



## Sustainability Reporting and Corporate Financial Performance of Listed Oil and Gas Firms in Nigeria

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### Abstract

*This study investigated the impact of sustainability reporting on corporate financial performance of listed oil and gas firms in Nigeria between 2015 and 2024, with return on equity (ROE) as the performance proxy. Using an ex-post factor design and purposive sampling, data were collected from annual and sustainability reports of ten listed firms and analyzed using panel regression models with random effects. The results indicated that energy intensity (EI) positively and significantly improved ROE, reflecting the profitability benefits of energy efficiency. Water management rate (WMR) also exerted a positive and significant effect, suggesting that responsible water use strengthened financial outcomes and stakeholder legitimacy. In contrast, air pollutant emissions intensity (APEI) had a negative and significant effect on ROE, confirming that higher emissions damaged profitability through compliance costs and reputational risks. Greenhouse gas emissions intensity (GHGI), however, was positive but statistically insignificant, implying that climate-related initiatives did not yet produce short-term financial benefits. These findings supported both the Triple Bottom Line and Legitimacy theories, highlighting how sustainability practices influenced profitability, stakeholder trust, and long-term corporate resilience. The study concluded that sustainability reporting played a critical role in shaping financial performance and recommended investment in energy and water efficiency, stronger emission control, and more credible greenhouse gas reporting. Overall, the research emphasized that integrating sustainability practices into business strategies was vital for achieving both environmental stewardship and financial success in Nigeria's oil and gas sector.*

**Key Words:** Sustainability reporting, Energy intensity, Water management rate, Air pollutant emissions intensity, Greenhouse gas emissions intensity, Return on equity, Corporate financial performance, Oil & Gas firms.

### Background to the Study

The global focus on sustainable development has significantly increased the importance of environmental performance metrics such as energy intensity, water management rate, air pollutant emissions intensity, and GHG emissions intensity. These metrics are now seen as crucial indicators of corporate environmental impact and operational efficiency. In Nigeria, where industrial and extractive activities dominate, integrating such environmental measures into sustainability reporting has gained growing attention from both academics and regulators. Recent studies indicate that carbon and GHG emissions disclosures may reduce market competitiveness among non-financial listed firms in Nigeria (Agbo et al 2024). Similarly, environmental investment disclosures have shown mixed effects on financial performance, with

water protection disclosures found to enhance performance, while air protection disclosures produced negative outcomes (Emenyi, 2024).

Alongside these trends, Nigeria's regulatory environment is undergoing significant transformation. In March 2024, the government announced that large firms must begin mandatory eco-friendly and climate-related disclosures by 2027, while smaller firms were given until 2030 to comply (Reuters, 2024). This regulatory momentum highlights the pressing need for empirical studies that can clarify how sustainability performance translates into financial outcomes, especially in industries associated with significant environmental externalities. Yet, empirical evidence directly linking carbon accounting and financial performance among listed manufacturing firms remains limited. A 2025 study revealed that although carbon

accounting influences return on assets, the relationship was not statistically significant (Appah et al 2025). This points to the need for broader inquiry into how environmental intensity metrics beyond carbon accounting shape profitability, particularly when profitability is measured through return on equity.

In the context of Nigeria's oil and gas sector, the environmental burdens are extensive, including high levels of emissions and water contamination, making the industry a focal point for sustainability research (Popoola & Onmonya, 2024). Given its central role in the national economy and its exposure to global scrutiny, it is crucial to examine how environmental stewardship in this sector intersects with financial performance outcomes such as return on equity. Therefore, situating sustainability reporting proxies such as energy intensity, water management rate, air pollutant emissions intensity, and GHG emissions intensity alongside corporate financial performance of oil and gas firms addresses an important research gap. This study seeks to provide fresh insights into how environmental intensity measures influence financial performance within high-impact industries, in line with emerging regulatory expectations and the rising investor demand for credible sustainability reporting.

