JOURNAL OF GLOBAL ACCOUNTING
9 (3) September, 2023.
ISSN: 1118 – 6828
https://journals.unizik.edu.ng/joga

ACCOUNTING FOR CLIMATE CHANGE AND OPERATIONAL PERFORMANCE OF QUOTED OIL AND GAS FIRMS IN NIGERIA AND SOUTH AFRICA

***Paper Type**: Original Research Paper.*
***Correspondence** katexangel@gmail.com*

***Key words:** Climate change, Revenue growth, Carbon accounting, Environmental problems, Return on investment, profit margin.*

CITATION: Nwankwo, K.N. & Orji-Okafor, T.G. (2023). Accounting for climate change and operational performance of quoted Oil and Gas firms in Nigeria and South Africa, *Journal of Global Accounting*, 9(3), 270 - 287.

Available:https://journals.unizik.edu.ng/joga

Kate N. Nwankwoh[1] Tochukwu G. Oiji-Okafor[2]

[1]Professor, [2]Research Scholar, [1&2]Department of Accountancy, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.
1. Email: katexangel@gmail.com
2. Email: tg.okafor@unizik.edu.ng

ABSTRACT:

This research work examined the topic: Accounting for climate change and operational performance of quoted oil and gas firms in Nigeria and South Africa. Specifically, this study assessed the relationship between greenhouse gas, carbon emissions, environmental issues, revenue growth, return on investment, profit margin, respectively for the period 2013 – 2022. The reason for this study is to establish new empirical findings to bridge the identified gaps observed in the literature review. This study is anchored on the contingency theory. Few empirical works were reviewed for this study. Ex – post facto research design was employed. The population of this study is twenty-seven (27) quoted oil and gas firms in Nigeria and South Africa as at 31st December, 2022. Inferential statistics of the stated hypotheses were analyzed with the aid of E-View 9.0 statistical software, using: co-efficient of correlation and regression analysis. Three null hypotheses were formulated. Results revealed that accounting for climate change does not have significant effect on revenue while positive significant was observed on return on investment. Net profit margin shows negative at 5% level of significance. Climate change based accounting mostly falls under non-financial reporting, which means it focuses on disclosing environmental, social, and governance (ESG) performance. The study recommended amongst others that Oil and Gas firms could conduct regular risk assessments to identify climate-related risks and their potential impacts on the company's operations and profitability to ensure that risk-mitigating strategies would not only manage risks, but also ensure business continuity and profitability that would benefit the stakeholders.

1. INTRODUCTION

Over the years, financial accounting literature discussed the nature of accounting information as well as its usefulness and its limitations, (Chua, 1986; Gaffikin, 2008; Hopwood. 2000). Accounting is a social practice that changes over time in relation to government policies economic, political and

environmental activities. Carmona and Ezzamel (2007); Jones and Oldroyd (2009), asserts that, the purpose and emphasis of accounting as a social practice will continue to change as demand for different information grows and as organizations priorities shift towards pressing social and environmental issues. This shift has been apparent over decades ago, as Accountants have become more involved in the disclosure of social and environmental information emerging from government organizations, non-governmental organizations, public and private corporations, (Adams & Frost, 2008; Campbell, Craven & Shrives, 2003;). Although researchers are still assessing the contribution that such information is making to a more sustainable and equitable future, it indicates a change in the broader sociopolitical context in which these institutions operate. Besides, towards the end of the last century, the world began to pay attention to issues relating to climate change, especially after the fourth industrial revolution in year 2000 and the resultant air pollution from factories, big companies and the emergence of the effects of global climate change. From the extant literature reviewed, it is glaring that there is observed gap between literatures on accounting for climate change and operational performance of firms from developed countries and similar works in emerging economies, especially Nigeria and South Africa.

Several studies have been carried out on accounting for climate change mainly in other countries but not specifically aliening it to operational performance, whose findings and results may not be suitably applied to Nigeria and South African environment, hence the need for this research to establish new empirical findings. The gaps that this study has identified and which it hopes to fill include period gap, diagnostic tools and variable segment gap of structural characteristics. This study will therefore fill these gaps by looking at the structural characteristics of firms and their effect on operational performance considering them for a period of ten (10) years as against five years in the reviewed literatures. Also, few authors used secondary data for their analysis; Majority based their analysis on primary data. In an attempt to bridge the established gap in the statistical tools, this study will employ the use of correlation analysis with the aid of E-view statistical tools to test and determine the nature, direction and the extent of the relationship between the studied variables. Furthermore, previous studies focused on mono country of the economy but this present study will be focused on two countries, Nigeria and South Africa. In addition to the aforementioned gap, most of the studies on Accounting for climate change particularly in Nigeria and South Africa failed to include the strong relationship that has been established in the literature between greenhouse gas emissions, carbon emissions, environmental issues and operational performance of firms.

