



**ECOLE DOCTORALE DES SCIENCES JURIDIQUES, POLITIQUES, ECONOMIQUES
ET DE GESTION**

FACULTES DE SCIENCES ECONOMIQUES ET DE GESTION (FASEG)



Année : 2026

N° d'ordre

THESE DE DOCTORAT

Formation doctorale : Economie et changement climatique

Présenté par:

Fadeke Omolabake ADEOYE

**PRATIQUES EN MATIÈRE ÉMISSIONS DE CARBONE ET PERFORMANCES
ORGANISATIONNELLES DES ENTREPRISES AU NIGÉRIA**

Supervisors :

**Directeur de Thèse : Mohamed Ben Omar NDIAYE, Professeur Titulaire, Facultés
Sciences Economiques, Université Cheikh Anta Diop de Dakar**

Co-directeur de Thèse: Popoola LABODE, Professeur Titulaire

Président du Jury

Mouhamadou Lamine DIAL : Professeur titulaire, Université Cheikh Anta Diop de Dakar

Rapporteurs

Omar SENE : Professeur Assimilé, Université Alioune Diop de Bambey

Mikemina PILO : Professeur Assimilé, Université de Kara, Togo

Amadou Thierno GAYE : Professeur Titulaire, Université Cheikh Anta Diop de Dakar

DECLARATION

I, Fadeke Omolabake ADEOYE hereby declare that this thesis titled “Carbon Emission Practices and Organizational Performance among Companies in Nigeria “which was submitted in partial fulfillment of the requirements for the award of the degree of Doctor of Philosophy (PhD) in Economics, specialty in Climate Change Economics at the Université Cheikh Anta Diop de Dakar is the product of my own work and that no part or whole of it has been submitted for the award of a degree or diploma at any level in the University or any other university or institution. All materials used for this thesis have been duly acknowledged both in the text and in the reference section.

Signature and Date

Main supervisor:

Mohamed Ben Omar Ndiaye, Ph.D.

Director of Development Policy Analysis Laboratory and Public Policy Institute
University of Cheikh Anta Diop (UCAD), Senegal;
West African Science Service Center on Climate Change and Adapted Land Use (WASCAL).

Co-supervisor:

Labode

Popoola, Ph.D., FFAN

Professor of Forest Economics & Sustainable Development
Department of Social and Environmental Forestry
Faculty of Renewable Natural Resources
University of Ibadan, Ibadan, Nigeria

DEDICATION

I dedicate this thesis to God, my parents, my siblings, husband Sunmola Kehinde Joshua and my daughter IseOluwa Excellent Sunmola.

ACKNOWLEDGEMENTS

I would like to seize this opportunity to express my appreciation to the Federal Ministry of Education and Research (BMBF) and West African Science Service Center on Climate Change and Adapted Land Use (WASCAL) for providing this amazing scholarship opportunity, and their huge financial investment and all the support for this doctoral programme. This scholarship has afforded me the opportunity for career advancement, expansion of professional and social networks, among other benefits.

I express my profound gratitude to the entire staff of the Climate Change Economics programme, West African Science Service Center on Climate Change and Adapted Land Use – Université Cheikh Anta Diop (WASCAL-UCAD), from the former Director Prof. Ibrahima Barry, to the current Director Prof. Assane Beye for their support that ensured the smooth running and completion of this programme.

To my thesis supervisors, Mohamed Ben Omar Ndiaye and Prof. Labode Popoola, I would like to specially thank them for their guidance, support, patience, comments and corrections, professional and fatherly advice that have significantly fostered the development and completion of this thesis. Their guidance has been operational to my career and self-discovery. I am greatly inspired by their high standard and vast knowledge, discipline and commitment. I am indeed very grateful for these. I am also grateful to all lecturers and board members for their constructive comments and feedbacks.

Special thanks to my wonderful husband, Mr. Sunmola Kehinde Joshua, my daughter, IseOluwa Excellent and my entire family for their enormous support. May the good Lord reward your labour and bless you abundantly. I am also grateful to all my friends and loved ones whom I met in the course of this Doctoral programme, for their support in diverse ways.

Table of Contents

Declaration -----	i
Dedication -----	ii
Acknowledgements -----	iii
Table of contents -----	iv
List of tables -----	vii
List of figures -----	viii
ACRONYMNS AND ABBREVIATIONS -----	ix
Abstracts -----	xi
GENERAL INTRODUCTION -----	1
1.1 General background -----	1
1.2 Problem statement -----	3
1.3 Research questions -----	10
1.4 Research objectives -----	10
1.5 Research hypotheses -----	10
1.6 Significance of the Study -----	10
1.7. Thesis structure -----	12
CHAPTER ONE: The effect of professional qualification and organization type on companies' decisions to adopt carbon emissions practices -----	13
INTRODUCTION	
2.1 LITERATURE REVIEW -----	14
2.1.1 Carbon Emissions Practices -----	14
2.2.2 Carbon Emissions Practices in Nigeria -----	15
2.2.2.1 Gas Flaring Reduction -----	15
2.2.2.2 Renewable Energy Adoption -----	16
2.2.2.3 Energy Efficiency Programmes -----	16
2.2.2.4 Sustainable Agricultural Practices -----	16
2.2.2.5 Urban Green Initiatives -----	16
2.2.2.6 Waste Management and Recycling -----	16
2.2.2.7 Carbon Credit Projects -----	17
2.2.2.8 Public Awareness and Education Campaigns -----	17
2.2.2.9 Industrial Emissions Monitoring -----	17
2.2.3 Carbon Emissions Practices Agencies -----	17
2.2.3.1 Federal Ministry of Environment -----	17
2.2.3.2 National Environmental Standards and Regulations Enforcement Agency (NESREA) -----	18
2.2.3.3 Nigerian Gas Flare Commercialization Programme (NGFCP) -----	18
2.2.3.4 Energy Commission of Nigeria (ECN) -----	18
2.2.3.5 Nigerian Energy Support Programme (NESP) -----	18
2.2.3.6 Nigerian Sovereign Investment Authority (NSIA) -----	19