### Statement of the Problem

The increasing global and national demand for sustainable business practices has drawn attention to how environmental performance measures such as energy intensity, water management rate, air pollutant emissions intensity, and GHG emissions intensity influence corporate financial performance, particularly return on equity among oil and gas firms in Nigeria. However, existing findings in the literature remain inconclusive and inconsistent. Popoola and Onmonya (2024) reported that environmental disclosure enhanced ROE but negatively affected other profitability indices, while Soomiyol et al (2023) observed only a weak link between sustainability practices and financial performance in listed firms. Likewise, Appah et al (2025) showed that carbon accounting had no significant impact on profitability indicators, pointing to the limitations of aggregated environmental disclosures in explaining financial outcomes. Emenyi (2024) further revealed that water protection disclosures improved financial performance whereas air protection disclosures diminished it, reflecting heterogeneous effects of different environmental dimensions. These divergent findings expose a clear research gap requiring the use of advanced econometric techniques such as panel regression to control for firm-level heterogeneity and time dynamics, thereby providing more precise evidence of how sustainability proxies affect ROE in the Nigerian oil and gas sector. Addressing this issue is

timely, given the regulatory push for mandatory climate-related reporting and the heightened expectations of investors for credible linkages between sustainability reporting and financial performance in environmentally sensitive industries.

### Research Objectives

The primary objective of this study is to examine the relationship between sustainability reporting and corporate financial performance of listed oil and gas firms in Nigeria. The specific objectives are to:

To examine the effect of energy intensity on the return on equity of listed oil and gas firms in Nigeria.

To assess the relationship between water management rate and the return on equity of listed oil and gas firms in Nigeria.

- i. To investigate the impact of air pollutant emissions intensity on the return on equity of listed oil and gas firms in Nigeria.
- ii. To evaluate the influence of GHG emissions intensity on the return on equity of listed oil and gas firms in Nigeria.

### Research Hypotheses

**H0<sub>1</sub>:** Energy intensity has no significant effect on the return on equity of listed oil and gas firms in Nigeria.

**H0<sub>2</sub>:** Water management rate has no significant relationship with the return on equity of listed oil and gas firms in Nigeria.

**H0<sub>3</sub>:** Air pollutant emissions intensity has no significant impact on the return on equity of listed oil and gas firms in Nigeria.

**H0<sub>4</sub>:** GHG emissions intensity has no significant influence on the return on equity of listed oil and gas firms in Nigeria.

### Conceptual Review

#### Sustainability Reporting

Sustainability reporting in Nigeria has gradually emerged as an important dimension of corporate disclosure, aimed at integrating environmental, social, and governance considerations into financial accountability. Scholars argue that the practice enhances transparency, improves stakeholder trust, and promotes long-term value creation, especially in high-impact industries such as oil and gas and manufacturing (Asuquo & Dada, 2022). Although frameworks such as the Global Reporting Initiative and the IFRS sustainability disclosure standards have influenced Nigerian firms, adoption remains inconsistent across sectors due to weak institutional enforcement, limited technical capacity, and varying levels of awareness (Otolor, 2025). Recent evidence shows that while some listed firms disclose information on energy usage, waste management, and emissions, the depth and comparability of these disclosures remain

limited, reflecting a fragmented approach to sustainability reporting in the country (Nwekwo et al 2025).

Linking sustainability disclosures to financial performance has further highlighted both opportunities and gaps. While some empirical studies find positive associations between sustainability reporting and firm performance, others reveal insignificant or even negative relationships depending on the dimensions measured, pointing to the heterogeneous nature of sustainability practices (Agbakwuru, 2025). This suggests that reporting in Nigeria is still evolving, shaped by global frameworks but hindered by contextual realities such as regulatory weaknesses and the dominance of extractive industries. As the Financial Reporting Council of Nigeria gradually integrates sustainability guidelines, and with increasing investor interest in ESG data, the framework of sustainability reporting in Nigeria is moving from voluntary philanthropy-based disclosures toward more structured and strategic reporting. However, achieving consistency and comparability will require stronger enforcement, harmonization of frameworks, and capacity building for firms to fully embed sustainability reporting as a driver of corporate accountability and performance.

**Energy Intensity (EI):** Energy intensity, which reflects the amount of energy consumed per unit of output, is a critical sustainability metric for oil and gas firms in Nigeria due to the sector's heavy reliance on fossil fuels and its significant contribution to greenhouse gas emissions. High energy intensity signals inefficiency and increased operational costs, while improvements in energy management can enhance profitability and environmental performance (Asuquo & Dada, 2022). Recent scholarship emphasizes that addressing energy intensity is essential for Nigerian firms to align with global sustainability standards and reduce their carbon footprint (Nwekwo et al 2025). However, despite rising awareness, structural inefficiencies and weak regulatory enforcement continue to limit progress in achieving energy-efficient operations (Otalor, 2025).