1.1 Objectives of the Study

The general objective of this study is to evaluate the effect of accounting for climate change on the operational performance of quoted Oil and Gas firms in Nigeria and South Africa. Specifically, the study intends:

i. to ascertain the effect of the level of climate change based accounting on revenue growth of quoted oil and gas firms in Nigeria and South Africa.
ii. to determine the level of association between climate change based accounting and return on investments of quoted oil and gas firms in Nigeria and South Africa.
iii. to evaluate the relationship between climate change based accounting and profit margin of quoted oil and gas firms in Nigeria and South Africa.

1.2 Hypotheses

The following null hypotheses were formulated:

H_{01}: Climate change based accounting is low and has no significant effect on revenue growth of quoted oil and gas firms in Nigeria and South Africa.

H_{02}: Climate change based accounting is not a significant predictor of return on investment of quoted oil and gas firms in Nigeria and South Africa.

H_{03}: Profit margin is not significantly affected by climate change based accounting of quoted oil and gas firms in Nigeria and South Africa.

2. LITERATURE REVIEW

2.1 Conceptual review

2.1.1 Climate Change

Climate change is the long-term alteration of temperature and typical weather patterns in an environment. The cause of current climate change is largely human activity, such as burning fossil fuel, natural gas, oil, and coal and petroleum for energy use. Burning these materials releases what we called greenhouse gases into Earth's atmosphere, (epa.gov, 2020). In researcher's point of view, climate change is seen as a global issue that affects human and environmental activities drastically.

2.1.2 Environmental issues

Environmental investments are no longer seen as an additional cost but they are seen as of corporate social responsibility therefore, environmental reports are seen as necessary in communicating with stakeholders to address their environmental concerns, Levine, (2016).

Companies are realizing that it is their corporate responsibility to achieve sustainable development whereby they meet the present needs without compromising the ability of future generations to meet their needs. Economic growth is important for both shareholders and stakeholder alike in that it provides the condition in which protection of the environment can best be achieved.

2.1.3 Carbon accounting

Carbon accounting by disclosure creates a competitive advantage for companies, and reduces the risk of corporations being penalized by governments. Carbon disclosure may even contribute to the company getting some government facilities. In addition, carbon accounting helps decision-makers in companies to build policies that reduce climate change by seeking alternative energy or products that are free of polluting emissions. It helps researchers measure the contribution of companies to climate change as well as their contribution to decontamination. (corporatefinanceinstitute.com, 2022).

2.1.4 Net profit margin

Net Profit Margin (also known as "Profit Margin" or "Net Profit Margin Ratio") is a ratio used to calculate the percentage of profit a company produces from its total revenue. It measures the amount of net profit a company obtains per naira of revenue gained. The net profit margin is equal to net profit (also known as net income) divided by total revenue, expressed as a percentage.

2.1.5 Revenue growth

Revenue according to Adam, (2006); is the fund required by companies to finance its activities. These funds are generated from different sources depending on the nature of each firm's business model. In other words, revenue is money and money surrogate received or receivable by firms or other types of business establishments through their operating activities, Hornsby, (2015). Also, Dandago and Alabade, (2000); described revenue as income required by businesses to finance its growing expenditure. Summarily, revenue may also be described as any derived or accrued income by a business entity through direct business activities, interests, dividends, and so on. Inferring from the foregoing definitions therefore, revenue simply is the total amount of income accruing to a firm from various sources within a specified period of time, Ekpoese, Umanah, Akpan and Okafor, (2019).

2.1.6 Return on Investment

According to Guy and Curry, (2021); Return on investment (ROI) is a performance measurement used to evaluate the efficiency or profitability of an investment or compare the efficiency of a number of different investments. ROI is calculated by subtracting the initial value of the investment from the final value of the investment (which equals the net return), then dividing this new number (the net return) by the cost of the investment, and multiplying it by 100.

2.2 Theoretical Review

2.2.1 Contingency theory

According to Fred, (1960); Contingency theory is an approach to the study of organizational behavior in which explanations are given as to how contingent factors such as technology, culture and the external environment influence the design and function of organizations. The essence of contingency theory is that best practices depend on the contingencies of the situation. Contingency theory is often called the "it all depends" theory, because when you ask a contingency theorist for an answer, the typical response is that it all depends. The term contingency as used in contingency theory is similar to its use in direct practice. A contingency is a relationship between phenomena. If one phenomenon exists, then a conclusion can be drawn about another phenomenon. The Contingency theory is important because it analysis dependent and independent variables to accomplish an effective work environment. Also, improving work environments for employees can increase an organizations overall performance. A Contingency theory is an organizational theory which claims that there is no best way to organize a corporation, to lead a company or to make decisions. Instead the optimal course of action is contingent upon the internal and external situations. The impact of contingency theory holds that the effect of organizational performance of organizational structure depends upon how far the structure fits the contingencies such as uncertainty, strategy and size (Kulkarni, 2017).