2.2.3.7 Clean Energy and Climate Change Initiatives (CECCI) ----- 19

2.2.3.8 Nigerian Upstream Petroleum Regulatory Commission (NUPRC) ----- 19

2.2.3.9 Lagos State Environmental Protection Agency (LASEPA) ----- 19

2.2.3.10 African Clean Energy Coalition (ACEC) -----19

2.2.4. Global Report Initiative Guidelines ----- 20

2. 2.4.1 Climate Change: Risk and Opportunity ----- 20

2.2.4.2 Greenhouse Gas Emissions (GHGE) ----- 20

2.2.4.3 Energy Consumption -----20

2.2.4.4 GHG Reduction and Cost -----21

2.2.4.5 Carbon Emission Accountability -----21

2.3 THEORETICAL REVIEW ----- 22

Corporate Social Responsibility (CSR) Theory -----22

2.4 EMPIRICAL REVIEW ----- 23

2.5 Materials and Methods -----26

2.5.1 Data ----- 26

2.6 Population of the Study ----- 26

2.7 Model of the study ----- 27

2.8 Results ----- 29

Chapter 2: impact of carbon emission practices on financial performance among firms in Nigeria

3.1 Introduction ----- 41

3.2 Literature Review ----- 42

3.2.1 Theoretical Review -----42

3.2.2 Triple Bottom Line (TBL) Theory ----- 42

3.2.3 Institutional Theory -----44

3.2.4 Stakeholder theory ----- 44

3.3 Empirical review ----- 45

3.4 Materials and methods ----- 46

3.4.1 Two-Stage Least Squares (2SLS) ----- 46

3.4.2 Model variables ----- 47

3.4.3 Model Specification ----- 48

3.4.4 Assumptions and Diagnostic Tests ----- 49

3.5 Conclusion ----- 51

3.6 Policy implications ----- 52

Chapter 3: Impact of carbon emission practices on non-financial performance among firms in Nigeria ----- 54

4.1 Introduction ----- 54

4.2 Literature review ----- 59

4.2.1 Theoretical Review ----- 59

4.3 Carbon Emissions Practices ----- 61

4.3.1 Regulatory frameworks on carbon emission practices ----- 61

4.3.2 Voluntary initiatives for carbon emission practices ----- 64

4.3.3 Non-financial performance ----- 65

4.4 Empirical Review -----66

4.5 Research Gap -----68

4.6 Materials and methods -----69

4.6.1 Data -----69

4.6.2 Methodology -----71

4.6.3 Variables of the model ----- 71

4.7 Results and discussion ----- 73

4.7.1 Two-Stage Least Squares 2SLS estimates analysis ----- 73

4.8 Robustness analysis: Endogenous Switching Regression Model estimates ----- 76

4.8.1 Estimation of the impact of CEP on NFP: Endogenous Switching Probit Regression ----- 77

4.9 Results ----- 80

4.10 Conclusion ----- 83

4.11 Policy Implication ----- 84

5.0 GENERAL CONCLUSION ----- 84

References ----- 87

Appendices ----- 97

List of Tables

Table 1: Descriptive statistics of the respondents -----	29
Table 2: Cross tabulation of the highest professional qualification and organization type -----	30
Table 3: Multivariate probit (Energy Consumption Dimension) -----	33
Table 4: Impact of highest professional qualification on carbon emission practices -----	36
Table 5: Organization type on carbon emission practices -----	38
Table 6: Two-stage least squares 2SLS: Impact of carbon emission practices on financial Performance -----	50
Table 7: Description of variables -----	72
Table 8: Two stage least square 2SLS: Impact of carbon emission practices on non-financial performance -----	73
Table 9: Endogenous switching regression results of impact of carbon emission practices on non-financial performance -----	80
Table 10: Conditional Expectations, treatment and heterogeneity effect -----	82

List of Figures

Figure 1: Cross tabulation graph of organization type and professional qualification -----	31
Figure 2: Trend of increasing CO ₂ emissions per capital -----	57
Figure 3: Share of global CO ₂ emissions from fossil fuel -----	58
Figure 4: Per capital CO ₂ emissions -----	58
Figure 5: Map of study area -----	120

