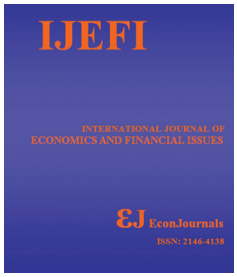

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Environmental Management Cost and Business Sustainability of Oil and Gas Firms in Nigeria

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ABSTRACT

The mounting environmental crises caused by phenomena such as climate change, global warming, water and food shortages, energy consumption, biodiversity loss, environmental degradation, and agricultural vulnerability highlight the need for increased measures to safeguard the environment from the hands of world leaders. The goal of this article was to analyze the relationship between environmental management costs and the sustainability of listed oil and gas firms in Nigeria. Specifically, it employed the Global Reporting Initiative's (GRI) sustainable environmental disclosure index as a measure of sustainability and environmental protection expenses, environmental remediation costs, and staff training costs as proxies for environmental costs. Using the ex-post facto research design, data was obtained from the chosen companies' yearly financial statements covering the period from 2014 to 2023. We utilized E-views 9.0, a statistical tool, to execute three independent analyses on the data set: Pooled Regression, Random Effect Model, and Fixed Effect Model. The idea was to establish which model functioned best. The results of the Hausman test showed that the Fixed Effect Model was the best match for the given data. All three independent variables—"Environmental Protection Costs" (EPC), "Environmental Remediation Costs" (ERC), and "Staff Training Costs" (STC)—had considerable and favorable implications on the organizational sustainability index, according to the results. Therefore, the study reveals that oil and gas businesses in Nigeria may ensure more sustainable operations and a better environment by efficiently managing their environmental expenses. The report suggests that Nigerian oil and gas corporations should put more money into environmental protection, environmental studies, and worker training to keep their operations functioning smoothly and prevent having to pay to clean up pollution.

Keywords: Business Sustainability, Environmental Accounting, Environmental Protection Costs, Environmental Remediation Costs, Staff Training Costs
JEL Classifications: Q56, M41, Q35

1. INTRODUCTION

Globally, environmental sustainability stands as a critical imperative topic for research and academic meetings/debates; demanding an unwavering focus to ensure continuous organizational existence and operations without limiting chances for future activities. Many academic and professional conferences, workshops, seminars and research have been undertaken; and some are ongoing to sensitize humanity and create awareness on the need to be environmentally conscious in her activities. This escalating prominence of climatic changes and global warming are now compelling businesses to adopt eco-friendly measures to mitigate the negative effect of their operations. Despite these global awareness efforts, some enterprises in Nigeria still balk due to the perceived high costs and burdens of sustainability; opting to maintain the status quo and flouting several national and global conventions on the environmental preservation. Such firms are obviously risking their existence as business entities.

The challenges within the corporate realm burgeon annually, evolving alongside shifts in business paradigms; hence business sustainability is also gaining attention within the Nigerian corporate world. In the current trajectory of global industrial expansion, mere economic gains no longer suffice as the primary aim of the firm and neither guarantees the continuous existence of the business. The current thinking, however, is geared towards how to guarantee the sustainability of the business environment; hence the oil and gas firms in Nigeria must key into this global phenomenon to preserve the environment. Consequently, emphasis must be laid on fostering symbiotic and sustainable models encompassing economic prosperity, environmental stewardship, and community welfare. There's therefore a growing momentum towards quantifying the nexus between economic value and ecological harm through concepts like eco-efficiency (Pai et al., 2018) and the discourse on sustainability is gaining much responsiveness among enterprises and their stakeholders worldwide (Caiado et al., 2017).

The environmental dimensions showcased by emerging challenges like climate change, water scarcity, energy usage, biodiversity loss, and agricultural sustainability, further underscores the interconnectedness of sustainability efforts (Arowoshegbe and Emmanuel, 2016). Entities reliant on natural resources, both directly and through supply chains, must acknowledge their environmental responsibilities and meticulously manage natural capital, understanding the intricate dynamics between resource consumption and preservation (United Nations Global Compact, 2015). These elements collectively encapsulate the triple bottom line concept, which serves as a comprehensive framework for assessing corporate sustainability (Arowoshegbe and Emmanuel, 2016).

