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ENVIRONMENTAL ACCOUNTING AND CORPORATE SOCIAL RESPONSIBILITY AS CATALYSTS FOR SUSTAINABLE NATIONAL DEVELOPMENT IN NIGERIA: AN EMPIRICAL ANALYSIS

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Abstract

Environmental accounting and CSR are increasingly adopted in Nigeria but remain underexplored and largely ineffective due to weak regulation, poor coordination, and limited empirical assessment of their impact on sustainable development. This study examines the roles of environmental accounting and CSR expenditure in promoting sustainable development in Nigeria, using GDP growth, education index, and health expenditure as key indicators. Adopting quantitative research design, the study utilizes secondary data from the Central Bank of Nigeria, National Bureau of Statistics, and World Bank covering the period 2000 to 2022. The study employed descriptive and inferential statistics. Specifically, correlation analysis, multiple linear regression, vector autoregression (VAR), Granger causality tests, and impulse response functions were employed to explore both static and dynamic relationships among the variables. Findings reveal that environmental factors significantly affect educational investment (e.g., CO₂ emissions: $\beta = -205.7, p < .001$), while CSR variables did not directly predict development outcomes. VAR analysis highlighted the positive lagged effects of CSR expenditure and renewable energy on GDP growth, further supported by Granger causality tests ($\chi^2 = 13.51$ and $22.71, p < .001$). Impulse response analysis showed renewable energy induces a strong yet volatile growth impact, while CSR drives more stable, long-term gains. The study concludes that CSR and environmental sustainability drive Nigeria's long-term economic growth despite limited short-term impact. In line with the findings, the study recommends that coordinated policies, investments in renewable energy, improved CSR integration, and data-driven planning to promote sustainable development in Nigeria.

Keywords: Environmental Accounting, Corporate Social Responsibility (CSR), Sustainable Development, GDP Growth, Nigeria.

JEL Classification:Q56, M14, O44, O55, E01

INTRODUCTION

The pursuit of sustainable national development has become a key agenda in global economic policy, especially in developing nations like Nigeria where environmental degradation and socio-economic inequality remain persistent challenges. Despite increased corporate activity and growth in national income, Nigeria continues to witness widening disparities in access to quality healthcare, education, and a healthy environment (Adebayo & Okafor, 2017; Nwachukwu, 2020). These concerns have elevated the need for sustainable practices, such as Environmental

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Accounting and Corporate Social Responsibility (CSR), to be integrated into both corporate governance and national development strategies.

Environmental accounting is increasingly recognized as a critical tool for capturing the environmental costs associated with economic activities, thereby providing a more holistic view of national progress. It involves the identification, measurement, and disclosure of environmental impacts and resource usage, which enhances the ability of policymakers and corporate actors to make environmentally conscious decisions (Schaltegger & Burritt, 2000). On the other hand, CSR encapsulates corporate initiatives aimed at balancing profit-making with social and environmental obligations, reinforcing the role of businesses in achieving inclusive development (Carroll, 1999; Amaeshi et al., 2006).

In Nigeria, CSR and environmental accounting practices are gaining prominence, yet their actual impact on development outcomes such as GDP growth, educational improvement, and health investment is not fully understood (Uwuigbe and Uadiale, 2011; Eze & Nwagbara, 2017). While some firms are actively engaged in CSR initiatives, ranging from educational scholarships to health infrastructure projects—many still approach such programs as philanthropic rather than strategic developmental tools (Okoye, 2012; Ogar & Ogar, 2018). Moreover, weak regulatory enforcement and lack of standardized environmental reporting mechanisms have limited the effectiveness of these practices (Akinpelu et al., 2015).

Despite the increasing engagement of Nigerian firms in corporate social responsibility (CSR) and the gradual adoption of environmental accounting practices, the country continues to struggle with environmental degradation, underfunded public health systems, and poor educational outcomes which are the key indicators of unsustainable development (Adebayo & Okafor, 2017; Nwachukwu, 2020). This paradox raises critical concerns about the effectiveness and alignment of corporate sustainability efforts with national development goals. While CSR initiatives are often implemented, they tend to be uncoordinated, short-term, or driven by image-building motives rather than measurable developmental impact (Okoye, 2012; Eze & Nwagbara, 2017). Furthermore, the lack of standardized environmental reporting and weak regulatory frameworks has limited the ability of environmental accounting to influence national policy and planning (Bassey et al., 2013; Ogar & Ogar, 2018).

Consequently, there is a pressing need for empirical investigation into how environmental accounting and CSR expenditure influence core development indicators such as GDP growth, educational attainment, and public health investments in Nigeria. Hence, this study examines the effects of environmental accounting and corporate social responsibility (CSR) in promoting sustainable national development in Nigeria. Specifically, the study assesses the impact of environmental accounting practices on key indicators of sustainable development in Nigeria. In addition, the study evaluates the relationship between corporate social responsibility (CSR) expenditure and national development outcomes in Nigeria.

