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Effect of oil spills and gas flaring on agriculture and environment: A case of crop farmers in Niger Delta Region of Nigeria (2000 - 2022)

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Abstract

Specifically, the study identified the major source of employment and threats of oil pollution to livelihood sources in the Niger Delta, ascertained incidence of oil pollution, current causes of oil spills from a historical perspective and identified severely oil polluted sites and nature of incidences; evaluated crop farmer's perception of the effect of gas flaring on their crops and ascertained major negative impacts of oil and gas activities on agriculture and environment. Simple random sampling was used in the selection of 837 crop farmers. Primary and secondary data sources were employed. Descriptive statistics and inferential statistics such as Paired Sample T test was used to actualize the objectives and test the hypothesis respectively. Qualitative technique such as content analysis was also employed. The findings revealed that majority (46.2%) of the working population engaged in agriculture, 20.0% engaged in trade, 5.2% engaged in fishing while 5.3% were of the educational sector. The threats of oil pollution to livelihood sources in the Niger Delta revealed 47.9%, 30.3% and 21.7% of crop farmers threat to be physical and economic threats, social threats and political threats respectively. The average number of oil spills is 186.5 while the quantity of oil spilled is 48346.5 barrels, quantity recovered was 3327.6 barrels while quantity loss to the environment is 45,018.9 barrels within the period. The paired t test result showed that there is no significant difference in the quantity of oil spilled and the quantity loss to the environment. The major causes of oil spills viz: blow-out (3.87), Pipeline corrosion (3.77), Equipment failure (3.65) and Sabotage (3.61). The result also showed that Bayelsa, Delta and River states had the most affected sites, and that forest water swamps were more impacted as well as the mangrove forest majorly as a result of oil spillage incidences. Gas flaring affected crop farmers yield. The result shows that the negative impact of oil and gas flaring activities as destruction of farming and fishing implements (72.0%), low productivity (69.0%) and degradation of fishing and farming sites (68.0%) as majority (78.0%) of crop farmers reported the government and oil companies doing nothing to address the impact of oil and gas activities on agriculture and environment. The study recommended the use of Geographical Information Systems (GIS) as an operational tool in ascertaining Information on the exact position and size of the oil spill.

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Introduction

Before the discovery of oil in Nigeria in early 1956 at Oloibiri, agriculture was the mainstay of the Nigerian economy, contributing more than 70% to the exchange rate of the Nigerian economy. Since the discovery of oil in most other places in Nigeria, the region has become the centre of intensive and extensive oil production activities, including exploration and exploitation. These activities have been associated either directly or indirectly with a myriad of environmental problems, which have been the main source of sorrow for the people of Nigeria as a whole (Obi *et al.,* 2021). This activity has polluted the water bodies and land terrestrial ecosystems. One of the prime concerns associated with this pollution in the environment is the risk of contamination to farmland, fisheries, and potable water since most of the people's livelihood depends on farming, fishing, and usage of water for domestic purposes (Ugwuanyi *et al.*, 2012). Nigeria has lost more than 30% of its habitable environment due to oil spills, which destroy crops and aquaculture through the contamination of waterways and groundwater, oil flaring of associated gas, and mismanagement of the land resources (Otunkor and Ohwovorione, 2015).

Oil spills have been proven to have significant negative impacts on crop yield and land productivity, which further impoverish the already poor farmers in the study area with the increasing soil infertility as a result of the destruction of soil micro-organisms and dwindling agricultural productivity. Farmers have been forced to abandon their land to seek non-existent alternative means of livelihood. This problem of land and environmental pollution has become a global issue due to its adverse effects on both human health and crop productivity. Nigeria is one of the world's third largest wetlands after Holland and Mississippi (Omene, 2021). The area especially the Niger Delta remains increasingly under threat due to rapidly deteriorating environmental conditions, especially the menace posed by oil companies. Since the discovery and subsequent exploration of crude oil in Oloibiri in 1956, the environmental pollution emanating from such exploration has led to unprecedented economic deprivation and underdevelopment of the area.

The area contains the bulk of proven oil reserves in Nigeria, which makes her one of the largest oils producing areas in the world. Oil and gas resources account for over 98 percent of the country's export earnings and 83 percent of the government's total revenue (Bayode *et al.*, 2011). This is a result of agriculture and agricultural productivity being relegated to the background due mainly to the effects of oil flaring on agriculture, which causes a lot of damage to productivity.

The ecological devastation occasioned by oil exploration has rendered farming and fishing which are the main occupations of the rural people of this region, insignificant. Pollution and continuous flaring of gas from oil prospecting and production have created health hazards and rendered fishing and farming activities almost impossible. Also, occasional large oil spills kill fish; destroy agricultural crops; pollute the waters which seriously affect families and communities. According to the Department of Petroleum Resources, between 1976-2001, a total of 6817 oil spillage which accounted for a loss of 3 million barrels of oil with more than 70% of it not recovered (Wariboko 2019). According to the UNEP report (2011), Bassey (2013), several years of oil exploration and exploitation by Multinational Corporations, and the hazards of spillage and gas flaring which accompany it, have degraded the environment of the region and left the communities desolate. Not only have farming and fishing the major occupation of these mostly Riverine minorities been decimated, their territories have continuously lacked basic infrastructure and amenities – electricity, road, schools, hospitals, portable water, etc. (Amnesty International, 2019).