In light of changing economic landscapes, businesses must openly communicate their commitments to environmental and societal well-being through the integration of corporate social responsibility initiatives in their annual reports and financial documents. These efforts entail tackling various environmental challenges affecting communities and ecosystems, with the goal of lessening the negative effects of environmental hazards on society. As a result, the emphasis moves beyond mere profit generation to encompass a consideration of the social and environmental impacts of corporate operations (Agbiogwu et al., 2016).

Nonetheless, it is critical to remember that environmental preservation measures frequently come with associated costs, necessitating careful cost management. Furthermore, these efforts play an important part in deciding the overall success or failure of businesses (Tapang et al., 2012). Consequently, conventional cost accounting approach fails to consider significant environmental costs and activities (Arong et al., 2015).

The effective management of environmental costs stands as a cornerstone in ensuring business sustainability. This entails evaluating the environmental ramifications of business operations and devising strategies to curtail costs while advancing sustainability objectives. Skillful handling of environmental costs not only enhances corporate financial performance but also fosters sustainable development. Environmental management accounting furnishes companies with essential data to adeptly oversee natural resources, pinpoint environmental expenditures, and enhance environmental stewardship. Through the adoption of green activity-based costing (GABC), organizations can allocate expenses based on environmentally friendly activities and gauge their impact on both financial performance and sustainability endeavors. Leveraging activity-based management tools like activity-based costing (ABC) can bolster cost precision and aid in product cost reduction.

The escalating levels of environmental degradation and depletion of resources, particularly evident in regions like the Niger Delta due to the activities of the oil and gas companies, raise serious concerns among those directly impacted by these challenges. The discontent among the communities due to oil spillages, destruction of aquatic lives, youth's unemployment and inadequate social amenities underscore the pressing need for environmental investments by oil and gas corporations in Nigeria (Agbiogwu et al., 2016).

Investigating how environmental costs affect corporate sustainability in the particular context of developing nations like Nigeria is therefore crucial. Consequently, this paper investigates the relationship between environmental costs—that is, the costs associated with environmental protection, environmental remediation, and staff training—and corporate sustainability, as measured by the sustainable environmental disclosure index of Nigerian oil and gas companies between 2014 and 2023.

2. LITERATURE REVIEW

2.1. Conceptual Review

2.1.1. Environmental accounting

The emergence of Environmental Management Accounting (EMA) has integrated new concepts into the accounting processes, particularly in the area of management accounting, emphasizing the importance of the environment as a measure of company sustainability. A lack of environmental information in management accounting can have a significant impact on managerial decisions, potentially damaging a company's reputation and sustainability. As a result, the implementation of EMA provides organizations with a competitive edge and improves their corporate social responsibility value (Tanç and Gökoğlan, 2015). EMA enables businesses to assess the environmental effect of their operations and allocate resources based on income and savings generated by environmental efforts. Using the Structural Equation Modeling (SEM), Fuzi et al. (2016) examine the relationship between EMA and environmental accomplishments in business. They analyzed elements such environmental expenses, safety precautions, continuous improvement, and management commitment.

In accounting, the interaction with the environment is intrinsic as accounting operates within an open system. The concept of social responsibility accounting emerges alongside the broader concept of social responsibility, with environmental accounting serving as a sub-branch. Environmental accounting encompasses the documentation, reporting, and scrutiny of expenditures related to environmental concerns (Pratiwi et al., 2020). It involves identifying, measuring, and allocating environmental

costs within a business, integrating these costs transparently into corporate management practices to demonstrate environmental stewardship (Bassey et al., 2013). Ethical investment movements prompt businesses to prioritize environmental considerations to attract funds from environmentally conscious individuals and groups. Unlike traditional accounting, which primarily focuses on monetary aspects, environmental accounting encompasses environmentally conscious production, services, and trade, with a key aim being the reduction and prevention of environmental costs (EPA, 1995).

2.1.2. Environmental cost

Various understandings have resulted from the substantial insights made by numerous specialists on the issue of environmental costs inside the corporate sector. Environmental expenses are often recognized as important components of the costs associated with business operations. Environmental costs, according to Aerts et al. (2013), cover the expenses associated with the incidence, detection, repair, and avoidance of environmental harm. They categorize these costs into four categories: failure costs (external, internal, detection, and preventive), which all relate to the present or expected depletion of natural resources as a result of economic activity. Various understandings have resulted from the substantial insights made by numerous specialists on the issue of environmental costs inside the corporate sector. Environmental expenses are often recognized as important components of the costs associated with business operations. Environmental costs, according to Aerts et al. (2013), cover the expenses associated with the incidence, detection, repair, and avoidance of environmental harm. They categorize these costs into four categories: failure costs (external, internal, detection, and preventive), which all relate to the present or expected depletion of natural resources as a result of economic activity.

