

Corporate Eco-Efficiency and Performance of Oil and Gas Companies in Nigeria: An Empirical Examination

Dr Nwifo Christopher Ifeanyichukwu; Dr. Ibrahim, Kamaludeen F.A; Etibensi, Jackson Edet

Department of Accounting, University of Abuja

DOI: <https://dx.doi.org/10.47772/IJRISS.2024.803152>

Received: 27 February 2024; Revised: 09 March 2024; Accepted: 14 March 2024; Published: 17 April 2024

ABSTRACT

Activities of oil and gas exploration continuous to post serious challenges to the environment. Recognizing this, the current study examines the effect of eco-efficiency on the performance of oil and gas companies and the impact of firm size on the relationship. The sample includes listed oil and gas companies in Nigeria. The data utilized were extracted from the annual report data stream for period of ten years from 2011 to 2020. Multiple regression through ordinary least square was employed to analyse the data. The study shows a positive association between eco-efficiency and firm financial performance. Also, the study provides support for a positive interacting relationship for firm size in the relationship between eco-efficiency and firm financial position. These findings provide support for the stakeholder theory that purports that managers must develop a relationship with stakeholders by embarking on environmental friendly practices to maintain a positive firm performance.

Keywords: Eco-efficiency; environment, financial performance, oil and gas.

INTRODUCTION

Background to the study

Activities of oil and gas exploration in Nigeria in recent times are skyrocketing in a geometric progression this has in a way brought untold and unprecedented challenges to the environment wherein which Oil and Gas companies operates. (Adati, 2012) The reduction in the Global prices of the crude has also contributed to the increase in oil exploration and extraction. This is because government, oil and gas companies, petroleum marketers amongst others increases the volume of oil they produced, market as well as export despite the reduction in the global market price. The aim is to meet up with increasing government and individual company's expenditure in different countries. (NETI, 2017)

It is also noted that other factors contribute to the increased exploration activities, some of which are increase in the world's population, increase in demand at the international oil market, over dependence of some countries on oil as the major source of revenue, and even the Dutch Disease. (Saidu, S, Aliyu, B,& Zubair, A, 2016).

All of this exerts pressure on oil companies who increases their exploration and production of increasing volume of crude oil. Besides, multi-national oil companies are also increasing efforts to ensure sustained maintenance of an increased level of commercial oil reserves, especially within this Nigerian context under review. This is with high expectations that the price of oil would spring up in within the nearest future. The resultant effect of all of this is that oil exploration and extraction activities have increased. This therefore

excretes negative externalities the host communities as well as the ecosystem in general. (Achudume, 2009).

In recent times, the oil exploration and extraction activities within the Niger-Delta region of Nigeria increases with every passing day. As such, here is a geometric increase in oil exploration and exploitation activities including other inherent human actions, which have led to numerable issues of environmental concern. This include but not limited to riverbank erosion, bio-diversity depletion, loss of soil fertility, gas flaring, noise pollution, sewage and waste/water pollution, deforestation and desert encroachment to oil spillage, flooding, health hazards, and reduction in the life expectancy range of people in the host communities. (Adati, 2012).

The oil and gas sector was and is still the main stay of the Nigeria economy (which is import driven) over the decades, so oil is therefore the major source of income, since it contributes to about 95% of our export, it also plays a vital role in the structuring of the economic, business and political structures of Nigeria (Adati 2012). Recently, there has been a growing quest for environmentally sustainable development within the corporate world even the field of corporate business. Corporate environmental reporting is a requirement that is gradually becoming an integral need for oil and gas companies, and it is aimed at protecting them from reputational and business risk. This includes a broad continuum of Corporate Social Responsibility (CSR) including other relevant environmental concerns within the entire operational levels in organizations. There is therefore a growing need for the identification and utilization of an effective and efficient instrument that could assist in the measurement and interpretation of sustainable level of business' activities especially within the oil and gas industry of Nigerian socio-economic space and also transform them into precise objectives with the aim of guarding the ecosystem and at the same time ensuring ecological balance and enhancing socio-geographical progress while carrying out exploration of the oil and gas business operations profitably. (Lee & Kotler, 2013).

It is however pertinent to mention that all the actions taken by governments and industries to protect the environment have cost attributable to them. Also, the indicator used in measuring the effect of these cost and other measures taken to mop up these excesses on the output of these companies assists in defining the concept of eco-efficiency. According to Lehin (2000), environmental problems relating to economic and cost accounting and the application of relevant tools in the measurement.

Furthermore, it is essential to evaluate organizations' success in terms of their objectives, regulations, and activities in financial terms (Agola, 2014). Financial performance is an important feature that reveals company competitiveness, potentials, management's economic interests and the dependability of present and future contractors (Dufer a, 2010). If firms have good financial performance, their shareholders will be rewarded for their investments (Ongore& Gemechu, 2013). The financial performance of a company can be determined by assessing how much the shareholders benefitted at the end of a certain period compared to when they began. This can be done using equations based on balance sheets and income statements or stock market prices (Baraza, 2014).

From the forgoing, it therefore become pertinent to establish the extent to which oil exploration cost, gas flaring cost, and the cost of mopping up the damages caused and review their impact on the Earnings and other profitability values of companies in the oil and gas industries in Nigeria. It is also important to determine the relationship between the cost of oil spillage and the output in the oil and gas produced in Nigeria. Drawn on this background, it become expedient to examine the effect of ecoefficiency on the financial performance of listed oil and gas companies in Nigeria.

Statement of the problem

Environmental concerns related to petroleum activities like clearing of sites, building roads and storage facilities, oil platforms and pipelines, and other activities for drilling, exploration, and production wells have

caused major environmental worry for oil and gas companies. Issues that arise include improper disposal of toxic waste streams such as oily sludge and gas flaring, contamination of water sources, destruction of habitats, accidental discharges from wells, vandalized pipelines with free leakages, oil bunkering, high exploration fees; kidnaping of exploration expatriates; all of which contribute to negative externalities that affects the operations. This has created serious challenges for the host communities, government, and other stakeholders. It is therefore pertinent for us to review the concepts of business/environmental sustainability, while proffering the ways to sustain the business going concern, especially to systematically important oil and gas companies which sizes of assets and operation have a great impact on the existence of the industry.

