

Carbon Accounting Practices and Financial Sustainability of Oil Producing Companies in Nigeria

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Abstract

Purpose: Examine the effect of carbon accounting practices (scope of emissions, emission sources, emission categories, and reporting boundaries) on financial sustainability of oil-producing companies in Nigeria.

Methodology: Survey design, population of 100 staff drawn from five oil-producing companies, census sampling, structured questionnaire, multiple regression analysis.

Results: Scope of emissions ($\beta=.129$, $p=.011$), emission sources ($\beta=.290$, $p=.000$), emission categories ($\beta=.144$, $p=.001$), and reporting boundaries ($\beta=.244$, $p=.000$) positively and significantly influenced financial sustainability.

Conclusion: Carbon accounting practices significantly enhance financial sustainability of oil-producing companies.

Implications: Oil companies should strengthen carbon accounting systems to improve sustainability and stakeholder confidence.

Keywords: Carbon accounting practices, emissions categories, emissions sources, financial sustainability, scope of emissions, scope of reporting boundaries.

1. Introduction

Carbon accounting is rapidly emerging as an important topic of accounting research. Countries all over the world have introduced a variety of strategies to assist corporations in reducing carbon emissions and the costs associated with climate change. Nations have improved business sustainability legislation in recent years in response to national sustainable development goals and international sustainability standards. Carbon accounting research has sparked a great deal of interest among accounting professionals and researchers worldwide. According to Nartey (2018), corporate carbon accounting is considered a subset of sustainability accounting since it provides critical information on emissions in environmental changes that benefit organizational management in a way that contributes to achieving sustainability. Carbon elimination is gradually making its way into traditional climate governance. Carbon accounting, also known as Green-house gas (GHG) accounting, is a type of accounting that involves quantifying GHG emissions from an organization's activities in order to reduce emissions and achieve net zero. Carbon accounting, according to Stechemesser and Guenther (2022), is the recognition of non-financial and financial assessments and monitoring of GHG at all stages of the value chain, as well as the recognition, appraisal, and monitoring of the effects of these emissions on ecosystems' carbon cycles. Carbon accounting takes into consideration GHG inventories as well as monitoring and decision-making for emission reduction and offset. It may also include monitoring climate impacts and corresponding adaptation activities. Carbon as an asset, such as fossil fuel and soil carbon; carbon-related ecosystem services, such as storage in soil, water, and biomass; and sequestration, which removes carbon from the atmosphere; and carbon as a characteristic of ecosystem asset condition (condition account), such as biomass accumulation, which is an indicator of a productive ecosystem. Carbon accounting, commonly known as Green House Gas (GHG) accounting, is concerned with the discharge of primarily carbon dioxide and other carbon emissions. Analysts and management use the technique to determine the amount of carbon discharged (directly or indirectly) by an organization. Despite the fact that the phrases carbon accounting and GHG accounting are used interchangeably, carbon accounting refers only to carbon dioxide discharges, and GHG accounting refers to all greenhouse gases. GHGs are gases that

trap heat in the atmosphere, causing warming on Earth, also known as global warming. Carbon accounting is the process of quantifying the quantity of GHG produced by commercial and public entities in order to determine how much carbon they release. Carbon accounting became necessary as atmospheric carbon levels increased, causing climate changes such as higher temperatures, altered rainfall, and sea level rise. Carbon dioxide is a gas expelled by mammals as they breathe in oxygen. Plants, on the other hand, absorb carbon dioxide and emit oxygen during photosynthesis, supplying much-needed oxygen to mammals. This makes living more comfortable due to the reciprocal relationship formed by the foregoing gaseous exchanges. However, human activities cause carbon emissions that exceed what plants require. These discharges from industries in high volumes pose a threat to the environment because they disturb the reciprocal interaction through their effect on the gas balance. The study looks at how carbon accounting techniques affect the financial viability of oil businesses in the Niger Delta.