Examining environmental costs from a wider angle, two perspectives are available: costs caused, which denotes expenses incurred by economic entities that either directly or indirectly contribute to environmental degradation through their operations, and costs borne, which represent expenditures incurred by economic entities that do not directly contribute to pollution. The means by which information about environmental costs is communicated to various stakeholders is environmental accounting. The economy depends on an understanding of the role of the natural environment, which illuminates the costs associated with pollution and resource depletion as well as the contributions made by natural resources to economic progress (Bassey et al., 2013).

Research has explored various aspects of environmental costs, including fines, penalties, expenditures on employee health, waste management, and compensatory payments (Oti et al., 2012). Arong et al. (2015) investigated factors such as the financial consequences of oil spills, gas utilization, and the profitability of gas production in the oil and gas industry. Oluwafemi et al. (2018) examined environmental cost variables such as environmental protection costs (EPC), environmental remediation costs (ERC), and staff training costs (STC), which were included in this study due to their significance and applicability.

2.1.3. Business sustainability

Academic literature's current take on sustainability has its roots in the Brundtland Report's concept of sustainable development, which aims to address current needs without jeopardizing future generations' capacity to do the same (Solomon, 2023; WCED, 1987). Various fields, aspects, and geographical settings have since contributed to the emergence of a wide range of viewpoints on sustainability. These opinions comprise a wide range of factors, including rules, guidelines, and structures (Baral and Pokharel, 2017; Westman et al., 2020), as well as practices, performance indicators, strategies, innovation, and leadership methods (Dissanayake and Sridhar Nerur, 2021). Furthermore, debates also expand to solution conceptions, multiple opinions, corporate ideals, and other pertinent concerns (Chigbu, 2015; Rizos, 2016; Reynolds et al., 2018).

Penzenstadler (2013) proposes that frameworks should be put in place to drive corporations toward fair and balanced methods of production and use in order to ensure corporate sustainability. Research and development, environmental management, pollution prevention measures, market values, corporate governance, and investor accountability are all included in the definition of corporate sustainability, according to (Omodero and Ihendinihu, 2016). In the opinions of Engert et al. (2016), corporate sustainability is founded on connecting sustainability values and efforts with strategic formulations. Key supporting topics are organizational structures, cultures, leadership attributes, management controls, employee motivations, qualifications, and communication. Navigating corporate sustainability issues remains challenging despite agreeable definitions, with the goal of perpetual company flourishing in service of mankind and the environment, Sustainable businesses live on futuristic thinking, strategic problem-solving, and developmental adequacy (Penzenstadler, 2013), which encourages high-level strategic initiatives to create innovation and advancement. Corporate sustainability requires answering issues about what to sustain, why sustainability is important, and for whom enterprises should sustain themselves.

Businesses are called upon to deliver goods and services with integrity and consciousness, recognizing the intertwined requirements of economic, environmental, and social sustainability (Hahn et al., 2014). While some advocate for prioritizing economic sustainability, emphasizing financial gains as a means to address environmental and societal issues (Gao and Bansal, 2013; Garriga and Melé, 2013), others underscore the limitations of solely relying on economic advantages to confront ecological and social challenges (Hahn et al., 2014). These challenges encompass issues like global warming, deforestation, loss of biodiversity, and social inequalities, illustrating the diverse nature of sustainability and its capacity to fulfill a broad spectrum of developmental needs. Exploring the interrelated elements of sustainability indicates that corporate sustainability entails the integration of flexible capabilities, models, and initiatives to promote innovative outputs that drive the growth of enterprises, organizations, and society today and in the future (Searcy, 2016). Corporate sustainability is defined as a set of business practices that attempt to improve economic efficiency, social dynamics, and environmental conservation. In this light, achieving company sustainability means

implementing progressive strategies, practices, and capabilities that balance environmental, social, and ethical implications with economic goals. A comprehensive approach to business operations is necessary, needing a broad awareness of business dynamics and a common commitment to addressing long-term and short-term goals while dealing with numerous challenges (Chassé and Courrent, 2018).