Oil and Gas companies are looking for ways to reduce these environmental costs while still achieving high levels of output and profit. Little wonder then those companies are now taking on corporate social responsibility with the aim to maintain a sustainable business environment that meets the financial needs of the organization, while protecting the environment and making lives easy for the host communities. The problem therefore lies in having a uniform way of measuring the environmental cost like those associated to oil spillage and gas flaring in relations to the output generated while incurring this cost, and examining if it affects the overall going concern of the industry.

This study looked at challenges in measuring such costs concerning output produced; managing the effects the production activities on the environment and community and measuring their impact on the profit reported by companies. The paper also sought to establish a benchmark for eco-efficiency that must be met by companies before being considered eco-efficient, which is considered in recent times as one of the major concerns for companies. Many researchers are also silent on this, thus this paper. Limited researchers have carried out studies on the impact of ecoefficiency on profitability of oil and gas companies in Nigeria, as such this study will review the concept of ecoefficiency and its impact on the profitability of companies.

Objectives of the Study

Consequence upon the problem of the study as highlighted in the preceding section, the study generally aimed at examining holistically, the influence of the effect of Corporate Eco-efficiency on the performance of oil and gas companies in Nigeria. Specifically, the study focuses on the following: to

1. Assess the extent to which oil eco-efficiency affect the performance of oil and gas companies in Nigeria.
2. Investigate the extent to which gas eco-efficiency affect the performance of oil and gas companies in Nigeria.
3. Examine the association between firm size and the performance of oil and gas companies in Nigeria.
4. Analyze the extent to which firm size affect the nexus between oil eco-efficiency and the performance of oil and gas companies in Nigeria.
5. Analyze the extent to which firm size affect the nexus between gas eco-efficiency and the performance of oil and gas companies in Nigeria

Research Questions

The study specifically provides answers to the following research questions based on the research objectives acknowledged above: to

1. What extent does oil eco-efficiency affect the performance of oil and gas companies in Nigeria?
2. What extent does gas eco-efficiency affect the performance of oil and gas companies in Nigeria?
3. What is the association between firm size and the performance of oil and gas companies in Nigeria?
4. What extent does firm size affect the nexus between oil eco-efficiency and the performance of oil and gas companies in Nigeria.

5. What extent does firm size affect the nexus between gas eco-efficiency and the performance of oil and gas companies in Nigeria.

Research Hypotheses

The study is guided by the following hypotheses stated in null form:

H_{01} : Oil eco-efficiency does not affect the performance of oil and gas companies in Nigeria.

H_{02} : Gas eco-efficiency does not affect the performance of oil and gas companies in Nigeria.

H_{03} : Firm size does not affect the performance of oil and gas companies in Nigeria.

H_{04} : Firm size does not affect the nexus between oil eco-efficiency and the performance of oil and gas companies in Nigeria.

H_{05} : Firm size does not affect the nexus between gas eco-efficiency and the performance of oil and gas companies in Nigeria.

Scope of the study

This study appraised the impact of eco-efficiency on the Profitability of oil and gas industry in Nigeria. The study covered ten oil and gas companies in Nigeria with special focus on companies within the Niger-Delta region of Nigeria. The researcher reduced, the time frame for the study to a 10-year period, ranging from year 2011 to 2020. This period was chosen to make the study more current and up-to-date, especially as it concerns the availability of the financial statements and oil production data of Nigeria. Also, studies have shown that the period 1992-2000 marked the period that the concept of eco-efficiency gained its initial recognition, application and acceptance. Also 5 (oil) companies that operates within the Niger Delta area of Nigeria were sampled due to volume of oil and gas activities carried out within this area of the country, and the availability of data from oil and gas companies in Nigeria.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Introduction

This section presents the reviews of existing literature that were found to be relevant to the study of eco-efficiency and financial performance of oil and gas industries. The section is organized into three main parts: The conceptual framework; theoretical framework and the review of other empirical studies that give support to works done by other researchers, especially as it concerns the subject matter.

Use of Earnings Per-share Net Asset and Return on Asset as a Measure of Financial Performance

Muryani Aarsal (2021) reviewed the impact of earnings per share and dividend per share on firm value. Aarsal, (2021) in the study reviewed the impact of earnings per share (EPS) and dividends per share (DPS) on the value of the company on the Indonesian stock exchange for the period 2014-2017. This study used data from 6 food industry companies listed on the Indonesian Stock Exchange to examine the impact of these variables. Multiple regression models were used to determine the effect of earning per share and dividend per share. The results of the research show that earnings per share separately have a significant and positive impact on company value. However, the dividend per share does not substantially affect the value of the company. The findings of this research also found that firm value is affected simultaneously by EPS

and DPS. The study concludes that investors can use Earnings per Share as the basis for making investment decisions, particularly on the Indonesian Stock Exchange for companies in the food industry. In practical terms, the implications of this research indicate that the management of companies listed on the Stock Exchange must formulate a dividend policy and develop a company strategy aimed at internal and external factors to increase the value of the company. This work supported the reason why dividend per share was dropped as variable for the measurement of Financial Performance of oil and gas companies in Nigeria.

A review of study by (Al Nimer, Warrad, & Al Omari, 2015) The Impact of Liquidity on Jordanian Banks Profitability through Return on Assets: The study sought to find out whether liquidity through quick ratio has significant impact on Jordanian banks profitability through return on asset (ROA). The study used the 2005-2011 financial reports of 15 Jordanian banks listed at Amman Stock Exchange (ASE). The study revealed that there is significant impact of independent variable quick ratio on dependent variable return on asset (ROA). That means profitability through return on assets (ROA) in Jordanian banks is significantly influenced by liquidity through quick ratio. To examine the research hypotheses the researchers used the SPSS program to prepare the table of analysis of variance (ANOVA) table. The researchers maintained that Return on Asset (ROA) is a vital tool to reflect the profitability position of companies and could be affected by the liquidity position of the company.