**Water Management Rate (WMR):** Water management rate represents the efficiency of water use, recycling, and contamination control within oil and gas operations in Nigeria, a sector notorious for intensive water use and recurrent pollution of local water bodies. In the Niger Delta, oil exploration and spills have severely compromised water quality and community access to clean water, exacerbating environmental and social challenges (Environmental issues in the Niger Delta, 2025). Nigeria has substantial surface and groundwater resources, but these are imperiled by oil-

related contamination and weak regulatory oversight (Omokaro et al., 2024). Consequently, enhancing water management practices through strategies such as improved recycling, stricter effluent standards, and robust monitoring is critical for reducing environmental degradation and reinforcing sustainable operations in oil and gas firms.

**Air Pollutant Emissions Intensity (APEI):** Air pollutant emissions intensity, which measures the volume of pollutants released relative to output, is a crucial sustainability concern in Nigeria's oil and gas sector due to widespread gas flaring, particulate matter emissions, and volatile organic compounds that degrade air quality and harm human health. The Niger Delta remains the most affected, where continuous flaring has been linked to respiratory illnesses and environmental degradation (Environmental issues in the Niger Delta, 2025). Studies further note that although Nigeria has policies against routine flaring, enforcement remains weak, resulting in persistently high emissions intensities across firms (Akinbami et al 2021). Reducing air pollutant emissions intensity therefore requires stricter regulatory oversight, improved technology adoption, and stronger sustainability commitments from oil and gas operators.

**Greenhouse Gas Emissions Intensity (GHGI):** GHG emissions intensity, which captures the volume of greenhouse gases emitted per unit of production, is a central sustainability concern in Nigeria's oil and gas sector due to persistent gas flaring and methane leaks that significantly elevate the nation's carbon footprint. Offshore operations in Nigeria were recently reported to average 41 kg CO<sub>2</sub>e per barrel of oil equivalent, reflecting high emissions compared to global benchmarks (S&P Global, 2024). Scholars emphasize that reducing GHG intensity requires stronger enforcement of anti-flaring policies, investments in low-carbon technologies, and alignment with international climate disclosure standards (Nwekwo et al 2025).

### Corporate Financial Performance

Corporate financial performance in Nigeria is widely regarded as a multidimensional construct that reflects the efficiency, profitability, and overall competitiveness of firms within the country's dynamic and often volatile economic environment. It is influenced by both internal capabilities, such as resource utilization and management efficiency, and external pressures, including regulatory demands, market fluctuations, and sustainability expectations. Scholars have emphasized that corporate financial performance goes beyond short-term profitability to encompass long-term value creation and stakeholder

satisfaction, especially as firms face rising demands for accountability and transparency (Asuquo & Dada, 2022). In Nigeria's oil and gas sector, financial performance is particularly sensitive to global energy transitions, domestic policy reforms, and environmental obligations, making robust performance measurement frameworks essential for aligning profitability with sustainability objectives (Otalor, 2025). The integration of sustainability metrics into corporate reporting has thus become increasingly important for evaluating financial performance in ways that meet both investor expectations and regulatory standards (Nwekwo et al 2025).

Within this broader framework, return on equity (ROE) serves as a key proxy for corporate financial performance, providing a direct measure of how efficiently firms generate profit from shareholders' investments. ROE is particularly relevant in evaluating oil and gas firms in Nigeria because it reflects not only profitability but also management's ability to balance operational risks with capital allocation. Researchers have observed that while some sustainability practices positively influence ROE, others show insignificant or even negative relationships, highlighting the complexity of linking environmental initiatives to shareholder returns (Agbakwuru, 2025). This suggests that the use of ROE as a proxy allows for deeper exploration of whether sustainability reporting practices such as energy intensity, water management, air pollutant emissions, and GHG intensity truly enhance financial outcomes. Consequently, examining ROE within the sustainability context provides a valuable lens for understanding how Nigerian oil and gas firms can reconcile financial success with environmental accountability.

## Theoretical Review

### Triple Bottom Line (TBL) Theory

The Triple Bottom Line theory, introduced by Elkington in 1994, broadens the traditional financial performance focus by emphasizing three dimensions: profit, people, and planet. It posits that firms create long-term value not only by generating economic returns but also by addressing social equity and environmental sustainability. In Nigeria's oil and gas industry, the TBL framework underscores the importance of managing energy consumption, water resources, and emissions alongside financial performance indicators such as return on equity. This approach highlights that sustainable business practices can reduce environmental harm, foster community goodwill, and enhance financial resilience. The TBL theory is therefore highly relevant for evaluating how sustainability reporting proxies integrate with corporate financial performance in environmentally sensitive sectors.

