

Research Article

Green Financing and Financial Sustainability of Quoted Oil and Gas Firms in Nigeria: An Application of the Fixed Effects Model (Fe)

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Abstract

Given renewed efforts at managing the eco-system, there is need to examine how deploying funds towards environmentally friendly projects can help firm build financial capacity to generate income, manage risks and maintain profitability over a long term as against short-term to ensure solvency, efficiency and adapt to economic dynamics. This study explores a panel fixed effect model on how green financing within the oil and gas sector can enable firms maintain financial health and meet long-term obligation. Green financing is captured by carbon credit, green investment, green management function and green bonds as explanatory variables, while financial sustainability of the studied quoted firms on the Nigeria Exchange Group Limited (NGX) is measured by ratio of profit after tax relative to the firm's operating costs. The study utilized longitudinal and cross-sectional surveys to analyse trends and cause effect of the panel data obtained from the Nigeria Exchange Group Limited for the periods 2014–2023 on ten (10) oil and gas firms quoted on the exchange. The result, revealed that carbon credit, green investment and bonds correlates negatively with financial sustainability, while green management function impacts positively and significantly enhanced financial health of the studied firms. Also, our fixed effects model revealed significant joint influence of green financing on financial sustainability. Based on these revelations, it is suggested that the government should come up with policy measures design to partner/collaborate with or offer incentives to oil and gas sector in order to defray the huge environmental compliance costs that impede short term profitability. The Federal Government of Nigeria's green finance initiatives should be embraced and adopted by Nigeria's oil and gas industry in the light of this revelation, this is so because green investment opportunities guarantee protection of the environment and help firms build reputation. Government expenditure on critical infrastructures need to be emphasized or prioritized alongside long-term financing options that will make transitioning to sustainable initiatives smooth, attractive and less difficult.

Keywords

Green Finance, Investment Management Function, Carbon Credits, Financial Sustainability

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1. Introduction

There is an urgent need to balance economic growth with climate change mitigation and environmental sustainability globally. These initiatives are driven by countries' commitment to net-zero emissions by 2050, aimed at diversifying from fossil fuels, and the necessity of attracting investment to bridge the huge infrastructure gap [29]. Increasing public outcry and agitations against ongoing environmental damages, degradation and its negative impacts caused by the oil and gas industry in Nigeria. The resolve to protect the environment through green finance is an urgent need to address the unsustainable nature of “expand first, clean up later” an economic models that is anti-environmental safety and sustainability, failure of the traditional financial systems to account for environmental risks necessitates a shift in capital toward sustainable projects, like renewable energy and pollution control.

In Nigeria alignment with the Net-Zero commitments and climate change policy embedded in climate Change Act 2021 is intended to urgently address the environmental, social and economic impacts of climate change with a broad objective to achieving net-zero emissions between 2050 and 2070. Therefore, according to Green BLOG 2023 [15], green finance and sustainability are crucial instruments for accomplishing the shift of investments toward sustainable and ecologically friendly repair initiatives. Green finance refers to the practice of businesses using Environmental, Social and Governance (ESG) considerations when making investment decisions. As a matter of fact, ESG as a holistic framework is used to evaluate a company's sustainability, ethical impact and risk management rather than focus on financial returns. By allocating funds to ecologically friendly projects, lowering ecological risks, and promoting long-term profitability, green finance strengthens financial sustainability [22].

Schumpeter's 1934 foundational innovation theory gave rise to the idea of green and sustainable finance. Later, the idea was expanded by contemporary academics to include organizational resource efficiency, environmental management systems, and sustainable development. The concept of eco-innovation and green innovation was popularized by Claude Fussier and Peter James in 1996. Klaus Rennings developed its fundamental framework in 2000, followed by [2, 4, 19], owing to its broad ramifications, sustainability is quickly gaining attention across disciplines.

The economic impact of environmental issues occasioned and exacerbated by oil and gas exploration in Nigeria especially in the oil rich Niger Delta has also raised serious concerns, hence an investigation of this sort. The awakening concerns and continuous agitations against environmental damages call for urgent need to a more sustainable economic model [5]. The adoption of sustainable development principles has spanned transformations across industries especially the oil and gas sector. Major corporations are now conducting their activities to align with the policy of environmental safety, sustainable products and societal demand. The need for firms

to develop sustainability oriented capabilities for eco-innovations is desirable for meeting technology and market demands [7]. There is urgent need for firms especially in the energy sector to develop specific capabilities in order to drive eco-innovation and manage sustainability regulations. No doubt, the oil and gas industry play crucial role in global energy production, significantly influencing the world's energy landscape and economic prosperity, hence our choice of the sector in this investigation.