In line with the position of Investopedia (2022), return on assets (ROA) is a financial ratio that indicates how profitable a company is in relation to its total assets. Corporate management, analysts, and investors can use ROA to determine how efficiently a company uses its assets to generate a profit. According to (Kusuma, 2021) in a study on Measurement of Return on Asset (ROA) based on Comprehensive Income and its Ability to Predict Investment Returns, it was made clear that ROA net income is better able to predict future investment returns. ROA comprehensive income has more relevance value when other items of comprehensive income that could be realized are included. In assessing performance, users are advised to keep using the ROA of the net income version, and when using the ROA of the comprehensive income version, it is advisable to include only OCI which will be reclassified. This affirms the position of Investopedia and that of the paper in the use of Return on Assets as a measurement of financial performance.

Empirical Review on the relationship between Eco-efficiency and Financial Performance of Companies

Studies have shown that proactive firms are found to perform better than reactive firms in terms of profitability and eco-efficiency but firms that combine both proactive and reactive EMS perform even better, which shows the benefit of adopting commitment-based approaches alongside the compliance-based approaches to environmental management. For instance, a review of the work carried out by Mercyline K, & Razack B.L (2013) attest to this fact.

Mercyline K, & Razack B.L (2013) in their work examined the linkage between the profitability of firms measured by return on assets (ROA) and environmental performance measured by eco-efficiency and the impact of a good environmental management system (EMS) on profitability and eco-efficiency of firms. These environmental management practices were captured by the type of EMS a firm adopts that classified firms as either environmental leaders or environmental laggards. To achieve this panel data regression model with ROA as the dependent variable and eco-efficiency scores as the regressors was performed. The results suggest that there is a potential gain in the profitability of the firm by improving eco-efficiency in resource use. This work supports the research study and gives strong backings to the application of the concept of eco-efficiency in financial reports of different companies whose activities have a great impact of the going concern as well as the need for sustainability of the environment. In the same context, in their study, Hart and Ahuja (1996) argue that the investments made by companies to reduce emissions negatively affects the net profit for the following two financial years and, consequently, higher emission reduction

levels were associated with companies with larger profits.

Ibida, Nneka, and Emeka (2019) in their work measured the effect of Corporate Social Responsibility (CSR) on financial performance of oil and gas companies in Nigeria. Secondary data were obtained from published financial reports and accounts of randomly selected active oil and gas firms quoted on the Nigerian Stock Exchange for the period 2006 – 2015. Ethical, economic, and legal responsibilities were selected as independent variables while the firm performance was selected as the dependent variable, and these were incorporated into the model. Ethical responsibility was measured by expenditures on social donations, economic responsibility was measured by earnings per share while legal responsibility was measured by a summation of directors' remuneration, auditors fee, tax paid, interest expenses and staff costs. The data were analyzed using correlation and Ordinary Least Squares (OLS) regression analysis. The regression result showed that Ethical and Legal CSR have a negative significant relationship with firm performance while Economic CSR has a positive significant relationship with firm performance. The research recommends that economic responsibility should be encouraged as there is a significant positive relationship with firm performance. An increase in economic responsibility also brings about an increase in firm performance. Legal responsibility should be encouraged as there was a positive relationship with firm performance though it was not significant. An increase in legal responsibility encourages an increase in firm performance. This study therefore provides backing to the research work, especially as it concerns the measurement of Corporate Social Responsibility and its impact on the financial performance within the Nigerian ecosystem.

Further review of study by Brian Kurniantaa and Wiwiek Dianawatib (2020) on *The Impact of Eco-efficiency on Firm Value and Firm Size: An Indonesian Study*, revealed that firm sizes could moderate the effect on eco-efficiency on the value of the company. The study analyzed the impact of eco-efficiency implementation on firm value with firm size as a moderating variable. The research used secondary data from the annual reports of manufacturing companies listed on the Indonesian Stock Exchange (BEI) during the period 2013-2017. Purposive sampling was applied in the research which resulted in 469 samples chosen according to the criteria. The data analysis used multiple linear regression analysis with SPSS. The result showed that: (1) Eco-efficiency as measured by ISO 14001 certification has a significant effect on the value of a company; and (2) Firm size moderates the effect of eco-efficiency on the value of a company. This supports the researchers' choice of firms whose firm sizes were above the industrial average of N40billion in Net Asset Value. (NETI 2022)

Further literature review revealed clear discrepancy in operating performance between firms with high eco-efficiency ratings and those with low ratings. The paper by Nadja Guenster, Jeroen Derwall, Rob Bauer and Kees Koedijk (2004) on *The Economic Value of Corporate Eco-Efficiency* reviewed whether adopting environmental management policies are economically valuable to the firm. The study focused on the concept of eco-efficiency and added new insights to the environmental-financial performance debate. Using a large database of monthly eco-efficiency ratings which have received little academic attention hitherto, the study provided evidence of a positive but non-linear relationship between corporate eco-efficiency and the firm's Tobin's. The research work pointed to a clear discrepancy in operating performance between firms with high eco-efficiency ratings and those with low ratings. It revealed that Environmental leaders do not have a return on assets superior to that of the control group, but laggards display significant operational underperformance.

The work concluded that there is a tradeoff between eco-efficiency and financial performance which would help investors in making investment decisions. This was in sharp contrast to the position of other researchers Mercyline K, & Razack B.L (2013) and others discussed above that showed a strong link between financial performance of companies and eco-efficiency.

Another review of study by (Pérez-Calderón, Milanés-Montero, Meseguer-Santamaría, & Mondéjar-Jiménez, 2011) on eco-efficiency: effects on economic and financial performance: evidence from Dow

Jones sustainability Europe Index. In their study eco-efficiency theory had become an issue of considerable interest. The work, focused on the fact that enterprises can maximize their economic benefits and minimize the impact on the environment at the same time. They recommended the choice of the win-win strategy, which allows for getting a double economic environmental benefit by means of a good management of productive resources, the rationalization of consumption and the right treatment of generated outputs.