3. THEORETICAL REVIEW

3.1. The Stakeholders Theory

This research employs the Stakeholders' Theory as a basic framework for examining the intricate relationships among varied interest groups and evaluating the influence of environmental charges on corporate sustainability. Initially conceived by the Stanford Research Institute (SRI) to incorporate entities important for organizational sustainability, the Stakeholders' Theory claims that the success of a corporation depends on adeptly managing interactions with all stakeholders (Bassey et al., 2013). Stakeholders, as described by Nduke and John (2015), are individuals or groups capable of exerting influence on or being impacted by the activities, choices, policies, practices, or objectives of the firm. Tapang et al. (2012) criticised the conventional attitude of management objectives in economic theories, stating that profit maximization should not be the lone aim of management and asking for a move towards corporate and organizational sustainability.

As per the Stakeholders' Theory, firms are expected to display more environmental concern and widen their corporate strategy to include non-traditional stakeholders, such as opposing and regulatory groups, to fulfill growing society expectations (Trotman, 1999). This theory underlines the relevance of addressing environmental cost components, their evaluation, and their integration into financial statements within the subject of environmental accounting. Gray et al. (1996) advocated that firms should regard stakeholders as entities requiring appropriate management to promote company outcomes. According to this theory, corporations may effectively traverse stakeholder interactions by taking into account elements such as the organizational environment, the significance of stakeholder groups, and the values of decision-makers as they drive the prioritization process (Donaldson and Preston, 1995).

3.2. Empirical Review

Okore (2022) undertook a study aiming at examining how environmental expenditures affect the performance of different industrial firms in Nigeria, using return on assets as a performance metric. The study analyzed many costs including environmental training, charitable donations, waste management fees, and investments in corporate social responsibility as indices of environmental spending. By employing Panel Least Squares methodology, the research established a high and beneficial correlation between environmental training, donations, waste management expenses, and corporate social responsibility spending, and the return on assets of Nigerian manufacturing businesses. Consequently, the study concluded that dedicating resources to environmental training, charitable activities, waste management, and maintaining social responsibility standards positively influences the operational performance of manufacturing companies in Nigeria, emphasizing the importance of these allocations for long-term business sustainability.

Confidence and Comfort (2022) launched a project seeking to examine the influence of environmental accounting practices on financial performance. Employing an ex-post facto design, research studied this link. Environmental Accounting (EVA) was researched by quantifying expenses associated with waste management (WMC), community development, and employee health and safety, while financial success was gauged using measures including return on assets, return on equity, and profit margin. Canonical correlations were performed to assess the acquired data. The findings highlighted a notable correlation between components of environmental accounting (waste management costs, community development expenditures, employee health and safety expenditures) and crucial organizational performance indicators (return on assets, return on equity, and profit margin). The study advocated the obligatory incorporation of environmental accounting systems into annual reports, noting that a large percentage of firms presently neglect to include their environmental initiatives in their yearly disclosures.

Abiola & Agboola Olugbenga (2021) studied the impacts of environmental charges on the financial performance inside Nigeria's extractive sector. Their investigation indicated that specific environmental components, such as Environmental Remediation Cost and Administrative Cost, greatly influenced financial success. Interestingly, Business Location Cost was revealed to have a noticeably adverse effect on financial performance. Conversely, Research and Development Cost and Social Cost had no noteworthy impact on the financial performance of the analyzed extractive industry in Nigeria. The research underlined the adverse influence of Business Location Cost on financial performance, contrasting with the minimal effects of Research and Development Cost and Social Cost. As a vital insight, the study highlighted that the extractive industry in Nigeria should focus financial expenditure control to boost their performance potential.

Nwaimo (2020) undertook a study to analyze how environmental expenditures affect the performance of publicly traded companies in Sub-Saharan Africa. The research followed a longitudinal/panel ex-post facto research design and using random sampling methodologies. Data spanning from 2007 to 2016 from sixty-four extractive and industrial businesses listed on the Stock Exchanges in four Sub-Saharan African nations were collected. Statistical analysis involved Ordinary Least Squares regression (OLS) on panel data. The investigation concluded that environmental expenses relating to employee health and safety, waste management, and community development did not significantly influence crucial metrics such as return on capital employed, earnings per share, and return on equity. The study stated that companies operating in Sub-Saharan Africa should concentrate their focus on environmental stewardship and clearly identify expenses in their annual, integrated, and sustainability reports.