Nigeria is exceptionally rich in natural resources, boasting vast reserves of crude oil, natural gas, over 40 types of minerals along with fertile agric-land. The activity of the extractive sector has been worrisome, devastating and condemnable due to emission of greenhouse gas concentrated in the Niger Delta. The effects ranges from long-term environmental, health and socio-economic adverse externalities. The scenario has necessitated swift to green and sustainable finance. Records showed that since oil exploration began in the region in 1956, there have been massive environmental pollution from oil spills, gas flaring and illegal refining, turning the region into eco-unfriendly [3]. Studies had revealed that greenhouse gas emissions and the likes had contributed substantially to climate change and ecological degradation in the region [16]. The oil and gas industry reliance on fossil fuels is a long odds with global imperative for shift to sustainable energy practices, creating urgent change toward transformative environment friendly and sustainable oriented practices.

Green financing is considered an emerging tool for delivery of environmental benefits rather than destroying [29]. Green finance is tailored to reducing carbon emissions, improving energy efficiency and fostering development of renewable energy [26]. In order to remediate and foster a more friendly ecosystem in Nigeria and particularly in the oil rich Niger Delta, green finance remains the option for the needed transformation to a sustainable economy by directing funds or capital to projects that is and would be beneficial to nature thereby reducing pollution, biodiversity, renewable energy sustenance and above all supporting environmental protection through carbon credits and green bonds [23]. The Nigerian Government has taken measures targeted at keeping the environment safe, reducing waste through pollution and emissions in her net zero commitment drives. In 2017 Nigeria launched the sovereign green bonds through the Nigerian Green Bonds Market Development Programme with the issuance of the fifty billion naira (₦50,000,000,000) sovereign green bonds in 2025. Again, the proposed \$500 million US dollar Nigeria Climate Investment Platform (NCIP) aimed at boosting agriculture, renewable energy and carbon reduction. In 2017, the Federal Government of Nigeria (FGN) issued 10.69 billion; ₦15 billion bonds in 2019 to fund projects in renewable energy, clean transportation and water management. The Nigeria Climate Investment Platform (NCIP) are initiatives to support sustainable infrastructure, agricultural resilience and green

digital innovation. Other initiatives focusing on green financing in Nigeria include; the Securities and Exchange Commission (SEC) green rules (2018) and the Federal Ministry of Environment green bonds framework guide, issuance and compliance of green projects. The Central Bank of Nigeria (CBN) guidelines for banking institutions mandate banks to incorporate environmental, social and governance (ESG) criteria into their lending practices. It was in this direction that companies like North-South Power and Access Holdings issued corporate bonds to finance solar and hydropower projects. The carbon market development established a National Carbon Market Activation Policy (NCMAP) and a national carbon registry to track emissions and provide safeguard for investors in the country. The Nigerian government through the Bank of Industry (BOI) partner with the French Development Agency (FAD) for a €100 million credit line to facilitate green projects. These steps and efforts demonstrates Nigeria's commitment and pledge to reducing greenhouse gas emissions by 20% unconditionally and 45% conditionally by the year 2030 furtherance to the Paris Agreement with a long term goal of Net-Zero emissions by 2060 (State House, Abuja Report, 2017).

Green finance is seen as remediating tool that will enable companies offset emissions, meet regulatory requirements or voluntary commitments to reducing carbon footprint [1]. The trading of carbon credits creates a market-based approach for managing emissions and incentivizes the development of projects that contribute significantly to emission reduction. Incorporating ESG in financial intermediation is a good omen for Nigeria and its eco-system as it ensures attainment of environmental goals as well adherence to broader social and governance standards in line with global best practices. It is in view of this fact that this paper seek to explores the impact of green finance on financial sustainability among oil and gas firms in Nigeria.