The study used a sample of 122 firms from different sectors which belong to Dow Jones Responsibility Index Europe for the years 2007 through 2009. The work methods used were structural equation models (SEMs). The work revealed that firms with the best environmental performances during this period also obtained the largest economic and financial benefits. Therefore, the investments done to improve the environmental performance can be a good incentive for these companies. This work supported the study carried out by Brian Kurniantaa and Wiwiek Dianawatib (2020), and Mercy line K, & Razack B.L (2013)

Empirical Literature Gaps

It is evident from the above empirical reviews that there is paucity of studies on eco-efficiency and performance of companies, however there is no work that reviews relationship between these two variable in the Oil and Gas Industries despite the fact that literatures of environmental concerns reviewed indicates that the Niger-Delta region of the Nigeria have been bastardized with the activities of oil and gas companies especially as it concerns gas flaring and oil spillage. To breach this gap, this work was tailored made to address the need of using the accounting measurements to unravel the connection between the environmental concerns and the financial performance of the oil and gas companies in the Niger Delta region of the country.

Few controversies have been unraveled in the measurement of eco-efficiency and even its impact on the financial performance, this study besides the ranging controversies was carried out with the intentions to contribute to existing literature and theories on eco-efficiency using financial performance to underpin the study since it is the reason for the interpretation of this research work. Existing work on eco-efficiency and financial performance appears scanty especially in developing nations like Nigeria. Hence this study fills the knowledge gap by carrying out an empirical examination of corporate eco-efficiency and performance of oil and gas companies in Nigeria.

RESEARCH METHOD

Research Design

This section presents the various methods employed to empirically examine the relationship between eco-efficiency variables and the performance of oil and gas companies in Nigeria together with the interacting role of firm size in the relationship. To be able to achieve this objective, the study utilizes both descriptive and expo-facto research designs. While the former allows the study to describe the descriptive properties of the time series metric variables employed, the latter is employed because the time series metric variables were sourced through secondary means.

Population and Sampling Strategy

The study covers all oil and gas companies listed on Nigeria Exchange Group (formerly Nigeria Stock Exchange – NSM). Out of the 7 companies listed under oil and gas sector, 5 have purposely selected. The reason for selecting this five is in twofold. First, they have all the data needed for the metric variables employed. Similarly, they have not undergone any form of suspension, delisting, and reconstruction between the period of study. The list of the sample companies is reported under Table 3.1.

Table 3.1: List of Sample companies

S/N	Company
1	MOBIL
2	NIGER-DELTA
3	SEPLAT
4	SPDC PET
5	Total Nig

Source: Nigeria Exchange Group

Sources and Methods of Data Collection

Due to the nature of the econometric models employed which was necessitated by the objectives of the study together with the research design employed, the study relies majorly on secondary sources of data. The data were collected from the annual reports of the sample companies, websites of the ample companies and from the Nigeria Exchange Group website for all the relevant periods. The study period covers a period of 10 years from 2011 to 2020. The data collected are in relation to the metric variables employed which include data on total assets, earnings per share, oil production, gas production, oil spillage and gas flared. Other data such as oil eco-efficiency and gas eco-efficiency were generated from those data collected.

Methods of Data Analysis

The study utilises econometric models to empirically examine the relationship between eco-efficiency variables and the performance of oil and gas companies in Nigeria together with the interacting role of firm size in the relationship. The multivariate analyses were performed through ordinary least square regression approach. Two measures of performance were employed, ROA and EPS. Accordingly, equations were adopted. Equation 3.1 utilises ROA as the dependent variable, while Equation 3.2 utilises EPS as the dependent variable.

$$ROA_{it} = \beta_0 + \beta_1 OE_{eff} + \beta_2 GE_{eff} + \beta_3 InSize + \beta_4 InSize * OE_{eff} + \beta_5 InSize * \beta_2 GE_{eff} \dots \dots \dots 3.1$$

$$EPS_{it} = \beta_0 + \beta_1 OE_{eff} + \beta_2 GE_{eff} + \beta_3 InSize + \beta_4 InSize * OE_{eff} + \beta_5 InSize * \beta_2 GE_{eff} \dots \dots \dots 3.2$$

Where: ROA_{it} = Return on assets

EPS_{it} = Earnings per share.

OE_{eff}_{it} = Oil eco-efficiency.

GE_{eff}_{it} = Gas eco-efficiency.

$InSize_{it}$ = log of total assets.

$InSize_{OE_{eff}}$ = Interaction variable between size and oil eco-efficiency.

$InSize_{GE_{eff}}$ = Interaction variable between size and gas eco-efficiency.

Definitions and Estimations of Variables

All the metric variables employed in the study are measured in consistent with extant literature. The definition and estimation procedures utilised in relation to all the variables employed in the study are presented under Table 3.2

Table 3.2: Definitions and Estimation of Variables

Variable		Definition	Estimation procedure	Source	Expected outcome
Dependent Variable	ROA_{it}	Return on Assets	Proportion of earnings before interest and tax to total assets	Botchkarev (2011)	Not applicable
	EPS_{it}	Earnings per share	Proportion of earnings before interest and tax to total number of shares	Botchkarev, (2011)	Not applicable
Explanatory Variable	$OE_{eff_{it}}$	Oil eco-efficiency	Proportion of oil spillage to oil production	Brian & Wiwiek (2020) Sturm, et. al., (2004) Bidwell & Verfaillie (2002)	+
	$GE_{eff_{it}}$	Gas eco-efficiency	Proportion of gas flared to gas production	Brian & Wiwiek (2020) Sturm, et. al., (2004) Bidwell & Verfaillie (2002)	+
	$InSize_{it}$	Size of the company	Log of total assets	Brian & Wiwiek (2020)	+
Interaction Variable	$InSize_O_{eff}$	Interaction between size and oil eco-efficiency	The product of log of total assets and oil eco-efficiency	Authors' computation	+
	$InSize_G_{eff}$	Interaction between size and gas eco-efficiency	The product of log of total assets and gas eco-efficiency	Authors' computation	+

DATA PRESENTATION, ANALYSIS AND INTERPRETATION OF RESULTS

Introduction

This section provides the empirical results on the effect of eco-efficiency on the performance of oil and gas companies in Nigeria. As mentioned in the previous section, the study covers a period from 2011 to 2020.

Detail findings are provided under succeeding subsections. The data utilized in the study are provided under Appendix 1.

Descriptive Statistics and Preliminary Analysis

Descriptive Statistics

Table 4.1 Provides the summary statistics of the descriptive properties of the univariate timeseries metric variables employed in the study. Consistent with the period of the study, the table reveal 50 firm-year observations across all the variables employed indicating absence of any missing observation.