The United Nations Environmental Programme is now focussing on reducing the effects of gas flaring around the world, particularly in the Niger Delta (Leslie, 2019). Attempt has been made by individuals, government, non-governmental organizations, World Institutions like UNO, World Bank, most especially by scholars to address the lingering environmental pollution associated with oil spills and flaring of gas in the Niger Delta. Scholars like Aghalino, (2019; 2016), Ashton, (2015), Emoyan, (2018), Frynas, (2020, 2001), and Fagbami,

(1988), in their research works has attempted to address the perennial problems associated with the causes of gas flaring and oil spills. Some international institutions like the World Bank (2019, 2018), and the WHO, (2016), have equally reported facts on what constitute the causes and effects of oil and gas on a particular environment like the Niger Delta region. That the flaring of gas has continued to impact negatively on the vegetation's in the oil-producing community of Niger Delta is undoubted. Again, that oil spills which contaminated the sources of drinking waters and rivers in the Niger Delta, particularly on their farmlands and fish ponds, need urgent attention is glaring.

Flaring is combustion of associated gas from crude-oil exploitation and exploration operations that occurs in refineries, oil wells, oil rigs by fiery of the gas (Obi *et al.,* 2021), this occurs during the processing of crude oil through the top of a pipe or stack in which the burner and igniters are located (Aghalino, 2016; Eweje, 2017). This illustrates that gas in the production process burns clean until oil enters into the flare pipelines through the operating machine, and this has become common practice (Ikporukpo, 1986). Gas flaring began in Oloibiri in 1958 (Ockuko, 2011), when the economic value and market for gas was low and there were no pipelines or storage tanks to preserve it. The Niger Delta region was found to be the second largest flare site in the world, after Russia, with World Bank report showing that over 150 million cubic meters of natural gas were flared or vented annually in Nigeria, worth up to $30.6 billion dollars and equivalent to 25 percent of US gas consumption, or 30 percent of European Union (EU) gas used in a given year (World Bank, 2018; World Bank, 2020). Gas flaring is a process that takes place during oil drilling in Nigeria. The crude oil and gas are separated at flow stations. While the gas is flared at the flow station, the crude oil is pumped to the refineries. According to Research Initiative (2019), flaring is used to consume waste gases in a safe and reliable manner through combustion in an open flame. Therefore, gas flaring is a means of safely disposing of waste gases through the use of combustion (Evoh, 2020).

This is a common practice in Nigeria where oil is exploited. Consequently, this flaring is one of the most significant sources of environmental pollution from the Nigerian oil industry, affecting not only agricultural activities and potential, especially farming, but the health of the farmers and the ecosystem generally.

Oil pipelines sometimes run through farmlands. Other oil infrastructure, such as oil well heads and flow stations, are often close to agricultural lands. Studies by Ukegbu and Okeke (2017), noted the effects of gas flares on the growth, productivity, and yield of selected farm crops in the Izombe flow station located in Izombe Ohaji/Egbema/Oguta Local Government area of Imo state. They experience a 100% loss in crop yield in all crops cultivated about 200 meters away from the flare, a 45% loss for those about 600 meters away, and a 10% loss in yield for crops about 1000 meters away from the flare. The effects were reduced with increased distance from the flare. Obioma, (2019) conducted a similar study that investigated agricultural production decline in the Ogba-Egbem area of Rivers state. The results of his investigation showed that insects gathered to enjoy the warmth and light of the gas flare from the forest at night. The rapid increase in the insect population and their attendant destruction of the crops was a new phenomenon that had come with the oil production in the area. Farmers in the area have confirmed that these insects have inflicted heavy losses on them by eating and destroying their crops. Farmers find that their crops are no longer abundant and that the crops are stunted in growth as a result of acid rain (Gbadegesin, 2017). According to Olumide, (2016), when gas is being flared, the surrounding air is polluted by oxides such as nitrogen, carbon, sulphur, particle matter, sulphide, and soot from the flare. All these are capable of retarding the growth of cash and food crops tremendously and causing environmental degradation (Eregha & Irughe, 2019; Opukri & Ibaba, 2018; Okogun, 2014; Zabbey, 2014; Raheem, 2020; Turner *et al*., 2020; Alakpoda, 2020; Ogidiol, 2021; and Efe, 2021). This paper becomes imperative in addressing the effect of oil spills and gas flaring on environment and agriculture in the Niger Delta Region of Nigeria. The objective of this study is

to focus attention on oil Spills and gas flaring in the Niger Delta Region of Nigeria. Specifically, the study:

i. Identify major source of employment and threats of oil pollution to livelihood sources in the Niger Delta

ii. Ascertain incidence of oil pollution, current causes of oil spills from a historical perspective and identify severely oil polluted sites and nature of incidences;

iii. Evaluate crop farmer's perception of the effect of gas flaring on their crops and ascertain major negative impacts of oil and gas activities on agriculture and environment;

iv. Identify government and oil companies' action to address the impact of oil and gas activities on agriculture and the environment

Hypothesis of the study

The following null hypothesis was tested:

HO1: there is no significant difference in the quantity of oil spillage and quantity loss to the environment between the period of 2000 and 2021.

Material and methods

The Niger Delta is an area in South-South and South eastern part of Nigeria, comprising of wet and dry lands which covers about 70, 000sq kilometers. The region which consists of a number of distinct ecological zones, costal ridge barriers, mangrove swamps, fresh water swamps, forests, and low land rain forest is dominated by rural communities that depend solely on the natural environment for subsistence living. According to UNDP Report (2017), more than 70% of the people depend on natural environment for their livelihood. The region is home to more than 10 million people (Worldometer, 2017).

Fig. 1. Map of Niger Delta region of Nigeria.