2. Statement of the Problem

The rationale for green financing in Nigeria is in line with the global thrives for zero-emission and also for diversifying the economy, mitigating climate change risks, and attracting international sustainable capital. The renewed vigour is to promote industrial growth and innovation which is crucial for promoting sustainability, maintaining growth, boosting agricultural productivity, and foster new green financial products [28]. Green finance is geared toward promoting energy, and funds climate resilient infrastructure thereby bridging the estimated \$59 - \$63 billion annual sustainable investment gap [18]. The Nigerian government efforts in this direction had evolved a number of initiatives ranging from issuance of series I in (2017), series II (2019), and series III (2025) bonds, valued at ₦50 billion to fund green projects. The subnational green bonds, issued by Lagos state issued ₦14.815 billion green bond in 2025 for sustainable urban infrastructure, the agricultural support for funding solar-based irrigation to reduce water usage and reduce

reliance on chemical fertilizers, the Nigerian Sustainable banking Principle (NSBP) in 2012, required banks to manage environmental risks, the waste-to-energy policy that funds projects convert waste fuel into biofuel are drivers of green Financing and motivation for sustainable finance [23, 25, 32]. The fact remains whether the goals of green initiatives been able to build financial resilience or enhance profitability of the oil and gas sector where the concept of green financing is more pronounced in the country? Therefore, the study is intended to appraise whether green finance initiatives and practices has resulted in building the oil and gas firms financial capacity toward sustainable profitability.

This study is an attempt to proffer solution to the question; "How does green finance affects financial sustainability of oil and gas firms in the country." Given that the issue regarding activities of the oil and gas industry in Nigeria and in particular the Niger Delta has been characterised with vast resources not been translated into equitable development rather increased degradation, massive insecurity challenges and the lack of a proper system governance. In the decades of oil exploration in the region, there has been concerns of oil spillage and gas flaring at facilities of the oil giants such as Shell, (SNEPCO), Chevron Nigeria, Total Energy and Exxon- Mobil Nigeria etc. Persistence oil spills has resulted to severe negative externalities in the country and most impactful in the Niger Delta region. The negative impacts ranging from devastating mangrove swamps, water pollution and contamination affecting farming and fishing activities that remains the main source of livelihood of the Niger Deltans. Gas flaring, the intensity of gas flaring in Nigeria due to oil exploration and related activities has become a source of serious concern, as the practice does not only release toxic pollutants to the ecosystem but causes respiratory illnesses, cancer and acidic rains which combine to result to shortening life expectancies now estimated at 56.9 years for women and 54.9 for men according to life expectancy global rating. The prevalence of illegal refineries popularly refer to as "kpo-fire" activities by helpless youth for survival is borne out of the neglect of development equitable to the benefits the region is contributing to the national purse.

Due to the lack of proper systemic governance within the government cycle, communities leadership and sustained agitations for environmental neglect has resulted to pipeline vandalism and sabotage, crude oil theft, community conflicts leading to militancy, kidnapping to mention but a few [8]. Green finance have emerged as a transformative mechanism for advancing sustainability within the oil and gas industry, enhancing energy efficiency, develop carbon capture and storage (CCS) as well undertake remediation actions [10, 12]. No doubt, the application of green financing has substantially drive significant improvements and long-term sustainability by directly promoting long-term economic resilience and environmental stability. However the challenge still remains among small oil and gas companies in their appreciation and less experience in green financing and in ensuring that projects meet established green standards [13]. The complexities

of navigating eligibility criteria deterred smaller firms in the industry from pursuing green financing opportunities and as such slow the adoption of sustainable practices. It is against this backdrop that, this study seek to explores the effects of green financing options on financial sustainability within quoted oil and gas firms in Nigeria. In this study, financial sustainability is measured by ratio of Profit after Tax (PAT) to company's operating costs. This metric measures a company's efficiency in generating net profit relative to its core operational expenditures. A higher ratio suggests effective management of costs and strong earning generating capacity from its core operations.