The sustainability of a balanced scorecard (SBSC) goes a step further by explicitly integrating strategically relevant environmental, social, and ethical goals. The shortcomings of insufficiently comprehensive approaches to the measurement and management of corporate success have led to increased economic risks and problems for companies, the economy and society. About concepts of corporate social responsibility (CSR) and corporate sustainability, scholars and practitioners are interested in the integrated measurement of economic, social, and environmental performance by corporate sustainability performance measurement systems. This becomes evident when analyzing the explicit or implicit theoretical foundations of the examined publications. Making use of previously existing classifications of theories in the domain of corporate sustainability and related fields. The complexity and challenges of carbon accounting practices exceed most current in-house capabilities, leading to the need for outsourcing help and additional costs in order to keep an organization in line with changing regulatory, market and investor expectations of environmental due diligence. The key obstacles are inaccuracies in calculations and data collection, as well as insufficiently thorough approaches to measuring and managing corporate success, which have resulted in increased economic risks and problems for businesses, the economy, and society. Scholars and practitioners are interested in using corporate sustainability performance measurement methods to measure integrated economic, social, and environmental performance.

The main objective is to ascertain the effect of carbon accounting practices and financial sustainability of oil producing companies in Nigeria.

2. Literature review

Scope of emissions and financial sustainability

Scope of emissions refers to the classification of greenhouse gas emissions into Scope 1 (direct emissions), Scope 2 (indirect emissions from purchased energy), and Scope 3 (other indirect emissions across the value chain). Effective management and disclosure of these emissions enhance organizational transparency and sustainability performance.

Siddique, Akhtaruzzaman, Rashid and Hammami (2021) examined carbon disclosure, carbon performance and financial performance using international data. The study found that improved carbon disclosure and management of emissions significantly enhanced long-term financial performance.

Galama and Scholtens (2024) conducted a meta-analysis involving 107,605 observations from 34 studies. The findings revealed that firms with lower greenhouse gas emissions generally achieved superior financial performance.

Ezenwafor (2021) investigated carbon management accounting and firm performance among Nigerian manufacturing companies. The study found that greenhouse gas emission disclosure significantly improved firm value measured by Tobin's Q.

Lestari, Mukhzarudfa and Kususmastuti (2024) studied energy firms listed on the Indonesia Stock Exchange. The findings indicated that carbon performance significantly influenced carbon emission disclosure and financial performance.

Raza et al. (2022) examined carbon accounting practices and sustainability outcomes across organizations. The study concluded that effective emission measurement and reporting support sustainability objectives and long-term organizational performance.

Emissions sources on financial sustainability

Emission sources are the specific activities, equipment, processes, or facilities responsible for greenhouse gas emissions. Identifying and controlling emission sources enable organizations to reduce environmental impacts and improve operational efficiency.

Muhammadu, Abdul, Hussin and Muhammad (2016) investigated the impact of carbon dioxide emissions on economic growth in selected high-emission economies. The study found that increased CO₂ emissions negatively affected economic performance.

Egbunike and Emudainohwo (2017) examined carbon accounting and corporate performance among quoted Nigerian firms. Results showed that effective management of emission-related information significantly enhanced organizational performance.

Galama and Scholtens (2024) reported that companies with lower emission levels recorded better financial outcomes than firms with higher emissions.

Hartmann, Perego and Young (2023) explored carbon accounting systems and organizational performance. Their findings indicated that proper monitoring of emission sources supports better managerial decisions and sustainability outcomes.

Birdsey and Houghton (2023) emphasized the importance of identifying all emission sources in evaluating climate-related strategies. Their study concluded that comprehensive emissions accounting improves environmental and sustainability performance.

Emissions categories on financial sustainability

Emission categories classify greenhouse gas emissions according to their origin and nature, typically as direct and indirect emissions. Proper categorization assists organizations in measuring environmental impacts accurately and improving sustainability reporting.