Pratiwi et al. (2020) studied the relationship between environmental management accounting (EMA) and firm sustainability across different industries in Indonesia, including mining, agriculture, construction, energy, textiles, and apparel. Corporate sustainability comprised social and environmental components, while eco-efficiency energy measurements were supplied as benchmarks for monitoring EMA. The study involved both qualitative and quantitative reviews of data, including the review of annual and sustainability reports following the G4 standards specified by the Global Reporting Initiative (GRI). The results demonstrated a good association between company sustainability and the use of EMA processes.

Oluwafemi et al. (2018) evaluated the influence of environmental levies on the financial performance of Nigerian industrial businesses listed between 2008 and 2016. Utilizing panel least squares regression and trend analysis visualizations, the research indicated a high and positive correlation between staff training, employee benefits, and return on equity (ROE). Nonetheless, a moderate and unfavourable correlation was revealed between donations and Return on Equity (ROE). These findings reinforced the premise that investing in environmental expenditures had the power to boost financial success.

In a study done by Tochukwu (2018) concerns environmental cost accounting and reporting across publicly traded Nigerian oil businesses, the research evaluated the impact of environmental expenditures on financial performance. The study tries to show how environmental expenses affect corporate profitability. Through statistical analysis, the research revealed a good correlation between improving environmental performance and the fundamental worth of a corporation. Additionally, the application of environmental accounting was proved to boost overall firm performance by reducing financial limits connected to environmental and societal issues.

In a study done by Agbo et al. (2017), the analysis focuses on the influence of environmental spending on the operational efficiency of Nigerian Brewery Plc. The study collected data from the company's annual reports from 2011 to 2015, focusing on contributions (DN), Medical Expenses (ME), and Return on Asset (ROA) measures. Employing multiple regression analysis to test stated assumptions, the research findings indicated a negative link between return on assets (ROA) and both medical costs and donations. Conversely, a positive association was established between Training, Recruitment, and Canteen Expenses (TRC) and return on assets (ROA).

Ezejiofor (2016) spearheaded a study aiming at examining how incorporating sustainable environmental cost accounting systems influences the financial performance of Nigerian enterprises. Utilizing an ex post facto research design and examining time series data acquired from the annual reports and accounts of Nigerian firms, the study looked into this subject. By employing regression analysis to evaluate the assumptions, the research revealed that while environmental expenses might not directly drive sales for Nigerian firms, they do have a favorable influence in profit generation. Consequently, the study underlined the significance of continuously adhering to environmental accounting standards as a strategic plan to maintain consistent organizational performance.

Bassey et al. (2013) conducted a thorough investigation into the adoption of environmental cost management strategies and their effects on the operations of oil and gas enterprises in Nigeria from 2001 to 2010. Through the application of multiple regression analysis techniques, the research indicated a high correlation between environmental cost management features and the output levels of the Nigerian oil and gas sector. Additionally, the investigation underlined the lack of specialized strategies within the Nigerian oil and gas company for appropriately reducing environmental expenses.

3.3. Gap in Literature and Proposition of Hypothesis

After reviewing the empirical works above and establishing that most other works looked at environmental costs and organizational performance to the neglect of business sustainability, this paper therefore focusses on environmental management costs and business sustainability of the oil and gas companies in Nigeria and consequently proposes the following hypothesis:

H_0: Environmental Costs (environmental protection costs (EPC), environmental remediation costs (ERC), and staff training costs (STC)) do not have significant influence on Business Sustainability of oil and gas firms in Nigeria.

H_1: Environmental Costs (environmental protection costs (EPC), environmental remediation costs (ERC), and staff training costs (STC)) have significant influence on Business Sustainability of oil and gas firms in Nigeria.

4. METHODOLOGY AND DATA

The research applied both the pooled effect model and panel data technique, blending time-series and cross-sectional data for regression analysis. Following the methods given by (Mehrotra and Musolesi, 2017), multiple assessments were carried out, employing consistent cross-section units to study the influence of various factors throughout numerous time periods. Data ranging from 2014 to 2023 were acquired from G4 sustainability reports and yearly financial reports (annual reports) of firms. In Table 1, essential data related to distinct G4 parts of the Global Reporting Initiative (GRI) are presented.