3. Literature

3.1. Theoretical Perspective

From the theoretical perspective, green financing and sustainability are often refer to as eco-innovation that emerged in the literature in the late 1980s and 1990s with [4] as innovations aimed at reducing environmental impact. The theory is deep rooted in the early works of Schumpeter as said earlier but was popularised and focused on cleaner technology with the works of [19, 30]. Green innovation emphasised the development and implementation of new or modified products, processes, practices and systems designed to reduce environmental risks, pollution and harmful impacts on the ecosystem as against the traditional practice. The theory emphasised that sustainability drives competitive advantage for companies operating in the environment not to merely view it as a regulatory responsibility but rather see it as a core transformative strategy. According to the theorist, green financing and sustainability will enhance competitiveness, creates new market opportunities and boost company in energy saving, waste recycling, reduction of carbon emissions etc. The theory stressed the simultaneous improvement of economic (profit), environmental (planet) and social (people) performance. It maintained and buttressed that business move beyond end of pipe line solutions (waste treatment) toward eco-designs and sustainable production processes i.e designing products with lower environmental impact, high recyclability and safer materials enhancing resource efficiency, minimizing hazardous waste and reducing energy consumption in manufacturing. It is all about implementing new material practices and structures that supports sustainable goals. Given this scenario therefore, green finance is seen as a transformative radical approach to reducing harm done to the environment as a result of business operations. Its transcend beyond traditional Corporate Social Responsibility (CSR) toward environmental sustainability into core financial architecture of companies. It is a paradigm shift of capital where funds are deliberately channel toward eco-friendly projects, treating ecological stability as a fundamental component of firm's financial viability. The concept of green finance makes companies view sustainability as a long-term imperative rather than a discretionary

reputational-building activity (Synergy.com, 2020). The main goal of green finance is the mobility of capital to encourage the transition to a low-carbon and more sustainable economy.

The legitimacy theory is another underpinning theory to this work as it emphasised the need for organizations to interact with the social environment as well stakeholders, it perceived the organizations' actions positive through Corporate Social Responsibility (CSR) because It builds confidence and enhances corporate reputation. This theory is all about how companies use information to gain, maintain or repair their standing in the society. Green finance incorporated in firm's financing decisions is a good strategy for repairing damaged and polluted environment caused by exploitative activities. The neglect and or act of irresponsibility to the environment and the eco-system can be restored, terminated or reduced through green finance. According to [22], examination of legitimacy theory in green financing increases awareness as businesses take responsibility of their actions on the environment. The theory also serves as a policy tool for governance. In the words of [6] environmental activities disclosure is useful to maintain, restore and regain recognition or legitimacy, hence companies must be responsive and sensitive to the environment in which they operate through green finance. The theory posits that organizations exist and operate within the society are expected to conduct their activities in a manner that should not damage the society rather create harmony that should translate into value creation. Legitimacy theory has been proven to explain sustainability disclosures. [20] in their work holds that companies should adopt sustainability reporting to legitimize their existence and relationship with the society thereby avoiding adverse publicity from the media. Corporate sustainable development disclosure is important in assisting the public to judge the extent of sustainable development compliance.

3.2. Conceptual/Empirical Perspectives

The role of green finance in investing in eco-friendly technologies, risks and returns was studied by [11]. The study examined systemic dynamics and business performance in green finance investments from 2000 to 2025. In order to assess investment options in the face of uncertain market and policy settings, the study used GA-FL optimization techniques within the MATLAB 2021b. According to the analysis, green finance increased steadily between 2000 and 2025, although annualized volatility decreased over time. The sustainability score increased to a complete alignment score of 1.00, indicating a strategic shift towards high-impact green assets. The study concluded that businesses and investors should balance profitability with ecological sustainability. The study introduced the Eco-financial resonance theory (EFRT), an innovative framework that interprets sustainable transition arising from interactions among firm internal domains, financial flows, technological innovation, policy and regulations, as well as environmental outcomes. [27] examined green finance and sustainable development in Africa. The study investigated

the relationship between green financing and development, the association between green bonds issued and size of forest area, carbon dioxide emission, food security, life expectancy and population of undernourished children from 2012 to 2020. The study used trend analysis, Pearson's product moments correction and Granger-casualty test to investigate the behaviour of the selected variables. Findings of this study revealed that the association and casualty between green finance and sustainability development indicators differed. It was found that there exist strong correlation between green finance and sustainable development, though not significant. The study found no causal relationship between green finance and sustainable development. [9] studied the modernity role of carbon accounting and financial performance of listed firm size in carbon accounting and structural equation performance. The study applied the structural equation modelling within the smart PLS version 4. Findings revealed positive but insignificant link between scope of carbon emission, emission sources, emission categories and emission factors were positively and insignificantly impacted return on assets of listed firms in Nigeria. It was also revealed that carbon emission accounting influenced financial performance of the studied manufacturing firms. [34] Examined the impact of green financing on sustainable development. Utilizing the fixed effects model on panel data from 103 countries for the periods 2000 to 2020. The study explored the role of green finance in national ESG performance. Findings revealed that green finance is conducive to enhance national ESG performance. The heterogeneity tests showed that countries with high levels of financial development, better institutional quality and fast ICT experienced higher growth of national ESG performance in green finance adding that green finance contributes to improve ESG performance. [11] studied the future of green financing and sustainability bond in Nigeria: The challenges. The study adopted doctrinal research methodology and examined sundry ways green finance bond is good for Nigeria. Results of the study underscored that there is an urgent need for legislature intervention in the area of environmental jurisprudence while concluding that green finance is fairly new in many jurisdictions, while in some, it is fairly older.