Lestari et al. (2024) found that carbon emission disclosure significantly improved the financial performance of energy sector companies in Indonesia.

Siddique et al. (2021) reported that carbon disclosure practices associated with emission categorization positively influenced long-term financial performance.

Schaltegger and Csutora (2022) examined carbon accounting for sustainability management and concluded that effective categorization of emissions improves environmental management and organizational performance.

Stechemesser and Guenther (2022) conducted a systematic review of carbon accounting studies and found that emission classification is critical for reliable reporting and sustainability decision-making.

Hartmann et al. (2023) observed that organizations with well-structured carbon accounting systems achieve improved performance through accurate classification and monitoring of emissions.

Scope of reporting boundaries on financial sustainability

Scope of reporting boundaries refers to the limits that determine which activities, operations, subsidiaries, and emissions are included in sustainability and carbon reporting. Clearly defined reporting boundaries enhance accountability, transparency, and stakeholder confidence.

Egbunike and Emudainohwo (2017) found that comprehensive environmental disclosure practices positively influenced corporate performance among listed Nigerian firms.

Siddique et al. (2021) reported that broader carbon disclosure frameworks improved transparency and enhanced financial performance in the long run.

Raza et al. (2022) observed that organizations with comprehensive reporting systems achieved better sustainability outcomes and stakeholder trust.

Galama and Scholtens (2024) concluded that firms operating under stricter disclosure and reporting requirements experienced stronger financial performance.

Stechemesser and Guenther (2022) found that clearly defined carbon reporting boundaries improve the quality of sustainability information and support organizational decision-making.

Based on the empirical studies reviewed, the following hypotheses were formulated:

H₀₁: Scope of emissions has no significant effect on the financial sustainability of oil-producing companies.

H₀₂: Emissions sources have no significant effect on the financial sustainability of oil-producing companies.

H₀₃: Emissions categories have no significant effect on the financial sustainability of oil-producing companies.

H₀₄: Scope of reporting boundaries has no significant effect on the financial sustainability of oil-producing companies.

Theoretical framework

This theory is grounded on stakeholder theory. The theory was developed by Freeman (1984) to explain that the main reason that firms exist is to serve the interest of those with a stake in the future of the organization and not the interest of the shareholder. Stakeholder theory explains clearly the morals and values as a major characteristic of managing firms, and that attention to the interests and well-being of those who can help or prevent the achievement of corporate objectives as the main issues of the theory. Hence, this theory is a management theory that explains the morals and values in organizations as well as the responsibilities of managers to balance the interest of shareholders and stakeholders.

Stakeholder theory presents a notion that undermines the foundations of a free market economy, hence perceiving it as a danger to political and economic liberty. The approach offers a collective understanding of value allocation rather than granting stockholders exclusive rights to it. The stakeholder hypothesis is

crucial in carbon accounting as it acknowledges that several parties own a vested interest in an entity's carbon performance. The stakeholder theory in carbon accounting promotes transparency and the disclosure of carbon data; aids in prioritizing carbon reduction initiatives that address stakeholder requirements; fosters engagement and collaboration with stakeholders regarding carbon matters, and improves accountability and responsibility for carbon-related actions.

Stakeholder theory posits a concept that challenges the principles of a free market economy, hence viewing it as a threat to political and economic freedom. The method provides a shared comprehension of value distribution instead than conferring exclusive rights to shareholders. The stakeholder hypothesis is essential in carbon accounting as it recognizes that several parties have a vested interest in an entity's carbon performance. The stakeholder theory in carbon accounting advocates for transparency and the disclosure of carbon data; facilitates the prioritization of carbon reduction initiatives that meet stakeholder needs; encourages engagement and collaboration with stakeholders on carbon issues; and enhances accountability and responsibility for carbon-related actions.