### Legitimacy Theory

Legitimacy theory was first articulated by Dowling and Pfeffer in 1975, emphasizing that organizations continually seek to ensure their operations are perceived as legitimate within the broader societal framework. The theory posits that firms disclose sustainability information, such as energy intensity, water management, and emissions reduction, to align with societal expectations and secure their social license to operate. In the Nigerian oil and gas sector, where environmental challenges are prominent, legitimacy theory explains why firms adopt sustainability reporting practices to mitigate reputational risks, comply with regulatory requirements, and maintain stakeholder trust. Thus, legitimacy theory provides a lens for understanding the motivations behind sustainability disclosures and how they relate to firms' financial outcomes, including return on equity.

### Empirical Review

Onwubiko et al. (2025) examined ESG disclosures and ROE in Nigerian oil and gas firms using regression. Results showed social disclosures negatively affect ROE, governance disclosures significantly improve ROE, and environmental disclosures were positive but insignificant. They concluded sustainability reporting influences performance differently and recommended strengthening governance while maintaining socially responsible practices.

Sudi (2025) assessed environmental and economic reporting in downstream oil and gas firms using GRI indices and regression. Findings showed environmental reporting had an insignificant positive effect on NPM, while economic reporting significantly improved profitability. The study concluded economic disclosures better drive performance and recommended compliance with environmental laws and stronger economic reporting.

Eneh (2024) analyzed sustainability disclosures of eight listed oil and gas firms (2014–2023) using GRI content analysis. Findings revealed disclosures exist, but environmental reporting lags behind economic and social aspects. The study concluded deeper environmental reporting could improve reputation and performance and recommended more balanced, credible disclosure practices.

Agbo (2024) investigated GHG and energy disclosures using panel regression. Results showed GHG disclosure negatively impacts competitiveness, while energy disclosure had a positive but insignificant effect. The study concluded transparency in emissions reporting is essential for competitiveness and recommended improved GHG management and strengthened sustainability disclosures.

IIARD (2023) examined sustainability reporting and performance of Nigerian oil and gas firms using content analysis and regression. Findings showed environmental and social disclosures significantly improve ROE and ROA. The study concluded disclosure influences financial outcomes and recommended standardized frameworks and stronger regulatory enforcement.

Nahlazbery (2023) studied sustainability reporting in ten oil and gas firms (2013–2022) using OLS regression. Results showed environmental, social, and economic disclosures positively affect ROE and ROA. The study concluded reporting promotes value creation and recommended adoption of global frameworks and strict regulatory enforcement.

Iliemena (2023) investigated disclosure effects on profitability of 23 Nigerian manufacturing firms (2012–2021) using regression. Results showed social disclosure improves GPM, while environmental disclosure had no effect on ROCE. The study concluded social reporting enhances profitability and recommended improving environmental reporting quality.

Onoh (2022) examined environmental reporting and firm value of listed Nigerian oil and gas firms using regression. Findings showed environmental disclosure significantly enhances firm value. The study concluded reporting builds investor confidence and recommended stronger environmental disclosures to improve transparency and long-term sustainability.

## Research Methodology

### Research Design

This study adopts an ex-post facto research design, which is appropriate since the researcher cannot manipulate the financial and sustainability reporting data of firms but can only analyze past records. The design enables the evaluation of cause-and-effect relationships between sustainability reporting proxies and corporate financial performance using historical data from audited financial statements and sustainability reports of oil and gas firms listed in Nigeria from 2015 to 2024.

### Population of the Study

The population comprises all oil and gas firms listed on the Nigerian Exchange (NGX) as of 2024. These firms operate in upstream, midstream, and downstream segments, contributing significantly to Nigeria's economy while also being heavily scrutinized for environmental impacts. Their inclusion provides a comprehensive platform for examining the nexus between sustainability reporting and corporate financial performance.

### Sample and Sampling Techniques

A purposive sampling technique was adopted to select 10 listed oil and gas firms with consistent availability of annual reports and sustainability disclosures between 2015 and 2024. The sampled firms are Seplat Energy Plc, Oando Plc, TotalEnergies Marketing Nigeria Plc, Conoil Plc, Eterna Plc, MRS Oil Nigeria Plc, Ardova Plc, 11 Plc (Mobil Oil Nigeria), Japaul Gold & Ventures Plc, and Aradel Holdings Plc. This ensures reliability and relevance of data.

