

SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACT OF CRUDE OIL EXPLORATION AND PRODUCTION ON AGRICULTURAL PRODUCTION: A CASE STUDY OF EDJEBA AND KOKORI COMMUNITIES IN DELTA STATE OF NIGERIA.

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ABSTRACT

The study examined the socio-economic and environmental impact of oil exploration on agriculture with particular reference to Edjeba and Kokori communities of Delta State, Nigeria. Both communities are oil-producing communities and agriculture constitutes the primary income generating activities of the indigenes. A 15 item close-ended questionnaires was used to elicit responses from 100 animal, crop and fish farmers. This sample was made up of 55 and 45 farmers randomly drawn from Edjeba and Kokori communities respectively. The results showed that oil exploration and production activities have caused damage to farmlands and water bodies as a result of oil spillage leading to a decrease in agricultural output and hence the income earning capacity of the people has declined appreciably. The results also showed an increase in the occurrence of health hazard, air/noise pollution and heightened deforestation in these communities. It is recommended that regular inspection of oil pipelines, monitoring of oil fields, adequate and timely compensation payments, provision of farm inputs including agricultural extension services and improved seeds be made available to host communities for improved agricultural production.

KEY WORDS: socio-economic effects, environment impact, oil production, agriculture, Delta State.

INTRODUCTION

The Nigerian environment and the Niger Delta in particular are confronted with severe environmental problems and challenges. This is because the Niger Delta region is the oil producing region of the country. Its oil resource accounts for over 80% of the nations export revenue. Agriculture is the major economic activity in Delta State. It accounts for about 90% of all peasant economic activities and revenue. The state is also endowed with oil mineral resources the exploration and exploitation impact on the environment through frequent spills, pipe explosions, pollution, sabotage, gas flaring and effluent emission. Other sources of oil to the environment include transportation, effluent water from oil refineries, lubrication oils and other wastes in the form of sludge, bitumen, slops and oil sand/sediment present in large amount within oil flow stations, storage terminals and tanks (Nwilo, 1998; Ogr, 2001).

Ikporukpo (1985) reported that oil companies have considerably disturbed the traditional role of the rural peoples as the source of primary products such as agricultural commodities. He maintained that farmers have been reported as disadvantaged in the rural areas despite some compensations received for land and crops loss due to oil exploration. The major occupation of farmers continues to suffer hard blows as many rural dwellers now prefer working as temporary staff in oil related contracting firms around the villages instead of on the farms. This has led to labour shortage for many farm operations and has resultantly caused food shortage. Intensive oil exploitation activities have led to abandonment of farmlands in the Niger Delta areas of Nigeria. Observations have shown that oil producing states of Nigeria including Delta, Edo, Bayelsa, Rivers, Akwa-Ibom, Imo and Ondo suffer various consequences of oil spills including death as a result of drinking polluted water (Oteri, 1981; Mason, 1993). In some areas, oil spills have been reported to halt economic activities such as fishing and farming (Stanley, 1990). The long-term effect of oil spillage includes traces of oil in surviving organisms and little environmental restoration several years after the spill. Lal (1995) traced the perpetual food deficit, malnutrition and poor standard of living to

mismanagement and degradation of soil resources and resource based agricultural systems as well as human interference with the ecosystem including oil activities.

Edjeba is in Uvwie local Government Area (L.G.A.) While Kokori is in 'Ethiopo East Local Government Area of Delta State. Both communities are oil-producing communities. Part of the premises of Shell Petroleum Development Company West (Warri) is located in Edjeba. Oil pipelines run across the community. There are many oil wells, flow stations, oil pipelines as well as gas flare sites in Kokori. Both communities are fishing and cropping communities.

The present study has been undertaken to provide information on the socio-economic and environmental impact of oil exploration and exploitation activities on agriculture with particular reference to Edjeba and Kokori communities of Delta State, Nigeria.