Table 4.1: Descriptive Statistics

Variable		Observation	Mean	Std. Dev.	Min	Max
Dependent Variable	ROA_{it}	50	9.29	8.90	- 12.06	41
	EPS_{it}	50	38.85	40.38	-2.78	206.3
Explanatory Variable	$OE_{eff_{it}}$	50	0.04	0.05	0.00	0.29
	$GE_{eff_{it}}$	50	0.38	1.16	0.01	7.33
	$InSize_{it}$	50	11.81	0.97	9.84	13.36
Interaction Variable	$InSize_OE_{eff}$	50	0.42	0.56	0.04	3.61
	$InSize_GE_{eff}$	50	4.22	12.42	0.07	77.88

Note: ROA_{it} = Return on assets EPS_{it} = Earnings per share; $OE_{eff_{it}}$ = Oil eco-efficiency.

$GE_{eff_{it}}$ = Gas eco-efficiency; $InSize_{it}$ = log of total assets; $InSize_OE_{eff}$ = Interaction variable between size and oil eco-efficiency; $InSize_GE_{eff}$ = Interaction variable between size and gas eco-efficiency.

For clarity purpose, all the variables are divided into three parts based on their utilization in the study- 1) dependent variables, 2) independent variables, 3) interaction variable. In relation to the dependent variable, Table 4.1 shows that the average (mean) values of ROA and EPS are 9.29 and 38.85 respectively suggesting that majority of the companies reported positive earnings during the period of the study. This revelation is important for the study as it allows the study to quantify the effect of eco-efficiency on firm performance.

Regarding the three explanatory variables, the table shows that $GE_{eff_{it}}$ has the higher mean value of 38% compared to the other eco-efficiency variable ($OE_{eff_{it}}$) which has a value of 4%. This indicates the likelihood of a greater contribution of the former in the eco-efficiency and performance model employed in the study. In all, $InSize$ has a mean value of 11.81. Of the two interaction variables, $InSize_GE_{eff}$ has the higher mean value of 4.22 compared to $InSize_OE_{eff}$ with a mean value of 0.42. Overall, all the variables behaved as expected.

Preliminary Analysis

The study adopts a multi stage analysis before deciding on the most efficient and unbiased method for analysing the results of the study. In essence, standard panel method was followed in all the analysis. It begins with investigating possible multicollinearity among the explanatory variables using Pearson correlation coefficient and variance inflation factor (VIF) before regressing the relevant panel data using the

ordinary least square (OLS) method followed by generalized least square (GLS) random effects method and then OLS fixed effect method. The results of necessary effect tests influence the choice of most appropriate method.

Pairwise Correlation

The study assesses the pairwise correlation among the explanatory variables to detect possible level of multicollinearity using Pearson correlation coefficient. Table 4.2 presents the outcome of the results under Panel A and Panel B. While Panel A uses ROA as the dependent variable, Panel B utilizes EPS as the dependent variable. The panels reveal the magnitude and direction of correlation between all the time series metric variables. The Pearson coefficients of all the variables across the two panels are considerably low indicating weak multicollinearity among the bivariate.

Table 4.2: Pairwise Correlation

PANEL A: Pairwise Correlation (Using ROA as the Dependent Variable)

Variable	ROA_{it}	$OE_{eff_{it}}$	$GE_{eff_{it}}$	$InSize_{it}$	$InSize_OE_{eff}$	$InSize_GE_{eff}$
ROA_{it}	1.000					
$OE_{eff_{it}}$	0.106	1.000				
$GE_{eff_{it}}$	0.210	0.103	1.000			
$InSize_{it}$	0.410	0.101	0.240	1.000		
$InSize_OE_{eff}$	0.108	1.100	0.104	0.207	1.000	
$InSize_GE_{eff}$	0.211	0.103	0.200	0.240	0.024	1.000

Note: ROA_{it} = Return on assets EPS_{it} = Earnings per share; $OE_{eff_{it}}$ = Oil eco-efficiency.

$GE_{eff_{it}}$ = Gas eco-efficiency; $InSize_{it}$ = log of total assets; $InSize_OE_{eff}$ = Interaction variable between size and oil eco-efficiency; $InSize_GE_{eff}$ = Interaction variable between size and gas eco-efficiency.

PANEL B: Pairwise Correlation (Using EPS as the Dependent Variable)

Variable	EPS_{it}	$OE_{eff_{it}}$	$GE_{eff_{it}}$	$InSize_{it}$	$InSize_OE_{eff}$	$InSize_GE_{eff}$
EPS_{it}	1.000					
$OE_{eff_{it}}$	0.149	1.000				
$GE_{eff_{it}}$	0.218	0.294	1.000			
$InSize_{it}$	0.444	0.117	0.243	1.000		
$InSize_OE_{eff}$	0.382	0.461	0.407	0.413	1.000	
$InSize_GE_{eff}$	0.224	0.292	0.397	0.238	0.402	1.000

Note: ROA_{it} = Return on assets EPS_{it} = Earnings per share; $OE_{eff_{it}}$ = Oil eco-efficiency.

$GE_{eff_{it}}$ = Gas eco-efficiency; $InSize_{it}$ = log of total assets; $InSize_OE_{eff}$ = Interaction variable between size and oil eco-efficiency; $InSize_GE_{eff}$ = Interaction variable between size and gas eco-efficiency.

Test of Variance Inflation Factor (VIF)

Table 4.3 presents the outcome of test of VIF and tolerance to further confirm the absence of multicollinearity among the independent variables. The table is divided into two parts. Partone utilises ROA

as the dependent variable while Part Two utilises EPS. The values of all the variables for VIF and tolerance for the two parts are consistently lower than the maximum tolerable value. According to Field (2013) and Hill et al. (2011) the maximum allowable value for VIF is 10 and a minimum tolerance value of 0.10. To sum up, there is absence of multicollinearity between the variable of interest as the magnitude of all the correlation coefficients are quite small and values of VIF and tolerance fall within the allowable threshold.