ACRONYMNS AND ABBREVIATIONS

CSR: Corporate Social Responsibility

NOSDRA: National Oil Spill Detection and Response Agency

CLN: Carbon-Limits Nigeria

CCN: Climate Change Network Nigeria

NESP: The Nigerian Energy Support Programme

NGFCP: Nigerian Gas Flaring Commercialization Programme

NDCs: Nationally Determined Contributions

NESREA: National Environmental Standards and Regulations Enforcement Agency

ECN: Energy Commission of Nigeria

NESP: Nigerian Energy Support Programme

NSIA: Nigerian Sovereign Investment Authority

CECCI: Clean Energy and Climate Change Initiatives

NUPRC: Nigerian Upstream Petroleum Regulatory Commission

LASEPA: Lagos State Environmental Protection Agency

ACEC: African Clean Energy Coalition

EC: Energy Consumption

CPD: Continuing Professional Development

NUC: National Universities Commission

2SLS: Two-Stage Least Squares

FP: Financial Performance

NFP: Non-financial performance

CEP: Carbon Emission Practices

SASB: Sustainability Accounting Standards Board

GRI: Global Reporting Initiative

ESR: Endogenous Switching Regression

UCLA: University of California, Los Angeles

NPCC: The National Policy on Climate Change

DPR: Department of Petroleum Resources

REMP: Renewable Energy Master Plan

TBL: Triple Bottom Line

MNCs: Multinational corporations

GRI: Global Reporting Initiative

CAC: Corporate affairs commission

HPQ: Highest Professional Qualification

NES: Nigerian Environmental Society

COREN: Council for the Regulation of Engineering in Nigeria

CIPSMN: Chartered Institute of Purchasing and Supply Management of Nigeria

GHG: Greenhouse gas

GHGE: Greenhouse gas emissions
IPCC: Intergovernmental Panel on Climate Change
HAQ: Highest Academic Qualification
IPPU: Industrial processes and product use
ACR: American Carbon Registry
VCS: Verified Carbon Standard
TCFD: Task Force on Climate-related Financial Disclosures
NFPM: Non-Financial Performance Measures
PCA: Principal Component Analysis
LO: Level in Organization
ATE: Average Treatment Effects
HE: Heterogeneity Effects
TT: Treatment effect on the treated
TU: Treatment effect on the untreated

Abstracts

There is growing demand on companies to practice carbon emission reduction strategies that comply with sustainability standards as global climate obligations increase. That is why this study aims to investigate the relationship between carbon emission practices and organizational performance of companies in Nigerian companies. Primary data were obtained using a well-structured questionnaire administered to 384 companies cutting across manufacturing, oil and gas, extractive industries, information technology, and construction/real estate. The variables consist of both financial performance indicators such as income tax, profit and total assets and non-financial performance indicators such as customer loyalty, employee morale, product quality and market share. To achieve the aim of the study, data collected from companies from selected states in the country were analyzed using descriptive statistics, principal component analysis (PCA), multivariate probit regression, quantile regression, two-stage least squares (2SLS) regression and endogenous switching regression. The analysis was done in three stages. First, multivariate probit model was adopted to estimate the determinants of adoption of carbon emission practices using quantile regression for robustness check. It was shown in the findings that organizational type is a strong determinant showing the tendency of construction/real estate firms to adopt carbon emission practices. There is more likelihood for professionals at the higher cadre to adopt carbon emission practices. The second phase involved the use principal component analysis to capture financial performance and non-financial performance indexes which are organizational performance indicators. Two-stage least squares (2SLS) regression was adopted to estimate the effect of carbon emission practices on financial performance of companies and the results showed that adoption of carbon emission practices has a positive influence on companies' financial performance implying that companies with environmentally friendly activities improve their financial outlook. Nonetheless, adoption of carbon emission practices negatively influences non-financial performance. Lastly, Endogenous Switching Regression (ESR) was used for robustness check so as to ascertain the consistency of the findings, showing that adopters and non-adopters of emission practices experience significantly different performance trajectories. In general, the results highlight two parallel realities; carbon emission practices improve financial performance but also result in short-term non-financial performance trade-offs, especially in capital-intensive industries. Getting Nigerian companies to adhere to national climate targets, sector-specific sustainability regulations, more robust institutional incentives, and professional training are necessary. The study concludes that while carbon emission practices can strengthen financial competitiveness, they impose short-term non-financial trade-offs in the Nigerian context. Policy implications include the need for sector-specific sustainability frameworks, professional training, and financial incentives to companies that adopt the practices. Also, green finance such as green bonds and climate funds should be accessible so as to encourage investment in sustainability practices.

Keywords: Carbon emission practices, organizational performance, financial performance, non-financial performance, Nigeria

GENERAL INTRODUCTION

1.3 General background

In recent years, Nigeria has achieved unprecedented progress in industrial and economic development which has resulted in significant increases in carbon emissions from diverse sectors, particularly oil and gas, manufacturing, and energy. Numerous international accords, like the Paris Agreement and the Kyoto Protocol, put Nigeria on notice of the need to enact policies that simultaneously reduce carbon emissions and economic expansion. With regard to sustainability, many organizations in Nigeria were skeptical that environmental laws could negatively impact business profitability and operational efficiency (Okoye and Adeleke, 2023). However, literature coming from developed countries believe a favourable reputation from environmentally-friendly initiatives eventually results in efficient, and thus, cost-effective organizational performance. Under the direction of National Environmental Standards and Regulations Enforcement Agency (NESREA) and Department Petroleum Resources (DPR), the Nigerian government has developed monitoring and controlling emissions guidelines, with most of the government's attention focused on compliance. Although many firms continue operating unsustainably, the means by which the Nigerian government attempts to change this behaviour is relatively weak. Despite the support of green financing from the banking sector, industries still face challenges in adopting greener innovations due to lack of understanding and expensive alternatives. In Nigeria, some work has been done to understand the relationship between corporate responsibility towards the environment and the profitability of businesses, but results vary by business sector, large or small scale enterprises, and how much regulations are followed (Erin, Adegboye and Bamigboye, 2022). Some companies have started using corporate social responsibility (CSR) in their business strategy to increase customer loyalty and attract financiers while using carbon management to meet their branding objectives. On the other hand, small and medium-sized enterprises (SMEs) have more difficulties employing measures to reduce greenhouse gas emissions because of budgetary issues and insufficient skilled staff. Extractive industries, particularly oil and gas ventures in the Niger Delta region, have been heavily condemned for environmentally destructive practices which impair their social license to operate and create tensions with local communities. The international companies operating in Nigeria have adopted carbon control measures more readily because of pressure from outsiders and the parent company's policies. There are encouraging signs of change of attitude of some companies because more of them now appreciate the positive side of reducing carbon emission.