MATERIALS AND METHODS

Methods of data collection include surveys, interviews and questionnaires. Visits were made to the oil industry base. The impact of oil pollution on their farming and fishing sites and their socio-economic status measured using well structured closed-ended questionnaires administered to 100 farmers and fisher folk. The hundred questionnaires were distributed 55 (10 animal/livestock production, 12 fish farmers 10 crop farmers while 23 combined the three enterprises) and 45 (5 animal/livestock production, 4 fish farmers, 20 crop farmers and 16 combined them) in Edjeba and Kokori respectively. This indicates that some of the respondents in Edjeba and Kokori communities were involved in single farming enterprise such as animal / livestock production, fish farming and crop farming while others combined the three enterprises (Table 1). Information on sex, level of education, farming activities, non-farm work engaged in by farmers and their perception of environmental impact of oil industry were elicited from respondents. Data collected were subjected to descriptive and inferential statistics using frequency counts and percentages. Chi Square was used to test for significant differences between the means.

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Table 1. Socio-economic and demographic features of respondents, Edjeba and Kokori, April 2000

	Edjeba number of respondents		%	Kokori number of respondents		%	$\chi^2_{0.05}$
Sex							
Male	30	30.25	54.55	25	24.75	55.56	Cal-0.02
Female	25	24.75	45.45	20	20.25	44.44	Tab-3.84
Total	55		100	45		100	
Current age							
<21	3	3.85	5.45	4	3.15	8.89	
21-40	30	27.5	54.55	20	22.5	44.44	Cal-1.462
41-60	20	20.9	36.36	18	17.1	40.00	Tab 7.81
> 61	2	2.75	3.64	3	2.25	6.67	
Total	55		100	45		100	
Education							
Literate	40	40.15	72.73	33	32.85	73.73	Cal-0.558
Non literate	15	14.85	27.27	12	12.15	26.67	Tab-3.84
Total	55		100	45		100	
Residence							
Permanent	45	42.32	81.82	32	34.65	71.11	Cal-1.60
Temporary	10	12.65	18.18	13	10.35	28.89	Tab - 3.84
Total	55		100	45		100	
Farming activities							
Animal production	10	8.25	18.18	5	6.75	11.11	
Fishing	12	8.80	21.82	4	7.20	8.89	Cal-9.35
Arable crop farming	10	16.50	18.18	20	13.50	44.44	Tab -7.81
Fishing, arable crop production and animal production	23	21.45	41.82	16	17.55	35.56	
Total	55		100	45		100	

RESULTS AND DISCUSSION

Table 1 shows the socio-economic and demographic characteristics of the respondents. No significant relationship existed in the demographic features of the respondents in Edjeba and Kokori communities at the 5% level of probability (Table 1).

The Edjeba sample comprised 54.6% males and 45.4% females, while the Kokori sample consisted of 55.6% males and 44.4% females. The number of males sampled was higher in both communities because as heads of farm families they made themselves more available for the interview and were more willing to fill in a questionnaire than the women folk. Edjeba, respondents aged 21 – 60 years were 90.91% while in Kokori they were 84.44%. This shows that respondents were adults who were knowledgeable in community affairs. Majority of the respondents were literate, 72.73% in Edjeba and 73.33% in Kokori. With respect to residence at the time of survey, 81.82% of Edjeba respondents and 71.11% of Kokori lived in the community permanently while 18.18% of Edjeba respondents and 28.89% of Kokori's respondents lived temporarily in the community. There was a strong/significant relationship in farming activities engaged in by farmers in Edjeba and Kokori communities ($\chi^2 = 9.35$; $P < 0.05$). This shows that some farming activities and combination of farm enterprises were more predominant in some communities than the others as shown in the observed frequencies. It is evident from Table 1 that in Edjeba 21.82% of the respondents were fishermen, 18.18% were arable crop farmers, 18.18% were into animal production, while 41.82% combined animal livestock production, fishing and arable crop farming. In Kokori, 8.89% of the respondents were fishermen, 44.44% were arable crop farmers, 11.11% were in animal production, while 35.56% of them combined the three enterprises. This result is in accordance with previous reports of Ikporukpo (1985) and Nwankwo and Ifeadi (1988). The perception of the

