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Oil spillage cost, gas flaring cost and life expectancy rate of the Niger Delta people of Nigeria

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Abstract

The study examined the degree of influence of oil spillage and gas flaring costs on life expectancy rate of the Niger Delta people of Nigeria. It was intended to survey the life threatening impacts of lost revenue occasioned by oil spillage and gas flaring activities of the Oil and Gas companies operating in the Niger Delta region of Nigeria between 1979 and 2008. The descriptive survey research method was used to select forty oil and gas producing local government areas from the nine states of the Niger Delta region. Data on oil spillage rate, gas flaring rate, oil spillage volume, gas flaring volume, oil spillage cost and gas flaring cost were obtained from NNPC, the oil and gas companies and the Central Bank of Nigeria for the thirty years studied. Data for life expectancy were obtained from the United Nations Common Database for the thirty years. The study revealed a total oil spillage and gas flaring revenue lost of US $175,795,811 or ₦20,671,321,766.00 with a mean life expectancy rate of 49.12 years between

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1979 and 2008 with an insignificant correlation between life expectancy rate and the costs of oil spillage and gas flaring ranging between 1.8% and 5.2% but a significant impact of oil spillage and gas flaring activities on socio- economic conditions and poverty rate of the people of the Niger Delta region of Nigeria for the years studied. Based on these results, the study recommended that government should enact mandatory legislations for oil and gas prospecting companies to establish Oil and Gas Compensation Fund to control the frequency of oil spillage and gas flaring in the Niger Delta region of Nigeria. Nigerian Government need to initiate people oriented policies in governance to ensure micro economic empowerment and human capital development of the people of the Niger Delta region aimed at reducing the rate of poverty. There should be a conscious implementation of the Niger Delta Master Plan to fast track infrastructural development in the region and to enhance life expectancy rate of the people of Niger Delta.

JEL classification numbers: M40, M41, M48
Keywords: Spillage cost, Flaring cost, Life Expectancy rate, Spillage volume, Spillage rate, Flaring volume, Flaring rate, Niger Delta Region

1 Introduction

Petroleum exploration and production is Nigeria’s largest and most important industrial sector. Petroleum products came to the forefront of foreign exchange earnings after the most reliable sustainer of the Nigeria economy, agriculture, had been pushed to the background. Petroleum prospecting and exploration in the Niger Delta of Nigeria dates back to the early 50s while actual oil and gas development started in 1954 with the discovery of crude oil deposits in commercial quantity. Oil and gas contribute over 95% revenue to Nigeria’s Gross

Domestic Product (GDP), 95% of external reserve and 90% of the country's National Annual Budgets (David-West, 2008).

In 2001, Nigeria's crude oil production averaged 2.1 million barrels per day. Nigeria's natural gas reserve was well over 187 trillion standard cubic feet, making it three times as substantial as the crude oil reserves. The majority of Nigeria's natural gas is flared off and it is estimated that Nigeria loses 18.2 million U.S Dollars daily from flared gas (Nigeria crude oil and gas industry, 2010).

The production of petroleum today stands at an average of 2.2 million barrels per day (Mb/d) of crude oil and 5 billion standard cubic feet per day (Bscf/d) of natural gas. Thus, Nigeria is the 6^{th} largest oil producing Nation in the world with more than 32.8 Billion barrel of crude oil reserves and 184 trillion standard cubic feet of gas reserve which place Nigeria as the 7^{th} largest gas reserve in the world (Amu, 1997 and Yar'Adua, 2007).

Petroleum exploration and production have far reaching impacts on different people from different directions. To the producing and consuming nation, it is a source of revenue to the government and a supposed means of livelihood to the indigenes of the oil producing communities. The ecological impact of oil and gas production as a source of service to humanity is not desirable while the host Communities are disadvantaged by way of oil spilled and gas flared without commensurate development of the communities.