Interest in this regard has markedly increased as researchers look at how carbon emission activities affect business profitability, competitiveness, and compliance in different Nigerian sectors (Okoye and Adeleke, 2023; Sanusi and Sanusi, 2019). The growing focus on sustainable business activities indicates that organizational performance in Nigeria is likely to be more and more dependent on appropriate strategies for managing carbon emissions.

The economic activities that result in carbon emissions have attracted a lot of attention recently in relations to their contribution to protecting the environment, economic development, and ethics in the business world. There are numerous theoretical frameworks that aim to reason and justify the existence of these practices including, Stakeholder Theory, Institutional Theory, the Triple Bottom Line (TBL) Theory and Corporative Social Responsibility Theory (CSR). These theories state that businesses are not supposed to only focus on profit maximization but also take into account the social and environmental consequences of their business activities (Yusuf and Ogundele, 2021). The reasons for implementing carbon emission practices have also been associated with positive economic impacts like better financial results, improvement of corporate image, compliance with legal regulations, and reduced costs over time. Supporting evidence has been gathered from Nguyen *et al.* (2021) and Orjinta *et al.* (2024), suggesting that firms adopting green energy technologies and sustainability reporting often leads to profitability and increase in investor confidence. These approaches, however, come under fire for their effectiveness as some experts claim that the implementation of carbon discharging policies could financially burden, especially small, resource-poor firms. Stringent environmental regulations often require a substantial capital investment which can lead to a rise in operational costs, reduced competitiveness, and job cuts in fossil fuel-based industries. Still, global and domestic businesses regulations continue to grow, driving businesses towards sustainable practices. For instance, in Nigeria, the government is trying to deal with carbon emissions by introducing carbon emission policies like the Nationally Determined Contributions (NDCs) part of the Paris Agreement and different environmental sustainability policies. Still, the NDCs are poorly enforced and underfunded leading to questions regarding the effectiveness of these policies. Evidence provided in Okoye (2021) and Sanusi and Sanusi (2019) pointed out that there is an increase in Nigerian firms embracing sustainability policies, but more so among large firms than in smaller ones due to the resource constraints. Furthermore, as a result of inconsistent regulations micro and small businesses find it difficult to comply because of limited resources. Incongruities and corruption within governance structures equally obstruct the effective enforcement of carbon emission policies. A third important

constraint pertains to the level of existing projects and policies which do not motivate active participation from corporations. On the one hand, larger firms have the means to fund the implementation of sustainable approaches, whereas, smaller firms do not have access to funding and technical know-how. This difference leads to different rates of progress in carbon emission reductions among economic sectors. Besides, there is very little literature on carbon emission practices especially in Nigeria, as most studies give attention to developed countries with stronger regulatory systems. The gap in research focusing on the specific context of Nigerian firms that bear most of the burden of complying with the carbon emission practices makes it impossible for policymakers to formulate substantive policies. In addition, literature usually neglects the socio-economic and political context of carbon emission control policies in developing countries, which results in policies not suitable for Nigeria being formulated (AbdulKareem, Elaigwu and Ismail, 2021).

The scanty literature on the peculiar difficulties experienced by Nigerian firms in adopting carbon emission practices presents a problem, since there are no efficient policies that can be formulated to aid Nigerian firms in such cases. Therein lies the gap. Furthermore, the literature largely ignores the socio-economic and political context of developing countries which may result in carbon emission policy implementation that is inappropriate for Nigeria. Notable, and often accepted is the fact that something needs to be done about the Nigerian emission practices, but by far less understood is the fact that something needs to be done to tackle the difficulties of carrying out such emission practices especially for developing economies like Nigeria. There remains a great need to address the most obvious industry specific obstacles in order to devise unambiguous means of meeting the sustainability targets. Policymakers also need to make policies that connote tougher punitive measures, financial subsidies, and proper publicity to entice more firms to be emission friendly. Failure to resolve these issues will place Nigeria among the nations that are lagging behind with no hope of partaking in a low carbon economy, which will be detrimental to the growth of the economy in the future as well as the environment.

1.2 Problem statement

Carbon emission practices have been analyzed from various approaches, each illustrating distinct actions taken by a company in relation to the environment. Stakeholder theory claims that an organization must pay attention to customer, investor, government, and community engagement,

to mention but a few, when considering reducing carbon emissions. Many firms in developing economies like Nigeria, with inadequate resources, attempt to balance stakeholders' expectations with basic economic survival, often succumbing to the lure of short-term profits instead of sustainable long-term environmental policies (Chukwu and Adebajo, 2023). Institutional theory holds that regulations governing an industry, its market, and society can control the extent to which a corporation will practice carbon control to these frameworks, but in the case of Nigeria where enforcement is generally weak and policies inconsistent, compliance practices among firms vary. Some companies are coerced into adopting green practices, whether out of normative or mimetic pressure, while others remain stubbornly noncompliant because of no penalties or incentive schemes aligned with socially responsible practices. With the aim of controlling carbon sustainably to increase future profitability, Triple Bottom Line theory, expands the scope of corporate performance from solely economic, to include environmental and social. Regardless, several of Nigerian firms still see carbon reduction initiatives as expensive and do not embed them into the primary business operations, which in turn, diminishes environmental sustainability (Adebayo and Ibrahim, 2022). The CSR theory explains that businesses have moral responsibility in alleviating the harm caused to the environment, however, a lot of organizations in Nigeria do carbon management for reputation purposes rather than genuine commitment to reduce sustainability challenges. The discretionary nature of CSR activities implies that companies can pick and choose to undertake carbon mitigation measures that suit their self-interests, which creates substantial obstacles to efforts towards national sustainability. While many of the large foreign businesses operating in Nigeria are subjected to more global parameters of sustainability, local firms often do not have the funds or incentive to adopt comprehensive carbon reduction plans.