In line with the objectives of the study, the following hypotheses were stated:

- i. H₀₁: Environmental accounting practices have no significant impact on sustainable development indicators in Nigeria.

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- ii. H₀₂: Corporate social responsibility (CSR) expenditure has no significant relationship with national development outcomes in Nigeria.

LITERATURE REVIEW

Environmental accounting refers to the process of identifying, measuring, and disclosing the environmental costs and impacts of corporate or national economic activities. It enables organizations and governments to account for the depletion of natural resources, environmental degradation, and pollution costs within financial and policy frameworks (Bartolomeo et al., 2000). This concept is rooted in the broader movement toward sustainability accounting, which seeks to ensure that environmental concerns are integrated into decision-making processes (Schaltegger & Burritt, 2000). In developing economies like Nigeria, environmental accounting has gained relevance due to growing concerns over oil spills, deforestation, and pollution caused by industrial activities (Basse et al., 2013). However, its application remains limited due to weak institutional frameworks, lack of technical expertise, and inadequate enforcement of environmental regulations (Akinpelu et al., 2015).

Corporate Social Responsibility (CSR) encompasses corporate initiatives aimed at fulfilling legal, ethical, and philanthropic obligations to society. It reflects a company's commitment to contribute to sustainable economic development by improving the quality of life of employees, local communities, and society at large (Carroll, 1999). CSR practices may include investments in education, healthcare, infrastructure, and environmental sustainability. In the Nigerian context, CSR is often undertaken by multinational corporations and large domestic firms, particularly in the oil and gas sector, though many initiatives remain uncoordinated and lack strategic alignment with long-term national goals (Amaeshi et al., 2006; Okoye, 2012). While CSR can serve as a tool for mitigating social and environmental externalities, its effectiveness depends on transparency, stakeholder engagement, and integration with national development objectives (Uwuigbe & Uadiale, 2011).

Sustainable national development refers to economic growth that is inclusive, equitable, and environmentally responsible, ensuring the well-being of current and future generations (WCED, 1987). It encompasses improvements in health, education, income, and environmental quality. In Nigeria, sustainable development remains a critical goal due to persistent issues such as poverty, inequality, environmental degradation, and inadequate public infrastructure (Nwachukwu, 2020). The integration of environmental accounting and CSR into national development planning is increasingly seen as a pathway to address these challenges. By ensuring that corporate and governmental actions account for environmental and social impacts, these concepts support the achievement of Sustainable Development Goals (SDGs) and long-term national prosperity (Eze and Nwagbara, 2017).

Theoretical Framework

The theoretical foundation of this study is anchored on Stakeholder Theory which was propounded by R. Edward Freeman (1984). The theory emphasizes that a company's responsibilities extend beyond shareholders to include all stakeholders—such as employees, customers, suppliers, government, communities, and the environment. Freeman (1984) argues that organizations should consider the interests of all these groups in their operations to ensure long-term success and social

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acceptance. This theory is central to understanding CSR, as it highlights why firms should invest in social and environmental programs that benefit the wider society. In the context of Nigeria, where issues such as environmental degradation, poor health infrastructure, and educational inequality are prevalent, the theory supports the argument that CSR initiatives targeted at these areas can contribute to sustainable national development. It aligns with the study's aim of examining the role of CSR in enhancing development indicators like GDP growth, education, and health outcomes.

Empirical Review

Duo-Duo (2025) investigated the relationship between CSR cost and financial performance of quoted oil and gas companies in Nigeria from 2018–2023. Ex-post facto research design was used. Descriptive statistics, Pearson product moment correlation, and multiple regression was adopted using SPSS version 27 to analyze the data. The study covered a period of 5 years (2018–2023). Findings reveal that CSR proxies significantly relate to net profit margin and return on investment of listed oil and gas firms. It was recommended that management should develop well-articulated CSR strategies focusing on human resource development, community development, and environmental protection.

Olubukola and Olaleye (2024) examined the relationship between CSR in the capital market and firm performance of quoted companies in Nigeria, using Seplat Energy Plc as a case study. Ex-post facto was used as research design. The data was analysed with the use of simple linear regression analysis using SPSS version 25. The study covered a period of 6 years (2014–2020). Findings indicate that CSR has a negative and insignificant effect on net profit margin, but a positive and insignificant effect on return on equity, return on assets, and share price. It was recommended that corporate organizations should establish CSR units to align with international best practices, and the government should monitor CSR policy compliance.