environmental impact of oil industry activities in Edjeba and Kokori communities is presented in Table 2. No significant relationship existed between the level of soil degradation due to oil industry activities in Edjeba and Kokori communities ($\chi^2 = 1.16$, $P > 0.05$) (Table 2). This indicates that the level of soil degradation as a result of crude oil production activities is equivalent in the two communities. The present results confirm the reports of Adams and Ellis (1960), Ellis and Adams (1961), Garner (1971), Rowell (1977), Udo and Oputa (1984), Atuanya (1987), Nicolotti and Eglis (1998) and Ogr (2001) that oil pollution affects the biological, chemical and physical properties of soil. Similarly, no significant relationship was found between the level of air noise and water pollution from oil industry activities in Edjeba and Kokori communities at the 5% level of probability (Table 2). This indicates that with respect to the level of air, noise and water pollution crude oil industrial activities affect the two communities equally. Similar reports have been made by Bossert and Bartha (1984) and Ikiebe (1986).

A total of 81.82% of the respondents in Edjeba agreed that the activities of oil industries in that area had increased health hazards while only 18.18% said no. Similarly, 91.11% of Kokori residents (at the time of survey) attributed the high occurrence of health hazards in the area to oil industry activities. Death normally occurs as a result of drinking polluted water, ingestion of polluted fish and crop plants as well as the outbreak of epidemic diseases including dysentery, cholera, stooling, ringworm, eye and throat infection and gastric-intestinal disorders (Ikporukpo, 1985).

A total of 96.36% of the respondents in Edjeba and 100% of Kokori confirmed that their soil has been degraded. Pollution of farmlands as a result of oil activities is a well-known phenomenon (Ekeke, 1981; Nwankwo and Irrechukwu, 1981). Oteri (1981), Siddiqui and Adams (2002) reported that hydrocarbon contamination in soils is toxic to plants and soil microorganisms and act as a source of ground water contamination. Oil spillage can cause a massive

Table 3: Effects of oil industry activities on the social life of Edjeba and Kokori communities.

	Edjeba number of respondents	%	Kokori number of respondents	%	%	χ^2 0.05
Farm size						
Seriously affected	40	41.25	72.72	35	33.75	77.78
Not seriously affected	13	11.55	23.64	8	9.45	17.78
No effect	2	2.2	3.64	2	1.8	4.44
Total	55		100	45	100	
Adequate compensation payments						
Yes	10	10.45	18.18	9	8.55	20.00
No	45	44.55	81.82	36	36.45	80.00
Total	55		100	45	100	
Intention to leave because of oil Pollution/activities						
Yes	30	33	54.55	30	27	66.67
No	25	22	45.45	15	18	33.33
Total	55		100	45	100	
Non-farm work engaged in by Farmers						
Petty trading	15	14.85	27.27	12	12.15	26.67
Local brewing & distillery	2	2.2	3.64	2	1.8	4.44
Farm produce processing	6	4.4	10.91	2	3.6	4.44
Local craft making/ Blacksmithery	6	4.95	10.91	3	4.05	6.67
Carpentry & joinery	4	2.75	7.27	1	2.25	2.22
Hunting	2	3.3	3.64	4	2.75	8.89
Bricklaying/Masonry	4	7.15	7.27	9	5.85	20.00
Food vendors	5	5.5	9.09	5	4.5	11.11
Civil service	5	5.5	9.09	5	4.5	11.11
Teaching	6	4.4	10.91	2	3.6	4.44
Total	55		100	45	100	
Adequate social amenities/ Infrastructural development.						
Yes	11	9.35	20.00	6	7.65	13.33
No	44	45.65	80.00	39	37.35	86.67
Total	55		100	45	100	