Many scholars have made errors concerning the financial implications of these strategies. However, mitigating carbon emissions, particularly within carbon-intensive sectors, can help realize significant economic opportunities for organizations in Nigeria (Uadiale and Fagbemi, 2019; Yusuf and Ogundele, 2021). Implementing carbon reduction frameworks offers numerous advantages; one being enhanced energy use efficiency which translates to lower operational costs. This, however, is not the reality among most Nigerian firms. Many Nigerian businesses are stuck in traditional fuel-based systems because of high upfront capital expenditures and poor government support. However, businesses in developed economies have shown that implementing, reducing, and streamlining resource consumption, waste generation, and overall resource usages can sustain long-term profitability. Furthermore, the economic benefits associated

with carbon reduction practices is the increased access to green financing aligned with the changing tide of bank and investor scrutiny, where funding is now directed towards environmentally responsible companies. In Nigeria, adopting sustainable practices can raise the expectation of receiving concessional interest rates on green loans or reduced government grants, thus improving the financial performance of these firms.

Moreover, those firms practicing carbon efficiency are more likely to withstand future environmental changes, thus mitigating any negative impact on their finances related to compliance cost burden. Firms that practice carbon reduction in business strategy are more self-sufficient as a result of less dependency on fossil fuels and lowered exposure to volatile energy market (Ogbonna and Emodi, 2021). The CSR Theory together with Stakeholder Theory and Institutional Theory, alongside Triple Bottom Line (TBL) Theory present a wide range of opportunities for reducing carbon emissions. However, the unwelcome outcomes that these theories will create have not yet been considered. Stakeholder Theory operates under the premise that organizations have the ability to fulfill all the financial needs of different stakeholders, which, in practice, becomes a problem. The very existence of multifarious interest is troublesome, and the struggle to achieve these interests leads to negative cash flow. In trying to satisfy competing stakeholder demands, companies may become inefficient in resource allocation and spend more than necessary, thereby financially sabotaging core operations. According to the Institutional Theory, firms adopt carbon reduction practices due to regulatory, normative, or mimetic pressures, but in economies like Nigeria, its weak enforcement and inconsistent policies could cause emissions to only comply symbolically. This leads to the phenomenon where claiming to be green becomes rampant with no real environment friendly policies being implemented to mislead stakeholders and reduce trust among the public. On the other hand, The Triple Bottom Line (TBL) Theory seeks equilibrium in profit, people and planet but focusing on environmental and social aspects before financial performance may hurt many businesses, especially small and medium enterprises (SMEs) with low financial resources. Trying to balance these forces leads to higher operative costs. This state drives some firms to scale down to survive, cut back on employee perks, or leave the market altogether if they can no longer sustain profit. This creates an uneven burden on the market placing systems immensely. This unequally constitutes a one-sided competition where only the financially capable corporations can afford to implement extensive carbon reduction strategies while putting smaller businesses at a more disadvantaged state.

Every empirical study review claim to contain within it a complete set of practices pertaining to emissions, governance *vis-a-vis* the sustainability disclosures and the financial outcomes of the company, which in one way or another are interlinked. It is clear that there is a gap, and in some cases, even noted inconsistencies are prevalent. On one hand, Nguyen *et al* (2021) proved that firms within China's pollution-heavy industries, who adopted green technologies and enhanced their governance frameworks, performed better financially. This, however, does not seem to be the case in Nigeria due to differing regulatory enforcement and industrial frameworks. Okoye (2021) maintained that in Nigeria, sustainability reporting is shaped by the regulative policies. Such policies, however, are said to be harsher and lead to better disclosures but are unattainable by small firms which are financially drained. Sanusi and Sanusi (2019) reinforced this concern, showing that there is irregular adoption of sustainability reporting features among mid-sized firms in Nigeria's manufacturing sector, where advanced firms report adopting environmental sustainability practices, while smaller ones stifle because of weak enforcement and financial constraints. Likewise, Setiawan *et al.* (2021) showed that foreign directors increase compliance to CSR in Indonesia, indicating that international experience enhances sustainability. However, this remains unclear in the Nigerian context given the stark differences in foreign participation on corporate boards. Talab *et al.* (2023) noted that both strong governance and having a diverse, independent board of directors leads to improved ESG performance, which raises concerns as to whether Nigerian firms with weaker governance structures can enjoy the same benefits. Tiamiyu *et al.* (2021) stated that there is an increased level of disclosure of sustainability information by wider and more profitable firms, implying that financial strength is one of the determinants of transparency, thus suggesting that Nigerian firms with poorer financial resources may struggle to provide meaningful sustainability disclosures. Uadiale and Fagbemi (2019) corroborated the argument that reporting on sustainability improves the performance of the corporation in Nigeria, but also pointed out the low levels of reporting as a sign that there are no incentives or awareness. Rowland (2023) and Chrun *et al.* (2019) focused on the difficulty for nations to achieve carbon neutrality, citing political opposition and expensive costs, which raises concerns as to whether Nigeria can effect carbon reduction strategies. Emissions reduction was correlated with improved financial outcomes for the oil and gas industry in Nigeria as highlighted by Orjinta *et al.* (2024). However, the degree to which firms emplace emission control measures due to internal factors versus external factors remains ambiguous. Downar *et al.* (2020) and Harvard Law School Forum (2021) assert that there is an improved performance together with reduced capital costs for firms