Table 4.3: Variance Inflation Factor (VIF)

Variable	ROA as the Dependent Variable		EPS as the Dependent Variable	
	VIF	Tolerance	VIF	Tolerance
OEeffit	1.02	0.980	1.29	0.777
GEeffit	1.15	0.871	1.96	0.511
InSize _{it}	1.33	0.752	2.14	0.466
InSize_Oeff	1.32	0.757	2.85	0.351
InSize_GEeff	1.16	0.653	3.36	0.298
Mean VIF	1.196		2.32	

Note: ROA_{it} = Return on assets EPS_{it} = Earnings per share; $OEeff_{it}$ = Oil eco-efficiency.

$GEeff_{it}$ = Gas eco-efficiency; $InSize_{it}$ = log of total assets; $InSize OEeff$ = Interaction variable between size and oil eco-efficiency; $InSize GEeff$ = Interaction variable between size and gas eco-efficiency.

Empirical Results

This section presents the empirical results on relationship between eco-efficiency variables and the performance of oil and gas companies in Nigeria together with the interacting role of firm size in the relationship. Consistent with the models specified in the preceding section, two proxies of performance (ROA and EPS) were utilized as the dependent variables. Table 4.4 presents the outputs of the OLS regression results in relation to the variables of interest. Utilizing the two equations, the coefficients of F-statistics are 117.93 and 124.61, both significant at 5% level. The significance of this statistics indicates that the models employed in the study are well fitted and appropriate to test hypotheses formulated. The Adjusted R-square for the two equations are 0.351 and 0.331. This revelation suggests the explanatory variables explain the variation in the dependent variable by 35% and 33% in Equations 1 and 2, respectively.

Utilising ROA as the dependent variable, the result from Table 4.4 further reveals that the two coefficients of eco-efficiency variables, $OEeff_{it}$ and $GEeff_{it}$ are 0.020 and 0.069 respectively. Both are positive and statistically significance at 5% indicating that eco-efficiency positively engenders the performance of firms. The same positive and statistical significance result was reported regarding the coefficient of $InSize$ with a value of 0.461. This revelation suggests that size influences the financial performance of companies. The coefficients of $InSize OEeff$ and $InSize GEeff$ are significant and positive with values of 0.195 and 0.215 respectively. This suggest that firm size positively moderate the relationship between eco-efficiency and performance of companies.

Table 4.4: Empirical Results

	Equation 1	Equation 2
Variable	Dependent Variable	Dependent Variable
	ROA	EPS
OEeffit	0.020	0.021

	(1.97)**	(2.97)**
GEeffit	0.069	0.029
	(5.09)**	(0.30)*
InSize _{it}	0.461	0.277
	(3.98) *	(2.30)*
InSize_Oeff	0.195	0.210
	(5.71)*	(8.83)**
InSize_GEeff	0.215	-0.190
	(5.71)**	(8.83)**
Constant	1.244	0.111
	(5.71)*	(0.70)
F-Statistics	117.93**	124.61**
Adjusted R-Square	0.351	0.331

** and * indicate that values are significant at 5% and 1%, respectively.

Absolute values of t-statistics are in parentheses.

^aROA_{it} = Return on assets EPS_{it} = Earnings per share; OEeff_{it} = Oil eco-efficiency.

GEeff_{it} = Gas eco-efficiency; InSize_{it} = log of total assets; InSize_OEeff = Interaction variable between size and oil eco-efficiency; InSize_GEeff = Interaction variable between size and gas eco-efficiency.

Utilising EPS as the dependent variable, the result from Table 4.4 also reveal similar results like the one previously discussed. The two coefficients of eco-efficiency variables, OEeff_{it} and GEeff_{it} are consistently positive and significant with coefficient values of 0.019 and 0.029, respectively. This further reveal that eco-efficiency influences the performance of firms positively. The coefficient of InSize is 0.277 which is statistically significant 1% suggesting that firm size positively affect firm performance. The coefficients of InSize_OEeff and InSize_GEeff are consistently positive and significant with values of 0.210 and 0.190, respectively. This additionally suggest that firm size positively moderate the relationship between eco-efficiency and performance of companies.

Discussion of Findings

The study postulates five hypothesises in relation to the effect of eco-efficiency on performance of oil and gas companies. Regarding the first and second hypothesises, the study discovered statistical positive relationship between OEeff and GEeff and the two dimensions of firm performance employed. Consequently, the first-two null hypothesises are rejected. These findings reveal that eco-efficiency enhance the financial performance of oil and gas companies in Nigeria. This suggest that large firms that spent more on the environment will have higher reported earnings compared to companies that refrain from spending on the environment.

The findings from the regression result also lead to the rejection of the third hypothesis. This is necessary because the coefficient on InSize is positively significant across the two measures of financial performance employed. This suggest that large firms have the propensity to make more profit compared to small firms. Consistence with the expected outcome, the findings from the two measures of performance employed lead to the rejection of the last-two hypothesises. This finding reveals that size contribute positively to the nexus

between eco-efficiency and firm financial performance of listed oil and gas companies in Nigeria. This suggest that larger firms spent more on the environment which positively enhance their financial performance compared to small firms.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary of the Study

Activities of oil and gas exploration in Nigeria in recent times are skyrocketing in a geometric progression which brings unprecedented challenges to the environment. In recent times, the oil exploration and extraction activities within the nation increases. These activities continuously post serious threat to the environment. It is against this bedrock this study examines the effect of eco-efficiency on the financial performance of listed oil and gas companies in Nigeria.

In line with the above stated objectives, the study hypothesized five hypotheses which guided the direction of the study. The study utilized mainly secondary data sourced from the annual reports of the sample companies. Employing two econometric variables, and in consistent with the expected outcomes, the results from the study reveal some striking revelations. In particular, the study documented a statistical significance positive relationship between eco-efficiency variables and firm performance. Similarly, the study found that size of the firms engenders positive significance moderating relationship between eco-efficiency and financial performance of listed oil and gas companies in Nigeria. These findings are consistent with the findings from extant literature.