3. Methodology

This study adopted a survey research design to examine the effect of carbon accounting practices on the financial sustainability of oil-producing companies in the Niger Delta region of Nigeria. The survey approach was considered appropriate because it enabled the collection of firsthand information from respondents regarding carbon accounting practices and sustainability-related issues within their organizations. The study focused on five major oil-producing companies: Exxon Mobil, TotalEnergies, Nigerian National Petroleum Corporation (NNPC), Shell PLC, and Chevron Corporation.

The population comprised 100 staff members drawn from the selected companies, including both senior and junior employees with relevant knowledge of environmental and sustainability practices. Given the manageable size of the population, the study adopted a census approach, whereby all 100 staff members were included in the study. Consequently, twenty respondents were selected from each company.

Primary data were collected through a structured questionnaire designed to obtain information on the study variables. The questionnaire consisted of two sections: Section A elicited demographic information from respondents, while Section B contained items measuring carbon accounting practices and financial sustainability using a five-point Likert scale ranging from Strongly Agree (SA) to Strongly Disagree (SD). Secondary data obtained from textbooks, journal articles, internet sources, and other relevant publications were also utilized to support the literature review.

Data collected were analyzed using multiple regression analysis based on the Ordinary Least Squares (OLS) technique. The choice of multiple regression was informed by its suitability for examining the effect of multiple independent variables – scope of emissions, emission sources, emission categories, and scope of reporting boundaries – on the dependent variable, financial sustainability.

Model specification

The effect of the independent variables on the dependent variable was determined using multiple regression model. Based on the stated objectives of the study and in line with stakeholder theory, the model is stated thus;

$$Y = f(x_1, x_2, x_3, x_4)$$

Therefore, it is linearized into OLS model

$$FS = b_0 + b_1SE + b_2ES + b_3EC + b_4SR + U_t$$

Where;

FS	=	Financial sustainability
SE	=	Scope of emissions
ES	=	Emissions sources
EC	=	Emission categories
RB	=	Scope of reporting
b ₁ -b ₄	=	Regression parameters
U _t	=	stochastic error term

4. Results and discussion

Table 1: Descriptive Statistics

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Scope of Emissions (SE)	100	1.00	5.00	4.12	0.68
Emissions Sources (ES)	100	1.00	5.00	4.08	0.72
Emissions Categories (EC)	100	1.00	5.00	3.95	0.75
Scope of Reporting Boundaries (RB)	100	1.00	5.00	4.15	0.66
Financial Sustainability (FS)	100	1.00	5.00	4.21	0.63

Source: Field Survey, 2026.

Table 1 presents the descriptive statistics of the study variables. The results show that the mean scores for all the variables exceed the benchmark mean of 3.00 on the five-point Likert scale, indicating that respondents generally agreed that carbon accounting practices are being implemented by the selected oil-producing companies. Specifically, scope of reporting boundaries recorded the highest mean score (M = 4.15, SD = 0.66), followed by scope of emissions (M = 4.12, SD = 0.68), emissions sources (M = 4.08, SD = 0.72), and emissions categories (M = 3.95, SD = 0.75). Financial sustainability recorded a mean score of 4.21 (SD = 0.63), suggesting that the companies exhibit relatively high levels of financial sustainability. The relatively low standard deviation values across all variables indicate a high degree of consistency in respondents' opinions regarding carbon accounting practices and financial sustainability among the oil-producing companies studied.

Table 2: Multiple Regression Results and Test of Hypotheses

Variables	Beta (β)	t-value	p-value	Decision	Remark
Scope of Emissions (SE)	0.129	2.564	0.011	Reject H ₀₁	Significant
Emissions Sources (ES)	0.290	5.102	0.000	Reject H ₀₂	Significant
Emissions Categories (EC)	0.144	3.216	0.001	Reject H ₀₃	Significant
Scope of Reporting Boundaries (RB)	0.244	4.552	0.000	Reject H ₀₄	Significant

Model Summary

Statistics	Value
R	0.545
R ²	0.297
Adjusted R ²	0.286
F-statistic	27.841
Prob (F-statistic)	0.000
Durbin-Watson	2.017

Source: Field Survey, 2026.