Sulaimon (2023) examined the relationship between CSR and organizational performance of SMEs in Lagos State, Nigeria. Survey research design was adopted using questionnaires. Descriptive statistics and Z-test was used to analyse the data. Findings indicate that socially responsible SMEs outperform those that are not socially responsible, though financial strength and profitability were below the minimum threshold. It was recommended that SMEs should invest more in CSR, particularly focusing on employees and the communities in which they operate.

Ofurum and Ngoke (2022) investigated the relationship between CSR costs and financial performance of listed oil and gas companies in Nigeria. Descriptive research design was used for the study. Pearson Product Moment Correlation and Regression Statistical Techniques was adopted for the analysis of the data. Findings show that CSR costs are positively correlated with the financial performance of Nigerian-listed oil and gas companies. Recommendations were made that publicly traded oil and gas companies should increase CSR expenditures, and regulatory frameworks should be established to improve cost-effectiveness and reporting of CSR initiatives..

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Itoya, Akhator, Igbokwe and Owuze (2022) assessed the effect of CSR on financial performance in Nigeria. Findings state that CSR has a positive impact on financial performance, suggesting that socially responsible practices contribute to better financial outcomes. It was recommended that companies should integrate CSR into their core strategies to enhance financial performance.

Ikhu-omoregbe and Ugbogbo (2022) examined the influence of board mechanisms on CSR disclosures in Nigeria's oil and gas sector. Descriptive statistics, correlation, and regression analysis using E-view (9.0) were used to analyse the data. The study covered a period of 10 years (2012–2021). Findings reveal that board independence has a significant negative influence on CSR disclosures, while board size and gender diversity have insignificant negative influences. It was recommended that enhancing board independence may improve CSR disclosures among quoted oil and gas companies in Nigeria.

Mbonu and Amahalu (2022) ascertained the effect of CSR costs on the financial performance of listed deposit money banks in Nigeria. Ex-post facto research design was used. Pearson Correlation Coefficient and Panel Least Square (PLS) Regression analysis via STATA 13 was used to analyse the data. The study covered a period of 10 years (2011–2020). Findings show that corporate donations, occupational health and safety costs, training costs, and remediation costs have significant positive effects on return on assets. It was recommended that deposit money banks should engage more in CSR activities to enhance financial performance.

Onoja, Ashiko and Shakpande (2020) examined the link between CSR and profitability of quoted Nigerian firms, emphasizing the role of firm size. Ex-post facto was used for the research design and hierarchical linear regression analysis was adopted to analyse the data. Findings reveal that corporate donations and employee relations have significant positive effects on profitability, with firm size mediating the CSR-profitability relationship. Recommendations were made that Nigerian firms should adopt CSR strategies for creating shared value and improving financial performance. Regulatory authorities should monitor corporate investment in CSR to promote sustainable economic development

Despite the growing body of literature on corporate social responsibility (CSR) and environmental accounting, significant gaps remain in understanding their direct contributions to sustainable national development in Nigeria. Previous studies have largely focused on the financial performance of companies in relation to CSR (Ofurum and Ngoke, 2022; Mbonu and Amahalu, 2022) and the environmental impact of corporate practices (Ikhu-omoregbe and Ugbogbo, 2022). However, few studies have empirically examined how these practices specifically influence broader national development indicators such as GDP growth, educational attainment, and public health expenditure in Nigeria.

Moreover, while some research has investigated the relationship between CSR and corporate profitability (Onoja et al., 2020; Duo-Duo, 2025), there is a paucity of studies that analyze the integration of environmental accounting and CSR expenditures into a holistic framework aimed at fostering sustainable development at the national level. Furthermore, existing studies have not sufficiently addressed the role of regulatory frameworks in promoting CSR and environmental

reporting standards (Ikhu-omoregbe and Ugbogbo, 2022). This study seeks to bridge this gap by empirically exploring the relationship between CSR, environmental accounting, and sustainable national development in Nigeria, considering the period from 2005 to 2023.

METHODOLOGY

This study employs a quantitative research design to empirically analyze the influence of environmental accounting and corporate social responsibility (CSR) on sustainable national development in Nigeria. Secondary data were employed for the study with data sourced from the Central Bank of Nigeria (CBN), the National Bureau of Statistics (NBS), and the World Bank. The period covered 2000 to 2022 due to data availability. As at the time of carrying out this study, the World Development Indicators (WDI) database had not been updated beyond 2022.

Key variables considered include CSR expenditure, CSR projects, CO₂ emissions, renewable energy consumption, access to electricity, GDP growth rate, educational expenditure, health expenditure, and renewable internal freshwater resources. These variables were selected to capture the economic, social, and environmental dimensions of sustainability. Descriptive statistics were computed to summarize the central tendencies and variability within the data. Relationships between variables were initially explored using Pearson correlation coefficients, computed as:

$$r_{xy} = \frac{(\sum(x_i - \bar{x})(y_i - \bar{y}))}{(\sqrt{\sum(x_i - \bar{x})^2}\sqrt{\sum(y_i - \bar{y})^2})} \quad (1)$$

where r_{xy} represents the correlation between variables x and y.