2.3 Empirical Review

Several, qualitative and quantitative studies have examined the relationship between accounting for climate change and operational performance of firms in different countries and sectors over the last few decades.

Babalola, (2012); examined the relationship between corporate social responsibility and profitability of randomly selected firms in Nigeria. Ordinary least square was employed for data analyses. Findings from the analyses showed that the sampled firms invested less than ten percent of their annual profit in social responsibility, thus the result obtain was a negative relationship. It was noted that the study showed a mix results of the relationship between concerned dependent and independent variables, which makes the research in this area inconclusive. For instance, many researchers conducted their

studies using different disclosure indices and different measures for dependent and independent variables. Again, most previous researchers adopted profit after tax and before tax as preferred measure of performance. As a way of complementing the gap observed in previous literature in this subject area, the current researchers deemed it important to examine social cost and revenue growth in the oil and gas sector of the Nigerian economy.

Chapple, Ariel and Zuk (2011), examined the association between high- and low-carbon emissions intensity (a dichotomous variable) and the market value of equity for a sample of 58 publicly traded Australian firms expected to be affected by a proposed national Emissions Trading Scheme (ETS) that was originally scheduled to begin in 2011. The study found that the market penalized firms that will be affected by the proposed ETS, and relative to low carbon-intensive firms, high carbon-intensive firms suffer a penalty of 6.57 percent of market capitalization. However, the study neither examined nor corrects the voluntary nature of the firms' carbon emission (for instance, self-selection bias).

Clarkson, Li, Richardson and Vasvari (2008**);** used a sample of 191 firms in five high-pollution industries, and developed a content analysis index based on the GRI to assess the level of discretionary environmental disclosures in environmental and corporate social responsibility (CSR) reports (or similar disclosures provided on the firms' websites). The study provided evidence that firms with better (worse) environmental performance with respect to Toxics Release Inventory emissions are more (less) likely to provide voluntary environmental disclosures in environmental and CSR reports.

Kingston and Scott, (2021); re-inventing regulation for the challenge of Climate change, in their study which evaluated the 'new' regulatory techniques, their advantages and their limitations and asked whether market based methods potentially have as many drawbacks as more traditional methods. The researcher argued that, in addition to market based methods, a broader range of regulatory techniques should be considered which makes use of the combined power of law, the market and also social and community pressures to influence behavior in a way that effectively addresses climate change.

Ekemezie and Okafor, (2020); examined the relationship between environmental accounting disclosures of selected manufacturing firms and their return on assets, net profit margin and earnings per share. Correlation research design was employed in the study and time series data of 40 randomly selected quoted manufacturing firms were collected from their annual reports and analyzed using point bi-serial correlation analytical tool with the help of SPSS version 23. The findings revealed that there exists a significant and positive association between environmental accounting disclosures and earnings per share, return on assets, net profit margin, firm's age and audit firm type. The researcher concluded based on the findings that environmental accounting disclosure influences performance of

firms and It was recommended that government and standard setters should develop a standard framework for the mandatory disclosure of corporate environmental information to ensure uniformity, consistency and comparability of environmental information, enhance performance of firms and allow stakeholders to know when these firms are environmentally responsible.

Brammer Brooks and Pavelin, (2006); investigated the relationship between environmental accounting disclosure and performance, findings showed a negative relationship between environmental performance and stock returns which was largely attributed to large amount of expenditure in environmental disclosure.

Fahria, Sahibzada andAbdul, (2016); investigated the impact of environmental disclosure on firm's performance in USA for the year 2015 using greenhouse gas emission, water consumption and waste disposal was used to measure the independent variable while market share was used to measure the dependent variable; findings revealed that reduction in greenhouse gas emission, water consumption and waste disposal has a significant positive relationship with performance of firms by increasing firm's value and demand for products.

Okafor, (2018); Environmental costs accounting and reporting on firm's financial performance: A Survey of Nigerian quoted oil companies. The author aimed at ascertaining the effect of environmental costs on firm performance. To achieve this objective, the study made use of financial reports of oil companies quoted in the Nigerian Stock exchange market from years 2006 – 2015. Regression analysis was employed with the aid of statistical Package for social sciences (SPSS). The results of the statistical analysis indicate that better environmental performance positively impact business value of an organizations. Moreover, environmental accounting provides the organization an opportunity to reduce environmental and social costs and improve their performance.