metal poisoning and skin disease. Water pollution is a threat to water quality, the marine ecosystem and sea resources. Oil spillage tends to destroy plant and animal life giving rise to a change in the ecology of the coastal zone if not properly cleaned up (Ikibe, 1986). Oteri (1981) stated that there were cases where local inhabitants complained of oil-polluted water coming out of boreholes meant for domestic use. Reports of wells located near some oil refineries containing a mixture of oil and water as a result of seepage/leakage from subterranean tanks are wide spread (Nwankwo and Irrechukwu, 1981; Ifeadi and Nwankwo, 1987). The dangers of transferred effect of oil spill from aquatic creatures/life forms to human beings should give Nigerians some concern particularly at this time when many Nigerians depend on frozen fish as their source of protein. Spilled oil in the aquatic environment may cause damage to aquatic lives in a number of ways. It may form slick, either buried in the sediments or stranded on the riverbanks, thereby preventing oxygen diffusion into the water and subsequent activities of aquatic life forms. Immediate effects of oil spillage on fishing resources and fishermen according to Mason (1993), were massive fish mortality, tainting of fishes, killing of fish food hence the consequential reduction in the cash returns of fishermen. He also reported devaluation of water front properties. Aquatic life forms including phytoplankton, aquatic macrophytes, mangroves, larvae, amphibians, crustaceans, bivalves, oysters, lobsters, crabs and other fauna are usually destroyed in the event of oil spillage/pollution. Bamidele and Agbogidi (2000) and Agbogidi (2003) reported the death of some aquatic macrophytes in the presence of crude petroleum oil and its products in water bodies. Odeyemi and Ogunseitan (1985) maintained that rivers providing drinking water for host communities become contaminated whenever there is oil

spillage. The swamps and mangroves of the Niger Delta have not only been cleared off, their environment has been seriously degraded due to oil exploration activities (Ikibe, 1985; Nest, 1991). Seabirds which bath in oil soaked water ingest some quantity of crude oil due to emaciation and loss of subcutaneous and visceral fats. Birds on the shore lose their young ones due to coating of oil on their eggs. This prevents unsuccessful hatching of the eggs. Many of the respondents agreed that oil spills halt economic activities such as fishing and farming.

Table 3 shows the effects of oil industry activity on the social life of Edjeba and Kokori communities. On farm size, 72.72% of the respondents in Edjeba and 77.78% in Kokori agreed that their farm size has been seriously affected by oil industry activities (Table 3). Ikporukpo (1985) and Nest (1991) stated that large expanses of land are usually acquired by oil companies for their operational activities. These include location of companies industrial and residential accommodations, drilling locations (rigs), flare sites, oil fields and oil wells, pipes laying, access roads, installation of oil rigs and borrows (Stanley, 1990). The cumulative effect of all these activities is the displacement of other land users (Nest, 1991). Reduction of farm sizes as a result of oil activities and man's wanton spirit of exploitation of the rural resources poses a serious danger to the survival of the rural population. There is a need to strike a balance between the needs of the present generation and the chances of survival of the future generations. Only 3.64% of respondents in Edjeba and 4.44% in Kokori said oil industry activity had no significant effect on farm size. With respect to compensation payments (Table 3), only 18.18% of the respondents sampled in Edjeba and 20.00% in Kokori agreed that compensation payments were adequate. On the other hand, the greater percentage 81.82%

destruction to farm lands, food and cash crops including cassava, kola nuts, palm trees and cashew hence it brings a set back to communities whose main source of survival is agriculture. Oil exploration activities have significant reductions in crop output. Ifeadi and Nwankwo (1987) reported that in Nigeria between 1976 and 1986, about 62.8% of oil pollution incidents occurred on farmlands. Baker (1970) also observed that the presence of crude oil on farmlands renders the land unproductive and has serious adverse effects on plant growth and consequently a decrease in their income earning capacity. These problems have subjected the inhabitants of host communities to economic and social hardship (Stanley, 1990).