when carbon disclosures are made compulsory, while Bahriansyah and Ginting (2022) observed that carbon disclosure enhances performance, especially in the case of energy consuming industries. These findings indicate that certain polluting industries in Nigeria could enjoy similar outcomes if incentive-shifted policies and enforcement structures were put in place. Moreover, The Harvard Law School Forum (2023) asserts that mandatory disclosure policies stimulate prompt action towards achieving climate goals showing that Nigeria would likely see similar results from policy enforcement. Additionally, Downar *et al.* (2020) noted that corporations subjected to carbon reporting tend to experience different financial impacts which suggests that Nigerian firms might face an assortment of financial implications based on their ability to achieve the integration of sustainability into proposed business frameworks.

The University of California, Los Angeles (UCLA) Anderson School of Management (2023) noted the absence of uniform practice concerning corporate sustainability, revealing gaps pertinent to Nigeria where firms operate with disparate reporting logic. There is, however, a gap in the effectiveness of emission control measures and climate change policies, sustainability reporting, governance, and the financial strength of the corporation. From these empirical observations, we can conclude that in as much as carbon reputation management and emission control practices as well as sustainability grading can drive financial performance and stakeholder confidence, the situation in Nigeria is complicated by lack of enforcement, financial control, and corporate governance spin. The existing carbon policies in Nigeria exemplify an attempt to strike a balance between addressing climate change and fostering economic growth. However, there are still gaps in policy enforcement, implementation, and effectiveness. The Nigerian government is a signatory to international treaties like the Paris Agreement where as a primary member, Nigeria pledged to reduce greenhouse gas emissions by twenty percent unconditionally and forty-seven percent with international support by 2030. Yet, despite these policies, there is ongoing increase in emission levels as a result of the country's over-reliance on fossil fuels, industrial pollution, and deforestation. The National Policy on Climate Change (NPCC) gives a framework of emission control towards defined targets but the actual enforcement of such limits and mechanisms is very weak and most industries do not comply because of lack of regulatory supervision.

The Department of Petroleum Resources (DPR) has put in place measures to lessen the impact of gas flaring, but oil companies routinely default on them by using the fine payment option instead of adopting long-term solutions. The National Environmental Standards and Regulations

Enforcement Agency (NESREA) as the enforcement authority for environmental compliance is also handicapped by insufficient budgetary allocation and logistical constraints that have stalled progress. The absence of a robust regulatory oversight framework for carbon emitting industries fosters a market system where profit is prioritized over environmental stewardship. Policies like the Renewable Energy Master Plan (REMP) proposes the diversification of energy resources in Nigeria, but the slow pace of adopting renewable energy technologies, due to high costs and inadequate infrastructure, stifles progress. Though there are policies and initiatives such as the carbon emissions reduction project in Nigeria's vision 2030, they face several obstacles that impede their effectiveness, resulting in an unbridged disparity between policy intentions and real world outcomes. An example of this is ineffective regulation enforcement; government bodies not having the funding, technical manpower or support from the political sphere, to guarantee proper regulation compliance by industry players stifles possibilities of complete compliance.

Numerous corporations, especially those in the oil and gas industry, still partake in environmentally detrimental activities such as gas flaring and pollution, preferring to pay penalties rather than invest in more sustainable practices. The existing corruption in some regulatory agencies leads to weak enforcement, allowing non-compliant companies to freely break the law without any repercussions. Federal, regional, and local government entities do not collaborate. This is the primary reason for disjointed policy execution as they work in silos without unified directives.

The body of literature exploring carbon practices and organizational performance in Nigeria is insufficient in the scope which impedes understanding the topic at hand. Most notable among them is a lack of case studies specific to the country, as available intelligence originates from sophisticated industrial economies, which is difficult to adapt to the Nigerian context regarding its economy and other peculiar regulations. These studies tend to consider sustainability as a collective and not as a singular focus on carbon emission reduction strategies, missing critical insights on how emission reductions impact operational achievements of a business. Also, previous research predominantly focuses on the positive impacts on the Nigerian environment while disregarding the financial and operational burdens imposed on Nigerian businesses due to carbon reduction policies. Moreover, there is no literature on SMEs (small and medium enterprises), as the majority of research targets large entities, even though SMEs are a substantial part of Nigeria's economy. Another drawback is the use of data from organizations which capture their own

information because such data can be inaccurate and unreliable, especially when firms are likely “greenwashing” their operations to portray an eco-friendly image. Many empirical studies use cross-sectional data instead of longitudinal, making assessing the long-term impacts of carbon reduction strategies on business performance more difficult. Stakeholder Theory, Institutional Theory, and Triple Bottom Line (TBL) Theory have been extensively used, but too few have sought to explore their shortcomings in Nigeria. There is insufficient research integrating the economic, environmental, and social aspects of the problem which results in a lack of comprehensive understanding of the problem. The lack of robust empirical analysis due to limited publicly accessible data and inconsistent reporting of carbon emissions makes the situation more challenging,