Mongie, (2019); Voluntary climate change disclosure in South Africa: There is increasing evidence that anthropogenic carbon dioxide emissions are the major cause for global warming. A changing external environment and societal pressure is driving companies to respond to climate change and to limit further contribution where possible. Despite carbon emissions still being largely unregulated and carbon disclosure not being mandatory, many companies in South Africa have voluntarily decided to reduce emissions and make disclosures to the Carbon Disclosure Project (CDP). Institutional, socio-political and economic voluntary disclosure theories all indicate that there is a pressure for companies to monitor their climate mitigation, evaluate the costs of disclosing and manage stakeholders' pressures by producing voluntary climate change disclosure. The CDP scores the disclosure made by each company as a measure of the company's progress towards environmental stewardship.

3. MATERIAL AND METHOD

This study used *ex-post facto* research design and secondary data. Data sourced from Nigeria and South African Stock exchange and their annual accounts. The researcher made use of the entire population known as census sampling technique. The reason being that the population were few in number and can be captured with ease. The selected quoted firms includes: Nigeria: Shell Nigeria, Exxonmobil, Chevron, Total, Agip oil, Addax Nigeria, NNPC, Equinor, Nexen and Petrobas. South Africa: Adco, Petrosa, DCD, Camac-energy Inc, Chevron, KCA-Deutag, Lesedi-nuclear service, Autopipenational oil wellvarco, Prowalco, SA oil and oil alliance, Sac oil holdings ltd, Schlumberger, Shell, SA petroleum refineries(SAPREF), Total, Toal Gaz, Worley parson. The data extracted includes: environmental problems, green house gas, carbon emissions, total assets, shareholders fund, inventory turnover, total liabilities, net income, as well as other relevant ratios that were required by a particular variable of the quoted oil and gas companies on annual basis from 2013-2022.

Table 1 Variable Description / Operationalisation of Variables

Variables (Code)	Operational Definitions
Dependent Variable (Operational Performance)	
Metrics:	
Net Profit Margin	Net Profit/Total revenue x 100
Return on Investment	Net Profit x 100 Cost of investment 1
Revenue growth	Difference between current year's revenue and immediate prior year's revenue.
Inventory turnover	Cost of goods sold divided by the average inventory for the period.
Cost of sales	Add Beginning inventory to purchases for the period less ending inventory.
Independent Variable (Accounting for Climate change)	
Proxies:	
Environmental issues	GRI G4 index and ISO 26000 as a standard to measure environmental issues in this study.
Carbon emissions	To measure the carbon emissions of companies and calculate the contribution of companies in the cost of removing the effects of carbon pollution and contribute to the reduction of climate change.
Green house gas emissions	GRI G4 index

Control Variables	
Firm Size (FSZ)	Natural logarithm of total asset
Leverage (LEV)	Total liabilities/Total Asset

Source: Researchers' compilation.

The model of this study was adopted from panel regression model of Hausman, (1978). In Statistics, the Hausman test is sometimes described as a test for model misspecification. In panel data analysis (the analysis of data over time), the Hausman test can help you to choose between fixed effects model and a random effects model. The test evaluates the consistency of an estimator when compared to an alternative, less efficient estimator which is already known to be consistent. It helps one evaluate if a statistical model corresponds to the data. Panel data, sometimes referred to as longitudinal data, is a data that contains observations about different cross sections across time. Examples of groups that may make up panel data series include countries, firms, individuals, or demographic groups. The model used for this study is as below:

$Y_{it} = \beta o + \beta_1 G_{it} + \beta 2 C_{it} + e_{it}$

Where,

Y_{it}: represents operational performance of firms at time t.

G_{it}: is a vector of accounting for climate change variables.

C_{it}: Control variables.

e_{it}: the error term which account for other possible factors that could influence Y_{it} that are not captured in the model.

Based on the above model, five regression equations are developed based on the objectives of this study to do the desired analysis. These models are:

Model 1: $RG_{ít} = \beta o + \beta_1 GHGít + +\beta_2 CEít + B_3 ENVít + \beta_4 FSZít + \beta_5 LEVít + \varepsilon_{it}$

Model 2: $ROI_{ít} = \beta o + \beta_1 GHGít + +\beta_2 CEít + B_3 ENVít + \beta_4 FSZít + \beta_5 LEVít + \varepsilon_{it}$

Model 3: $NPM_{ít} = \beta o + \beta_1 GHGít + +\beta_2 CEít + B_3 ENVít + \beta_4 FSZít + \beta_5 LEVít + \varepsilon_{it}$

Where:

βo = Constant term (Intercept)

$B_1 - \beta_5$ = Coefficients to be estimated

ε = Error term that are not captured in the model

$RG_{ít}$ = revenue growth of individual firm í at time t

$ROI_{ít}$ = return on investment of individual firm í at time t

$NPM_{ít}$ = net profit margin of individual firm í at time t

GHG_{it} = greenhouse gas emissions of individual firm í at time t

CE_{it} = carbon emissions of individual firm í at time t

ENV_{it} = Environmental problems of individual firm í at time t

FSZ_{it} = Firm Size of individual firm í at time t

LEV_{it} = Leverage of individual firm í at time t

í: individual firms

t: time periods.

