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SOCIO-ECONOMIC IMPACT OF INDUSTRIAL EFFLUENT DISCHARGE ON IBESE RIVER AND INHABITANTS OF VILLAGES ALONG ITS COURSE IN NIGERIA

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ABSTRACT

Quest for industrial hazard impact both on the inhabitants and environment, necessitated the study of Socio-economic Impact (SEI) of Industrial Effluent Discharged (IED) on Ibese river and inhabitants of villages along its course in Nigeria. The SIE of IED was conducted after water quality result of the Ibese River has been ascertained. Based on the water quality result, the river course was demarcated into direct industrial effluent discharged Ibese river site, upper Ibese River site and control (free of effluent discharge) river site outside the Ibese River location. The river that is Free of Industrial Effluent Discharge (FIED) site served as control. Simple random sampling technique was used to sample 10% of farmers from farmers' organization list in IED and FIED to give a total of 180 farmers selected for the research. Data were collected through the use of interview schedule and were analyzed using descriptive and inferential statistics. Result revealed that high number (92.3mg/L) of phosphate an acid element and low (3.30) dissolve oxygen were discovered in IED site. Concerning heavy metals, higher mean level Fe 12.63, Pb 2.01 Cu 4.86 and Zn 7.88mg/L were found in IED water quality analysis. Majority (80.0%) of the farmers in FIED areas cultivated between 5.1 and 20 hectares of farms while 50.0% belong to this categories in IED. In FIED, higher proportion (86.0%, 64.0%, and 62.0%) generate income from crop planting, sheep and goat keeping and cassava processing respectively whereas fewer (24.4%, 16.7% and 6.6%) generate income from these sources in IED site. Impairment of used water was rated by 93.3% of the farmers as the most prominent harmful effect of IED. Income discrepancy between industrial effluent discharge site and non industrial effluent discharge site was statistically different at $P<0.005$. The finding revealed that SIE of IED is severe in IED site.

Keywords: Industrial effluent discharge, socio-economic, impact, industrial, inhabitant.

INTRODUCTION

The world is rapidly changing and agriculture has become more complex, more intensive as more competitive demand is on land is on the increase, so that there is a striking increase in the awareness of environmental problems. The decades 1990 – 2010 have witnessed a greater awareness of the destructive effect of uncontrolled exploitation of the environment without conscious effort of replacing the used resources (Onasanya, 2008). Nature is dynamic and therefore, causes changes in the environment. However, nature does maintain equilibrium among elements in the environment. Thus, ensuring environment stability overtime. The physical activities of human beings

on the environment are dynamics but they cause disequilibrium in the inter relationships among the elements of the environment. One of human activities is the development of industrial sector promoting sustainable environment for human survival. Despite its importance, industries activities are dynamic and they displace environmental elements which are not returned to the proper place in the environment. In some cases they disappear or change their natural state both in quality and quantity (Onasanya, 2008).

In using technology to solve some human problems, other problems emanate. For instance, in the process of exploiting crude oil, unintended gas flaring, oil spillage, land degradation emanate. It has been found that the use of chemical fertilizers to increase farm productivity pollutes surface water when run-off carried the chemicals into the streams (Danazumi and Bichi, 2010 and Emongor*, et al., 2005*). Consequently, it creates a serious impact on the fishers life and finally on the consumers. Moreover, many established industries generate chemical effluents and other toxic liquid wastes which they released into the streams, lakes and land.

The industrial effluent river pollution is an environmental problem in third world countries. While developed nations adopt stringent water quality requirements to control river pollution from point and non-point sources, the situation is different in most developing countries. Wastewater treatment is not given the necessary priority it deserves and therefore, industrial waste and domestic sewage are discharged into receiving water bodies without treatment (Suriptono *et al.,* 2000) There are ample documentation of water quality deterioration due to industrial effluent and municipal sewage discharge. For instance, the contamination of Cauvery River (India) by heavy metals (Pb, Cr, Zn) was reported and its impact on agricultural, industrial and anthropogenic activities around the river (Begum, *et al.,* 2009). The bio-accumulation of heavy metals in different terrestrial biota was investigated in Kenting National Park, Taiwan and high concentration of Cd, Hg, and Sn was found in snail, earthworm, crab, lizard, snake, and bat. Similarly, high level of Hg was found in invertebrates, amphibians and reptiles which revealed a strong influence from industrial effluent (Hsua, 2009).

In Nigeria, the characteristic qualities of five textile industries' effluent in Kaduna was analyzed and high level of COD, TSS, NH3, BOD5 and S2- that exceeded the FEPA limits by several folds was reported (FEPA, 1991). Also, water quality of Ogun river which industrial effluent from Lagos and Abeokuta is discharged, was assessed (Jaji 2007) and it was reported that the level of turbidity, oil and grease, faecal coliform and iron were very high in all the sampling sites.