This outlines existing gaps within the Nigerian carbon management literature. A specific focus on informal businesses, for example, is absent despite their notable contributions to the country’s carbon emissions – largely a result of the lack of data. It appears that many studies also disregard intra-national variations across Nigeria based on the unequal advancements in industrialization and regulatory enforcement within the country’s different states, adopting a one-size-fits-all approach to carbon management. Moreover, there is inadequate research on consumer perceptions of carbon mitigating companies, restricting the understanding of market drivers to foster incentivized sustainability efforts. There exists a gap in literature regarding the application of green financing in Nigeria, particularly concerning the motivation it offers for mitigating carbon emissions, thus suggesting a lack of responsiveness to such financial incentives. There is also a paucity of research assessing the impact of international collaboration and donor-funded initiatives on the development and post-sustainability of carbon policies. Lastly, the literature seems to lack in-depth case studies documenting Nigerian firms that have adopted carbon reduction procedures, hindering peer learning for other businesses. Methodological limitations, such as small sample sizes and lack of comparative studies, reduce the generalizability of findings. Many studies focus on regulatory frameworks without analyzing the political and economic constraints that affect policy implementation in Nigeria. The role of technological advancements in reducing corporate carbon footprints is often under-examined, limiting knowledge on innovation-driven sustainability strategies. Research on the social and employment impacts of carbon reduction policies is also insufficient, leaving unanswered questions about how these policies affect job creation and workforce dynamics. Addressing these literature gaps requires more country-specific, data-driven, and interdisciplinary studies that consider Nigeria’s unique economic, regulatory, and

infrastructural realities to provide a holistic understanding of carbon emission practices and their implications.

1.3 Research questions

1. What is the effect of professional qualification and organization types on companies' decisions to adopt carbon emissions practices?
2. What is the influence of carbon emission practices on financial performance among firms in Nigeria?
3. What is the influence of carbon emission practices on non-financial performance among firms in Nigeria?

1.4 Research objectives

The main objective of this study is to determine the effect of carbon emission practices on organizational performance in Nigeria. The specific objectives are:

1. To estimate the effect of professional qualification and organization type on companies' decisions to adopt carbon emissions practices.
2. To assess the impact of carbon emission practices on financial performance among firms.
3. To assess the impact of carbon emission practices on non-financial performance among firms.

1.5 Research hypotheses

The research hypotheses for this study are stated in null forms for the three objectives as follows:

1. There is no significant impact of professional qualification and organization type on companies' decisions to adopt carbon emissions practices.
2. There is no significant impact of carbon emission practices on financial performance among firms in Nigeria.
3. There is no significant impact of carbon emission practices on non-financial performance among firms in Nigeria.

1.6 Significance of the Study

Grasping how carbon emission activities affect financial performance in Nigeria's firms is important as businesses are placed under increasing pressure from investors, regulators, and consumers to be sustainable. Firms that venture into carbon mitigation strategies may achieve

superior financial performance as a result of cost savings, improved brand reputation, and higher investor morale. Empirical evidence, such as Nguyen *et al.* (2021) and Uadiale and Fagbemi (2019), suggest that companies with good environmental performance tend to be more profitable and have low capital costs. Nonetheless, the situation is more complicated than that because compliance with carbon mitigation policies may also bring about substantial costs, particularly for small and medium-sized enterprises. Analyzing this circumstance will provide answers as to whether carbon emission activities are a drain or an economic asset for Nigerian firms.

Also, understanding the effect of emission practices on other social dimensions of the firm is equally important considering that firms are rated based on their social responsibility, employee relations, and other non-financial issues. Businesses that reduce carbon emissions often report higher employee satisfaction levels, better relations with stakeholders, and greater competitiveness in the industry. Bahriansyah and Ginting (2022) as well as Sanusi and Sanusi (2019) note that sustainability or corporate social responsibility (CSR) reporting promotes corporate governance, enhances reputation, and increases compliance to laws and regulations. The features and extent of non-financial value that Nigerian firms possess, however, is significantly unknown creating a need for this study that seeks to understand the impacts of carbon emission policy aside from financial return. This study seeks to understand the drivers of firms' carbon emission behaviours in Nigeria where compliance differs remarkably by sector and company size. Some firms do so out of better corporate social responsibility (CSR) values, some do it because they are part of the global supply chain, while others do so merely because they have to or they stand to make money. Firms' carbon emission behaviours are subject to a host of factors including regulatory policies, the industry in question, available finances, and technology. According to Okoye (2021), Nigerian firms with reasonable governance and good external capital seem to be more willing to comply with the restrictions. Additionally, the role of institutional pressures, such as consumer demand for environmentally responsible products and investor expectations, must be examined to understand the motivation behind corporate sustainability commitments.

By addressing these research objectives, this study will contribute to the growing discourse on corporate sustainability and environmental responsibility in Nigeria. It will provide empirical evidence to guide policymakers in designing effective regulations that encourage carbon reduction without imposing excessive financial burdens on businesses. The findings will also offer practical insights for business leaders, investors, and other stakeholders seeking to balance profitability with

sustainability. Furthermore, understanding the barriers to carbon emissions adoption can help in formulating targeted interventions that support smaller firms in implementing cost-effective carbon reduction strategies. As Nigeria strives to meet its commitments under international climate agreements, such research is vital in ensuring that corporate efforts align with national sustainability goals. Ultimately, this study will bridge the existing knowledge gap and provide a foundation for future research on corporate sustainability in emerging economies.