Petroleum exploitation and production in the Niger Delta over the years have resulted in a number of environmental, socio-economic and political problems in the region. Oil spillage and gas flaring have caused severe environmental damages, loss of plants, animals and human lives, and loss of revenue to both the oil producing companies and the government. Petroleum exploration, exploitation, production, storage, distribution and transportation activities affect the environment in a conspicuously negative manner. Vegetations are removed to make way for seismic lines, sites for rigs are leveled, roads are built and drilling mud and oil sometimes find their way to the streams, surface waters and land thus

making them unfit for consumption nor habitable by man or animal. Storage, distribution and transportation of oil and gas using Tankers and pipeline network result in some quantities of petroleum products being released into the environment (Tolupe, 2004).

Man, in his endevour to satisfy his needs and aspiration for better living condition through resource exploitations, have created an increasing number of environmental problems. In spite of the "blessings" from petroleum products, in particular oil and gas, there are negative impacts on human, ecology and the environment (Oyegun, 1997).

The socio-economic problems include, amongst others, poverty, unemployment, ecological deficiencies, health hazards and poor infrastructural development all resulting in low life expectancy rate. The political problems include, amongst others, tussle for resource control between the States and the federal Government on one hand and the host communities and the government on the other hand leading to youth restiveness, militancy, kidnapping and hostage taking of oil and non-oil workers by the aggrieved communities in the region. It is believed that lives and well-being of the people have been negatively affected by oil spillage and gas flaring activities in communities of the Niger Delta region of the country. These activities have negatively affected the per capita and the national incomes of Nigerians and Nigeria.

This research examined how oil spillage cost and gas flaring cost have affected live expectancy rate of the Niger Delta people between 1979 and 2008.

In order to scientifically measure the effect of spillage and flaring costs on life expectancy the following hypothesis was subjected to empirical test.

The costs of oil spillage and gas flaring have no significant effect on the rate of life expectancy of the Niger Delta people.

2 Preliminary Notes

The different costs associated with oil spillage and gas flaring are the resultant effects of some operational and production negligence and/or deficiencies. The oil spilled and gas flared pollutes the surface and environmental habitations and redirect revenues needed for life improvement toward settlement and clean up exercise. This incident impacts negatively on the socioeconomic and health conditions of the local communities, thus reducing life expectancy rate in the region. Different views by way of theories have been put forward by different scholars on the area of spillage costs and gas flaring as they affect the well being of local inhabitants. The relevant theories, though not exhaustive, are examined below.

2.1 Cost estimation theory

The theory reveals that the location, oil type, the quantity of oil spilled, the rate of spillage and the clean up strategy used are the five major factors which significantly affect the costs of oil spillage per unit, apart from other minor associated factors (Etkin, 1995). Extending the theory to analyze average cost per ton it reveals that the cost, on a ton basis, decreases significantly with increasing amount of quantity of oil spilled. An analysis of a sample of 96 Non U.S.A. Oil Spills in the OSIR, International Oil Spill Data base, shows that cost per ton is significantly inversely correlated with spilled quantity.

{Spearman's rho (rs) = - 0.362, P< 0.01 and Kendall's tau = - 0.245, P< 0.01}

Spearman's rho and Kendall's tau are non parametric statistical measures of ranked correlation.

$$\text{Spearman's rho } (r_s) = 1 - 6\sum \frac{d^2}{n(n^2-1)}$$

Where:

d = difference in ranking of cost in the different spill size categories;

n = No. of samples

Similarly:

$$\text{Kendall's tau} = 1 - \frac{Q}{n(n-1)}$$

Where:

Q = Total of cost rank in different spill size categories;

n = No. of samples.

2.2 Conflict and risk theory

Petroleum exploration and production is the most complex and risky business in the world yet it is the most attractive venture for investment by the private and government sectors due to its high revenue yielding, profit maximization and employment generation potentials.