The indiscriminate discharge of chemical toxins, especially Pb, Cd, Cr, Co, etc, into the environment results in the transfer of these toxins into plants, animals and man and it was reported that high concentration of heavy metals in irrigation waters could results in death of crops, interfere with uptake of other essential nutrients or form objectionable deposits on fruits and render the edible portion of plants toxic to human and grazing animals (Lapai, 1992). Another study indicated a strong correlation between high cases of malaria in settlements located at Sharada, Challawa and Bompa industrial estates due to the presence of wastewater which provided a breeding ground for mos-

quitoes. Also the incidence of too much acidity and/or alkalinity in ground water in the area is attributed to contamination by industrial waste which renders the well water unpalatable. Residents in the area were reported to complain about the contamination of air which causes odour that is highly objectionable (World Health Organization (WHO), 2003) The combined effect of all these might be the reason of shorter life expectancy in this part of the world (Mophapatra, 1995 and Damazumi and Bichi 2010).

Nichemtex textile industry is one of the biggest industries in Nigeria. It was established in 1977 (Doherty, 2003). Since its existence, the industry has no any efficient and effective waste treatment. Billions of litres of its untreated waste waters have been discharged per day into the Ibese River-Ikorodu, Lagos State Nigeria. Prior to the establishment of Nichemtex industries, Ibese River was known as an important fishing site, source of drinking waters and sources of irrigation to nearby farms. Doherty (2003) in analyzing toxic waste product discharged into streams found that water the pollution result into deleterious effect such as harm to living resources, hazards to human health, and hindrances to aquatic activities.

However, since the Nichemtex has been discharging effluent into the river, little or no effort has been made towards obtaining reliable empirical data on the socio-economic impact of the discharged on the inhabitant living along its course. Therefore, collection of empirical data on the socio-economic impact of the discharged along the Ibese river on the inhabitant along its course necessitates this research. The research was guided by the under listed objectives:

(i) ascertain the personal characteristics of the inhabitants living along the river course; (ii) generate water quality data of the river, in effluent discharged zone and free effluent discharged zone from (Doherty 2003) Ibese water quality analysis; (iii) examine the socio-economic characteristic of inhabitant living along Ibese River course and the control rivers; (iv) identify income generating activities of the inhabitant in effluent discharged area and free effluent discharged zone; (v) ascertain income level of inhabitant in effluent discharge and free effluent discharge zones and (vi) ascertain the harmful effects of effluent discharge on inhabitant.

The following hypothesis was tested: there is no significant difference between farmers in free effluent discharge site's mean income and industrial affected river farmers' mean income.

MATERIALS AND METHODS

In carrying out analysis of water quality, secondary data were used for the water quality analysis. The Doherty river Ibese's empirical laboratory water quality data analysis carried out in 2003 was adopted. That is, his research is what prompted the conduct of this research to ascertain the socio-economic impact of effluent on the people living along Ibese River course. The river course was demarcated into direct industrial effluent discharged Ibese River site, upper Ibese River site and control (free of effluent discharge) river site outside the Ibese River location.

From the list of inhabitants kept by socio-organization on industrial effluent discharge and free effluent discharged strata, 90 inhabitants were randomly selected from each stratum which cumulated into 180 inhabitants that were interviewed for the study. Data

were collected by administering structured interview schedule. Description statistic such as frequency counts, percentages and inferential l statistics such as t-test, and Anova were use to analyze the data

RESULT AND DISCUSSION

Assessment of Water Quality

Data in Table 1 indicate water quality parameters. The industrial effluent affected river (Ibese) contained higher mean number of acidic elements such as phosphate 92.3, sulphate 625.3 and nitrate 127.5 mg /L as against lower number of phosphate 3.8, sulphate 32.6 and nitrate 28.4mg/L acidic elements in free effluent discharge Ajebo River site. Water quality analysis further revealed that Ajebo River, the control river outside industrial effluent location contained lower number of Fe 3.76, lead 2.28 and copper 0.41mg/L of heavy metal as opposed to higher concentration of heavy metal in Ibese industrial effluent affected site. As regard to dissolve oxygen and others elements, the Ibese effluent site contained low oxygen 3.30, and higher detergent 29.6mg/L, oil and grease 230.70 mg/Las opposed to higher - oxygen 6.04mg/L and lower detergent 0.01 and 2.3 gm/L oil and grease in free effluent industrial site (Ajebo) river. Aquatic funa were found in Ajebo River site whereas none was recorded at the Ibese River industrial effluent site. The findings are similar to the World Bank reported that about 19000 tons of hazardous waste is produced annually in Nigeria and the waste comes mainly from steel, metal processing, pharmaceuticals, textiles, tanneries, and oil refining industries (Egbu, 2000).