3.1 Decision Rule

Accept the alternative hypothesis, if the Prob (F-stat) of the test is less than 0.05. Otherwise reject.

4. RESULT AND DISCUSSIONS

4.1.1 Descriptive Statistics

Table 2: Numerical Description of Variables

	NPM	ROI	RP	INVT	COS	ENV	C	GHG	LEV	SIZE
Mean	-5.725	-0.089	3.052	0.688	0.722	9.043	2.245	1.117	0.201	11.01
Maximum	21.29	4.260	245.8	2.060	3.826	40.00	22.00	11.00	1.233	14.62
Minimum	-319.7	-6.335	-0.793	0.047	0.406	0.000	0.000	0.000	0.000	8.945
Std. Dev.	36.09	1.046	25.47	0.258	0.952	8.607	4.998	2.444	0.268	0.842
Kurtosis	65.29	20.68	89.73	51.31	4.293	4.288	9.775	8.700	6.669	7.616
Obs	92	94	94	90	92	94	94	94	94	94

Table 2 above is a collection of measures of central tendencies of each study variable for South Africa and Nigerian oil and gas companies. Beginning with measures of profitability, Net Profit Margin (NPM) had a mean value of -5.725 implying that on the average, oil and gas companies made losses even with earned revenue. The negative value of NPM is attributed to higher expenses in comparison with revenues. Normality of data via kurtosis value shows that the distribution is leptokurtic, implying that there are more extreme values in the distribution in relation to the mean. This is confirmed by the minimum and maximum values of -319.7 and 21.29. The measure of dispersion connoted by the standard deviation of 36.09 shows that data values largely varied with one another. The next profitability measure, ROI was averagely -0.089 implying that investors or shareholders had negative book returns across the period. In other words, every unit of currency in shareholders' fund yielded a negative return of -0.089. Kurtosis value was above 3 and confirmed high frequency of 'outliers' within the distribution. The spread of values is confirmed by the standard deviation of 1.046 and

expected range calculated from the difference between minimum value, -6.335 and maximum value, 4.260.

On growth in earnings, mean revenue growth was 3.052 implying that most times, revenue increased from a previous year to a current year. Kurtosis value of 89.73 showed that the distribution did not meet normality assumptions (k>3). Some companies also had revenue decline in subsequent periods as confirmed by a negative minimum value, -0.793.In measuring cost of sales, it was important to have it in ratio forms to ensure that all firms have relative base for comparison. Thus cost of sales was measured as a proportion of revenue. On the average, cost of sales was 72% of total revenue from operations as depicted by the mean value of 0.722. Minimum value was 0.406 confirming 40.6% of revenue while maximum value was 3.826 confirming extremely high direct costs at almost four times revenue value.

Control variable, leverage had a mean value of 0.201 implying that on the average, oil and gas companies studied had 20 percent debt financing in their capital structure. The highest debt ratio was 1.233 while the least was 0 showing that some firms were all-equity financed in some of the periods. Firm size showed that least asset values were in hundreds of millions of naira while largest firms had asset values in trillion naira. Carbon reporting, environmental reporting and reporting on greenhouse gases emissions ranged between 1 and 9 items reported on average. There were quite large values of disclosures of up to 40 reported items.

Table 3: Comparative Descriptive Values of Selected Variables

	Nigeria			*South Africa*		
	CARBON	ENV	GHG	CARBON	ENV	GHG
Mean	1.279	5.603	0.500	4.769	18.038	2.731
Maximum	17.00	22.00	7.000	22.00	40.00	11.00
Minimum	0.000	0.000	0.000	0.00	6.00	0.00
Std. Dev.	3.697	5.456	1.430	6.866	8.915	3.606
Skewness	3.035	1.926	3.425	1.771	0.670	1.152
Kurtosis	11.10	5.775	14.67	5.063	2.690	2.964
Observation	68	68	68	26	26	26

Comparing the disclosures in both countries, reporting in oil and gas companies in terms of carbon, environmental and emissions reporting were more detailed in South African countries. All South African companies in all the periods reported on environmental responsibilities unlike Nigerian companies that had no reports on environmental impacts for some companies in particular periods.