Companies align with GRI's G4 principles when exposing their economic, environmental, and social performances, indicating their commitment to long-term sustainability. Table 1 underlines the significance of corporate sustainability reporting for effective communication. This index works as a tool for performance evaluation, supporting the identification of new targets and opportunities to strengthen risk management capabilities involving transparency, accountability, and sustainability activities within firms (Demirel and Erdogan, 2016). The study mainly focused on the environmental aspect of sustainability, addressing the tendency of many organizations to disregard this dimension while focusing largely on economic sustainability facets.

Table 1: Selected G4 environmental guidelines of global reporting initiative (GRI)

Variables	Selected indicators	Operationalization (Content Analysis)	Reference
Business Sustainability (ENVD)	(EN1)	Materials used according to volume or weight: (non-renewable materials used, renewable materials used, recycling, waste management system).	GRI, 2016 (Nur Kasbun, Tze San & Heng Teh 2016)
	(EN2)	Energy: (Energy saving initiatives for energy renewable energy, consumption,).	
	(EN3)	Water: (Water saving initiatives; water and noise pollution; recycling water; compensation for air,).	
	(EN4)	Biodiversity: (Green-tech oriented buildings and technologies; conserving environment; reforestation; initiatives to control greenhouse gas and other gas emissions)	

We conducted an analysis of business sustainability utilizing content analysis techniques, measuring the extent of disclosures by counting pages, words, and sentences, as outlined by (Aras et al., 2017). Employing sentences as the coding unit was preferred over other units due to the potential inconsistencies that may arise with word-based analyses, as noted by (Ahmad, 2018). The methodology of the study involved content analysis using a scoring or weighting system to evaluate environmental efforts. Each action reported by the research subject was assigned a value ranging from "1" to "0." By summing these values, the entity's overall score was determined, allowing for the calculation of an index using a specific formula.

$$Business\ Sustainability\ Index\ (BSI) = \frac{Total\ ENVD}{Total\ Selected\ ENVD} \times 100$$

4.1. Where: Total ENVD

Total Environmental Sustainability Disclosed by the company out of the total selected Environmental Sustainability from the GRI, G4 Guidelines.

4.2. Total Selected ENVD

Total Selected Environmental Sustainability by the author from the GRI, G4 Guidelines for the purpose of this study.

4.3. Technique for Data Analysis

This research uses multiple regression analysis to explore the links between dependent variables and various independent factors. Various regression techniques including ordinary least squares (OLS), fixed effect, and random effect were applied. Furthermore, the Hausman test was undertaken to find the most appropriate model for the investigation. Additionally, correlation matrix approaches and descriptive statistics were applied for analysis purposes.

4.4. Model Specification

In this study, the model explores the relationship between environmental cost factors and organizational sustainability. The research draws inspiration from the paradigm presented by Okere (2017), which studied the influence of environmental investments on the financial performance of Nigerian manufacturing enterprises. It also considers the analysis undertaken by Oluwafemi et al. (2018), which studied the relationship between environmental costs and financial performance.

$$BSI = f.\ (\text{Environmental Cost}) \quad (1)$$

$$BSI = f.\ (EPC, ERC, STC) \quad (2)$$

$$ENVD = \beta_0 + \beta_1 \log EPCit + \beta_2 \log ERCit + \beta_3 \log STCit + \mu it \quad (3)$$

Where:

- ENVD: Environmental Disclosure Index, (used to measure Business Sustainability)
- EPC: Environmental protection costs
- ERC: Environmental remediation costs
- STC: Staff training costs on environmental issues
- μ: random error term
- β_0: Intercept, B_1, β_2, and β_3 are the parameters to be estimated.

5. RESULTS AND DISCUSSION

The findings in Table 2 provide a summary of the descriptive statistics, including measures of central tendency (represented by Mean and Median), range (represented by Maximum and Minimum Values), and dispersion (highlighted by Standard Deviation) for each variable. Notably, the Jarque-Bera test assumes a normal distribution for all data.

