

# An Analysis of the Extent of Implementation of Environmental Cost Management and Its Impact on Output of Oil and Gas Companies in Nigeria, (2001-2010)

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## Abstract

This study was set out to critically analyzed the extent of implementation of environmental cost management and its impact on output of oil and gas companies in Nigeria from 2001 to 2010. The paper was aim at ascertaining the extent to which implantation of environment cost management has impacted on the oil and gas industries in Nigeria. Using multiple regression analytical technique," data from the central bank of Nigeria (CBN) and Environmental Impact Assessment Agency were obtained. Findings revealed that there exist a significant relationship between the parameters that influence environmental cost management and output of oil and gas produced in Nigeria. Also, it was discovered that there are no established standards in Nigeria guiding environmental cost management in the oil and gas industries in Nigeria. Again there is a lacuna in external reporting of environmental cost data in Nigeria. It was concluded that the extent of environmental cost management in the oil and gas industries is at its rudimentary stage. It was however recommended inter alia that; there should be improvement in external reporting of environmental cost data in the oil and gas industries in Nigeria. And the adoption of the United Nations Environmental cost Management Accounting (ECMA) guidelines which will enhance the formulation of a Generally Accepted Accounting Principles (GAAP) in Nigeria, which will evolve environmental cost management accounting practice. This will facilitate the global campaign for environmentally enhanced society.

**Keywords:** Social contract, Eco-efficiency, Environmental quality cost, Environment pollution prevention costs, Environmental internal failure costs, Environmental external failure costs, Environmental detection costs

## 1.0 Introduction

The need for environmental cost management in the oil and gas industries has become the concern and focus of nations and responsible corporate managements the world over. It became one of the foremost issues on the agenda of nations and business earlier in the 1990s and the reasons for this were varied emanating from both within and outside of the firm and particularly at the global level, Okoye and Ngwakwe (2004:220-235). A lot of government enactments, laws and regulations on environmental protection have been made in several nations of the world. The United States of America, Canada, Norway, the United kingdom and the Netherlands have led in the pursuit of degradation and pollution prevention, control and the need for environmental safety, Nagle (1994).

Also, leading developing nations are Zimbabwe, Namibia, the Philippines and Indonesia. They have led in championing policies to address need for accounting and accountability for environmental costs management. Nigeria is also slowly responding. In the light of the awakening to environmental protection, various laws and regulations such as the Environmental Impact Assessment Act, 1992 and the department of petroleum Resources (DPR), environmental guidelines and standards for the petroleum industry in Nigeria (EGASPIN:2002) were enacted. They require corporate managements to consider the environmental implications of all internal decisions of their managements. In addition, all organizations monitored by environmental policy agencies in Nigeria are expected to demonstrate much consideration in decision making. The need for corporate organizations to develop environmental cost responsiveness and to disclose in

annual financial report environmental information has become imperative. The conventional approaches of cost accounting have become inadequate since conventional accounting practices have ignored important environmental costs and activities impacting consequences on the environment. Corporate neglect and avoidance of environmental costing leave gap in financial information reporting. There is no completeness and correctness of fair view to users of financial information, such as shareholders, environmental regulatory agencies, environmentalists and potential financial investors. For example, degradation or other negative impact on the environment could affect output level and corporate financial statement such as create actual or contingent liabilities and may have adverse impact on asset values. Consequential effect on corporate organizations may result in incurring future capital expenditure and cash flows which may impinge on going concern as balance sheet secured loans may not be secured after all if land values for instance are affected by environmental factors. Also, the limited awareness of environmental costing principles and methodology has become an important issue to be addressed. If vital environmental issues and activities are not disclosed, financial statement cannot be said to reveal state of a "true and fair view of affairs. It is necessary too, to note that ethical investors will only invest in ethical companies and therefore, will watch out for these ethically responsible companies. Ethical companies therefore, have marketing advantage if they strategically position themselves environmentally. Ethical companies stand at advantage for corporate financing. In addition, the challenge of cost and valuation for damage, depletion and degradation of the environment externalities is a critical problem which continues to demand attention. Since current requirement for reporting on environmental issues is voluntary, it is observed from most financial statements of corporate organizations that it has engendered disclosures of information which totally exclude environmental issues. At best where reported, are grossly inadequate. Environmental disclosures have become critically important to an informed public and financial stakeholders. Also pertinent is the difficulty in evaluating environmental remediation for environmental degradation where environmental costs do exist. According to Bailey (1991) "corporations are recognizing the benefits to their long-term corporate profitability of reducing their environmental impacts. Both the-accounting and the environmental areas are concerned about how to identify, measure, report and manage environmental cost impact" This is particularly critical for the oil and gas 'industries (prospecting and producing), the downstream sector (refining and distribution) which impact heavily on the environment in Nigeria. This study therefore focuses on Nigeria oil and gas industries which are recognized as causing heavy degradation on the environment. For emphasis, the Nigerian business environment is yet to recognize environmental cost management for environmental information and issues of raw materials, energy consumption and use of natural resources which have systematically depleted the environment. In the light of increasing environmental attention and the fact that the oil and gas industry have profound production impact on the environment, the study has explored an analysis of environment cost management in this economic sector in Nigeria. This is expected to facilitate effective and efficient costs management, measurement and reporting for corporate decision making. To guide the researcher in achieving the objective of this study, the following hypothesis is formulated:

H<sub>0</sub>: Environmental cost management does not influence oil and gas output in Nigeria.

## 2.0 Literature review and theoretical framework

### 2.1 Theoretical Framework

#### 2.1.1 The social contract concept

The social contract concept of Corporate Social Reporting (CSR) has been well acknowledged in many past works. Matthews (1993), Lavers & Kouhy (1995) and Solomon (2005) agreed that social contract concept is responsible for corporate social Reporting (CSR) Dicrkes (1979) opines that social contract is central to social change and reforms. Deegan (1998) associates the social contract expectation with the legitimacy theory where "there is a social contract between the organization and those affected by the organization's operations".

#### 2.1.2 Environmental Accounting

The study of Nagle (1994:243), on environmental accounting reveals that corporate managers are placing high priority on environmental accounting. Environmental accounting as a prevalent subject in the international community is not yet a priority in Nigeria. Epstein (1996) explain pertinent aspect of environmental degradation and cost as those including emissions into the air, water and land. Also, aspects of untreated domestic waste outflows into rivers and coastal oceans quantities of solid waste that must then be disposed of perhaps through land spreading

or incineration. Pollution include airborne  $SO_2$  emissions from power plants by stack- gas scrubbing which leaves a highly concentrated sludge and degradation which incorporates midnight dumping, illegal dumping along the sides of roads or in remote areas. Field (2001) has done tremendous work on the economics of natural resources and in this instance explored the approach of benefit-cost analysis through discounting of future based input and output values of environmental projects and activities. Measuring benefit- costs analysis has been eventually through regulatory Evaluation Impact Assessment study on the environment.

Dierkes (1979), in his works condemn the whole essence of placing monetary value above other human virtues in environmental issues. He also recognized the absurdity of discounting and discountenancing future environmental impact on human values. From investigations with the Federal Ministry of Environment, EIA study conducted by the oil and gas (exploration and producing) and other companies having activities that impact on the environment has been accepted as a regulatory requirement in Nigeria. Achieving effective EIA is however fraught with uncertainties in Nigeria since the objective estimation of input and output values is not so reliable. Besides, there is excessive fluctuation in the discount factor for purpose of benefit- cost analysis. Non-available market values for certain natural resources costs and benefits such as the fauna, fishing ponds or rivers, among others, makes it extremely difficult to place monetary value on the factors of measurement.

#### 2.1.3 Eco-Efficiency Framework

An ecosystem is largely determined by the natural environment as opposed to the activities of man. There is a dynamic interrelationship between the natural environment and man. Environmental right Action (ERA) (1998:109) contribution to the issue of environmental sustainability emphasize man's critical responsibility to face the challenge of depletion of the environment. Eco-efficiency suggests that organizations can produce more useful products while simultaneously reducing negative environmental impacts, resource consumption and costs.

