 (100)	4.17
6	654(41.9)	644(41.3)	151(9.7)	65(4.2)	46(2.9)	1560 (100)	4.15
7	550(35.3)	725(46.5)	155(9.9)	78(5.0)	52(3.3)	1560 (100)	4.05
8	574(36.8)	694(44.5)	176(11.3)	70(4.5)	46(2.9)	1560 (100)	4.08
9	689(44.2)	622(39.9)	167(10.7)	52 (3.3)	30(1.9)	1560 (100)	4.21
10	595(38.1)	699(44.8)	146(9.4)	82(5.3)	38(2.4)	1560 (100)	4.11

11	553(35.4)	748(47.9)	153(9.8)	72(4.6)	34(2.2)	1560 (100)	4.10
12	531(34.0)	647(41.5)	170(10.9)	121(7.8)	91(5.8)	1560 (100)	3.90
13	700(44.9)	551(35.3)	154(9.9)	103(6.6)	52(3.3)	1560 (100)	4.12

Source: Researchers field work (2020)

N:B SA strongly agree, A agree, D disagree, SD strongly disagree & UD undecided

1. Sabotage is the major cause of oil and gas pipeline vandalization; 2. Mechanical failure is the major causes of oil and gas pipeline vandalization; 3. Corrosion is the major causes of oil and gas pipeline vandalization; 4. Negligence from oil and gas operators is the major causes of oil and gas pipeline vandalization; 5. Oil and gas pipeline vandalism affect the revenue of the oil and gas companies; 6. Poor governance is responsible for frequent oil and gas pipelines vandalism; 7. Lack of sense of belonging is the major reason for frequent oil and gas pipelines vandalism; 8. Poor Resource Management is responsible for frequent oil and gas pipelines vandalism; 9. Inadequate Compensation is responsible for frequent oil and gas pipelines vandalism; 10. Adequate security and public education is the best way to curb the frequent oil and gas pipelines vandalism; 11. Adoption of community-based surveillance is the effective way of curbing the oil and gas pipeline vandalism; 12. Improved technology involvement by oil companies will stop oil and gas pipeline vandalism; 13. Empowerment and Improved Socio-economic Activities will put an end to oil and gas pipeline vandalism.

The causes of pipeline vandalism based on community dwellers perspective is presented in table 3. respondents agreed that sabotage is the major cause of oil and gas pipeline vandalization (87.5%), while 9.3% disagreed and 3.1% are undecided. The respondents agreed that mechanical failure is a major cause of oil and gas pipeline vandalization (74.9%) while the respondents that disagree accounted for 21.7%. Respondents also agreed (75%) that corrosion is the major causes of oil and gas pipeline vandalization, while 22.3% disagreed and 2.6% of the respondents were undecided. The respondents who disagreed that negligence from oil and gas operators is the major causes of oil and gas pipeline vandalization accounted for 15.7%, while 82.4% agreed. The finding here disagrees with that of the company workers regarding the same issue. Respondents adduced that they agreed (85.1%) that oil and gas pipeline vandalism affect the revenue of the oil and gas companies, while 12.8% disagreed. Also, Poor governance (83.2%) is responsible for frequent oil and gas pipelines vandalism, but 13.9% disagreed, while 2.9% of the respondents were undecided. Respondents also agreed (81.8%) that lack of sense of belonging is the major reason for frequent oil and gas pipelines vandalism, while 13.1% disagree, while 3.3% were undecided. This confirms the earlier study of (Babatunde, et al, 2012), who averred that, dissatisfaction with the operations, control of resources and sharing of proceeds from oil mining in the area is one of the major motivating factor to vandalize oil pipe lines. Respondent agreed poor resource management (84.1%) is responsible for frequent oil and gas pipelines vandalism, 14% disagree and 1.9% is undecided. Also, respondents agreed (82.9%) that inadequate compensation is responsible for frequent oil and gas pipelines vandalism, while 14.7% disagreed. This differ from the perception of the company workers. Inadequate security and lack of public education results in frequent oil and gas pipelines vandalism (83.3%) while 14.4% of the respondents disagreed. Most respondents agreed (75.5%) that lack of community-based surveillance is a cause of oil and gas pipeline vandalism, 18.7% of respondents disagreed, and those who were undecided accounted for 5.8% of the whole respondents. Respondents also agreed (52%) lack of improved technology involvement by oil companies is a cause of oil and gas pipeline vandalism, while 46% disagree and 2% of the respondents are undecided. Respondents agreed (80.2%) that lack of empowerment and improved socio-economic activities is a cause of oil and gas pipeline vandalism. The weighted mean in table 4.3 gives insight into understanding the most important of causes of pipeline vandalism in the area based on community perception. Sabotage; inadequate compensation and lack of adequate security and public education are the major causes of pipeline vandalism in the area, while the minor cause is mechanical failure of oil and gas pipeline with a weighted mean of 3.8.

IV. DISCUSSION

The causes of pipeline vandalism based on company worker's perspective identified sabotage, mechanical failure; corrosion, negligence from oil and gas operators, poor governance, lack of sense of belonging. Also, poor resource management, inadequate security and lack of public education, lack of improved technology involvement by oil companies, lack of empowerment and improved socio-economic activities. This confirms the earlier study of (Babatunde, et al, 2012), who averred that, dissatisfaction with the operations, control of resources and sharing of proceeds from oil mining in the area is one of the major motivating factor to vandalize oil pipe lines. On the other hand, the causes of pipeline vandalism based on community dwellers perspective include sabotage, mechanical failure, corrosion, negligence, revenue misappropriation, lack of sense of belonging, poor resource management, inadequate compensation**, i**nadequate security and lack of public education, lack of community-based surveillance, lack of improved technology, lack of empowerment and improved socio-economic activities. The finding of this study differs slightly from that of Adebayo and Dada

(2008) who identified sabotage as the major cause of pipeline vandalism and is because of long history of neglect, marginalization and repression of the host communities.

V. CONCLUSION AND RECOMMENDATION

The study unravelled that the causes of pipeline vandalism ranged from sabotage to failure of equipment and installations. It is concluded in this study that improvement is required in the social inclusion of the locals, improvement in techniques for oil pipeline installations monitoring. This will not only improve the environmental quality of the area but will also improve the array of economic activities that can engage the locals. In realising this the following recommendations are germane:

a) the government should partner with the oil companies to improve the social life of the locals and by implication reduce the quest for oil theft in the area.

b) Surveillance equipment and pipeline monitoring should be enhanced in the area, this will reduce crude oil theft, and in the case of wear and tear ruptures, the alert system can warn in real time and by implication mitigate the environmental effects of crude oil spills.

c) the government and the oil companies should continue to create awareness about the dangers of crude oil theft in the area. Radio stations, town hall meetings, and television stations can be used in this regard.

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