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, 2017). The Niger Delta includes the States of Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo and Rivers. The Niger Delta region is richly endowed with natural resources with oil and gas accounting for over 85% of the National Gross Domestic Product (GDP), over 95% of the National budget and over 80% of the national wealth (Dokubo, 2014). Paradoxically, the region remains the poorest, due largely to the ecologically unfriendly exploitation of oil and State's policies that expropriate the indigenous peoples of Niger Delta of their rights to these natural resources. It is believed that since the advent of oil exploration some decades ago, the region has become the breadwinner of the nation, accounting for over 90% of the nation's export earnings since 1975. Niger Delta region is rated as the most oil-impacted environment and polluted area in the world most especially by environmental experts from the UK, the USA and Nigeria (Kia, 2019; Ikelegbe, 2019; Obi, 2020).

This study was carried out in the South-South and South-East part of Nigeria where environmental pollution is heavily felt due to oil exploration and exploitation. The states that are mainly affected are Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo, and Rivers. These states are known as MPP9, which stands for the nine oil producing states of Nigeria. The communities in these states are known as the Niger Delta. Ninety-three crop farmers from each state were randomly selected from all affected oil polluted sites using a list provided by Agricultural Development Programmes (ADPs) making a total of 837 crop farmers sampled for the study.

This paper addressing the perennial controversy over oil pollution and gas flaring as it concerns the environment and agricultural production. Primary and secondary data were sourced which included questionnaires, books, journals, newspapers, and Internet searches. State ministries of environment, land, and urban development; the National

population commission; and meteorology were also used. The objectives were analysed using descriptive statistics such as mean, graphs, tables and frequency while Paired Sample T test was used to test the hypothesis. Qualitative technique such as content analysis was also employed to actualize objective three.

Result and discussion

Major source of livelihoods and threats of oil pollution to livelihood sources in the Niger Delta

Table 1. Distribution of Employed Working Population by activity and Region.

	Livelihood Sources							
States	Agric.	Fish	Manuf.	Constr.	Trade	Transp.	Public Admin	Education
Abia	47.0	0.0	6.0	3.0	25.0	4.0	4.0	4.0
Akwa Ibom	45.0	5.0	3.0	2.0	26.0	5.0	4.0	3.0
Bayelsa	34.0	19.0	3.0	4.0	16.0	2.0	7.0	8.0
Cross River	68.0	2.0	1.0	1.0	9.0	2.0	5.0	5.0
Delta	38.0	6.0	4.0	4.0	21.0	5.0	7.0	8.0
Edo	41.0	7.0	6.0	4.0	22.0	5.0	3.0	5.0
Imo	50.0	0.0	7.0	5.0	21.0	4.0	3.0	3.0
Ondo	42.0	4.0	3.0	3.0	27.0	4.0	5.0	5.0
Rivers	51.0	4.0	4.0	5.0	13.0	3.0	6.0	7.0
Mean	*46.2*	*5.2*	*4.1*	*3.4*	*20.0*	*3.8*	*4.9*	*5.3*

Source: World Bank 2021; values in percentages.

Table 1 showing the distribution of the employed working population by activity and region reveals majority (46.2%) of the working population to have engaged in agriculture, 20.0% engaged in trade, 5.2% engaged in fishing while 5.3% were of the educational sector. This implies that, agriculture is still a major source of employment in the Niger Delta; contrariwise petroleum is not a key employer of labour in the region. According to Raheem (2020), this was due to the dwindling prices in oil as stakeholders and the government of Nigeria called for all hands to return to farming so that Nigeria may have sustainable food security for her teeming population in the future. Presently, it has become a global concern to search for measures to sustain agriculture and agricultural productivity in Nigeria in order to meet with the millennium development goals of eradicating hunger and poverty.

Spoliation of livelihood sources in the Niger Delta

Threats to livelihood sources in the Niger Delta are diverse and varied. Among the several sources that have come to the focus of scholars include physical and economic threats, political threats (Oruwari, *et al.*, 2014) and social threats. Table 2 showing the threats of oil pollution to livelihood sources in the Niger Delta revealed 47.9%, 30.3% and 21.7% of crop farmers threat to be physical and economic threats, social threats and political threats respectively.

Table 2. Distribution of Employed Working Population by activity and Region.

Threats	Physical & Economic threats		Social threats		Political threats	
States	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Abia	21	22.6	36	38.7	36	38.7
Akwa Ibom	24	25.8	26	28.0	43	46.2
Bayelsa	68	73.1	14	15.1	11	11.8
Cross River	37	39.8	52	55.9	4	4.3
Delta	71	76.3	14	15.1	8	8.6
Edo	52	55.9	13	14.0	28	30.1
Imo	34	36.6	46	49.5	13	14.0
Ondo	51	54.8	21	22.6	21	22.6
Rivers	43	46.2	32	34.4	18	19.4
Average		*47.9*		*30.3*		*21.7*

Source: World Bank, 2021.

Physical and Economic threats

Economic threats to livelihood sources in the Niger Delta manifest in the depletion of aquatic lives, deforestation of farm lands and loss of biodiversity resulting from overexploitation of existing resources and the resultant pollution. Agricultural production had experienced dwindling fortunes since the ascendancy of crude oil. Men turn from agriculture to seek alternative employment in the oil and gas sector. Thus, economic threat to livelihood sources in the Niger Delta has a gender dimension. It is highly skewed against women. Some argue this result from the highly physical nature of oil and gas activities. To that extent, the industry is male dominated. This structural arrangement alienates women who are in most cases the bread winners of their respective homes (Omorodion, 2014).