Conclusions

Based on the findings of the study, the study reached the following conclusions:

1. Eco-efficiency affects the performance of oil and gas companies in Nigeria. Accordingly, companies that spent more on the environment have a better financial performance compared to companies that spent low on the environment.
2. Firm size enhances the performance of oil and gas companies in Nigeria. Consistent with the finding, larger companies perform better compared to small firms.
3. Firm size enhances the relationship between oil-eco-efficiency and financial performance of listed oil and gas companies in Nigeria. This implies that larger firms spent more on the environment which positively enhance their financial performance compared to firms that are smaller in size.
4. Firm size enhances the relationship between gas-eco-efficiency and financial performance of listed oil and gas companies in Nigeria. This implies that larger firms that embrace environmentally friendly policies like reduction of gas flared, and mopping up of the impact of gas flared on the environment receives positive impact with regards to the social standing with the host communities and that also positively enhance their financial performance compared firms that are smaller in size. This also reflects on the host community protection of their oil installations.

REFERENCES

1. Achudume, A. (2009). The effect of Petrochemical Effluent on Water Quality of Ubeji Creek in Niger Delta of Nigeria” *Bulletin of Environmental Contamination and Toxicology*, 83 (3) 410-415
2. Adati, A, K (2012). Oil Exploration and spillage in Niger Delta of Nigeria *Civil and Environmental Research Papers*, (3)
3. Al Nimer, M., Warrad, L., & Al Omari, R. (2015). The impact of liquidity on Jordanian banks profitability through return on assets. *European Journal of Business Management*, 7(7), 229-232.
4. Aarsal, M. (2021). Impact of earnings per share and dividend per share on firm

- value. *Jurnal Ilmiah Akuntansi* 4(1), 11-18.
5. Asika, N (2004). *Research Methodology in the behavioral Sciences*. Lagos Nigeria.
 6. Bayode, Adewunmi, O J, Obunwole, E. A. (2011). Environmental Implications of oil explorations in Coastal region of Ondo State, Nigeria: A regional planning appraisal. *Journal of Geographical and Regional Planning* 4(3)
 7. Bebbington, J and Gray, R (2001). *Accounting for the Environment*, Second Edition, London; Sage Publications
 8. Bidwell, R. & Verfaillie, H. (2002) *Measuring Eco-efficiency a Guide to Reporting Company Performance*, World Business Council for Sustainable Development, Geneva
 9. Birkin F., Woodward D., (1997), *Management accounting for sustainable development*. Part III., *Magazine for Chartered Management*, 75, 58-60
 10. Botchkarev, P. A. (2011) *The Use of Return on Investment (ROI) in the Performance Measurement and valuation of Information System*. ResearchGates. <https://www.researchgate.net/publication/251422412>
 11. Brian K & Wiwiek D (2020) *The Impact of Eco-efficiency on Firm Value and Firm Size: An Indonesian Study*, *International Journal of Innovation, Creativity and Change*. 13(4)
 12. Burlea, A. S., & Popa, I. (2013). Legitimacy theory. *Encyclopedia of corporate social responsibility*, 21, 1579-1584.
 13. Czaplicka, K, Burchart-korol, D & Krawczyk, P (2010) *Eco-efficiency conception: Journal of Achievement in Materials and Manufacturing Engineering*, 43(1)
 14. Dickey, D.A. & Fuller, W.A. (1981) *Likelihood ratio statistics of autoregressive time series with unit root*, *Econometrica*, 49, 1057-1072.
 15. Donaldson, Thomas; Preston, Lee E. (1995). "The Stakeholder Theory of the Corporation: Concepts, Evidence, and Implications". *Academy of Management Review*. 20 (1): 65–91
 16. Dowling, J., & Pfeffer, J. (1975). *Organizational legitimacy: Social values and organizational behavior*. *Pacific sociological review*, 18(1), 122-136.
 17. Duckworth, Holly Alison; Moore, Rosemond Ann (2010). *Social Responsibility: Failure Mode Effects and Analysis*. p. 10. ISBN 978-1439803745.
 18. Enahoro, J. A. (2009) *Design and Bases of Environmental Accounting in Oil & Gas and Manufacturing Sectors in Nigeria (A published Thesis)* Covenant University Ota, Nigeria
 19. Etuk, E. J (2010) *Business Research methods: Concept, Processes and Applications*. Uncial Press, Calabar-Nigeria
 20. Federal Environmental Protection Agency (1992) *Environmental Impact Assessment Act*. Retrieved June 2015 from www.nigerialaw/federal-environmental-protection-agency
 21. Guilford, J. P. & Fruchter B (1973). *Fundamentals Statistics in psychology and education*; New York Mc. Hill
 22. Guthrie, J., Cuganesan, S., & Ward, L. (2007). *Legitimacy theory: A story of reporting social and environmental matters within the Australian food and beverage industry*. Paper presented at the Asia Pacific Interdisciplinary Research in Accounting Conference (5th: 2007)
 23. Hansen, D. R & Mowen, M. M (2000) *Cost Management, Accounting and Control*, Third Edition; South-West College Publishing a division of Thomson Learning
 24. Hart S.L., Ahuja G., (1996), *Does it pay to be green? An empirical examination of the relationship between emission reduction and firm performance*, *Business Strategy and the Environment*, 5, 30-37
 25. Howes, R (2002) *Environmental Cost Accounting: An Introduction and Practical Guide*, London, Chartered Institute of Management Accountants.
 26. http://www.docstoc.com/docs/84838188/oecd_decoupling
 27. <https://corporation.nnpcgroup.com/pages/afs2020.aspx>
 28. <https://reports.shell.com/annual-report/2021/services/downloads.html>
 29. <https://www.investopedia.com>
 30. Huppes G., Ishikawa M., (2005), *Eco-efficiency and its terminology*, *Journal of Industrial Ecology*, 9, 43-46. Huppes G, Hunkler D., Rebitzer, G. Lichtenvort, K. (2005) *what is LCC?* In working draft