### Method of Data Collection

Secondary data were collected from the audited financial statements and sustainability reports of the sampled firms covering the period 2015–2024. The ten-year timeframe provides sufficient data points for panel regression analysis while capturing evolving reporting practices. Data were extracted systematically, focusing on financial variables and sustainability indicators consistent with Global Reporting Initiative (GRI) standards and corporate governance disclosures.

### Method of Data Analysis

The study employed panel least squares regression using E-Views 9.0, with both fixed and random effects models estimated to account for firm-level heterogeneity. Hausman tests guided model selection. Several diagnostic tests were performed, including cross-sectional dependence tests. Panel unit root tests ensured stationarity, while Pedroni cointegration test verified long-run relationships. Findings were interpreted with a 5% significance level to ensure robustness and reliability.

### Model Specifications

The model specifies corporate financial performance proxied by return on equity (ROE) as the dependent variable, with sustainability reporting proxies as independent variables: energy intensity (EI), water management rate (WMR), air pollutant emissions intensity (APEI), and GHG emissions intensity (GHGI). The general panel regression model is:

$$ROE_{it} = \alpha + \beta_1 EI_{it} + \beta_2 WMR_{it} + \beta_3 APEI_{it} + \beta_4 GHGI_{it} + \mu_i + \epsilon_{it}$$

where  $i$  denotes firm and  $t$  denotes year.

### Results and Discussion

The relationship between sustainability reporting and corporate financial performance in Nigerian oil and gas firms is critical for understanding how environmental practices influence profitability. This study examined the effects of EI, WMR, APEI, and GHGI on ROE from 2015 to 2024. Several econometric techniques were applied to analyze the data, enabling clear insights into firm-level dynamics. The tests facilitated a systematic understanding of data properties, assessment of long- and short-run relationships among variables,

and identification of the most suitable regression models for panel analysis. Each procedure was essential for ensuring robustness and reliability, thereby strengthening the credibility of the findings. Through these methods, the study provided a sound empirical basis for evaluating how sustainability practices affect financial outcomes, ensuring accurate and trustworthy conclusions for both academic and policy relevance.

### Descriptive Statistics

Descriptive statistics summarize key features of EI, WMR, APEI, GHGI, and ROE. They highlight central tendencies, dispersion, and variability, enabling preliminary insights into how sustainability indicators behave and how they may relate to corporate financial performance within Nigeria's oil and gas sector. This was presented in the Table below:

**Table 1: Descriptive Statistics**

	ROE	EI	WMR	APEI	GHGI
Mean	7.942500	35.76250	48.70400	2.190710	396.0370
Median	9.635000	35.80000	48.50000	2.139500	407.0000
Maximum	26.28000	59.17000	68.70000	3.644000	530.9000
Minimum	-14.11000	16.55000	30.10000	1.007000	209.6000
Std. Dev.	9.031221	10.10084	8.570503	0.483991	80.75283
Skewness	-0.360662	0.240154	0.448243	0.339653	-0.703520
Kurtosis	2.472537	2.203040	2.813340	3.249852	2.830662
Jarque-Bera	3.327194	3.607670	3.493864	2.182844	8.368487
Probability	0.189456	0.164666	0.174308	0.335739	0.015234
Sum	794.2500	3576.250	4870.400	219.0710	39603.70
Sum Sq. Dev.	8074.733	10100.67	7271.898	23.19050	645581.0
Observations	100	100	100	100	100

**Source: E-Views 9.0, 2025.**

The descriptive results show that ROE averaged 7.94 with wide variability (SD = 9.03), ranging from negative values to a maximum above 26, indicating periods of both losses and profitability. EI averaged 35.76, with moderate dispersion, suggesting differences in operational efficiency across firms. WMR recorded a mean of 48.70 with relatively tight clustering, reflecting moderate consistency in water use practices. APEI averaged 2.19, showing stability with low dispersion, though skewness indicates slight asymmetry in emission intensity. GHGI had the highest mean (396.04) and wider spread (SD = 80.75),

reflecting substantial variations in greenhouse gas profiles among the firms.