Multiple linear regression models were specified to assess the direct effects of CSR and environmental indicators on sustainable development outcomes:

$$Y_t = \beta_0 + \beta_1 CSR_{exp_t} + \beta_2 CO2_t + \beta_3 RE_t + \beta_4 Elec_t + \varepsilon_t \quad (2)$$

where Y_t denotes dependent variables such as GDP growth, educational expenditure, or health expenditure, β_i are the coefficients to be estimated, and ε_t is the error term. To capture the dynamic interactions and feedback effects among key variables, a Vector Autoregression (VAR) model was utilized:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + u_t \quad (3)$$

where Y_t is a vector of endogenous variables including GDP growth, CSR expenditure, and renewable energy consumption, A_i are coefficient matrices corresponding to lag i , and u_t is the vector of stochastic errors. Granger causality tests were conducted to examine the predictive causal relationships between variables, using hypotheses of the form:

$$H_0: \beta_{1i} = 0 \text{ for all } i = 1, \dots, p \quad (4)$$

with rejection of H_0 indicating that past values of one variable help predict another. All analyses were performed using Stata 15, leveraging built-in commands for time series diagnostics, regression modeling, VAR estimation, and Granger causality testing. Stationarity of the time series was confirmed through Augmented Dickey-Fuller (ADF) tests, while diagnostic checks for multicollinearity, heteroscedasticity, and autocorrelation ensured model robustness.

This methodological approach provides a rigorous framework to explore the temporal and causal linkages among environmental accounting, CSR, and sustainable national development in the Nigerian context.

RESULTS AND DISCUSSION

Exploratory Data Analysis (EDA) provides an overview of the data landscape, setting the stage for our investigation into Environmental Accounting and Corporate Social Responsibility as Catalysts for Sustainable National Development in Nigeria. Key indicators, including CSR Expenditure, CO₂ emissions, Renewable Energy, and GDP Growth, are summarized and examined for underlying patterns. Correlation analysis and time plots unveil the interconnected rhythms of environmental impact, social investment, and

national progress over time.

Table 1: Descriptive Statistics

Variables	Mean	Std. Dev.	Min	Max
CSR Expenditure	427.4126	112.2567	168.154	642.806
CSR Project	7.772727	1.631004	5	10
CO2	3.300152	12.55271	.491376	59.5
Renewable Energy	83.4	2.423888	79.9	88.1
Access to Electricity	77.07165	121.4805	43.17997	620.59
GDP Growth	5.231888	3.743916	-1.794253	15.32916
Educational Expenditure	270.7682	193.6972	39.88	646.75
Health Expenditure	3.604636	.5800413	2.49064	5.05361
Renewable Internal Freshwater resources	1331.877	367.3846	31.28785	1798.913
N	22			

The descriptive statistics in Table 1, offer a comprehensive snapshot of the variables under investigation. CSR Expenditure averaged ₦427.41 million with moderate variability (SD = 112.26), while CSR Projects showed a consistent implementation rate, averaging nearly 8 projects annually. CO₂ emissions demonstrated high dispersion (M = 3.30, SD = 12.55), suggesting irregularities in environmental impact, likely due to fluctuating industrial activity. Renewable Energy usage remained relatively stable (M = 83.4%, SD = 2.42), indicating consistent engagement with sustainable energy sources.

Access to Electricity showed remarkable variability (SD = 121.48) despite a mean of 77.07%, hinting at disparities in infrastructure or data anomalies. GDP Growth recorded an average of 5.23% (SD = 3.74), with a broad range from economic contraction to robust expansion. Educational Expenditure (M = ₦270.77 million, SD = 193.70) and Health Expenditure (M = 3.60%, SD = 0.58) both exhibited moderate variability, reflecting fluctuations in public investment. Renewable Internal Freshwater Resources stood out with a high average of 1,331.88 cubic meters per capita (SD = 367.38), emphasizing substantial but uneven water resource availability. These patterns provide essential context for exploring relationships and trends among the variables.