Eco-efficiency further suggests that rather than focus on the consequences of negative environmental impact, attention should be on attacking the causes. In the opinion Aert, Cormier & Magnam (2006) this concept suggests at least three important messages, firstly, improving ecological and economic performance which should be seen as complementary. Secondly, that improving environmental performance should not be viewed as charity and goodwill but a matter of competitive necessity. This is in contrast to Deegan (1998) view where he had opined that social costs (i.e environmental costs) which are not matched with related revenue are incurred not for the good of the individual company but for the society. A third suggestion is that eco-efficiency should be seen as supportive of sustainable development. In the views of Walley and Whitehead (1994:46- 52), eco-efficiency which has been emphasized as environmental management system (EMS) is the application of accounting design to attain financial and economic savings in resource usage. It is also, the reduction of wastes, energy and emissions that will necessarily lead to reductions in corporate adverse impact on the environment. Art, Cormier and Magnam (2006) further proffered definition for sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." They opined that although, absolute sustainability may not be attained, progress towards its achievement has some merit. Eco-efficiency, an implication of improving environmental performance will. Secure several advantages such as increasing customers demand for cleaner products, those produced without degrading the environment. Also, employees prefer to work for environmentally friendly organization. Other benefits are that environmentally responsible firms tend to capture external benefits such as lower cost of capital and lower insurance rates; efficient environmental performance in an organization will secure good health to humanity; the consciousness to pursue environmental cleanliness will serve as a drive for improved technology and a policy of clean environment and the implementation of the policy are capable of reducing environmental costs and making for a competitive advantage.

#### 2.1.4 Environmental quality cost Theory

This is also known as environmental cost reduction model. It suggests that the lowest environmental costs will be attained at the point of zero-damage to the environment. It is considered that before environmental costs information can be provided, environmental costs must be defined. Environmental quality model is the ideal state of zero-damage to the environment, which is analogous to environmental quality management (EQM), a zero-defect state of total quality management. This is certainly compatible with the concept of eco-efficiency. Environmental costs incurred are costs arising because poor environmental quality exists or may exist and these have to be

prevented, reduced or remedied (see tables 2.1 and 2.2). Aert, Cormier and Magnam (2006) have defined environmental costs "as costs associated with the creation, detection, remediation and prevention of environmental degradation." They therefore, classify environmental costs into four categories of (1) prevention costs (2) detection costs (3) internal failure costs and (4) external failure costs.

## **2.2 Significance of Environment Cost Management Accounting (ECMA)**

The significance of ECMA are identified as not only involving information provision, management planning and control but an adaptation from the German Environment Ministry (2003) identifies three broad benefits of ECMA as emphasis on compliance, Eco- efficiency and strategic positioning, ECMA supports environmental protection through cost efficient compliance with environmental policies. Examples are in planning and implementing pollution control investments or projects. It involves also, investigating and purchasing cost efficient substitutes for toxic materials and the reporting of environmental wastes and emissions to regulatory agencies. On the benefits of eco-efficiency, ECMA supports the simultaneous reduction of costs and environmental impacts through more efficient use of water and materials in internal operations. On strategic planning, ECMA supports the evaluation and implementation of cost- effective and environmentally sensitive programmes to ensure organizations' long-term' strategic position. Examples are working with suppliers to carry out the design of products and services for environmentally -responsive market and to estimate internal costs of likely future regulations. Strategic planning may also involve reporting to stakeholders such as the customers, investors and the local communities. Conventional approaches of costing have become inadequate because they ignore important environmental costs and potential cost savings. Gray, Kouhy and Lavers (1995) emphasize the therefore, that environmental accounting is not only about accounting for the environment, rather it is also to the extent that environmental issues can be reflected in conventional accounting practice. This is with the view of improving the condition of the natural world such as reduced land degradation and pollution abatement which enhances sustainable development.

<Insert Table 1here>

<Insert Table 2 here>

### **2.2 Environment pollution prevention costs**

These are costs of activities which are meant to prevent the production of contaminants and wastes which could cause damage to the environment. The costs include costs incurred in evaluating and selecting pollution control equipment, quality environment consumables, designing processes, designing products and carrying out environment studies. Other are auditing environmental risks and developmental management systems.

### **2.3 Environmental detection costs**

Environmental detection costs are costs resulting from activities to determine if products, processes and other activities within the company are in compliance with appropriate environmental standards. The costs include auditing environmental activities, inspecting products and processes, developing environmental performance measures, testing contamination and measuring contamination level.

### **2.4 Environmental internal failure costs**

These are costs resulting from the activities performed because contaminants and wastes have been produced -but have not been discharged into the environment. Internal costs are incurred to eliminate and manage the wastes produced. The costs are costs for operating pollution control equipment, licensing facilities for producing contaminants and costs resulting from recycling scrap.