4.2 Discussion of findings

Results revealed that accounting for climate change did not have significant effect on changes in revenue. Climate change accounting mostly falls under non-financial reporting, which means it focuses on disclosing environmental, social, and governance (ESG) performance. While this information is valuable to investors and stakeholders concerned about sustainability, it does not have a direct impact on the company's financial results or revenue growth. As an ESG performance related report, effects may be more stock-market based than on just direct income given that such climate change concerns and implementation of sustainable practices might attract environmentally conscious environmentally focused investors within and outside the region. The insignificance recorded can also be attributed to the low consciousness of the catastrophic impacts of climate change among consumers especially among Nigerian consumers, 63 percent of which, have been categorized as living in multi-dimensional poverty according to the National Bureau of Statistics (November, 2022). Furthermore, addressing climate change and sustainable practices generally involve long-term investments and strategies. These efforts may not result in immediate financial gains or increased revenue growth in the short term. Instead, they are geared toward building resilience, managing risks, and ensuring the company's viability in the face of changing environmental regulations and market expectations. The results negate the findings of Babalola, (2012) that revealed negative relationship between related sustainability costs and revenue growth in the oil and gas sector of the Nigerian economy. Ogbonna *et al.* (2019) in the same vein found an inverse relationship between weak control of carbon emission [synonymous with absence of accounting for climate change on firm level] and output value on a national scale.

A return on Investment was found to be positively influenced by climate-change based accounting. Implementing sustainability measures and adopting environmentally friendly practices can lead to cost reductions and increased operational efficiency. This could be through investing in waste reduction, energy-efficient technologies and resource usage optimization which reduces utility and material expenses. These cost-saving initiatives are thus bound to directly improve a company's bottom line and increase ROI. Climate change poses various risks to businesses, from regulatory risks such as fines and litigation for exceeding emission limits, physical risks such as unsustainable supply chains and adverse weather events and brand image risks. By accounting for climate change and proactively addressing these risks, companies can reduce the potential financial impacts of such events and protect their investments, leading to more stable and predictable ROI. In addition, Investors are increasingly taking environmental factors into account when making investment decisions.

Companies with robust climate change accounting and sustainability strategies are more likely to attract socially responsible investors and gain access to sustainable investment funds. Access to such capital can help companies finance growth opportunities, research and development, and other strategic initiatives that can drive higher returns on investment. Companies that account for climate change are more likely to identify new business opportunities arising from sustainable products and services. These opportunities when embraced support innovation in exploration and other oil and gas activities leading to higher ROI. Companies that take a proactive stance on climate change and communicate their efforts transparently to stakeholders can build a positive brand reputation that may translate to customer loyalty and higher sales volumes in the petroleum downstream sector, contributing to better returns on investments. This study results confirm to those of Oti *et al.* (2012) when they found that returns on investments were positively affected by environmental responsibilities in manufacturing firms. In the same vein, Fahria *et al.* (2016) found that reduction in greenhouse gas emission, water consumption and waste disposal has a significant positive relationship with performance of firms by increasing firm's value and returns in the United States. Matsumura *et al.* (2011) also predicted and found that less carbon emission levels from conscious organizational actions improved firm value. Elmadhoun and Reddy (2020) also affirmed that accounting for carbon creates competitive advantage for firms, which in turn reflect in rising return on investments, Osemene *et al.* (2016) had contradictory results as these scholars found that environmental accounting is not a significant determinant of return on capital employed. Rather, the Researchers attribute returns to service quality. Study outcome also showed that accounting for climate change negatively impacts reported profit margins. Oil and gas companies may face higher costs associated with environmental compliance and mitigation efforts. They may be required to invest in emissions reduction technologies, carbon capture and storage, and environmental restoration, which can increase operating expenses and squeeze profit margins. For South Africa, carbon pricing mechanisms such as cap-and-trade systems and carbon taxes exist, and these obligations directly impact oil and gas firms by increasing the cost of carbon-intensive activities, leading to reduced profitability.

As climate change becomes a greater concern, some investors may shy away from oil and gas companies or demand higher returns to compensate for perceived risks, which can impact the firm's cost of capital and profitability. If an oil and gas firm decides to transit towards more sustainable practices or alternative energy sources, there may be substantial costs associated with diversification and restructuring. These transition costs can impact short-term profitability before potential benefits materialize. As global efforts increase towards transition to cleaner and more sustainable energy sources, there is a growing shift away from fossil fuels. This decline in demand for traditional energy products can lead to reduced sales volumes and lower revenue, putting pressure on the firm's profit

margin. Comparing with past works, Osemene *et al.* (2016) and Ekemezie and Okafor, (2020); found a positive effect of environmental accounting on net profit and earnings per share across sampled manufacturing companies, as against the negative relationship found in this research work. Shehu (2013) also negated this study's findings with an insignificant impact found on profit after tax of Nigerian banks.