Conflict during oil exploration and production ensues as a result of disagreements, dissatisfaction and agitations from one party against another involved in the oil business. For instance, the production of crude oil in commercial quantity and the monetization of the associated gas flaring cushioning impact by the government for the socio-economic development of the people might be the common cause of conflict. While Government is interested in generating revenue for implementation of her ambitious budgets and policies, the people (Host communities) are interested in their safety and survival in an environment polluted with spilled oil and flared gas. Thus, a conflict exists between the government and the people over the common goal of mineral exploration, exploitation and production. In a detailed research by Ebiye, (2000) on "Community Resources Conflicts in the Niger Delta Region", the following were identified as the causes of conflicts in the Region.

- Corporate policies on resource control

- Undemocratic control of resources
- The quest for Autonomy by the people of the Niger Delta
- The merciless striving for power
- Conflicting reward system and collective community grievances
- The norms and traditions of the people of the Niger Delta
- Taxation policies
- Religious rights
- Land disputes
- Political and economic dominance.

The research indicates that the last four: Taxation policies, religious rights, land disputes as well as political and economic interest dominated the crises landscape between 1854 and 1967 in the Niger Delta (Ebiye, 2000). Other researchers such as (Kinako 1996 and Tolupe, 2004) have made efforts to make an accurate evaluation of oil spillage and gas flaring and its specific effects on the environment and the impact on the socio-economy of the people of Niger Delta Region of Nigeria.

In assessing the risk associated with oil and gas exploration and production, the World Bank stated that over 2,300 barrels of Crude Oil in 3000 separate incidents were spilled into Rivers, Bayelsa and Delta States of Nigeria in 1991 and 1994, (N.N.P.C, 2005). Since 1996 the graph of oil spilled into the environment in the Niger Delta has gone up sharply with attendant cost to the environment, the economy and the future generation. The World Bank's figures of crude oil spills and theft have increased over time as revealed below:

- 300,000 barrels of crude oil equivalent to 8.5 million dollars are lost to illegal pipeline tapping per day.
- The volume of oil spilled per incident can be as high as 5.0 million dollars.
- In 2003, Vandalization of oil equipment left a bill of 5.8 billion dollars to the operators and Nigeria.

- In 1999 to 2003, oil industry production deferment led to a loss of 6.8 billion dollars, (Daukoru, 2006).

Hijacking of oil flow stations and export loading terminals, kidnapping and hostage taken of oil workers has led to several confrontations between the government (military) and the youths (militants) of the host communities. The casualty figures in the Odi invasion by soldiers in search of their missing colleagues was estimated at 2,000 persons, mostly women and children. The Abule Egba pipeline vandalization and the subsequent inferno claimed over 275 lives in 2006 (Afolayan, 2006).

3 Main Results

The study descriptively surveyed forty (40) oil and gas producing Local Government Areas in the nine (9) states of the Niger Delta region of Nigeria. Data from N.N.P.C and the Central Bank of Nigeria (CBN) were reviewed for the purpose of confirming information gathered within the studied area.

The surveyed Local Government Areas are listed in Table 1. Regression model was used in analyzing the research data. The variables measured in this model include:

Oil spillage cost, Gas flaring cost and life expectancy rate.

In this model life expectancy rate depended on oil spillage cost and gas flaring cost. These variables are represented in the model as follows:

$$LPR = b_0 + b_1 OSC + b_2 GFC + \varepsilon$$

where,

b_1 - b_4 = regression coefficients.