### **2.5 Environmental external failure costs:**

These are costs of activities performed after discharging contaminants and wastes into the environment. These costs are those for cleaning up a polluted lake, clearing up oil spills, cleaning up contaminated soil, settling personal injury claims which are environment related, restoring land to natural state, among others. The need for environmental accounting is to enhance and further drive for the benefit of eco-efficiency which maintains that organizations whose activities adversely affect the environment can carry out their activities of production while simultaneously reducing negative environmental impacts, resource consumption and costs.

### 3.1 Research methodology

The researcher used secondary data for this study which were obtained from the Central Bank of Nigeria (CBN) statistical bulletin. The research design adopted is exploratory research design since the data cannot be subjected to manipulation. In addition, the statistical technique adopted for the analysis of data in this study is multiple regression analytical technique because more than one independent variables are used.

The model built for the purpose of this analysis is given below;

$$\text{OPT} = F(\text{UTS}, \text{QTF}, \text{QTS}) \dots \quad (i)$$

Where OPT = Dependent variable

UTS, QTF and QTS = Independent variable    F = functional notation.

The ordinary least square for the above model is stated thus:

$$\text{OPT} = b_0 + b_1 \text{UTS} + b_2 \text{QTF} + b_3 \text{QTS} + e \dots \quad (ii)$$

Where:

OPT = Outputs of gas produced

UTS = Gas utilization

QTF = Quantity of gas flared

QTS = Quantity of oil spilled

b<sub>1</sub> to b<sub>3</sub> = coefficient of the regression parameters

e = error term

### 4.1 Analysis of result

<Insert Table 3 here>

The adjusted R-squared value of 0.996909 shows a goodness of fit of the model, indicating that the model fits the data well. The total variation in the observed behavior of outputs of gas produced is used as a measure of the extent of cost management. This is jointly explained by variation in gas utilization, quantity of gas flared and quantity of oil spilled up to 99%. The remaining 1% accounted for by the stochastic error term. To test for the overall significance of the model the ANOVA on the f-statistic is used. Here the high significance of f-statistic value of 968.5691 confirms that the high predictability of the model did not occur by chance. Testing for the individual statistical significance of the parameters, the f-statistic of the respective variables were taken into consideration. Considering their probability values, which were automatically generated during the computation process by the computer software, the constant term is significant at 5% level. The a priori expectations about the signs of the parameter estimates are conformation to economic theory. Here, the output of gas produced entered the model with a negative sign indicating a negative relationship between output of gas produced and the extent of environmental cost management in the oil and gas industries in Nigeria. However, both gas utilization, quantity of gas flared and quantity of oil spilled entered the model with a positive sign. By interpretation, a one percent increase in gas utilization, will increase or decrease the coefficient of 1.01% on output of gas produced, ceteris paribus. For quantity of gas flared, an increase in the variable will increase or decrease the coefficient of 1.03% on the output of gas produced and one percent increase in quantity of oil spilled will increase or decrease the coefficient of 0.002% on output of gas produced all things being equal.

In testing the hypothesis, it is pertinent to restate the hypothesis in both null and alternative form:

H<sub>0</sub>: Environmental cost management does not influence oil and gas output in Nigeria.

H<sub>i</sub>: Environmental cost management influence oil and gas output in Nigeria.

**Decision rule:** Accept H<sub>0</sub> if calculated f-statistic of 968.5691 is less than the tabulated f-statistics of 3.05.

Reject H<sub>0</sub> If calculated f-statistic is greater than the tabulated f-statistic.

From the data analysis, the calculated f-value of 968.5691 was found to be greater than the tabulated f-value of 3.05 at 5% level of significance. Thus, we accept the alternative hypothesis (H<sub>i</sub>) and conclude that environmental cost management influence oil and gas output in Nigeria.

### 4.2 Discussion of finding

The findings revealed that there is a significant relationship between the parameters that influence environmental cost management and output of gas produced in the oil and gas industries in Nigeria. It was also

discovered that there are no established standards (both international and domestic) in Nigeria guiding environmental cost management in the oil and gas industries in Nigeria. More importantly, the extent of environmental cost management in the oil and gas industries in Nigeria is at its rudimentary stage. It was however also discovered that there still exist a lacuna in external reporting of environmental cost data which invariably hampered the implementation of environmental cost management in the oil and gas industries in Nigeria.