Social threat

The ecological effects of oil exploration and exploitation on agriculture are not without their attendant social consequences on oil communities. One of such consequence's manifests in the social life, is oil locations create a false atmosphere of life being sweet. This false atmosphere precipitates a lot of unholy practices. "Ashawo villages" where single girls engage in sordid sex networking becomes commonplace. In some other oil communities, an upsurge in single girls renting rooms is widely seen and practiced. Credit sex is equally common, with sporadic quarrels resulting from the unwillingness/reluctance of a male oil worker to pay-up an outstanding "debt". The populations of the girls that patronize commercial sex networking in oil communities are both indigene and non-indigenes who migrate from neighbouring communities and states. Other consequences are that there is moral decadence in the family institution (e.g. sharp disagreements within families arising from legally married wives engaging sex networking), collapse of marriages (e.g. house wives splitting from husbands so as to par take in the sex trade) and its resultant effect in single parenthood, cost of living suddenly becomes skyrocketing, with prices of common household commodities beyond the reach of the common people who have little or nothing to benefit from the oil environment. It is such sad tales from Bonny that precipitated Jike (2014) to say, there is a compelling need to believe that the institution of marriage as it is traditionally conceived has been largely defiled and compromised. The wives' tales coming out of Bonny where the LNG projects are located are that many wives abandon matrimony in preference for young White oil workers who have more than enough money to spend as opposed to their struggling husbands. The link between husband and wife becomes more tenuous as the financial wherewithal of the husband diminishes. As expected, among young couple's divorce is on the rise, once-revered values have become supplanted by fads, and the prospects of institutional continuity have become more cumbersome".

Political threats

Threats to livelihood sources in the Niger Delta also have a political dimension. Political threats, amongst others include the appropriation of local resource rights by the federal might in Nigeria, the enabling legal environment that effectuates the appropriation process and the marginalization of local communities.

Incidence of oil pollution, historical causes of oil spills, Types of oil spills and number reported in Niger Delta, Nigeria 2000-2022

Table 3 shows analysis of oil spill incidences (number of oil spill, quantity spilled, quantity recovered and quantity loss to the environment) in the Niger Delta region (2000-2020). The table shows that the average number of oil spills is 186.5 while the quantity of oil spilled is 48346.5 barrels, quantity recovered was 3327.6 barrels while quantity loss to the environment is 45,018.9 barrels within the period.

Paired T test using a two-tail test (inequality) decision rule is that lf t Stat (0.123607) < -t Critical two-tail (-2.018082) or t Stat (0.123607) > t Critical two-tail (-2.018082), we reject the null hypothesis and accept the alternate hypothesis. Otherwise, we accept the null hypothesis and reject the alternate hypothesis. This is not the case, since t stat (0.123607) is not greater than t Critical two-tail (-2.018082), therefore, we accept the null hypothesis that there is no

significant difference in the quantity of oil spillage and quantity loss to the environment between the period of 2000 and 2021.

Table 3. Oil spill incidences (number of oil spill, quantity spilled, quantity recovered and quantity loss to the environment) in the Niger Delta region (2000-2020).

SN	Year	No. of Spill	Quantity spilled (in barrels)	Quantity Recovered (in barrels)	Quantity loss to the environment
1	2000	482	19028.9	543.04	18485.86
2	2001	194	3022.67	900.23	2122.44
3	2002	139	7686.99	4023.4	3663.59
4	2003	293	8344.79	923.3	7421.49
5	2004	123	75261.89	302.44	74959.45
6	2005	142	13467.89	932.3	12535.59
7	2006	103	432191	3994.23	428196.7
8	2007	201	54032.92	8490.3	45542.62
9	2008	212	9033.02	323.23	8709.79
10	2009	120	9342.2	269.83	9072.37
11	2010	140	39430.3	9503.7	29926.6
12	2011	168	45304.4	233.6	45070.8
13	2012	194	50420.37	6532.7	43887.67
14	2013	199	63234.6	3004.3	60230.3
15	2014	345	90020.34	9030.74	80989.6
16	2015	192	2234.44	2102.2	132.24
17	2016	192	43043.4	144.67	42898.73
18	2017	101	4034.23	293.04	3741.19
19	2018	78	49233.54	8930.2	40303.34
20	2019	201	4933.342	302.4	4630.942
21	2020	192	10301.23	9034.3	1266.93
22	2021	93	30021.3	3392.32	26628.98
Mean		*186.5*	*48346.5*	*3327.6*	*45018.9*

Source: Niger Delta Environmental Survey (NDES), 2021, Vol 1, Socio-Economic Characteristics Lagos: NDES

Test of Hypothesis

Table 4. Paired T test output of quantity spilled and quantity loss to the environment Comparism in the Niger Delta region (2000-2021).

Statistical parameters	Quantity spilled	Quantity loss to the environment
Mean	48346.53	45018.96
Variance	8.02E+09	7.93E+09
Hypothesized Mean Difference	0	
df	42	
t Stat	0.123607	
P(T<=t) one-tail	0.451108	
t Critical one-tail	1.681952	
P(T<=t) two-tail	0.902216	
t Critical two-tail	2.018082	

Source: Excel computation (2023).

Fig. 2 below shows the number of spills recorded in the entire Ijaw oil producing communities of the Niger Delta Region, and the increased level of the spills from between the period of 2000 and 2004 as well as 2010 and 2014, which meant that a spills control and management system was not being enforced by the Federal government, particularly by the oil companies. According to Aghalino (2019) and Ikporuko (1986), the oil companies opted to flare gas rather than utilise it because it was the cheaper option. One can therefore argue that the refusal to capture the unused gas for industrial purposes, and the laxity of both the federal government and the oil companies in implementing the oil regulations were the main reasons oil producing communities in the Delta had been subjected to decades of unnecessary and wasteful gas flaring.