LPR = Life expectancy rate.

b_0 = alpha intercept at LPR

OSC = oil spillage cost

GFC = gas flaring cost

ε = regression error term

Table 1: Oil and gas producing local government areas in the Niger Delta

State	**Local Government Areas**
Abia	Ukwa West
Akwa Ibom -	Eket, Esit Eket, Eastern Obolo, Ibeno, Onna, Ikot Abasi Oron.
Bayelsa -	Yenegoa, Sagbanna, Kolokuma/opokuma, Nembe, Brass, Ogbia.
Cross River -	Bakassi
Delta -	Isoko North, Udu, Bomadi, Sapele,Warri south, Okpe, Isoko South, Burutu.
Edo -	Egor, Ovia Southwest, Oredo, Ikpoba-okha, Orhionmwon.
Imo -	Ohaji Egbema, Owerri west.
Ondo -	Ese Odo, Ilaje.
Rivers -	Tai, Patani, Okrika, Ahaoda west, Khana, Degema, Oyibo, Gokana.

Source: Federal Republic of Nigeria Official Gazette, vol. 94, (2007)

The study revealed that 4,220,803 barrels of crude oil was spilled resulting in a total cost or lost revenue of US $ 175,141, 289 while 112, 408, 693 mscf of gas was flared at a total cost or lost revenue of US $ 654, 522 for the 30 years studied. A mean life expectancy rate of 49.13 years and a standard deviation of ± 2.84 for every born child were revealed in the study for people living in the Niger Delta region of Nigeria. A total of N20, 593, 771, 984.00 worth of oil spilled and N77,

548, 785.80 worth of gas flared were revealed from 1979 to 2008, (Tables 3 and 4, see in Appendix).

The research asserts that the cost of oil spillage and gas flaring do not significantly affect the socio-economic development of the Niger Delta people of Nigeria, measured by their life expectancy rate. The research assertions are confirmed by the linear regression analysis models presented in Tables 5 and 6.

The computed F-value (1.532) is less than the critical F-value (4.20) with df = 1and 28 at 0.05 level. The null hypothesis was thus retained. This means that the cost of oil spillage and gas flaring does not significantly affect the socio-economic development of the people measured in terms of life expectancy rate.

The observed mean rate of gas flaring was higher than the mean rate of oil spillage and their standard deviations follow the same direction. The mean life expectancy rate of 49.1167 and standard deviation of 2.8366 were observed. The mean life expectancy rate is below the expected rate of 52 years. The regression coefficient - r (0.229), gave an R-square of 0.052 and adjusted to 0.018. This showed that between 1.8% and 5.2% of the variations in life expectancy are explained or accounted for by oil spillage and gas flaring costs as shown in Table 5.

Table 5: Mean, standard deviation and model summary for predicting rate of life expectancy from total cost of oil spilled and gas flared

Variables	n	Mean	Std. Deviation
Life expectancy	30	49.1167	2.8366
Total loss cost	30	5859860	8019818

Model	R	R-squared	Adj. R-square	Std. Error
Linear	0.229	0.52	0.018	2.811

Table 6: The regression results for life expectancy rate on total costs of oil spillage and gas flaring in the Niger Delta Region of Nigeria

Source of variation	SS	df	Ms	f
Regression	12.102	1	12.102	1.532
Residual	221.24028		7.901	
Total	233.34229			

Model Variables	Unstd. Coeff		Std. coeff	T	Sig.
	β Std	Error			
Constant	48.645	0.639		76.078	0.000
Total cost	8.055E-8	0.000	0.228	1.238	0.226

The total lost revenue due to oil spillage and gas flaring is significantly influenced by the rate of oil spillage and the quantity of oil spilled, the rate of gas flared and the quantity of gas flared. Similarly, the total lost revenue due to oil spillage and gas flaring in the Niger Delta does not significantly influence or affect the socio-economic development of the Niger Delta people as measured by the rate of life expectancy of the people of the region.

3.1 Discussion of Results

The costs of oil spillage and gas flaring are directly proportionate to the rate of oil spillage/ gas flaring and the volume of oil spilled/ gas flared in the Niger Delta Region. On the other hand, the cost of oil spillage in the Niger Delta is not significantly influenced by the rate of gas flared.