Variables	CSR Exp.	CSR Project	CO2	Renewable Energy	Access Electricity	GDP Growth	Educational Exp.	Health Exp.	Renewable Internal Freshwater
CSR Exp	1								
CSR Project	-	1							
CO2	0.0708	-0.378	1						
Renewable Energy	-0.138	0.0301	-0.285	1					
Access to Electricity	0.0670	-0.379	0.999***	-0.309	1				
GDP Growth	-0.147	0.0104	-0.0919	0.530*	-0.119	1			
Education Exp.	0.0756	-0.243	0.400	-0.735***	0.431*	-	1		
Health Exp.	-0.145	0.0177	0.129	0.0133	0.0188	0.684***	-0.341	1	
Renewable Internal Freshwater	0.0517	0.260	0.0177	0.129	0.0133	0.0188	-0.341	1	

Renewable Internal Freshwater	0.252	0.344	-	0.606**	-0.810***	0.503*	-0.837***	0.146	1
			0.787***						

Table 2: Correlation Matrix

* p < 0.05, ** p < 0.01, *** p < 0.001

Table 2 presents the correlation matrix, revealing meaningful relationships among the study variables. Notably, CO₂ emissions exhibit a nearly perfect and highly significant positive correlation with Access to Electricity (r = 0.999, ***p < 0.001), suggesting that increased electrification is closely tied to carbon-intensive energy sources. In contrast, Renewable Internal Freshwater Resources display strong negative correlations with both CO₂ emissions (r = -0.787, ***p < 0.001) and Access to Electricity (r = -0.810, ***p < 0.001), implying that areas with more water resources may rely less on carbon-heavy energy systems. Additionally, Renewable Energy is significantly negatively correlated with Educational Expenditure (r = -0.735, ***p < 0.001), perhaps pointing to divergent policy or funding priorities. GDP Growth shows a positive and significant relationship with both Renewable Energy (r = 0.530, *p < 0.05) and Renewable Internal Freshwater Resources (r = 0.503, *p < 0.05), highlighting potential environmental contributions to economic performance. Meanwhile, CSR Expenditure and CSR Projects show weak or negative correlations with other variables, indicating limited direct statistical association within this context. Overall, the results underscore the complex interplay between environmental quality, social investment, and economic development.

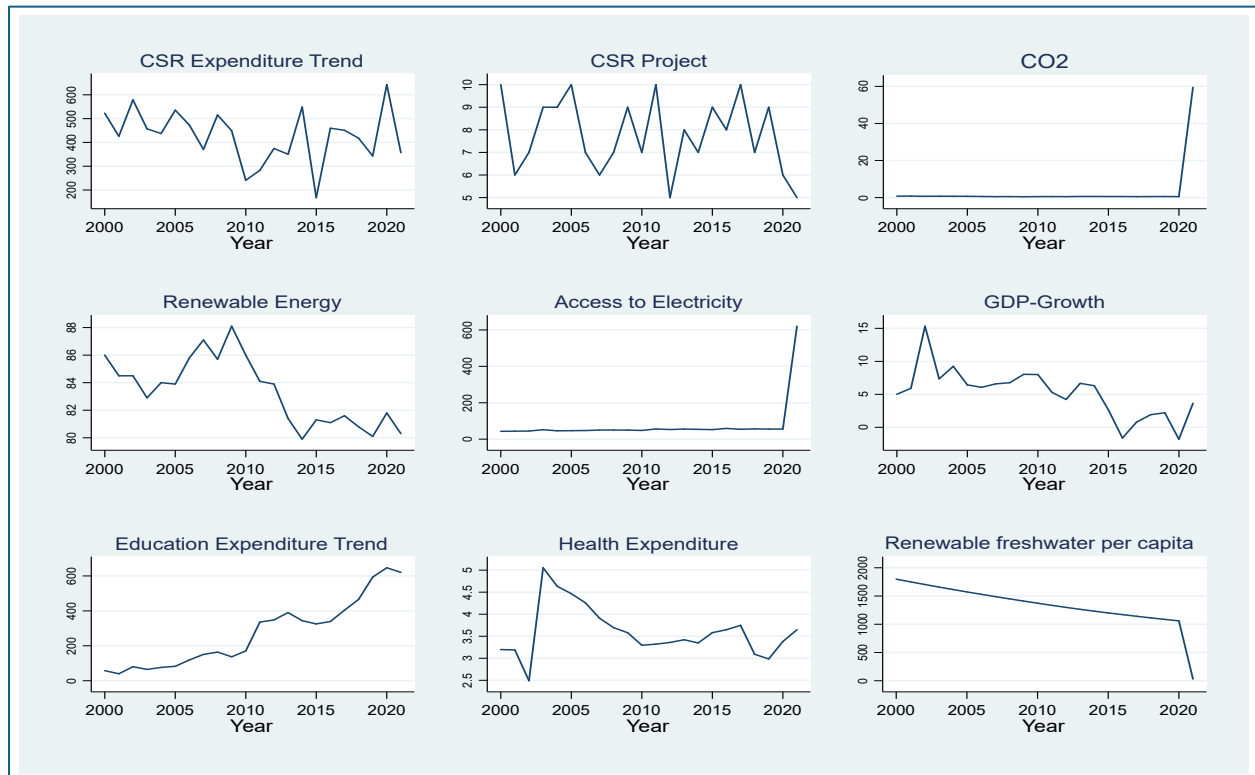


Figure 1: Time Plot (2000-2021)