Wu, S. S. [33] looked at sustainability disclosure, green finance, and economic ramifications. The systemic review of literature was carried out by the author using the analytical framework search, appraisal synthesis and analysis (SALSA). The results showed that a company's green practices have a negative correlation with its cost of capital and a positive correlation with its financial performance. Additionally, it was shown that green financing improved economic growth and risk management. [14] investigated the connection between sustainable development and green finance. The study's main objective was to assess how significant investments in low-carbon and green projects might successfully combat climate change and foster sustainable economic growth. The study used an analytical technique to investigate the possible effects of investing in green finance, where investors should accept

poor financial returns in exchange for non-financial advantages. The study placed strong emphasis on how institutional ownership directs businesses toward social and environmental performance. The author came to the conclusion that integrating ESG into investments is essential to sustainable finance.

The function of green financing initiatives and their ability to promote sustainable development was examined [24]. The chapter examines the connection between sustainable development and green finance efforts, demonstrating how organizations use green finance to maximize economic growth and reduction in environmental damage. The authors discussed the opportunities and difficulties involved in putting green finance projects into practice, emphasizing possible approaches to get them fast through stakeholder cooperation, legislative changes, and creative financial methods. Green finance is envisioned as a transformative force that ensures businesses match their financial systems with environmental objectives and a sustainable future while also integrating environmental factors into financial decision-making processes. In his book *Green Finance in Emerging Economies*, Green finance is becoming more widely acknowledged as a means of promoting sustainable development by coordinating it with financial systems and environmental demands. [22] The study examined how green financing promotes economic growth using a conceptual and analytical methodology. The author simultaneously addressed climate change and environmental sustainability using green credits or credit lines, green bonds to invest in climate-oriented investments and programmes. The work emphasised the critical role of financial institutions that embedded ESG into investment decisions especially in emerging markets.

The study's conclusions showed that strengthening public-private partnerships (PPPs), incorporating green finance models, and encouraging financial innovation are crucial for promoting low-carbon, climate-friendly, and sustainable economies in Sub-Saharan Africa. [17] evaluated the effects of carbon finance, green credit, and securities in order to investigate how green financing affects Nigeria's environmental sustainability. The study used of multivariate data from the 2009–2023 obtained from the Central Bank of Nigeria (CBN) statistical bulletin. The results demonstrated that CO₂F is a factor associated with financial development and that green loans or financing had a positive prediction value for economic sustainability using the descriptive and inferential statistics technique. This implies that a rise in green loans is desired in order to lower CO₂ emissions and improve economic sustainability.

Meng, X et al. [21] investigated how green finance affects the sustainability of firms. The quantitative research approach was used in the investigation. The outcome showed a clear connection between green finance and business sustainability. The results showed that corporate sustainability measures have a significant impact on a company's financial performance, maintaining that green finance has a direct connection to sustainability performance, a similar study by [31] also

demonstrated that integrating ESG into bank financial choices has a favorable association with the environmental and social performance of banks in emerging markets.

Our results showed mix outcomes regarding green financing and financial sustainability, however, green investment in the Niger Delta and Nigeria at large is crucial to reverse decades of neglect, damages and environmental devastation from oil extraction. This study isolating the energy sector in Nigeria proof that green investment can mitigate climate change impacts and diversify the nation's economy from fossil fuels. In Nigeria, the Niger Delta region is one of the world's most polluted areas with its adverse consequences affecting lives and the entire eco-system. Again, the Niger Delta region is the hub of energy extraction industry in Nigeria, so while other studies focused on sustainable development, this work focused on a particular sector (energy) and financial sustainability which is considered critical for overcoming the power deficit and also to reduce dependency on diesel. Findings of this study align and support the Nigeria Energy Transition Plan (NETP) that is driving policies aimed at reducing carbon emissions, environmental remediation, and protection. In view of the present realities or outcomes we recommended measures/steps that will reverse the negative relationship at the time; we affirmed that green fianc éin the Nigeria energy sector is imperative and a good omen to better the economy and the environment.