CONCLUSION AND RECOMMENDATIONS

This study employed inferential tools in determining the implications of firm-specific accounting for climate change on firms reported operational and profitability performance. The research demonstrated that accounting for climate change has mixed effects on corporate performance. On the positive side, companies that proactively address climate change concerns and implement sustainable practices can achieve cost savings through energy efficiency measures, access new market opportunities in the renewable energy sector, and attract investors that prioritize sustainability. Furthermore, transparency can heighten firm reputation, leading to potential competitive advantage and increased performance. On the negative spectrum, challenges such as regulatory compliance costs, increasing popularity of renewable energy sources, costs of transitioning from unsustainable to sustainable processes and unrest from host communities can cause immediate decline of direct costs, inventory turnover and profit margins in the oil and gas industries especially with recurring instances of gas-flaring and oil spillage. In conclusion, climate change accounting is no longer merely an issue of legal or voluntary adherence; it is a strategic requirement for organizations to maintain their resilience, competitiveness, and long-term viability. Companies may not only prevent risks but also capitalize on opportunities given by the shift to a low-carbon economy by incorporating climate change consideration into their financial and operational decision-making processes. Companies that embrace climate change accounting and integrate their plans with environmental aims also have high potentials of success in the developing global landscape as governments, investors, and consumers prioritize sustainability.

Based on these findings, the study proffers the following recommendations:

Improved transparency especially for Nigerian firms, would increase demand in international supply chain especially for regions such as Germany with the recent German Supply Chain Act, that require companies that supply products adequately report on environmental and other areas of sustainability. Implementing emissions reduction strategies, such as investing in advanced technologies, carbon capture and sequestration techniques, and process optimization, can help mitigate the adverse environmental footprints of oil and gas operations while improving overall efficiency. Identification

of opportunities to improve energy efficiency, reduce and recycle waste, and optimize resource usage to lower direct costs has also been recommended for practice.

REFERENCES

Abba, M. 2015 (as cited in Dandago and Alabade, 2000), Expenditure and internally generated revenue relationship. https://papers.assrm.com.

Adams, C.A. and Frost, G.R. (2008); Integrating sustainability reporting into management practices. Accounting forum, 32(4), 288-302.

Adams, W.M. (2006), The future of sustainability, rethinking environment and development in the twenty-first century.

Ascui, F. (2014), A review of carbon accounting in the social and environmental accounting Literature. Social and environmental accountability, *journal*,. 34(1), 6 – 28.

Babalola, Y.T. (2012); The impact of corporate social responsibity on firm's profitability in Nigeria. *Euro journals Inc 2012 https://www. Eurojournals.com/EJEFAS.htm/*

Brammer, S., Brooks, C. and Pavelin, S. (2006); Corporate social performance and stock return, https://doi.org/10.1111/j.1755-053x 2006.tb00149.x

Campbell, D., Craven, B. and Shrives, P.J. (2003); Voluntary social reporting in three FTSE sectors Emerald.

Carmona, A.J. and Ezzame, I. (2007); Development of management accounting in Russia.

Cassim, A., Radmore, J., Dinham, N.and Mccllum, S.,(2021); The South African climate finance landscape 2020.

Chapple, K., Ariel, H. B. and Zuk, M., (2011),Estimates of regional annual abundance- Science Direct.

Chua, W. F., (1986); Radical developments in accounting thought. 61(4), 601-632

Clarkson,P.M., Richardson, G.D. and Vasvari,F.P., (2008); Revisiting the relation between environmental performance – accounting organization and society 2008 vol. 33 issue 4-5, 303-327.k, M., (2011),Estimates of regional annual abundance- Science Direct.Corporatefinanceinstitute.com, 2022 – Carbon accounting explanation.

Ekemezie, C.N. and Okafor, O.G., (2020); Relationship between environmental accounting disclosures.

Ekpoese, J., Umanah, N., Akpan, R. and Okafor, U., (2019); Environmental cost and financial performance of quoted oil and gas companies in Nigeria.

Eltaib, E.E., (2012); Environmental disclosures on Australian oil and gas companies. https: //ro.uow/edu/au/thesis/3777.

Elmadhoun, R.I and Reddy, G.N. (2020), The role of carbon accounting in managing the climate change. IJSR.

Epa.gov, 2020 – Climate change definition.

Fahria, T., Sahibzada, M. and Abdul, B., (2016); The impact of environmental reporting on firm's performance: *International Journal of Accounting and Business Management.* 4*(2)*, 22-45. DOI: 10.24924/ijabm/2016.11/v41ss2/285.301.

Fang, R.W. and Steenkemp, E.M., (2008); Effect of service transition strategies on firm value, Journal of marketing 72(5).

Farlex, F., (2012); Reference and Learning tools – www.farlex.com

Fred, F., (1960); Fiedlers contingency model – leadership skills- mind tools.

Gaffikin, M., (2008); Accounting theory research, regulation and accounting practice. Pearson education, Sydney.

Global Reporting Initiative, (2017); Sustainability Reporting Standards. Available:https://www.globalreporting.org/information/about-gri/pages/default.aspx. Investopedia https//www,investopedia.com

Gonzalez-Benito, J. and Gonzalez-Benito, O., (2005); Environmental proactivity and business performance: An empirical analysis. *Omega*, 33*(10)*, 1-15.