On land, oil rapidly percolates into the soil and in the process, volatile fractions escape leaving the less volatile/heavier components for microbial attack or migration downwards under the force of gravity. The movement continues until the oil reaches the water table and eventually forms an oil lens on top of the soil water table (Kinghorn, 1989). Benka-Coker and Ekundayo (1995) reported that contamination of soil with petroleum hydrocarbons causes drastic changes in the biological, chemical and physical properties of soil. Oil spills on land can result in an imbalance in the carbon-nitrogen ratio, which if greater than 17:1 in soil will result in net immobilization of nutrients by microbes leading to loss of soil fertility. More than fifty four percent (54.54%) of the respondents in Edjeba and 55.56% in Kokori admitted that the declining crop yield and massive destruction of plants in these communities are mainly due to oil industry activities. Other factors that can lead to decline in agricultural output according to Lal (1995) and Nwoboshi (2000) include lack of fallow period, continuous cropping, use of low/poor yielding variety, depletion of soil manure by erosion, use of poor technology, inclement weather, climatic changes, poor use of fertilizer and crop and animal diseases. Baker (1970) studied the effects of oil on plants and observed that oil causes wilting, defoliation, reduced germination rate, stunted growth, delayed reproduction and finally death of plants. She also asserted that some metabolic processes of plants including photosynthesis, respiration, translocation and transpiration are negatively affected in the event of oil pollution. Low flora biomass and low species diversity have also been observed in areas where oil exploration and production are carried out (Ogri, 2001). In the same vein, the phytotoxic effects of crude oil have also been demonstrated by De Jong (1980). According to him, crude oil

spill on soil makes it unsatisfactory for plants growth. This may be due to insufficient aeration of the soil as a result of the displacement of air from the pore spaces by the oil and an ensuring increasing demand for oxygen caused by the activities of soil decomposing microbes (Gudin and Syrratt, 1975). Oil in the soil causes poor aeration, creates some unfavourable conditions that make some essential nutrients such as nitrogen unavailable to plants and accumulates others like manganese and ferrous elements to a toxic level (Fowell, 1977; Atuanya, 1987).

Air/Noise pollution (Table 2) is a major problem in Kokori because of the presence of gas flare sites. Oil industries contribute to air pollution. Majority of the respondents (94.54% in Edjeba and 97.78% in Kokori) agreed that oil exploration and exploitation have contributed immensely to air and noise pollution in host communities (Table 2). Hydrocarbons from fumes of oil stations and flaring gas not only contribute to greenhouse effect which has led to consequences on the ecosystem but have also led to acid rain which are observable in certain parts of oil producing communities in Nigeria. It has also been reported that acid rain has corrosive effect on zinc roofs of some oil producing communities and therefore some people change their roofs twice in a year. The effect of acid rain on the yield of crops is obvious as it impairs photosynthesis. Other consequences of oil industry include deforestation and noise. The large expanse of land degraded and deforested, as a result of oil exploration activities remain a major threat to sustainable development. Trees and other green vegetation purify the environment by their photosynthetic activities. Their indiscriminate removal is a threat to life. Nwoboshi (2000) stated that when the last tree dies, the last animal (including man) on earth dies. Noise or vibrations from drilling equipment is an environmental hazard, which should be recognized. Many villagers in oil producing areas have been reported to desert their homes because of unbearable noise during drilling of oil well. Vibrations have also been reported to pull down walls and ceilings of residential and official homes. Majority (94.55%) of the respondents in Edjeba and (95.58%) in Kokori agreed that their water was seriously polluted and there was a declining fish catch and fish quality. This observation corresponds to the report of Bossert and Bartha (1984) that oil pollution constitutes a major threat to ground waters and contributes to water poisoning and disease outbreak including

Table 2. Perception of the environmental impact of oil industry activities in Edjeba and Kokori communities.

	Edjeba number of respondents		%	Kokori number of respondents		%	$\chi^2_{0.05}$
Occurrence of health hazards							
Yes	45	44.55	81.82	41	36.45	91.11	Cal-2.10
No	10	7.7	18.18	4	8.55	8.89	Tab-3.84
Total	55		100	45		100	
Soil degradation							
Yes	53	53.9	96.36	45	44.1	100	Cal-1.16
No	2	1.1	3.64	-	0.9	-	
Total	55		100	45		100	Tab-3.84
Plant destruction/declining Yields							
Yes	30	30.25	54.55	25	24.75	55.56	Cal-0.01
No	25	24.75	45.45	20	20.25	44.44	
Total	55		100	45		100	Tab-3.84
Air/Noise pollution							
Yes	52	52.8	94.54	44	43.2	97.78	Cal-0.34
No	3	2.2	5.46	1	1.8	2.22	
Total	55		100	45		100	Tab-3.83
Water pollution							
Yes	52	52.25	94.55	43	42.75	95.56	Cal-0.05
No	3	2.75	5.45	2	2.25	4.44	Tab-3.84
Total	55		100	45		100	