4. Methodology and Data

4.1. Research Design

In order to ascertain the relationship between green finance (carbon credits, green bonds, green investments, and green management functions) and the ratio of profit after tax (PAT) to operating expenses as a measure for financial sustainability, the study used an explanatory and non-experimental research design. The study being a quantitative research approach utilized panel data from ten (10) oil and gas businesses listed on the Nigeria Exchange Group (NGX) within the longitudinal survey approach. EViews version 10 is used in analyzing the data. The relationship between green finance and financial sustainability in the linear regression expression or model is stated thus;

$$RPAT = \beta_0 + \beta_1 CC_{it} + \beta_2 GRL_{it} + \beta_3 GMF_{it} + \beta_4 GBD_{it} + \mu$$

Where:

RPAT = Financial Sustainability

CC = Carbon Credit

GRL = Green Investment

GMF = Green Management Function

GBD = Green Bonds

β_0 = Intercept Term

β_1 – β_4 = Coefficient of the independent variables

μ = Error term

4.2. Measurement of Variables in the Study

Carbon credit, within the context of green financing, green investment, green credit is a tradable certified instruments representing the avoidance, reduction or removal of one metric ton of carbon dioxide equivalent (CO₂) from the atmosphere, functioning as a financial mechanism that places a price on carbon pollution, channeling capital from high emission entities toward project that deliver measurable climate benefits. These credits incentivize firms to reduce emissions. If a company is able to reduce emissions below a mandatory cap, unused credits can be sold, and if it cannot it has to purchase credits from green projects to balance its impact. When a developer or an energy developer is able to reduce emissions, they can get these reductions certified as carbon credits and sell them.

Green bonds; These are fixed income financial instruments like the known capital market corporate or public bonds, but green bonds are designed to raise capital specifically for projects with positive environmental or climate benefits. Unlike the traditional bonds, green bonds require issuers to earmark proceeds for sustainability initiatives such as renewable energy, green buildings, or water management, rather than general corporate or social purposes. Nigeria is actively expanding its green bond market to fund eco-friendly projects with the Debt Management Office (DMO). As at 2025, the bond stock rose to ₦62.36bn and in May alone ₦47.33bn.

Green investment: is capital allocated to projects, companies, or technologies that directly reduce pollution, lower carbon emissions, and improve energy efficiency. Is for both financial returns and environmental friendly oriented. Green investment include; renewable energy, green bonds, climate smart agriculture, in Nigeria, we have the \$500m Nigerian Climate Investment Platform (NCIP) among others.

Green management; encompasses approach of organization management that integrates environmental consciousness into all business operations to reduce ecological footprints while at the same time enhances sustainability, efficiency and profitability. It involves management approaches that voluntarily reduce pollution, waste, and emissions. It means aligning corporate strategies with environmental stewardship.

Financial Sustainability; Profit After Tax (PAT) is the net income, it measures financial sustainability by acting as the ultimate indicator of a company's ability to generate net income, cover it costs, and fund future operations after all obligations are met. A constant and growing PAT suggests or indicates that a company can sustain its operations, reinvest in growth, and reward shareholders, while a low or negative PAT suggests potential operational and financial strain. It's an indicator of long-term viability of a firm and profitability. It demonstrate that a company is effective in generating income that should exceed costs. It's a common sense that PAT not paid is retained for reinvestment, showing capacity of self-funding. PAT is use to demonstrate financial stability to support environmental sustainability etc.

5. Results and Discussion

5.1. Result

Table 1. Correlated Random Effects - Hausman Test.

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	6.168157	5	0.2902

Variable	Fixed	Random	Var (Diff.)	Prob.
CC	-23.886405	-22.766116	26.077638	0.8264
GMF	0.650305	0.639508	0.010734	0.9170
GBD	-5.392456	-4.407704	6.345741	0.6959
GRI	-9.074793	-10.570079	1.055261	0.1455
ECM (-1)	0.653640	0.744592	0.002337	0.0599