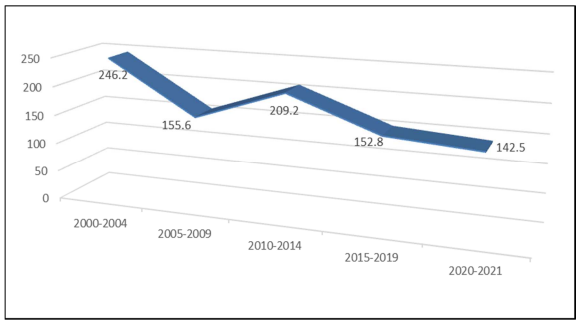

Fig. 2. Periodical summary of oil spill incidences in the Niger Delta.

Source: Niger Delta Environmental Survey (NDES), 2021

Causes of oil spills: argument from a historical perspective

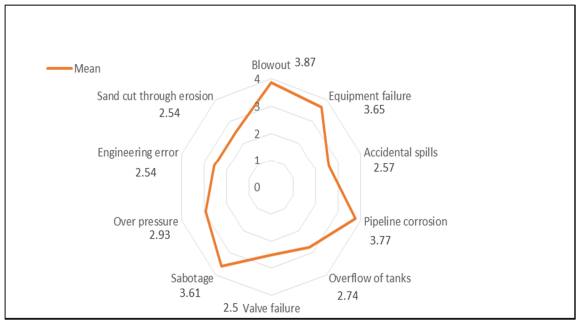

Fig. 3. Causes of oil pollution.

Source: Niger Delta Environmental Survey (NDES), 2021.

From the fig. 3above showing the causes of oil pollution in the study area, the following were revealed to be major causes of oil spills viz: blow-out (3.87), Pipeline corrosion (3.77), Equipment failure (3.65) and Sabotage (3.61). According to scholars (Ashton, 2001; Eweje, 2017; Aghalino, 2019; Aghalino, 2019), since the discovery of oil in Nigeria

in 1956, the country has been suffering the negative environmental consequences of oil development. Oil incidents have occurred in various parts and at different parts along our coast. In Nigeria, 50% of oil spills is due to corrosion of pipelines and tanker accidents, 28% is due to sabotage, and 21% are due to oil production operations while 1% of the oil spill is due to engineering drills, inability to effectively control wells, failure of machines and inadequate care in loading and unloading oil vessels. Oil bunkering is also a source of oil spill. The study was in conformity with Aaron (1996), who said that the major causes for the consistent oil spills in the Ijaw environment or elsewhere in the Niger Delta include blowout, pipeline corrosion, equipment failure and sabotage. Other minor causes of oil spills also include accidental spills, overflow of tanks, valve failure, over pressure, sand cut through erosion, and engineering error (HRW, 1999).

Bruce (2021) suggests that the obsolete leaking and rusting of oil pipelines had become a major cause for the Ijaw people, as in the case of the blowouts at Jesse Creek and Botem village in Ijaw and Ogoni land in the 1990s, with devastating effects on the courses that supplied them with drinking water (Jike, 2014; Saro-Wiwa, 1992). Blowout as a major factor responsible for spills occurs when there is too much pressure on the pipeline transporting oil to the terminal station, as in Bonny or Port Harcourt. Leaking and rusting pipelines led to the contamination of water and soil in the area. In the past, an offshore blowout of January 12, 1980 saw about 20,000 barrels of oil (8.4 million US gallon) spilled into the Atlantic, damaging about 340 hectares of the Delta mangrove (Nwilo, 2019). The Jesse Creek and Botem villages of Ijaw and Ogoni land witnessed the devastation of the environment, as the blowout entered the water courses that supplied them with drinking water.

Scientific tests conducted by the ERA (2018) to determine whether the waters at Botem village and Jesse Creek were contaminated as a result of the blowout showed that their environment was affected by hydrocarbon, heavy metals and sundry toxic substances. This has brought serious waterborne diseases and death to the people in the last 40 years of oil production, for example, field trip to the oil site in Oloibiri in 2010 showed that they have had no drinking water, and had relied on the polluted streams or rivers (Interview with Akpo). As a matter of fact, no human being could be drinking such contaminated water and enjoy sound health. This cast more light on the implications of oil production on the Ijaw people and their environment after its discovery in 1956. Oil pollution became rampant, and brought more damages than the development to their communities toward the end of 2006 (Interview with Ekpe & Akpan 2011).

Another serious blowout occurred at the Funiwa-5 oil well in 2007, with about 45,000 barrels spilled into the Niger Delta swamp. This station was owned by the Texaco Overseas Petroleum Company of Nigeria on a joint venture with NNPC and Chevron Nigeria (Aghalino & Eyinla 2019). Efforts to control it partly failed as a result of the absence of viable environmental laws at the time to enforce the company's prompt response. This blowout eventually caught fire, despite efforts by the Red Adair Corporation contracted by Texaco to combat the spills. Scientific tests conducted on the blowout sites to determine impact on vegetation and drinking water of other villages affected, such as Sangama, Kuluma 1, Kuluma 2, and Otuo Island, showed defoliation of the mangrove rhizophora seedlings and death of crabs and molluscs (oysters-crassostrea gasar), (Aghalino & Eyinla 2019). A total acreage of 836 of the mangrove was killed in those affected areas by the Funiwa blowout. Corrosion or rupture of pipelines has accounted for about 21% of oil spills in the Niger Delta area.