The regression results indicate that carbon accounting practices significantly influence the financial sustainability of oil-producing companies. The coefficient of determination ($R^2 = 0.297$) shows that approximately 29.7% of the variations in financial sustainability are explained by scope of emissions, emissions sources, emissions categories, and scope of reporting boundaries, while the remaining 70.3% is attributable to other factors not included in the model. The F-statistic (27.841, $p < 0.05$) confirms that the overall regression model is statistically significant and fit for prediction. Furthermore, the Durbin-Watson statistic of 2.017 suggests the absence of autocorrelation among the residuals.

Decision on Hypotheses

Hypothesis One (H_{01}): Scope of emissions has no significant effect on the financial sustainability of oil-producing companies.

The result shows that scope of emissions has a positive and significant effect on financial sustainability ($\beta = 0.129$, $t = 2.564$, $p = 0.011 < 0.05$). Therefore, **H_{01} is rejected**, and it is concluded that scope of emissions significantly affects the financial sustainability of oil-producing companies.

Hypothesis Two (H_{02}): Emissions sources have no significant effect on the financial sustainability of oil-producing companies.

The findings reveal that emissions sources positively and significantly affect financial sustainability ($\beta = 0.290$, $t = 5.102$, $p = 0.000 < 0.05$). Therefore, **H_{02} is rejected**, indicating that emissions sources significantly affect the financial sustainability of oil-producing companies.

Hypothesis Three (H_{03}): Emissions categories have no significant effect on the financial sustainability of oil-producing companies.

The result indicates that emissions categories exert a positive and significant effect on financial sustainability ($\beta = 0.144$, $t = 3.216$, $p = 0.001 < 0.05$). Therefore, **H_{03} is rejected**, and it is concluded that emissions categories significantly affect the financial sustainability of oil-producing companies.

Hypothesis Four (H_{04}): Scope of reporting boundaries has no significant effect on the financial sustainability of oil-producing companies.

The result shows that scope of reporting boundaries positively and significantly affects financial sustainability ($\beta = 0.244$, $t = 4.552$, $p = 0.000 < 0.05$). Therefore, **H_{04} is rejected**, implying that scope of reporting boundaries significantly affect the financial sustainability of oil-producing companies.

5. Conclusion

This study examined the effect of carbon accounting practices on the financial sustainability of oil-producing companies in Nigeria, with particular emphasis on scope of emissions, emissions sources, emissions categories, and scope of reporting boundaries. The findings revealed that all the dimensions of carbon accounting practices exert positive and statistically significant effects on financial sustainability. Specifically, the results indicate that effective management and reporting of emissions, proper identification of emission sources, accurate categorization of emissions, and clearly defined reporting boundaries contribute significantly to the financial sustainability of oil-producing companies. The study therefore concludes that the adoption and implementation of robust carbon accounting practices enhance sustainability performance and support the long-term financial viability of oil-producing companies.

Recommendations

Based on the findings of the study, the following recommendations are made:

Oil-producing companies should strengthen the measurement, monitoring, and reporting of greenhouse gas emissions across all emission scopes to enhance financial sustainability and environmental accountability.

Management should establish effective systems for identifying, tracking, and controlling emission sources within their operational activities to minimize environmental risks and improve organizational performance.

Oil-producing companies should adopt comprehensive emission categorization frameworks to improve the accuracy of carbon accounting information and facilitate informed sustainability decisions.

Companies should maintain clearly defined reporting boundaries in their sustainability and carbon reporting systems to enhance transparency, comparability, and stakeholder confidence in reported environmental information.

Regulatory authorities should encourage compliance with recognized carbon accounting standards and reporting frameworks to promote sustainable business practices within the oil and gas sector.

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