(Edjeba) and 80.00% (Kokori) said compensation payments were not adequate and timely. Many argued that they are not satisfied with methods of compensation payments and that the token paid to them was not commensurate with the damage done to their source of livelihood. The demand for compensations on damaged resources has placed the communities on collision course with the oil companies and brought about conflict. Intra and inter-communal conflict usually arises between emerging interest groups within and between communities. Respondents from both communities complained of poor educational services, increased moral problem, and lack of gainful employment especially to managerial/influential positions even when qualified. They also lamented that indigenous contractors are only occasionally patronized on menial jobs. Compensations are often underpaid and delayed despite the Petroleum Act Nos 21 and 23 of 1969 of Nigeria, which indicates that there should be fair and adequate payment of compensation. The feet-dragging attitude of oil companies in clearing oil spills and in compensating for damage could be explain by the fact that these oil companies feel that it is Nigeria's responsibility to repair ecological damage resulting from oil industry because the country takes the bulk (about 95%) of the generated oil revenue. The buck-passing which goes on between oil companies and Nigeria as a nation on the above issue affects innocent citizens who are today impoverished by the destructive consequences of oil industry.

Some of the farmers including the fishermen have migrated to other more fertile lands in other communities thus putting pressure on scarce fertile lands and generating environmental refugees who has led to increased frustration, misery and poverty in the communities. The aesthetic value of any ecosystem polluted with oil is usually lost. There are situations where both the tourist and industrial values of beaches have been lost as a result of pollution from crude petroleum oil. Such places are usually abandoned. There was no significant relationship in the effects of crude oil industrial activities on the social life of the people in Edjeba and Kokori communities ($\chi^2 = 0.52$; $P > 0.05$). This shows that there was almost an equal effect of crude oil production activities on the social life activities of the two communities. These findings are in accordance with previous reports of Odeyemi and Ogunseilatan (1985) and Stanley (1990). About 54.55% of the sampled population in Edjeba and 66.67% in Kokori indicated their intention to leave their communities because of oil pollution (Table 3). On the other hand, 45.45% (Edjeba) and 33.33% Kokori said they do not have the intention to leave for other communities as a result of oil industry activities. This is not unconnected to the fact that the respondents in both communities are involved in some non-farm work including petty trading, local brewing and distillery, farm produce processing, local craft making/ blacksmithery, carpentry and joinery, hunting, bricklaying/masonry, food vendors, civil service and teaching.

On the provision of social amenities/infrastructural development (Table 3), 20.00% of the respondents in Edjeba and 13.33% in Kokori agreed that social amenities provided were adequate while 80.00% and 86.67% of the respondents in Edjeba and Kokori respectively said that they were not adequate.

The findings of this study could be summarized as follows:

Oil exploration and production have resulted in reoccurring incidents of oil spillage caused by ruptured pipeline or sabotage.

Oil spillage in a major oil producing country like Nigeria is inevitable.

The benefit derived from petroleum industries by oil producing communities in Delta State does not in anyway match the exploitation of this non-renewable natural resource.

Both farmlands and water bodies are no longer as productive as they were before the oil activities in host communities. Farm sizes have reduced due to the large expanse of land acquired by oil companies for their operational activities hence the income earning capacity of the people has declined appreciably.

Oil production activities have in no way impacted positively on host communities. Unemployment rate is still very high, high level of poverty and low level of education with little or no development in these areas. Electricity and pipe-borne water are considered luxury and roads for easy transportation are lacking. Still, oil pollution from operational activities continues to devastate the environment. Peace and social stability have become elusive in the oil producing areas of Delta State.

The demand for compensation payments for damaged resources has placed the communities on collision course with oil companies and this has brought about conflict. Forest encroachment is on the increase in a bid to search for more oil wells and fields.

If oil exploitation proceeds without careful environmental and social safeguards, major damage could be done to both the forest ecosystems and the communities, which inhabit them.

CONCLUSION

The study has shown that crude oil exploration and production in Delta State impact negatively on agricultural productions thereby affecting the socio-economic and environment of host communities.

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