Life expectancy rate in the Niger Delta region of Nigeria does not significantly depend on the costs of oil spillage and gas flaring as the study revealed a total loss of US $175, 795, 811, equivalent to N20,671,321,766.00, being the total cost of

oil spillage and gas flaring in the Niger Delta for the 30 years studied and Nigeria was ranked the second highest gas flaring country in the world after Russia.

The rate of gas flaring, the quantity of gas flared and the regression constant are not significant predictors of the total cost of oil spillage and gas flaring when considered separately. It means that these predictors do not significantly influence the cost of oil spillage and gas flaring in the Niger Delta. The total lost revenue to oil spillage and gas flaring do not significantly influence the socio-economic development of the Niger Delta as measured by the rate of poverty in the region. Empirical test results revealed that a correlation coefficient of both the means and standard deviations of poverty and total cost of oil spillage and gas flaring is 0.175 resulting in a coefficient of determination of 0.031. This showed that only about 3.1% of the variation in poverty is accounted for by a variation in the total cost of oil spillage and gas flaring in the Niger Delta. Following this, an increase or decrease in the cost of oil spillage and gas flaring in the Niger Delta has little or no effect on the rates of poverty and life expectancy in the region.

The range between 1.8% and 5.2% of the variation in life expectancy was accounted for by the total cost of oil spillage and gas flaring which was quite insignificant to the mean life expectancy rate of 49.12%. There is high level of poverty in the Niger Delta region with the least poor state being Abia with a mean rate of 33.73% and the highest poverty year being 1979 with a mean rate of 12.16% while the highest poor state was Ondo with mean rate of 40.83% and the highest poverty years were 1995 and 2003 with a mean rate of 57.46%.

4 Conclusion

The cost of oil spillage and gas flaring have no direct significant influence on life expectancy rate of the Niger delta people but have significantly reduced

Socio – economic development of the Niger Delta and increased the rate of poverty in the region.

4.1 Recommendations

Having considered the critical position of the Niger Delta both for the political and economic survival of Nigeria and considering the findings of this research study, the following policy recommendations were suggested for adoption by both the oil and gas operating Companies and the Government of Nigeria. Government should, as a matter of urgency, legislate on the control of oil spillage and gas flaring in the Niger Delta to reduce the total lost revenue on oil spillage and gas flaring in the region. There should be a mandatory legislation for oil and gas prospecting Companies to establish oil spillage and gas flaring Compensation Fund to take care of future incident of oil spillage and gas flaring.

Nigerian Government should initiate people oriented policies in governance to ensure micro economic empowerment and human capital development of the people of the Niger Delta region aimed at reducing the rate of poverty. Government should as a matter of urgency implement the Niger Delta Master Plan to fast track infrastructural development in the region and to ensure human capital development for the people of Niger Delta.

Appendix

Table 2: The rate of life expectancy in the Niger Delta Region between 1979 and 2008

S/n	Life expectancy	
	Year	**Avg.No. of Years**
1	1979	42.00
2	1980	46.10
3	1981	46.10
4	1982	46.10
5	1983	46.10
6	1984	46.10
7	1985	46.10
8	1986	46.10
9	1987	46.10
10	1988	46.10
11	1989	46.10
12	1990	50.20
13	1991	50.20
14	1992	50.20
15	1993	50.20
16	1994	50.20
17	1995	50.20
18	1996	50.20
19	1997	50.20
20	1998	50.20
21	1999	50.20
22	2000	52.50
23	2001	52.50
24	2002	52.50

25	2003	52.50
26	2004	52.50
27	2005	51.50
28	2006	51.50
29	2007	51.50
30	2008	51.50
Total	30	1,472

Source: United Nations Common Database –102 (2000)

Table 3: Total cost of oil spilled using the annual exchange rate to the dollar between 1979 and 2008