Throughout the period covered in the study, sustainable environmental disclosure indices ranged from 0.5 to 1 among all enterprises, suggesting that these entities reported at least half of their sustainable environmental activities. The disclosure rate averaged 0.75, with a standard deviation of 0.13. The skewness and kurtosis scores were positive, at 0.03 and 3.49, respectively. The Jarque-Bera statistic produced a probability of 0.007 and a statistical value of 0.729.

In terms of Environmental Protection Costs (EPC), the range was −0.613 million to 2.845 million, with an average of 0.987 million. Dispersion was shown by the standard deviation, which was 0.734. At 0.393 and 2.583, respectively, skewness and kurtosis were positive. With a probability value of 0.315, the Jarque-Bera statistic value was 2.309. Environmental Remediation Costs (ERC) ranged between 0.082 million and 3.022 million, with an average of 2.019 million. The standard deviation was 0.779, indicating variation around the mean. The skewness was −0.912, the kurtosis was 2.798, the probability value was 0.007, and the Jarque-Bera statistic was 9.816.

Staff training costs on environmental issues (STC) ranged from −0.858 million to 2.957 million, with an average of 1.485 million. The standard deviation was 0.721, demonstrating variation around the mean. Skewness was −0.686, kurtosis was 3.795, probability was 0.026, and the Jarque-Bera statistic was 7.327.

5.1. Pearson Correlation Coefficient

The degree of relationship between the variables was determined using Pearson correlation. Pearson's correlation value scale clearly shows how closely two variables are related.

5.1.1. Interpretation

Table 3 shows the results of a Pearson correlation analysis performed on the independent and dependent datasets. There was a significant positive link (P = 0.0002) between environmental protection costs and business sustainability (0.4262). This finding suggests that an increase in environmental protection costs corresponded to an increase in Business Sustainability across the study period. In contrast, there was a positive but statistically insignificant correlation (P = 0.3845, r = 0.10555) between Environmental Remediation Costs and Business Sustainability, indicating a possible link between an increase in Environmental Remediation Costs and Business Sustainability. Furthermore, the study found a substantial positive association (P = 0.0094, r = 0.3083) between Staff training costs and Business Sustainability, showing that increasing Staff training costs could help to improve Business Sustainability.

Table 2: Descriptive stat results of the research variables

Measures	Variables			
	BS (ENVD)%	EPC	ERC	STC
Mean	0.757143	0.986855	2.019661	1.485639
Median	0.750000	0.743827	2.183904	1.497439
Max.	1.000000	2.845098	3.021682	2.956848
Min.	0.500000	−0.612610	0.082426	−0.858375
Standard deviation	0.134403	0.733809	0.779921	0.720570
Skewness	0.027148	0.393160	−0.911678	−0.685715
Kurtosis	3.497073	2.583389	2.797868	3.794462
Jarque-Bera	0.729253	2.309600	9.816007	7.326633
Probability	0.006944	0.315121	0.007387	0.025647
Sum	53.00000	69.07985	141.3763	103.9947
Sum Sq. deviation	1.246429	37.15477	41.97113	35.82626
Observation	70	70	70	70

Source: author's compilation E-Views 9 (2024)

Table 3: Correlation coefficient

Correlation probability	BS (ENVD)	EPC	ERC	STC
BS (ENVD)	1.000			

EPC	0.426208	1.000		
	0.0002	--------		
ERC	0.105548	−0.400233	1.000	
	0.3845	0.0006	------	
STC	0.308287	0.197895	0.519703	1.000
	0.0094	0.1006	0.0000	------

Source: author's compilation E-Views 9 (2024)

5.2. Hausman Test Result

In this study, we used pooled, random, and fixed regression models. The Hausman test findings indicate that the Fixed Effect Model best matches the data. As a result, the fixed effect model was used.

5.2.1. Interpretation

Table 4 provides a study that examines the influence of environmental expenditures on the sustainability of publicly traded oil and gas enterprises in Nigeria. It investigates seven listed oil and gas enterprises across a ten-year timeframe, applying the panel least square regression approach alongside the Hausman Test. The major purpose was to analyse Environmental Business Sustainability as the dependent variable, using independent factors such as environmental protection expenses, environmental remediation costs, and staff training in environmental issues.