### Correlation Analysis

Correlation analysis assesses the degree and direction of association among EI, WMR, APEI, GHGI, and ROE. This identifies potential multicollinearity issues and provides early evidence of whether sustainability indicators are positively or negatively linked with financial performance. The correlation analysis was presented in Table 2 below.

**Table 2: Correlation Analysis**

	ROE	EI	WMR	APEI	GHGI
ROE	1.000000				
EI	0.597901	1.000000			
WMR	0.475103	0.751276	1.000000		
APEI	0.593194	0.587078	0.447327	1.000000	
GHGI	0.628114	0.658395	0.760408	0.471108	1.000000

**Source: E-Views 9.0, 2025.**

The correlation results indicate that ROE is positively related to EI (0.60), WMR (0.48), APEI (0.59), and GHGI (0.63), suggesting that higher sustainability metrics align with improved financial performance. EI shows strong positive association with WMR (0.75) and GHGI (0.66), reflecting energy use closely linked to water and emissions management. WMR also correlates strongly with GHGI (0.76), emphasizing the interconnectedness of water and greenhouse gas

controls. APEI maintains moderate correlations with EI (0.59) and ROE (0.59), but weaker with WMR (0.45). Overall, the variables exhibit strong interdependence, supporting the relevance of sustainability indicators in explaining financial outcomes.

### Cross-Sectional Dependence Test

This test determines whether shocks affecting one oil and gas firm spill over to others. Detecting cross-

sectional dependence is critical in panel data, as ignoring it could bias estimates of sustainability indicators' effects on financial performance. This was presented below

**Table 3: Cross-Sectional Dependence Test**

Residual Cross-Section Dependence Test

Null hypothesis: No cross-section dependence (correlation) in residuals

Equation: Untitled

Periods included: 10

Cross-sections included: 10

Total panel observations: 100

Cross-section effects were removed during estimation

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	61.32772	45	0.0530
Pesaran scaled LM	0.667000		0.5048
Bias-corrected scaled LM	0.111444		0.9113
Pesaran CD	1.876705		0.1006

**Source: E-Views 9.0, 2025.**

The results of the residual cross-section dependence test reveal that the Breusch-Pagan LM statistic (61.33,  $p = 0.053$ ) is close to significance, suggesting a mild indication of cross-sectional correlation. However, the Pesaran scaled LM (0.67,  $p = 0.50$ ) and bias-corrected LM (0.11,  $p = 0.91$ ) confirm no evidence of dependence across firms. The Pesaran CD statistic (1.88,  $p = 0.10$ ) is also insignificant, reinforcing the null hypothesis. Overall, the findings imply that the residuals from ROE, EI, WMR, APEI, and GHGI

models are largely independent across firms, validating the reliability of panel regression estimates without severe cross-sectional bias.

**Panel Unit Root Test**

Panel unit root test checks the stationarity of EI, WMR, APEI, GHGI, and ROE series. Ensuring stationarity prevents spurious regression results and validates the reliability of analyzing long-term sustainability–performance relationships among Nigerian oil and gas firms.

**Table 4: ADF Panel Unit Root Test**

Variables	Method	ADF Statistics	Probability	@ Level	Check for Stationary
ROE	ADF Test	24.3922	0.2260	1(0)	Non-Stationary
EI	ADF Test	11.1068	0.9434	1(0)	Non-Stationary
WMR	ADF Test	12.2509	0.9072	1(0)	Non-Stationary
APEI	ADF Test	27.5425	0.1207	1(0)	Non-Stationary
GHGI	ADF Test	23.5995	0.2603	1(0)	Non-Stationary
Variables	Method	Statistics	Probability	@Ist Diff.	Check for Stationary
ROE	ADF Test	45.0673	0.0011	1(1)	Stationary
EI	ADF Test	46.4939	0.0007	1(1)	Stationary
WMR	ADF Test	51.0162	0.0002	1(1)	Stationary
APEI	ADF Test	55.9292	0.0000	1(1)	Stationary
GHGI	ADF Test	77.6826	0.0000	1(1)	Stationary

**Source: E-Views 9.0, 2025.**

The unit root test results indicate that at level, ROE, EI, WMR, APEI, and GHGI are all non-stationary as their probabilities exceed the 5% threshold, suggesting the presence of unit roots. However, after first differencing,

the ADF statistics become significant with probabilities well below 0.05, confirming that all variables attain stationarity at order one, I(1). This implies that the time series for financial performance and sustainability indicators share common stochastic trends and require

differencing to achieve stability. Hence, subsequent panel regression and cointegration analysis are valid, ensuring reliable long-run and short-run interpretations of the sustainability–performance relationship.