Table 1: Water Quality Analysis

Parameter	Ajebo River (Control river)(mg/L)	Ibese Upper effluent site (mg/L)	Ibese effluent site (mg/L)
Phosphate	3.8	40.4	92.3
Sulphate	32.6	204.1	625.3
Nitrate	28.4	81.5	127.5
Heavy Metals			
Iron	3.67	7.89	12.63
Lead	0.28	0.23	2.01
Copper	0.41	2.98	4.86
Zinc	1.27	2.69	7.88
Dissolved materials			
Oxygen	6.04	5.12	3.30
Detergent	0.10	0.50	29.6
Oil & Grease	--	2.8	230.70
Water colour	--	Straw	Brown
Aquatic fauna	Yes	Yes	--
Zooplanktons	Yes	Yes	--
Fishes	Yes	Yes	--

Source: Doherty's (2003) Ibese River water quality analysis

Social-economic characteristics of industrial effluent and control River (Ajebo) sites

Data in Table 2 shows that majority (93.3%) of the farmers in free industrial effluent site were in the age bracket of 20 and 50 years unlike 65% of the industrial effluent site that were in the age bracket of 50 years and above. It could be inferred from the finding that young farmers are in majority in free industrial effluent site as opposed to industrial effluent site. The implication of this is that, the farmers in free-industrial effluent areas are in their active age, the age which Ajayi (2000) and Bolarinwa (2007) regarded as the age when farmers will be more dynamic and willing to embark on risk that are associated with income generating activities. The educational status of farmers revealed that greater proportion (62.3%) of the farmers in the free industrial effluent site had educational level higher than primary school. However, in industrial effluent site, majority (86.6%) had education below primary educational level. With higher educational standard, the free industrial effluent site is likely to adopt improved farming system that will increase their production and economic status. Supporting this assertion, Igben (1998) in his study found that there is positive correlation between farmers' rate of adoption of improved technologies and their educational level. He found that education always increase adoption, farm produce, post harvest handling and marketing of agricultural produce.

Data in Table 2 also revealed that farmers in the free industrial effluent site cultivated higher land area (10-20) hectares of land whereas lower hectarages of lands between 1 and 10 were cultivated by farmer in the industrial effluent site. This low average of land cultivated by industrial effluent site could be traced to exodus of farmers in their active age of 20 and 50 years in the area.

Table 2: Socio-Economic Characteristics of the Farmers

Variable	Free effluent river site (Ajebo river)		Effluent site (Ibese river)	
	Frequency	Percentage	Frequency	Percentage
Age				
20-30	9	10.0	8	9.0
31-40	40	44.4	11	12.2
41-50	35	39.0	12	13.3
51-60	4	4.4	48	53.3
> 60	2	2.2	11	12.2
Total	**90**	**100**	**90**	**100**
Sex				
Male	62	68.8	65	72.2
Female	28	31.2	25	27.8
Total	**90**	**100**	**90**	**100**
Marital Status				
Single	10	11.1	18	20.0
Married	63	70.0	55	61.1
Divorced	9	10.0	9	10.0
Widowed	8	8.9	8	8.9
Total	**90**	**100**	**90**	**100**
Education				
Quranic	13	14.4	26	28.8
Primary	21	23.3	52	57.8
Secondary	34	37.8	12	13.4
Tertiary	22	24.5	-	-
Total	**90**	**100**	**90**	**100**
Farm size				
0.1-5.0	10	11.1	45	50.0
5.1-10.0	42	46.7	35	38.9
10.1-15.0	28	31.1	10	11.1
15.1-20.0	10	11.1	-	-
> 20	-	-	-	-
Total	**90**	**100**	**90**	**100**

Income generating activities of farmers in industries effluent and free industrial effluent sites

In this section, farmer's means of survival were examined as shown in Table 3. Higher proportion (95.0%) of farmers in free industrial effluent site engaged in crop planting, 60.0% in kept local fowl, and 71.1% kept sheep and goat while 54.0% of them engaged in fishing activities. Fewer number (24.4%) of the farmers in industrial effluent site engaged in planting crops, 5.5% kept local fowl and 6.6% kept sheep and goat. Farmers in the industrial effluent site did not embark on fishing activities because industrial effluent discharged made the water not conducive for fish and had destroyed fishes that were existing in the river before establishment of textile industries.

However, higher proportion (80.0%) of the farmers in industrial effluent site engaged in trading such as sale of provision; water sachet; textile materials and cloth.

It could be inferred from the water quality analysis that heavy metal and some other element discharge into the river made it not to be drinkable and useful for irrigation in the area. This assertion supported Doherty (2003) who found that heavy metal and oil and grease discharge often accounted for poison in the river which renders the water unstable for drinking and irrigation for inhabitant along the course of the river. Forest products gathering were also negatively affected in the industrial effluent discharge site as shown in Table 3. Farmers in the area were not able to gather forest product as against 54.4% who were able to gather forest product from the free industrial effluent site.