### 5.1 Conclusion

In this study, we have made an attempt to envisage on the extent and context of implementing environmental cost management in the oil and gas industries in Nigeria. It was observed that there are no standards guiding environmental cost management in the oil and gas industries in Nigeria. Nevertheless, there have been a missing gap in the external reporting of environmental cost data which in turn have hindered the implementation of environmental cost management in the oil and gas industrial in Nigeria. In a nutshell, the extent and contents of environmental cost' management in the oil and gas industries in Nigeria is at its rudimentary stage.

### 5.2 Recommendations

After an in depth study and analysis of the extent and content of implementing environmental cost management in the oil and gas industries in Nigeria, the author therefore recommend the following:

1. Improvement in external reporting of environmental cost data
2. The adoption of the United Nations Environmental Cost Management Accounting (ECMA) guideline which will enhance the formulation of a Generally Accepted Accounting Principle (GAAP) in Nigeria, which will evolve environmental cost management accounting practice. This will facilitate the global campaign for environmentally enhanced society.
3. The financial Reporting Counsel of Nigeria (FRCN) and the institute of Chartered Accountants of Nigeria (ICAN) should accommodate the growing awareness in environmental cost management and formulated disclosure requirements. The extent of environmental cost management as emphasized in this study should be considered.

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**Table 1**  
**Gas production and utilization in Nigeria (million cubic meters)**

Year	Outputs	Utilization	Quality flared	% flared
2001	31,587	7,536	24,588	78
2002	32,465	7,058	25,406	78
2003	33,445	7,536	25,908	77
2004	32,793	6,577	26,216	80
2005	32,980	6,910	26,070	79
2006	36,790	10,150	26,820	73
2007	36,755	10,207	26,548	72
2008	35,937	10,877	25,050	70
2009	37,613	17,904	19,709	52.4
2010	44,233	20,303	23,930	54.1

**Source:** Central bank of Nigeria, statistical, bulletin 2010.

**Table 2**  
**Oil spills in the petroleum industry (2001-2010)**

Years	Number of spills	Quantity spilled	Quantity recovered	Net quality cost to environment	% of quality cost to evrn.
2001	129	31866.00	6109.00	25757.00	80.83
2002	208	9172.00	1955.00	7217.00	78.69
2003	228	5956.00	2153.00	3803.00	63.85
2004	166	1410.35	2092.55	12057.80	85.21
2005	258	108367.01	2785.96	105581.05	97.21

2006	378	51187.90	1476.70	49711.20	97.12
2007	453	8105.32	2937.08	5168.24	63.76
2008	495	35123.71	2335.93	32787.78	93.35
2009	417	36677.17	3110.02	33567.15	91.52
2010	158	39903.67	1183.81	38719.86	97.03
Total	2,890	340,509.13	26,135.05	314,370.88	

**Source:** Niger Delta environmental survey, phase III Report (2010).

**Table: 4.1.1**  
**(Regression result)**  
**Dependent variable: OPT**

Variable	Coefficient	Std. error	T.statistic	Probability
Constant	-1081.132	1322.027	-0.817784	0.4447
UTS	1.013478	0.019974	50.73939	0.0000
QTF	1.033712	0.046592	22.18629	0.0000
QJS	0.001870	0.002289	0.816795	0.4453

$R^2 = -0.997939$ ,  $R^2 (\text{Adj}) = 0.996909$ , F. stat = 968.5691

SER = 208.9094, DW Stat. = 1.477799

\*significant at 1% level

OPT =  $-1081.132 + 1.03478\text{UTS} + 1.033712\text{QTF} + 0.001870\text{QJS} + e \dots \text{(iii)}$

**Source:** See regression result in appendix.

**APPENDIX 1**  
**REGRESSION RESULT**

Dependent variable: OPT				
Method: Least squares				
Date: 10/07/12	Time: 02:06			
Sample: 2001 2010				
Included observations: 10				
Variables	Coefficient	Std. Error	t-statistic	Prob.
C	-1081.132	1322.027	-0.817784	0.4447
TUS	1.013478	0.019974	50.73939	0.0000
QTF	1.033712	0.046592	22.18629	0.0000
QTS	0.001870	0.002289	0.816795	0.4453
R-squared	0.997939	Mean dependent var	35477.80	
Adjusted R-squared	0.996909	S.D dependent var	3757.601	
S.E. of regression	208.9094	Akaike info criterion	13.81085	
Sum squared Resid	261858.9	Schwarz criterion	13.93189	
Log likelihood	-65.05427	F-statistic	968.5691	
Durbin-Watson stat.	1.477799	Prob(F-statistics)	0.00000	

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