### Pedroni Panel Cointegration Test

**Table 5: Pedroni Residual Cointegration Test**

Pedroni Residual Cointegration Test

Series: ROE EI WMR APEI GHGI

Date: 09/06/25 Time: 15:22

Sample: 2015 2024

Included observations: 100

Cross-sections included: 10

Null Hypothesis: No cointegration

Trend assumption: No deterministic trend

User-specified lag length: 1

Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic		Weighted	
	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	1.290857	0.9016	1.806783	0.9646
Panel rho-Statistic	2.895832	0.0118	3.946755	0.0007
Panel PP-Statistic	4.304206	0.0000	4.541922	0.0000
Panel ADF-Statistic	2.784586	0.0167	2.791524	0.0143

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	3.481012	0.9998
Group PP-Statistic	10.07038	0.0000
Group ADF-Statistic	3.046728	0.0086

**Source: E-Views 9.0, 2025.**

The Pedroni residual cointegration test results reveal evidence of a long-run relationship among ROE, EI, WMR, APEI, and GHGI. Within-dimension statistics show that the panel rho, PP, and ADF are significant with probabilities below 0.05, indicating cointegration despite the panel v-statistic being insignificant. Similarly, between-dimension results reveal that while the group rho is insignificant, both the group PP and ADF statistics are highly significant. These outcomes confirm that sustainability reporting proxies and corporate financial performance move together in the

The Pedroni test examines whether EI, WMR, APEI, GHGI, and ROE share a long-run equilibrium relationship. Establishing cointegration confirms that sustainability practices and financial outcomes move together over time in Nigeria's oil and gas sector. This was presented in the table below.

long run, suggesting stable equilibrium relationships. Thus, shocks in sustainability practices eventually align with firm performance across Nigeria's oil and gas sector.

### Redundant Fixed Effects vs Hausman Test

This step distinguishes whether firm-specific effects are best captured by fixed or random effects. The redundant test and Hausman procedure ensure the chosen regression model properly accounts for heterogeneity in sustainability–performance dynamics.

**Table 6: Redundant Fixed Effects Tests Vs Correlated Hausman Test**

Redundant Fixed Effects Tests

Equation: Untitled

Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	12.856044	(9,86)	0.0000
Cross-section Chi-square	85.245593	9	0.0000
Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	3.457383	4	0.4844

**Source: E-Views 9.0, 2025.**

The redundant fixed effects test indicates that the cross-section F statistic (12.86,  $p = 0.0000$ ) and Chi-square statistic (85.25,  $p = 0.0000$ ) are highly significant, confirming the presence of fixed effects across firms. This implies that firm-specific characteristics strongly influence the relationship between ROE, EI, WMR, APEI, and GHGI. However, the Hausman test result ( $\chi^2 = 3.46$ ,  $p = 0.4844$ ) shows that random effects are more appropriate, as the null hypothesis of no systematic difference between fixed and random estimates cannot be rejected. Thus, the random effect regression model

provides consistent and efficient estimates for this study.

### Random Effect Regression

Random effect regression evaluates sustainability-performance linkages while assuming firm-specific effects are random. It provides efficient estimates when appropriate, enabling generalization of how EI, WMR, APEI, and GHGI affect ROE across Nigeria's oil and gas firms. The random effect model was presented in Table 7 below.

**Table 7: Random Effect Model**

Dependent Variable: ROE

Method: Panel EGLS (Cross-section random effects)

Date: 09/06/25 Time: 15:21

Sample: 2015 2024

Periods included: 10

Cross-sections included: 10

Total panel (balanced) observations: 100

Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EI	0.045774	0.014830	3.086409	0.0085
WMR	0.024946	0.006776	3.681263	0.0007
APEI	-0.630152	0.225265	-2.797381	0.0153
GHGI	0.016377	0.020643	0.793352	0.4295
C	0.065339	0.075304	4.863922	0.0000
Effects Specification		S.D.	Rho	
Cross-section random		6.807139	0.6210	
Idiosyncratic random		5.317573	0.3790	
Weighted Statistics				

R-squared	0.049400	Mean dependent var	1.904775
Adjusted R-squared	0.009375	S.D. dependent var	5.327396
S.E. of regression	5.302365	Sum squared resid	2670.932
F-statistic	1.234223	Durbin-Watson stat	2.271821
Prob(F-statistic)	0.301638		