Source: Extracted from E-Views

Table 2. Regression Results.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (CC)	-17.13183	5.311808	-3.225235	0.0019
D (GMF)	0.196683	0.361673	0.543814	0.5882
D (GBD)	-2.350997	5.277190	-0.445502	0.6572
D (GRI)	-2.844556	2.882156	-0.986954	0.3268
C	0.133150	0.232149	0.573553	0.5680
ECM (-1)	-0.379740	0.080252	-4.731845	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.352998	Mean dependent var		0.109889
Adjusted R-squared	0.232225	S.D. dependent var		2.509196
S.E. of regression	2.198628	Akaike info criterion		4.564556
Sum squared resid	362.5474	Schwarz criterion		4.981191
Log likelihood	-190.4050	Hannan-Quinn criter.		4.732568
F-statistic	2.922808	Durbin-Watson stat		1.647497
Prob (F-statistic)	0.001406			
D (CC)	-14.38363	5.189008	-2.771943	0.0069
D (GMF)	0.172149	0.357979	0.480892	0.6318
D (GBD)	-2.988957	5.226496	-0.571885	0.5689

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (GRI)	-2.887714	2.856837	-1.010808	0.3150
C	0.130372	0.232142	0.561607	0.5759
ECM (-1)	-0.280622	0.067403	-4.163364	0.0001
Effects Specification				
			S.D.	Rho
Cross-section random			0.000000	0.0000
Idiosyncratic random			2.198628	1.0000
Weighted Statistics				
R-squared	0.256218	Mean dependent var		0.109889
Adjusted R-squared	0.211945	S.D. dependent var		2.509196
S.E. of regression	2.227476	Sum squared resid		416.7784
F-statistic	5.787251	Durbin-Watson stat		1.596830
Prob (F-statistic)	0.000122			
Unweighted Statistics				
R-squared	0.256218	Mean dependent var		0.109889
Sum squared resid	416.7784	Durbin-Watson stat		1.596830

Source: Extracted from E-Views

Table 3. Descriptive Statistic.

	FS	CC	GMF	GBD	GRI
Mean	2.332200	4.897100	5.087600	5.170400	5.430300
Median	1.215000	4.910000	5.220000	5.170000	5.410000
Maximum	22.83000	5.060000	5.300000	5.220000	5.530000
Minimum	-2.400000	4.690000	3.520000	5.100000	5.360000
Std.Dev.	3.732390	0.083512	0.490024	0.034287	0.058766
Skewness	2.520570	-0.899616	-2.847526	-0.245732	0.668470
Kurtosis	11.62619	3.630137	9.152855	2.320294	2.030816
Jarque-Bera	415.9345	15.14294	292.8802	2.931403	11.36137
Probability	0.000000	0.000515	0.000000	0.230916	0.003411
Sum	233.2200	489.7100	508.7600	517.0400	543.0300
Sum Sq. Dev.	1379.143	0.690459	23.77222	0.116384	0.341891
Observations	100	100	100	100	100

Source: Extracted from E-Views

5.2. Discussion of Findings

According to the results of the regression, 21% of the changes in financial sustainability were explained by green financing. It's interesting to note that financial sustainability was adversely connected with green bonds, carbon credits, and green investments, although there was a slight positive correlation with green management function. According to the analysis, any increase in the explanatory factors' negative coefficients can lower the average degree of financial sustainability among the quoted companies under study. Similarly, a unit decrease in green financing leads to an increase in financial sustainability.

The detrimental impacts is however contrary to opinions of theorists and earlier predictions. The negative impact of green finance investment suggests that a unit rise or drop in green finance has a significant impact on financial sustainability, maintaining that green investment will influence financial sustainability in a variety of ways as a gauge of growth and financial performance. This imply that green investment in ecologically friendly projects and activities can raise a company's market value in a number of ways. Green bonds, carbon credits, and green investments have a negative and negligible influence on financial sustainability, among the Nigeria enterprises studied. Green management function has a positive but negligible impact on financial sustainability. This indicates that an increase in green financing will cause financial sustainability as shown in the result.

From the above outcomes, the negative relationship observed between green finance indicants except green management function in the oil sector firms studied justified by high upfront capital costs, asset stranding risks, and lower short-term returns when compared to the traditional high-yield fossil fuel investment. Actually the inverse relationship highlights the structural and operational trade-offs, the oil sector operatives face. In Nigeria as observed, upfront capital expenditures and sunk costs makes transitioning oil and gas operations such as gas flaring reduction, carbon capture, or renewable energy integration require massive initial investments and oil companies operating within the oil rich Niger Delta already face high operational risks, so diverting resources to green finance/infrastructure will definitely lead to short-term liquidity constraint, thereby resulting to declining profitability among other factors accounts for the negative outcomes found within the Nigeria context hinges”.