Figure 1 illustrates a compelling and complex landscape of socio-economic and environmental indicators from 2000 to 2022. Corporate social responsibility (CSR) expenditure fluctuated widely over the period, peaking around 2018 at nearly 600 units before dipping again, while the number of CSR projects oscillated

between 6 and 10 annually. Meanwhile, economic indicators such as GDP growth surged above 15% in the early 2000s, they declined steadily to under 5% after 2015, revealing signs of economic deceleration. CO₂ emissions remained low and stable until an abrupt spike around 2020, shooting from under 10 to over 60 units, suggesting a potential rebound in industrial activity or environmental regulation rollback. In contrast, renewable energy use declined from 88% in 2005 to approximately 80% by 2022, hinting at stagnation in sustainability transitions.

Furthermore, from Figure 1, access to electricity remained largely unchanged until a steep jump around 2020, rising from under 200 to nearly 1,000 units, likely due to infrastructure investment or policy breakthroughs. Education expenditure steadily climbed from near zero in 2000 to over 600 units by 2022, signaling either expanding access or escalating costs. Health expenditure, after peaking at 4.5 units around 2005, declined and stabilized between 3.0 and 3.5 units. Most concerning, however, is the steady depletion of renewable internal freshwater resources, dropping from 2,000 to below 1,000 units, an unmistakable red flag for environmental sustainability.

Overall, these trends paint a narrative of uneven progress: while advances in electrification and education are notable, they are juxtaposed with mounting environmental stress and economic uncertainty, underscoring the urgency for holistic and sustainable development policies.

The Influence of CSR Expenditure and Environmental Accounting Practices on Nigeria’s Sustainable Development Outcomes.

This section presents the empirical analysis examining how CSR expenditure and environmental accounting variables influence Nigeria’s sustainable development outcomes. By modeling GDP growth, education, and health expenditures.

Table 3: Effects of CSR Expenditure and Environmental Factors on GDP Growth, Education, and Health Expenditure in Nigeria

Predictors	<i>Model (1)</i>	<i>Model (2)</i>	<i>Model (3)</i>
	GDP Growth	Education Expenditure	Health Expenditure
CSR Expenditure	-0.00243 (-0.36)	0.0560 (0.23)	0.000531 (0.68)
CSR Project	-0.0932 (-0.21)	-13.37 (-1.16)	0.123 (1.49)
CO ₂ Emission	3.961* (1.90)	-205.7*** (-4.21)	-0.0381 (-0.12)
Renewable Energy Consumption	0.306 (1.05)	-26.43*** (-3.34)	0.0478 (0.86)
Access to Electricity	-0.412* (-1.89)	21.70*** (4.31)	0.00499 (0.15)
Cons	0.128 (0.00)	1561.2* (2.11)	-1.821 (-0.32)
<i>N</i>	22	22	22

t-statistics in parentheses

p*< 0.10, *p*< 0.05, ****p*< 0.01

The regression analysis results are presented in Table 3. CSR expenditure and CSR projects did not significantly predict GDP growth, education expenditure, or health expenditure (all *p* > .05). CO₂ emissions had a positive and marginally significant effect on GDP growth ($\beta = 3.961$, *p* < .10) but a strong negative effect on education expenditure ($\beta = -205.7$, *p* < .001). Renewable energy consumption showed no

significant impact on GDP growth or health expenditure, but it was negatively associated with education expenditure ($\beta = -26.43$, $p < .001$). Access to electricity was negatively related to GDP growth ($\beta = -0.412$, $p < .10$) yet positively and significantly related to education expenditure ($\beta = 21.70$, $p < .001$). None of the predictors significantly influenced health expenditure. These findings suggest that while environmental factors notably affect economic growth and education spending, CSR expenditure does not show a statistically significant direct impact on the sustainable development indicators studied.

The Bidirectional Relationships between CSR, Environmental Sustainability, and Economic Growth

This section investigates the dynamic and bidirectional relationships among corporate social responsibility (CSR), environmental sustainability, and economic growth. Utilizing time-series econometric techniques, it aims to uncover how these factors influence each other over time. The analysis provides insights into the causal links driving sustainable development in Nigeria.