- from SETAC WG on Life Cycle Costing
31. Ibida, N. Jane & Emeka-Nwokeji, N.A (2019) Effect of Corporate Social Responsibility (CSR) On Financial Performance Of Oil And Gas Companies In Nigeria. *Journal of Accounting, Business and Social Sciences* Volume 2 (1)
 32. Idekwulim P. C (2014). Teach yourself IFRS. Piccas Global Concept, Yaba -Lagos.
 33. Johansen, S. & Juselius, K. (1988). Statistical analysis of co-integration vectors, *Journal of Economic Dynamic Control*, 12, 231-254.
 34. Johnson, Chris (2006). *Australia's Mammal Extinctions* Melbourne: Cambridge University Press. pp. vii.
 35. Kusuma, M. (2021). Measurement of Return on Asset (ROA) based on Comprehensive Income and its Ability to Predict Investment Returns: an Empirical Evidence on Go Public Companies in Indonesia before and during the Covid-19 Pandemic. *Ekulilibrium: Jurnal Ilmiah Bidang Ilmu Ekonomi* 16(1), 94-106.
 36. Laplume, André; Karan Sonpar; Reginald Litz (Dec 2008). "Stakeholder Theory: Reviewing a Theory That Moves Us". *Journal of Management*. 34 (6): 1152–1189.
 37. Lee, Nancy; Kotler, Philip (2013). *Corporate social responsibility doing the most good for your company and your cause*. Hoboken, NJ: Wiley
 38. Lehni, M. (2000), *Eco-efficiency; Creating More Value with Less impact*, World Business Councils for sustainable Development – Geneva
 39. Lin, T C. (2018) *Incorporating Social Activism* 98 *Boston University Law Review* 1535 (2018)
 40. McIntyre, R.; Thornton, J. (1978). "On the environmental efficiency of economic systems". *Soviet Studies*. 30 (2): 173–192
 41. Mercy, K & Razack BL (2013) *Clean Production and Profitability: An Ecoefficiency Analysis of Kenyan Manufacturing Firms*, *Journal of Environment & Development* 22(2) 169–185
 42. Mobus, J.L. (2005), *Mandatory environmental disclosures in a legitimacy theory context*, *Accounting, Auditing, and Accountability Journal*, Vol 18 No 4, pp. 492-517. 7.
 43. Ndiyo, N. A. (2005). *Fundamentals of research in behavioral sciences and humanities*, Calabar: Wusen Publishers.
 44. NETI(2022-2011): *Nigeria Extractive Industries Transparency Initiative (NEITI) oil and Gas industry report*. Annual Gazette Journal.
 45. Newell, R. G. & Pizer, W.A. (2003) *Discounting the distant future: how much do uncertain rates increase valuations?* *Journal of Environmental Economics and Management* 46: 5:52-71.
 46. Odeyemi, O & Ogunsetian O.A (1985) *Petroleum Industry and its Pollution Potential in Nigeria Oil and Petroleum Pollution*, Elsevier Applied Sciences Publishers Ltd, England
 47. Owen, D. (2008), *Chronicles of Wasted Time? A Personal Reflection on the Current State of, and Future Prospects for Social and Environmental Accounting Research*, *Accounting, Auditing and Accountability Journal*, Vol. 21, No. 2, pp. 240-267
 48. Pérez-Calderón, E., Milanés-Montero, P., Meseguer-Santamaría, M.-L., & Mondéjar-Jiménez, J. J. (2011). *Eco-efficiency: Effects on economic and financial performance. Evidences from Dow Jones Sustainability Europe Index*. *Environmental Engineering Management Journal*, 10(12).
 49. Philip, P.C.B. & Perron, P. (1998) *Testing for a unit root in time series regression*. *Biometrika*, 62; 335-346.
 50. Porter M.E., Van der Linde C., (1995), *Green and competitive: ending the stalemate*, Harvard Business
 51. PricewaterhouseCoopers (2011) *Financial reporting in the oil and gas industry*, 2nd Edition, Retrieved from <http://www.pwc.com/energy>.
 52. Rebitzer, G. & Hunkeler, D. (2005) *The Concept of LCC' in Working draft from SETAG WG on Life Cycle Costing*
 53. Remenyi, D., Williams, Money. A. & Swartz, E, (2005) *Doing Research in Business and Management: An Introduction to Process and Method*, Sage Publication. London Review, 73, 120-134
 54. Rogowski, W. (2008) *Account of Investment efficiency*, Kluwer Cracow, Poland
 55. Saidu, S. A., Aliyu, B. S., Zubair, A. U. (2016). *Is the discovery of oil a curse or a blessing to*

- Nigeria? CBN Bullion, 40(1), 21-32
56. Shell (2020/2019) Cost of emission schemes and related environmental programmes. Seminar Papers (Nigeria)
 57. Steen B, Garling, A, Imrell A. M & Sanne, K. (2004) Development of interpretation keys for environmental product declarations (EPD Draft), Chalmers, ABB, Akzo Nobel, Sweden
 58. Steen, B. (1999). Systematic approach to environmental priority strategies in product development (EPS): Version 2000-General System characteristics CPM report1999:4. Centre for environmental Assessment of Products and material systems, Chalmers University of Technology, Goteborg, Sweden
 59. Steen, B. (1999). Systematic approach to environmental priority strategies in product development (EPS): Version 2000-Models and data of the default method, CPM report 1999:5. Centre for Environmental Assessment of Products and material systems, Chalmers University of Technology, Goteborg, Sweden
 60. Sturm, A, Muller, K &Upasena, S (2002) Eco-efficiency in the NOGEPA Covenant: Setting Weights on Environmental Effects. Leiden-Netherlands. Llk-ol 58-71
 61. Tietenberg, T (2006). Environmental Natural Resource Economics, Seventh Edition, Boston Pearson, Addison Wesley
 62. Winfree H. F, &Druller, S. P. (2000) Environmental Accounting and Management initiatives, NY, London: Oak Tree Press
 63. World Business Council for Sustainable Development, (2000) Eco-efficiency: creating more value with less impact, Geneva.
 64. World Business Council for Sustainable Development, Eco-efficiency: Creating more value with less Impact. Geneva 2000
 65. Yadong, Y (2013). “Eco-efficiency trends in china, 1978-2010:decoupling environmental pressure from economic growth”. Ecological Indicators. **24**: 177–184.
 66. Yushau, A & Sa’adiyya A (2020) Corporate Social Responsibility and Financial Performance: Evidences From Listed Oil And Gas Firms In Nigeria, Crawford Journal Of Business & Social Sciences (CJBASS) VOL. X NO.1