According to the report of the Niger Delta Environmental Survey (NDES, 1997), spills caused by corrosion occurred as a result of the old age of the pipeline and lack of regular inspection or maintenance stipulated in the Oil Pipeline Act 1963. The oil companies were required to replace the pipelines after 15 years but most found in the oil producing Ijaw communities were over 50 years old. Shell Nigeria had in 2015 claimed that about 50 percent of its spills occurred as result of pipelines

which crisscrossed the farmland in their area of operation, especially from Oloibiri to Port Harcourt (SPDC Bulletin, 2021). The company alone agreed that it had spilled about 106,000 barrels in Jones Creek between 1997 and 1998. Statistics reveals that Shell, Chevron Nigeria, Mobil Producing (Nigeria), Agip Oil, Elf Petroleum Nigeria were the worst offenders of the oil and gas laws which occurs and polluted the Niger Delta (Ojakorotu & Lysias, 2010). Shell however argued that the villages in most Delta areas, particularly in Ijaw land, had grown up around the pipelines and so to a large extent contributed to such environmental problems in the area (Moldoveanu, 1999). We can argue that this has led to the bitter disagreement between the oil companies and the local people over which of them should be held responsible for the environmental damage in the Ijaw oil-producing community.

Sabotage is another major source of oil spill in the Niger Delta oil-producing communities. This occurred as a result of the refusal of the federal government and the oil companies to compensate for the environmental damaged brought on the people in the oilfields. A Shell's staff who claimed anonymous asserts that most oil spilled in Botem, Jones Creek and Jesse Creek and Nembe were linked with saboteurs of oil installations by local protesters. Shell-BP argued that 77 out of the 111 spills in the Ijaw and Delta oil fields occurred as a result of sabotage, and no oil company is permitted to pay compensation for damages caused by saboteurs.

The local protesters were alleged to make spills look as if they were caused by technical failures, for example, by creating holes in the oil pipelines (Moldoveanu, 1999; Shell, 2014). Estimates of sabotage of oil pipelines by the local people before 1990s accounted for about 18% of the pollution in the Delta, but as of 1996 it had risen to 60%. Meanwhile, (SPDC Report, 1996) spills due to corrosion had declined, as many oil companies had started the replacement of their older oil pipelines. The company's claim is questionable, because oil spills linked to old pipelines has continued unabated in the Niger Delta.

The contamination of the freshwater swamp used for drinking in the Luwai area of eastern Delta (Ogoni) was tested and analysed in USA in 1997 to determine the extent of damage through scientific means. The result shows that the water had 18ppm (part per million) of hydrocarbon, about 360 times the level permitted in drinkable water by the EU (Nwilo & Badejo, 2019). A World Bank (2018) report shows that the vast majority of the Delta people, close to between 76-80% in rural areas and 50-56% in urban areas, lacked access to safe drinking water. This was responsible for water-related diseases of up to 80% reported in the oil village communities in the Niger Delta (NDDC, 2019).

The case of accidental spills occurred in Oyakama in 1981. The construction of a road by the Guffanti Company between Kaiama and Ahoada Ijaw communities accidentally drilled a hole in the Nigerian Agip oil company's 16-inch pipeline (Akujuru, 1996). About 120,000 barrels of oil was reported to have spilled and spread across to other village communities of the Ijaws, such as, Okpodu freshwater and Orashi River. Scientific evidence reveals the un-fertility of the farmland in those areas a year after of the spilled incidence. One can argue that the claim made by the Niger Delta people over environmental pollution were indeed true. The Mobil Quo Iboe oil spill of 12 January 1998 was linked with accidental spills. It occurred at the Mobil Producing Nigeria Idoho platform and its Quo Iboe onshore station in the south-east of the Delta state. The spillage based on the Human Right report (1999), spread into Fishtown, Koloama, Penington beach in Ijaw communities, up to 200 kilometres away. The communities reacted by submitting about 14,000 applications for compensation payment worth over US$100 million, despite the company's prompt response to combat the spills. A scientific report of the Quo Iboe oil spill incident shows that the water tested negative, as the Idoho River was not affected. The river water was collected with the reading between 0.82 and 83.15 parts per million (PPM), below the prescribed limit of the DPR standard for oil inland waters. This report was viewed differently by the local people who bore the brunt of the spills.

Shell-BP claimed in its Fact Book (1993) that, depending on the environment, oil pollution has a negative impact on water quality, vegetations and fauna of such an environment.

As discussed, the Oloibiri oil-producing community had farmed, lived and depended on farm produce such as vegetables, food crops and legumes (Steve, 2021; Ashton 2015, NAI 256/1957), but the operation of oil companies has brought changes to their environment by 1978 when the oil wells dried up. Many of the affected Olobiri and Ijaw people according to Campbell (2001), believed that pollution by oil had eroded the soil nutrients which brought sharp reduction in agricultural productivity. Ekpo commented on this when he said that: "As a result of the oil pollution our youths and women are unable to engage in farming, and fishing which are the main occupations in this area. So, they have nothing to look forward to." Aghalino and Raji added that the pollution of oil led to degradation of the environment, created gullies and debris as well as impacted the mangroves, destroying the flora and fauna of the Oloibiri and Ijaw areas (Ashton, 1998 and Awunudiogba, 2021).

The above explains the impact of perennial oil spills on the Ijaw people and the environment, particularly the mangrove and the swamp water resources in Oloibiri (Amnesty, 2019; Kia, 2019). Pollution of water had killed the fisheries and other life in the water and rendered the fishermen unproductive. Francis (2010) contended that the chemical pollution in the water not only destroyed the fisheries, but had decimated the coastlines vegetations. The activities of Shell and Chevron in the oil-producing areas of the Ijaws had precipitated the destruction of the local ecological balance and bio-diversity. Emordi, Osaghae and Nwaokocha (2018) contend and propose that before the crude oil discovery in the Delta, its eco-system had harboured a high concentration of bio-diversity, which supported a variety of crops, medicinal plants and freshwater fish. Tell Magazine (1993) presented a vivid picture of the devastated impact of oil pollution on the Niger Delta bio-diversity:

What [the Niger Delta people] used to call upon for their livelihood and well-being has been wreaked for eternity by the coming of oil and its exploitation by the Nigerian state. They cannot fish because marine life has been flushed out, they cannot hunt because the game fled a long time ago, thanks to the oil hunters, and their land no longer yields good harvest.