Table 3: Farmers' income generating activities

*Income Generating Activities	Free effluent river Site		Effluent site	
	Frequency	Percentage	Frequency	Percentage
Crop planting	86	95.5	22	24.4
Cassava processing	62	68.8	15	16.7
Palm oil processing	16	17.7	8	8.8
Keeping local fowl	54	60.0	5	4.4
Sheep & goat keeping	64	71.1	6	6.6
Fishing	49	54.4	-	-
Sales of leafy Vegetables	48	53.3	5	5.5
Sale of provision	15	16.7	62	68.8
Sale of water	20	22.2	68	75.5
Divination	-	-	10	11.1
Traditional medicine practice	10	11.1	18	2.0
Gathering of forest produce	49	54.4	-	-

* Multiple responses

Farmers' reaction to effluent discharge hazard

Data in Table 4 show that 93.3% of the farmers' emphasized that the effluent discharge impaired the use of water, while (88.8%) of the farmers said that the effluent discharged hindered them from performing fishing activities. Other activities such as crop farming, livestock keeping, and irrigation were hindered as supported by more than 50% of the farmers. As for ranking of the harmful effects of effluents discharged into the river, farmers' ranked impairment use of water first, hindering fishing activities was ranked second and hazard to human was ranked third. The implication of this is that while the textile industries were producing and making profit, the hazard that emanates from the industrial effluents discharge and waste products were not put into consideration.

Table 4: Harmful effects of discharge

*Harmful Effects	Frequency	Percentage	Ranking
Environmental Degradation	62	68.8	5th
Impairment of use of water	84	93.3	1st
Hazard to human health	72	80.0	3rd
Hindrance to aquatic activities	44	48.8	8th
Harm to living resources	65	72.2	4th
Hinder fishing activities	80	88.8	2nd
Disturb Irrigation farming	54	60	6th
Hinder Livestock farming	49	54.4	7th

* Multiple responses

Farmers in industries effluent discharge and free effluent discharge average income level per month

Data in Table 5 indicate that majority 84.4% of the farmers in the industrial effluent discharge site earned income that ranged between N10,000:00 and N60,000:00 per month as against 73% that earned higher income that range between N61,000:00 and N120,000:00 per month in free effluent discharge site. Lower income recorded in industrial effluent discharge site could be attributed to hazard that emanated from the discharge, which hinder farmers from performing their income generating activities.

In order to reverse effect of industrial discharge in the area, agricultural and human resource development programme should be organized for the inhabitant.

Table 5: Farmers' per month average income level in industrial effluent and free-effluent affected sites

Income Level	Industrial effluent site		Free Industrial effluent site	
	Frequency	Percentage	Frequency	Percentage
10,000-30,000	31	34.4	4	4.4
31,000-60,000	45	50	10	11.1
61,000-90,000	9	10	55	61.1
91,000-120,000	4	4.0	18	20.0
>121,000	1	1.6	5	3.3

T-test analyses of farmers' mean income level between free effluent river and industrial affected river

Data in Table 6 indicates that there is a significant difference between mean income levels of farmers in free industrial effluent river site (FIERS) and free- industrial effluent river site (IERS). The higher means index of N13,000 were recorded in (IERS) as against lower mean index of 27,063 recorded in (IERZ) as shown in Table 6. The test further confirmed that the inhabitants in industrial discharged site were experiencing severe impact of industrial discharged into their river.

Table 6: T-Test Analysis of Farmers' Income Level between Free Effluent River and Industrial Affected River

Zone	No of Cases	X	Cal	P	Decision
Industrial River Effluent Site	87	27,06.3	8.9	0.05	5
Free Industrial River Effluent Site	85	13,000	-	-	-
Site	N-1 = 172 171	-	-	-	-

CONCLUSION

The study established that physico-chemical parameter observed for the industrial discharge site was quite higher than the free effluent discharge site. The physico-chemical parameter discharge was higher than FEPA's limit for industrial effluent discharge. Farmers living along the river course with industrial effluent discharge site were unable to perform income generating activities, and recorded lower income level as opposite what is obtainable in non industrial effluent discharge site. It was found that the industrial effluent discharge areas farmers ranked water impairment, hindrance of fishing activities, and human health as the prominent hazards facing them. Fishes and zoo planktons were found only in the free industrial effluent site.

The exodus of youths to the urban area and engagement in non farming activities were prominent in industrial discharge site. In order to combat industrial discharge menace, there is need to enforce stricter treatment regimes and standard that will reverse water pollution in the area. Also, the ecosystem should be monitored at least once every four years and polluted aquatic ecosystem should be bioremediated. The inhabitant health and means of livelihood should be put into consideration along side of the textile industry to increase production in the site.

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