Groen, T., Nabuurs, G.J. and Schelhaas, M.J., (2006); Carbon accounting and cost estimation in forestry projects using CO2FIX V.3. Climatic Change 2006; 74:269–88. Grainger A. Compensating for opportunity costs in forest-based global climate change mitigation. *Critical Reviews in Environmental Science and Technology* 1997;27:163–76.

Guy, B.E and Curry, B. (2021); Understanding return on assets – Fobes.

Hahn, R., Reimsbach, D. and Sechiemann, F. (2015); Reviewing the literatures on carbon Disclosures.

Hahn, R., Sechiemann, F. and Reimsbach, D., (2015); Climate change and transparency – Organizations and environment.reporting.

Hausman, J.L., (1978); Specification tests in economics, econometrics, vol. 46, issue 6 125-1271

Hopwood, A.G., (2000); Accounting organizations and society, 25(8), 763 -766

Hornsby, S. (2015), Annual reports – https://www. Hornsby.nsw.gov.au.

Howard-Grenville,J., Buckle, S.J., Hoskins, B.J. and George, G., (2014); Climate change and Management from the editors. Published in Academy of mgt. Journal, 2014, June 57(3) 615 – 623.

International Organization for Standardization, (2010); ISO 26000: Social Responsibility Available:http://www.iso26000.info.org (Accessed March 7, 2019).

Investor Network on Climate Risk, Letter to Florence E. Harmon, Acting Secretary, *Securities and Exchange Commission* (22 October 2008), available at http://www.ceres.org

IPCC, (2013); Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y.

Jones, M.J., and Oldroyd, D., (2009); Financial accounting: past, present and future – Science Direct 33(1), 1-88.

Kingston, S. and Scott, C. (2021), Reinventing regulation for the challenges of climate change.

Kulkarni, V. (2017), Towards a contingency theory of enterprise risk management. https://www.research.net.

Levine, M.T. and Pranatharthi, H.C. (2016); Adverse effects of voriconazole: Matsumura, E., Prakash, R. and Vera-munoz, S.,(2014);Firm value effects of carbon emissions and carbon disclosures, the accounting review; 89(2)695-724.

Matsumura, E., Prakash, R. and Vera-munoz, S.,(2014);Firm value effects of carbon emissions and carbon disclosures, the accounting review; 89(2), 695-724.

Mongie, C., (2019); Voluntary climate change disclosure in South Africa. More top listed firms measure, Star – Business report (South Africa) 20 November, 2008

Ogbonna, G.N., Ojeaburu, F. and Ehilegun, E.C. (2019); The nexus between carbon emission and the performance of the Nigerian economy, University of Port-Harcourt, unpolished article.

Osemene, F.O, Kolawole, D, and Oyelakun, O., (2016): Effect of environmental accounting on the performance of quoted manufacturing companies in Nigeria.

Okafor, T.G, (2018); Environmental costs accounting and reporting on firm financial performance: A survey of Nigerian oil companies. *International journal of finance and accounting studies 7(1).*

Oti, P.A., Tiesieh, A.T. and Effiong, S.A., (2020); Environmrntal costs and its implication on the return, global journals of mgt & Business, 12(7).

Rafaj, P., Fischer, G.K. and Nebojsa, N. (2011); RCP 8.5–A scenario of comparatively high greenhouse gas emissions, Climatic Change, 109:33-57, doi:10.1007/s10584-011-0149-y

Rankin, M., Windsor, C. and Wahyuni, D., (2011); An investigation of voluntary corporate greenhouse gas – *accounting, auditing & accountability journal,* 24(8), 1037-1070.

Robinson, C. and Schumacker, R. (2009); Multiple linear regressions view points, 2009, Interaction effects: centering variance inflation factor.

Saha, A.K., Saha, B., Choudhury, T. and Jie, F., (2019); Quality versus volume of carbon disclosures and carbon reduction targets: evidence from UK higher education inst.

Sahibzada, M.H., Fahria, and, Abdul, B., (2016); The impact of environmental reporting on firms performance, school of accounting & Business mgt. FTMS College Malaysia.

Shehu, A., (2013*); Polish journal of food and nutritional sciences 63(4), advances in biological research 7(4), 122 – 128.*

Stern, N., (2006); The economics of climate change: the stern review - LSE

XU, J., (2019); Disclosure of Carbon Accounting Information in a Low Carbon Economy. DEStech Transaction on Social Science, Education, and Human Science, (iceme).

Yuan, Z., Hou, L., Zhon, Z.and Sun, Y., (2022); The impact of accounting information quality on corporate labour investment efficiency. Evidence from china: journal of systems sciences and system engineering 31, 594-618.