Table 4: Vector Autoregression Results

	(1)	(2)	(3)
	GDP Growth	CSR Expenditure	Renewable Energy
L.GDP Growth	-0.076 (0.174)	3.364 (9.267)	-0.119 (0.103)
L2.GDP Growth	0.029 (0.167)	-6.873 (8.891)	0.178* (0.098)
L.CSR Expenditure	0.015*** (0.004)	-0.145 (0.231)	0.004 (0.003)
L2.CSR_Expenditure	0.011** (0.005)	0.222 (0.281)	0.003 (0.003)
L. Renewable Energy	-0.225 (0.368)	-14.370 (19.584)	0.635*** (0.217)
L2. Renewable Energy	1.443*** (0.411)	8.097 (21.906)	0.215 (0.242)
Constant	-107.622*** (22.675)	934.305 (1207.488)	8.927 (13.356)

Observations = 20; Log-Likelihood = -191.23; AIC = 424.46; SBIC = 22.27

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Building on the findings from Table 3, Table 4 presents the vector autoregression (VAR) results examining dynamic interrelationships among GDP growth, CSR expenditure, and renewable energy consumption. The results indicate that past values of CSR expenditure have a positive and statistically significant impact on current GDP growth, both at lag 1 ($\beta = 0.015$, $p < .01$) and lag 2 ($\beta = 0.011$, $p < .05$), suggesting that CSR investments may contribute to economic growth over time. Additionally, lagged renewable energy consumption shows a significant positive effect on its current value at lag 1 ($\beta = 0.635$, $p < .01$) and lag 2 ($\beta = 1.443$, $p < .01$), reflecting persistence in renewable energy trends.

Notably, the second lag of GDP growth positively affects renewable energy consumption ($\beta = 0.178$, $p < .10$), implying that economic growth may encourage further renewable energy use in subsequent periods. Conversely, lagged GDP growth and CSR expenditure do not exhibit significant effects on current CSR expenditure or renewable energy, respectively, indicating some asymmetry in dynamic relationships. These results complement the earlier regression findings by highlighting the temporal influence of CSR expenditure on economic growth and the reinforcing role of renewable energy consumption over time.

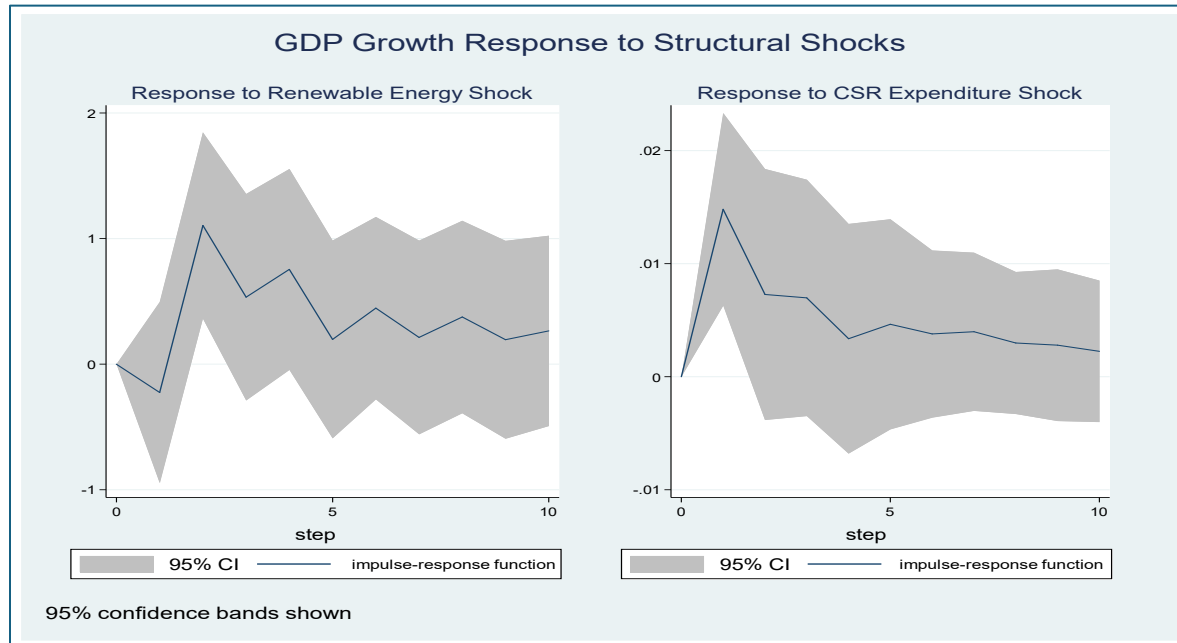
Table 5: Granger Causality Wald Test Results