S/n	Year	Cost of oil spilled (US$)	Exchange rate	Total cost of oil spilled (₦)
1	1979	19,038,000.00r	0.5965	11,356,167.00
2	1980	7,760,155.2	0.5464	4,240,148.80
3	1981	1,899,853.9	0.6100	1,158,910.88
4	1982	669,778.4	0.6729	450,693.89
5	1983	4,642,200.0	0.7241	3,361,417.02
6	1984	2,275,468.4	0.7649	1,740,505.78
7	1985	1,538,281.8	0.8938	1,374,914.27
8	1986	183,364.6	2.0208	370,543.18
9	1987	589,835.5	4.0179	2,369,900.06
10	1988	138,513.3	4.5367	628,393.29
11	1989	141,843.6	7.3916	1,048,451.15
12	1990	358,008.0	8.0378	2,877,596.70
13	1991	2,190,855.5	9.9095	21,710,282.60
14	1992	1,024,180.0	17.2984	17,716,675.30
15	1993	160,304.0	22.0511	3,534,879.63
16	1994	486,939.6	21.8861	10,657,208.80
17	1995	1,104,117.0	21.8861	24,164,815.10

18	1996	529,005.6	21.8861	11,577,869.50
19	1997	293,065.5	21.8861	6,414,060.84
20	1998	242,240.0	21.8861	5,301,688.86
21	1999	8,552,600.6	92.6934	792,769,628.00
22	2000	9,791,728.2	102.1052	999,786,366.00
23	2001	4,456,623.5	111.9433	498,889,141.00
24	2002	6,626,555.5	120.9702	801,615,744.00
25	2003	8,219,993.4	129.3565	1,063,304,576.00
26	2004	9,628,908	133.5004	1,285,463,110.00
27	2005	30,926,995.2	132.1470	4,086,909,635.00
28	2006	26,075,714.0	128.6516	3,354,682,327.00
29	2007	7,353,427.8	125.8331	925,304,616.00
30	2008	18,242,734.2	118.5669	2,162,984,442.00
Total cost of oil spilled				₦20,593,771,980.00

Source: Central Bank of Nigeria annual exchange report (2008)

Table 4: Total cost of gas flared using the dollar exchange rate to naira between 1979 and 2008

S/n	Year	Cost of gas flared (US$)	Exchange rate	Total cost of gas flared (₦)
1	1979	939.18	0.5965	560.23
2	1980	970.62	0.5464	530.35
3	1981	650.17	0.6100	396.60
4	1982	545.82	0.6729	367.28
5	1983	526.72	0.7241	381.40
6	1984	678.95	0.7649	519.33
7	1985	838.85	0.8938	749.76
8	1986	761.78	2.0208	1,539.41
9	1987	737.89	4.0179	2,964.77
10	1988	910.75	4.5367	4,131.80

11	1989	1,177.36	7.3916	8,702.57
12	1990	1,387.03	8.0378	11,148.67
13	1991	1,823.47	9.9095	18,069.68
14	1992	1,794.40	17.2984	31,040.25
15	1993	2,012.89	22.0511	44,386.44
16	1994	2,129.36	21.8861	46,603.39
17	1995	1,657.17	21.8861	36,268.99
18	1996	3,883.27	21.8861	84,989.64
19	1997	3,656.25	21.8861	80,021.05
20	1998	238.06	21.8861	5,210.21
21	1999	1,801.82	92.6934	167,016.82
22	2000	2,62.93	102.1052	267,610.58
23	2001	8,864.46	111.9433	992,316.91
24	2002	7,492.49	120.9702	906,368.01
25	2003	6,440.24	129.3565	833,086.91
26	2004	5,384.45	133.5004	718,826.23
27	2005	5,295.30	132.1470	699,758.01
28	2006	9,086.70	128.6516	1,169,018.49
29	2007	360,960.12	125.8331	45,420,730.90
30	2008	219,255.72	118.5669	25,996,471.00
Total cost of gas flared				₦77,549,785.80

Source: Central Bank of Nigeria annual exchange report (2008)

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