Severely oil polluted sites and nature of incidence in the Niger Delta

Table 5 shows some severely oil polluted sites in Niger Delta

Table 5. Some severely oil polluted sites in Niger Delta.

Location	Environment	Impacted area (ha)	Nature of incidence
Bayelsa State	Biseni	Fresh water swamp	20 oil spillage incidences
	Atama/Nembe	Forest	20 oil spillage incidence & fire outbreak
	Etelebu	Forest	30 oil spillage incidences
	Peremabiri	Forest	30 spillage incidences
	Adebawa	Forest	10 oil spill incidences
	Diebu	Forest	20 oil spill incidences
	Tebidaba	Fresh water swamp	30 spillage incidences
	Nembe Creek	Forest mangrove	10 spillage incidences
	Azuzuama	Mangrove forest	50 oil spillage incidences
Total	9 sites		
Delta State	Ouekebe	Barrie forest Island	50 oil spillage incidences
	Salt water intrusion jones creek	Mangrove forest	35 oil spillage & burning
	Ugbeji	Mangrove	2 spillage incidences
	Frefinary waste Ughelli	Fresh water Swamp forest	10 oil spillage – well head leak
	Jesse	Fresh water	8 product leak/Burning
	Ajato	Mangrove	Oil spillage incidence
	Ajala	Fresh water swamp forest	Oil spillage incidence
	Uzere	Fresh water swamp forest	Oil spillage incidence
	Afieser	Fresh water swamp forest	Oil spillage incidence
	Kwale	Fresh water swamp forest	Oil spillage incidence

Location	Environment	Impacted area (ha)	Nature of incidence
	Olomoro	Fresh water swamp forest	Oil spillage incidence
	Ughelli	Fresh water swamp forest	Oil spillage incidence
	Akakpare	Fresh water swamp forest	Oil spillage incidence
	Ughuvwughe	Fresh water swamp forest	Oil spillage incidence
	Ekerejegbe	Fresh water swamp forest	Oil spillage incidence
	Uzoro	Fresh water swamp forest	Oil spillage incidence
	Odimodi	Mangrove forest	Oil spillage incidence
	Ogulagha	Mangrove forest	Oil spillage incidence
	Otorogu	Mangrove forest	Oil spillage incidence
	Macraba	Mangrove forest	Oil spillage incidence
Total	20 sites		
Rivers State	Rumuokwurusi	Fresh Water swamp	20 oil spillage incidences
	Rukpoku	Fresh Water swamp	10 oil spillage incidences

Source: FME, NEF, WWF UK, CEEP – IUCN 2017 Niger Delta Resource Damage Assessment and Restoration Project.

The table 5 above showed that Bayelsa, Delta and River states had the most affected sites, and that forest water swamp forest were more impacted as well as the mangrove forest majorly as a result of oil spillages incidences.

Crop Farmers' Perception of the Effect of Gas Flaring on their Crops

Table 6 shows the content analysis of the nature of problem attributed to gas flaring by crop farmers.

Table 6. Extracts of the Nature of problem attributed to gas flaring by farmers.

Crop	Farmers Extract	Nature of problem attributed to gas flaring by farmers	Remark
Yam (*D. rotundata*)	Farmer 11B	Gas flare (GF) continuously emitted heat radiation, light and unburnt gas drastically reduced yield, both quantitatively and qualitatively.	Affected crop yield
	Farmer 45D	GF attracts insects, such as variegated grasshopper (Zonocerus variegates) that eats up vines, and yam beetle (Heteroligus spp.) that attacks yam tubers.	Affected crop yield
Cassava (*M. esculenta*)	Farmer 64D	Gas flare attracts grasshoppers, which eat up the plants	Affected crop yield
Rice (*O. sativa*)	Farmer 21R	No gas flare effect on rice reported.	Does not affect crop yield
Mango (*M. indica*)	Farmer 37B	Gas flare causes premature ripening of fruits, especially during the dry season months of December-March each year.	Affected crop yield
Sweet orange (*C. sinensis*)	Farmer 87D	Gas flare effect is similar to that of mango. I believe that toxic effluents dispersed by flood water to homes and farms adversely affect the crop.	Affected crop yield

Source: Focus Group Discussions (2022). NB:D=Delta state, B=Bayelsa state, R=Rivers state

This implies that gas flaring affected crop farmers yield. Daniel-Kalio and Braide (2017) argued that "there is some evidence to support farmers' belief that gas flaring in the study area adversely affects their crop yields. The effects are of two kinds: direct and indirect. Gas flaring induces unfavourable environmental conditions, which lowers the potentiality of plants to yield well. Indirect effects involve the predisposition of plants to higher pest and disease attacks, the attraction of yam beetles and grasshoppers to the area which attack crops, and the enhancement of some weeds which are tolerant to gas flaring. Generally, the nearer crops are to gas flares, the poorer is their plant aspect".

Ranking Order of Major Negative Impacts of Oil and Gas activities on agriculture

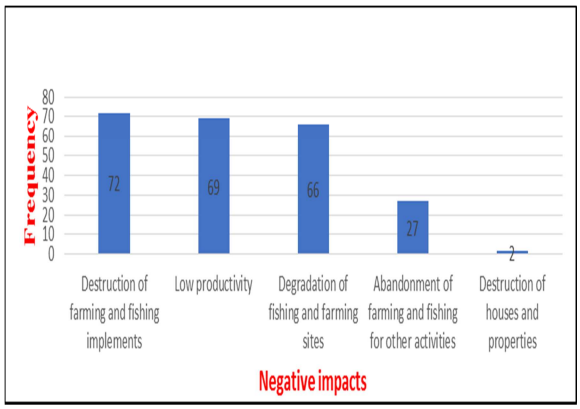

Fig. 4. Major Negative Impacts of Oil and Gas Activities.
Source: Field survey data (2022).