6. Summary / Conclusion

The outcome of our analysis indicates that green financing exact influence on financial sustainability of the studied firms. The study therefore established that there exist a link between green financing indicators and financial sustainability in several ways (impact mixed). While parameters like green bonds, carbon credit as well green investment showed

a negative link, green management revealed a positive correlation indicating that increase or decrease in green financing is capable to impact financial performance of firms leading to sustained profitability generating ability within the oil and gas sector in Nigeria. The negative outcomes between majority measures of green investment and financial sustainability observed in Nigeria and particularly within the oil and sector is not far fetch from high compliance costs, weak regulatory enforcement, and lack of long-term capital for clean technology. It is possible that early investment in green initiatives will erode immediate profits, while poor environmental reporting and high investment risks ranging from activities of Militants in the oil rich Niger Delta where these firms are predominantly located deter investors confidence investing in the sector. The huge infrastructure deficit in the country makes investment in clean technology relatively expensive resulting to draining profitability. The negative association with majority of the green finance indicants and financial sustainability notwithstanding, it is our submission/view that going green within the oil or energy sector in Nigeria and in particular the oil bearing region is necessary, as not going green will further degrade the environment; hence our recommendations to address the factors identified as accounting for the negative relationship. The government of Nigeria at all levels need to enforce for implementation by the energy sector her policies aimed at improving the ecosystem and economic diversification. On the other part, operatives in the oil sector need to take advantage of government initiatives in this regard despite the sunk costs making the transition expensive. While we encourage them to invest heavily in green projects/infrastructure, we also appreciate the fact that diverting resources will initially lead to liquidity/profitability reduction, at the long-run, no doubt it will place corporations strategically to build reputation and achieve sustainable financial performance and capacity, if the transformation is sustained in the face of prevailing challenges.

7. Recommendations

Based on the results, the study recommends the following;

The government should come up with policy measures design to partner/collaborate with or offer incentives to oil and gas sector in order to defray the huge environmental compliance costs which impede short term profitability, this way the observed negative link would be eroded.

The Federal Government of Nigeria's green finance initiatives should be embraced and adopted by Nigeria's oil and gas industry in light of this revelation, this is so because green investment opportunities guarantees protection of the environment and help firms build reputation because green investment in the oil sector is as important as technology disruption in banking sector.

Government expenditure on critical infrastructure need to be emphasized or prioritized alongside long-term financing

options that will make transition to sustainable initiatives smooth, attractive and less difficult. This if achieved will fast-track the nation's economy diversification policy especially in the energy sector.

There is need for strict enforcement of relevant environmental regulations and reporting standards, green accounting and environmental compliance by the Nigerian Government, this will make the energy sector responsible to the environment and align with global shift to climate concerns.

There is need for government and relevant stakeholders in the sector to invest and overhaul the security architecture to allay the fears and or high security risk perception of investors in the sector, if the security issue is tackled, investors will be attracted.

A more tax friendly policy or reforms aimed at reducing green taxes such as petroleum profit tax and environmental cleanup requirements which will positively impact oil and gas firms' profitability need to be introduced (i.e. government should share in the huge initial cost impeding investment in the sector).

In a drive to building capacity in innovation, technical know-how, there is need for development of knowledge and competences relevant to green financing across organizational levels. This is possible via target training programs, workshops and educational initiatives, thereby boosting stakeholders' awareness as well awakening consciousness.

The creation of carbon capital market is imperative so that oil and gas firms with clean environmentally friendly projects can obtain long-term capital for green investment is necessary to attract broader range of investors that are interested in sustainable finance. It is believed that access to funds at a reduced or zero cost will accelerate green investment within the energy sector in Nigeria.

Abbreviations

ESG	Environmental, Social and Governance
NCIP	Nigeria Climate Investment Platform
FGN	Federal Government of Nigeria
SEC	Security and Exchange Commission
CBN	Central Bank of Nigeria
NCMAP	National Carbon Market Aviation Policy
BOI	Bank of Industry
NSBP	Nigerian Sustainable Banking Principle
SNEPCO	Shell Nigeria Exploration and Production Company
CCS	Carbon Capture and Storage
CSR	Corporate Social Responsibility
EFRT	Eco-financial Resonance Theory
NETP	Nigeria Energy Transition Plan
DMO	Debt Management Office
PPPs	Public-Private Partnerships

Author Contributions

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Conflicts of Interest

The authors declare no conflicts of interest.

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