Dependent Variable	Excluded Predictor	χ^2	df	p-value
GDP Growth	CSR Expenditure	13.51	2	.001
GDP Growth	Renewable Energy	22.71	2	<.001
GDP Growth	All	28.63	4	<.001
CSR Expenditure	GDP Growth	0.62	2	.734
CSR Expenditure	Renewable Energy	0.63	2	.731
CSR Expenditure	All	1.27	4	.866
Renewable Energy	GDP Growth	3.75	2	.153
Renewable Energy	CSR Expenditure	2.92	2	.232
Renewable Energy	All	6.75	4	.150

Continuing from the VAR analysis, the Granger Causality Test results in Table 5 provide deeper insights into the directional influence among GDP growth, CSR expenditure, and renewable energy consumption. The test reveals that both CSR expenditure ($\chi^2 = 13.51$, $p = .001$) and renewable energy consumption ($\chi^2 = 22.71$, $p < .001$) significantly Granger-cause GDP growth, indicating that past values of these variables help predict future economic growth. The combined exclusion of CSR expenditure and renewable energy further strengthens this predictive relationship for GDP growth ($\chi^2 = 28.63$, $p < .001$).

Conversely, the results show no evidence that GDP growth Granger-causes CSR expenditure ($p = .734$) or renewable energy consumption ($p = .153$), nor that CSR expenditure or GDP growth Granger-cause renewable energy consumption ($p > .15$). Similarly, CSR expenditure is not predicted by either GDP growth or renewable energy consumption ($p > .7$). These findings underscore a unidirectional causality running

from CSR and environmental sustainability measures to economic growth, highlighting their leading role



in Nigeria’s sustainable development trajectory.

Figure 2: Impulse Response Functions of GDP Growth to Shocks in Renewable Energy and CSR Expenditure.

Figure 2 presents the impulse response functions (IRFs) of GDP growth to structural shocks in renewable energy and corporate social responsibility (CSR) expenditure over a 10-period horizon. In response to a one-standard-deviation shock in renewable energy, GDP growth initially rises sharply, peaking at approximately 1.2 percentage points in period 2 before entering a fluctuating pattern between 0.3 and 0.8 points. However, the response is surrounded by wide 95% confidence intervals, which extend from nearly -1 to +2 percentage points at their broadest, indicating substantial uncertainty in the longer-term effects. Conversely, a shock to CSR expenditure results in a more modest yet stable increase in GDP growth, peaking at approximately 0.015 (1.5%) in period 1 and gradually declining toward 0.005 by period 10. The confidence interval in this case remains relatively narrow, ranging between -0.01 and +0.02, which suggests greater precision and consistency. These results imply that renewable energy investment can generate a strong but unpredictable stimulus to economic activity, while CSR expenditure offers a smaller, steadier contribution to GDP growth, potentially reflecting the long-term institutional and reputational benefits of sustained social investment.

CONCLUSION AND RECOMMENDATION

Conclusion

This study provides a comprehensive and multidimensional insight into the interplay between corporate social responsibility (CSR), environmental indicators, and sustainable development in Nigeria. The descriptive and correlational analyses revealed a landscape marked by both progress and disparity. While CSR activities and renewable energy consumption exhibited relative stability, alarming variability in CO₂ emissions and electricity access reflected infrastructural gaps and an overreliance on carbon-intensive energy sources. Notably, access to electricity was closely tied to CO₂ emissions, while regions rich in freshwater resources tended to have lower emissions, highlighting an environmental imbalance that calls for targeted energy reforms.

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Despite their visibility, CSR expenditures and projects showed limited immediate statistical associations with development indicators such as GDP growth, education, and health investment. However, dynamic analyses told a more compelling story. VAR and Granger causality results uncovered that CSR and renewable energy consumption significantly drive economic growth over time, even though GDP growth does not reciprocally influence them. These findings underscore a critical shift in narrative: environmental and social investments are not merely reactive or supplementary, but proactive levers for economic advancement.

Further emphasizing this, impulse response analysis showed that shocks to renewable energy can trigger substantial but volatile economic gains, while CSR investments yield steadier, more predictable contributions to GDP. This dual character suggests that while green energy offers transformative potential, CSR provides structural stability, together, forming a complementary foundation for sustainable growth.

Recommendations

Based on the findings of this study, the following recommendations are proposed: The Federal Ministry of Environment, National Bureau of Statistics (NBS), and the National Planning Commission should institutionalize environmental accounting practices through mandatory reporting frameworks and capacity-building initiatives. This should include data-driven tools to track environmental indicators and integrate sustainability metrics into national development planning, ensuring informed policy decisions that support long-term environmental goals.

Also, the Federal Ministry of Finance, Corporate Affairs Commission, and National Planning Commission should develop a national CSR policy that mandates corporate reporting on social investments and provides fiscal incentives for impactful CSR initiatives. Emphasis should be placed on aligning CSR with development outcomes in health, education, and infrastructure, especially through public-private partnerships targeting underserved communities.

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