The result shows that the negative impact of oil and gas flaring activities is destruction of farming and fishing implements (72.0%), low productivity (69.0%) and degradation of fishing and farming sites (68.0%). Oil spills have caused a lot of agricultural and environmental problems in the Niger Delta (Ashton, 2001; Eweje, 2017). Accoding to Aghalino (2019), Oil spills have degraded most agricultural lands in the area and have turned hitherto productive areas into wastelands. With increasing soil infertility due to the destruction of soil micro-organisms, and dwindling agricultural productivity, farmers have been forced to abandon their land, to seek non-existent alternative means of livelihood. Aquatic life has also been destroyed with the pollution of traditional fishing grounds, exacerbating hunger and poverty in fishing communities (Gbadegesin, 1997). Farmers have lost their lands, and are consequently forced to emigrate to other communities in search of livelihood exerting additional pressures on natural resources in such areas (Omofonmwan & Odia, 2019). It is noteworthy that, the devastating consequences of oil spill in Niger Delta region with its eventual hazards on both aerial and terrestrial environs tantamount to an irreversible chain effect on both the bio-diversity and safety spills in populated areas affect crops and agriculture through contamination of the groundwater and soils. Spills also contribute to the contamination and death of fishes which affects the economy and human health adversely (Aghalino, 2019; NAE 384/2014; NNPC, 1997; Emoyan, Akpogorie & Akporhonor, 2018; Augustine & Sandford, 1976; Brouwer, 1971) and Sandford, 1974; Omofunmwan, 2018; Micheal 2021).

Government and Oil Companies Action to address the impact of oil and gas activities on Agriculture and the Environment

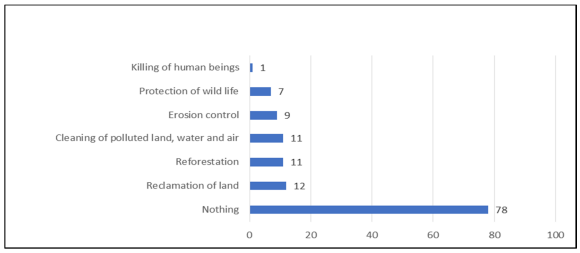

Fig. 5. Government and Oil Companies Action to address the impact of oil and gas activities on Agriculture and the Environment.
Source: Field survey data (2022).

The fig. 5 above clearly shows 78.0% of crop farmers to have reported the government and oil companies doing nothing to address the impact of oil and gas activities on agriculture and environment. Few proportion (12.05, 11.0%, 11.0%) said the government/oil companies reclaimed land, reforested, and cleaned oil polluted land, water and air respectively.

Conclusion

This paper has clearly shown the consequences of oil production on the Ijaw people and their environment cum agriculture over time. It showed that the exploration and production of oil within Niger Delta environment has brought changes to their eco-system. It can thus be argued that gas flaring occurred in the Ijaw land as a result of the burning of waste gases by combustion, because flaring has affected their vegetation, soil and climate, while oil pollution had contaminated the rivers, creeks and mangroves on which their livelihood relied on. Based largely on scientific reports in this paper, it is clear that flaring of gas has caused untold environmental devastation and health hazards both on humans and animals, as a result of the emission of gases such as nitrogen, sulphur oxides and carbon-monoxide, with an impact on vegetation, soil and climate. The study noted that oil spills occurred as a result of lack of proper maintenance of the oil flow lines or pipelines, sabotage, accidental and equipment failures by the oil companies. The study argued that the saboteurs had been forced out of their traditional jobs, having fished, farmed and survived off the natural environment until oil polluted and degraded their means of livelihood. Scientific evidence presented also showed that most of the rivers and waters in the Niger Delta were polluted as a result of blowout, sabotage or accidental spills. This paper also reveals that oil pollution was not the only cause of environmental degradation in Ijaw land and the entire Niger Delta. Other factors were sewage, vehicle emissions, solid wastes, toxic and hazardous substances. It concludes that Shell-BP and Chevron Nigeria and other oil operators in the Ijaw and Niger Delta should not be held completely to blame for all environmental problems, though oil and gas pollution still constitutes the basis for their agitation.

Recommendation(S)

So far, the measures are yielding good result even though there are still human sabotages here and there. To minimize the occurrence of oil spill in the oil producing areas, the following recommendations are made:

1. The causative factors should be taken care of.
2. Sabotage and oil bunkering can be stopped through proper engagement and empowerment of the youth and women groups and also through proper and adequate monitoring of pipeline and oil installations/facilities.
3. Corrosion can be prevented by pipeline and low line replacement, routine pigging and application of cathodic protection systems, which are regularly monitored and upgraded where necessary.
4. Oil spill response system should be upgraded.
5. Major flow stations should be stocked with first-line response materials (such as booms, absorbents and tanks) that enable field operators to respond promptly and effectively to spills.
6. The creation of regional spill response centers along coastlines will help in managing oil spill problems.
7. In order to reduce the response time and qualify the decision-making process, application of Geographic Information Systems (GIS) as an operational tool has been suggested. Information on the exact position and size of the oil spill can be plotted on maps in GIS and a priority of the combat efforts and means according to the identified coastal sensitive areas can be carried out.

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