The results reveal a very strong overall model, as evidenced by an F-statistical probability of 0.000000, indicating a strong match. Furthermore, with an R-squared value of 0.831264 (83 percent) and adjusted R-Squared of 0.805954 (80 percent), it is evident that the independent variables (environmental protection costs, environmental remediation costs, and staff training in environmental issues) explain 83 percent of the variability in the dependent variable business sustainability (BS). Additionally, the Durbin Watson statistic of 0.134403 demonstrates the absence of any serial autocorrelation concerns within the results.

The analysis discloses a positive and strong link between environmental remediation expenses and organizational sustainability, demonstrated by a correlation coefficient of 0.014665 and a P-value of 0.0567. This demonstrates that with each incremental unit of ERC, the commercial sustainability of the assessed enterprises acquires a 1.4% increase. Similarly, a good and sizable link is generated between staff training and business sustainability, seen in the correlation coefficient of 0.006219 and a P-value of 0.00618, meaning a 0.6% gain in business sustainability for every unit rise in staff training.

Table 4: Hausman result (Fixed effect model results)

Dependent Variable: Business sustainability (ENVD)				
Variables	Coefficient	Standard Error	t-Stat.	Probability
EPC	0.010943	0.065287	12.07472	0.0000
ERC	0.014665	0.019008	−0.575710	0.0567
STC	0.006219	0.028663	−0.511646	0.00618
C	0.788321	0.016637	0.373822	0.00709
Specification effects				
Cros-sec fixed (dummy var)				
R^2	0.831264	Mean dep var.		0.757143
Prob (F-stat).	0.000000	Durb-Wat stat.		0.134403
F-stat.	32.84284	Schz crit.		−2.684043
S.E reg	8.534694	Akai info crit.		−2.362829
Log-lik	1203.9415	S.D dep var.		−2.556453
Sum-squared	0.210317	Hanan-Quin crit.		1.586442
Adj. R^2	0.805954			

Source: author's compilation E-Views 9 (2024)

Furthermore, a correlation coefficient of 0.010943 and a P-value of 0.00000 shed light on a 1.09% increase in business sustainability for every rise in environmental protection expenses, demonstrating a strong and beneficial link between these costs and business sustainability. In summary, these findings emphasize that the independent variables—environmental protection costs, staff training and development, and environmental remediation costs—jointly exert a positive and significant impact on the long-term success of the designated publicly traded oil and gas enterprises in Nigeria.

6. DISCUSSION

Accordingly, the results of this research reveal a considerable and positive link between all of the independent variables (environmental protection expenses, environmental remediation costs, and staff trainings on environmental issues) and the aspect of business sustainability. This suggests a significant link between environmental cleanup, personnel training, environmental preservation, and the long-term viability of Nigeria's oil and gas industries. As a result, it appears that oil and gas enterprises' efforts in people training, environmental protection and remediation have greatly enhanced their long-term profitability.

Several studies have demonstrated a high and beneficial association between environmental costs and business performances (Bassey et al., 2013; Nnamani et al., 2017). Therefore, this research agrees with the perspectives presented in the above referred works but rejects the data and the findings provided by Ezejiofor (2016); Pek and Luky (2012).

7. CONCLUSION AND RECOMMENDATIONS

This concludes that environmental cost variables such as environmental protection costs, environmental remediation costs, and staff training on environmental issues have a positive and significant impact on business sustainability, as indicated by the sampled listed businesses' environmental disclosure indices. As a result, the study offers the following recommendations:

First, it suggests that the government enact regulations requiring corporations, especially those whose operations and activities impact on the environment, to declare and publish the entire amount spent on environmental expenditures in respect to environmental protection costs, environmental remediation costs, and staff training on environmental issues in their yearly financial statements. Furthermore, the government should strengthen the Environmental Regulatory Authority to enforce strict adherence to these policies.

Second, it recommends businesses to create and accept guidelines that supply staff with active and leadership training both in Nigeria and around the world, particularly on environmental protection and preservation. This strategy would expose staff and bring them up-to-speed with the best global practices and expand knowledge on environmental issues, contributing to overall organizational improvement.

Finally, the paper recommends that publicly traded oil and gas businesses focus on good environmental cost management in order to improve their long-term sustainability. This includes creating an environmental cost budget and ensuring its successful execution. Steps should further be taken to promote the optimal use of the budgets, hence optimizing environmental cost management techniques.

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