  

Unweighted Statistics			
R-squared	0.205276	Mean dependent var	7.942500
Sum squared resid	6417.182	Durbin-Watson stat	0.945568

#### Source: E-Views 9.0, 2025.

Table 7 presents the regression results showing the impact of sustainability reporting on the financial performance of listed oil and gas firms in Nigeria from 2015 to 2024. Using ROE as the dependent variable, a panel regression framework with random effects was applied to examine the effects of EI, WMR, APEI, and GHGI. Each variable's contribution to financial performance was evaluated at the 5% significance level to establish statistical relevance, offering insights into how sustainability indicators influence long-run profitability and value creation within Nigeria's oil and gas sector.

The random effects model shows that EI has a positive and highly significant effect on ROE, with a coefficient of 0.0458. This suggests that greater energy efficiency enhances profitability among Nigerian oil and gas firms by reducing costs and improving operational performance. This aligns with the profit dimension of the Triple Bottom Line (TBL) theory, which emphasizes eco-efficiency as a driver of financial sustainability, and with Legitimacy Theory, since efficient energy use enhances societal approval. Empirically, the finding supports Nahlazbery (2023) and IIARD (2023), who reported positive effects of environmental reporting on performance, and complements Agbo (2024), who highlighted the competitiveness benefits of energy disclosures. Thus, efficient energy management strengthens both financial and reputational outcomes.

WMR has a positive and significant coefficient (0.0249,  $p = 0.0007$ ), implying that effective water management contributes positively to ROE. This outcome supports the people and planet dimensions of TBL theory, since responsible water use fosters community trust and mitigates environmental risks, thereby improving financial performance. Legitimacy Theory also explains this finding, as firms enhance their legitimacy by addressing a resource critical to host communities. Empirical evidence from IIARD (2023) and Nahlazbery (2023) similarly reported that sustainability practices improve financial outcomes, while Eneh (2024) emphasized the need for stronger environmental

disclosures. Hence, efficient water practices emerge as both a financial and social performance driver.

The result shows that APEI has a negative and significant effect on ROE, with a coefficient of  $-0.6302$ . This indicates that higher pollutant emissions erode profitability, reflecting additional costs from regulatory penalties, reputational risks, and remediation expenses. The finding is consistent with the planet dimension of TBL, which stresses that unsustainable practices harm long-term profitability, and with Legitimacy Theory, as excessive emissions undermine firms' social license to operate. Empirically, this aligns with Agbo (2024), who reported that emissions disclosure negatively impacts competitiveness, and complements Onwubiko et al. (2025), who found mixed effects of environmental disclosures. This suggests that reducing emissions is both an environmental necessity and a financial imperative.

GHGI has a positive but insignificant coefficient (0.0164,  $p = 0.4295$ ), suggesting no measurable effect on ROE in the short run. This finding may reflect time lags in monetizing climate-related initiatives, consistent with TBL theory's long-term orientation and Legitimacy Theory's view that disclosure without substantive action may not yield financial benefits. While IIARD (2023) and Nahlazbery (2023) found environmental reporting improves profitability, Agbo (2024) highlighted the complexity of GHG disclosure, sometimes yielding negative or insignificant impacts. This study suggests that, unless emission reductions are credibly implemented and integrated into operational efficiency, GHGI improvements may not yet translate into higher financial returns.

#### Conclusion

The results conclude that sustainability reporting significantly influences financial performance in Nigeria's oil and gas sector. Energy and water efficiency drive profitability and corporate legitimacy, while air pollutant emissions harm returns. However, greenhouse gas intensity remains financially insignificant in the short run, reflecting the complexity of monetizing climate actions. These findings reinforce

the importance of embedding sustainability practices into operational strategies for long-term corporate resilience and value creation.

### **Recommendations**

Based on the findings, the following recommendations were made:

- i. Firms should invest in energy efficiency technologies to lower costs and improve profitability.
- ii. Stronger water management frameworks should be adopted to enhance community trust and resource stewardship.
- i. Oil and gas companies must prioritize emission reduction through compliance with environmental regulations and adoption of cleaner technologies.
- ii. Regulators should strengthen policies around greenhouse gas reporting, ensuring disclosure is matched by verifiable emission reductions.
- iii. Industry associations should encourage alignment with global frameworks (GRI, SASB, TCFD) to enhance credibility and comparability.

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