1.7. Thesis structure

This thesis is structured in three chapters. Chapter one treats the effect of professional qualification and organization type on companies' decisions to adopt carbon emissions practices. The second chapter focuses on impact of carbon emission practices on financial performance among firms in Nigeria. And the third chapter analyzes the impact of carbon emission practices on non-financial performance among firms in Nigeria

CHAPTER ONE: the effect of professional qualification and organization type on companies' decisions to adopt carbon emissions practices

INTRODUCTION

Institutions are responsible for developing strategies for mitigating carbon emission (Nguyen *et al.*, 2018). Recently, more emphasis has been laid on the role of institutional factors on environmental quality and to this end, many countries now put in place regulations that require them to measure and reduce their GHG emissions (Depoers *et al.*, 2016), including carbon pricing.

Nigeria's industrial sector generates a huge amount of carbon emissions although the energy sector seems more advanced. The industrial sector is an important sector that uses fossil fuels and contribute significantly to CO₂ emissions. (Antunes *et. al.* 2021). It is anticipated that emissions from this sector would rise as Nigeria attempts to further industrialize unless some carbon emissions reduction practices are put in place. Nigeria's CO₂ emissions in 2020 were around 126.9 million tonnes, primarily from heavy industries like cement production and the combustion of fossil fuels. Nigeria ranked second in Africa for greenhouse gas emissions in 2019. Oil and Gas exports are the main sources of income for the nation. According to a database called "Our World Data" published by Ritchie *et al.* (2020), Nigeria's per capita emissions from fossil fuels were approximately 0.64 tonnes of CO₂ released per person in a nation of over 204 million people.

The first developing nation to establish annual budgets and five-year GHG emission targets is Nigeria, which aims to achieve net-zero carbon emissions between 2050 and 2070. Nigeria may attain its goal of net-zero greenhouse gas emissions and improve the resilience of her economy and environment to climate change by implementing the Climate Change Act of 2021, which offers an institutional framework. It applies to all sectors including both public and commercial organizations. Regulations of Greenhouse Gas Emissions for Economic Sectors to guarantee adherence to the Action Plan, the Act controls both public and private organizations.

Nigeria already has several policies and strategic initiatives, which if properly implemented, can serve as adaptive as well as mitigative climate change measures. Many of the initiatives in these policies can be taken as anticipatory adaptation measures and plans, which can be fine-tuned into policy options for climate change response in the country. These comprehensive initiatives and response strategies will enable the translation of policies into meaningful inter-sectoral activities for sustainable environmental management.

With regard to Nigeria's short-, medium-, and long-term goals for climate adaptation and mitigation, the Climate Change Act offers a robust framework for climate action. It requires both governmental and private organizations to support sustainable lifestyles and a low-carbon economy. Working together with pertinent parties, such as civil society organizations, is another priority of the Act. For future climate-related legal battles and climate change activism, these actions establish a strong legal basis. The Act also offers remedies and compensation for victims of climate change, as well as sanctions for breaking its provisions.

Some of the limitations to effectiveness of the Climate Change Act of 2021 include corruption, poverty and insufficient technical and human resource capacities and political will on the part of the Government to implement environmental and petroleum Regulations (Olujobi and Yebisi, 2023).

2.1 LITERATURE REVIEW

2.1.1 Carbon Emissions Practices

Carbon emissions practices have evolved in response to growing environmental concerns and international commitments to fighting climate change. Orjinta *et al.* (2024) stated that as a major oil-producing nation, Nigeria has been a significant emitter of greenhouse gases, primarily from the energy sector, industrial activities, oil spillage and gas flaring, which has been a long-standing issue in the Niger Delta. Nigeria's vulnerability to climate change variability is due to a number of factors, including its geographical characteristics, limited adaptability, reliance on climate-sensitive resources, large population, and concentration of GDP-generating industries in climate-vulnerable areas (Olayide *et al.* 2016). Despite the country's reliance on fossil fuels, there is an increasing emphasis on transitioning to more sustainable energy practices. The government's initiatives such as the Nationally Determined Contributions (NDCs) under the Paris Agreement, have committed to reducing emissions by implementing policies promoting renewable energy, energy efficiency, and climate-resilient development. Many organizations and industries lack the technological infrastructure and financial resources needed to adopt greener practices. In addition, the monitoring of emissions has remained inadequate, limiting the effectiveness of environmental policies. Nonetheless, most companies in the country particularly, in sectors such as manufacturing and agriculture are beginning to embrace sustainability by adopting energy-efficient processes, waste management systems and renewable energy sources like solar power, which were not

considered before. In urban areas such as Lagos and Abuja, clean public transportation and waste-to-energy projects are gaining traction as well as reflecting a shift towards reducing carbon footprints. Corporate Social Responsibility (CSR) is well-known in advancing emissions reduction practices with organizations increasingly incorporating environmental sustainability into their CSR programmes which is a requirement in their annual report (Akinyemi *et al*, 2022; Jannah and Muid, 2014; Bahriansyah and Lestari Ginting, 2022). For example, most multinational companies operating in Nigeria have started adopting global environmental standards to remain competitive and comply with international regulations.

According to Alghorbany *et al.* (2024), reforming corporate societies' approach and engaging in environmentally sustainable practices is largely explained by the growing influence of various stakeholders: investors, civil society organizations, and consumers. International development agencies and, more generally, NGOs have enabled this transition by supporting and financing green initiatives. But the informal economy which accounts for a considerable share of Nigerian's economy operates largely in the absence of regulations, thus making it difficult to monitor emissions comprehensively. While progress has been made, the gap between policy and implementation remains wide, with limited public awareness and participation further worsening the situation. Education and capacity building are key in engendering a culture of sustainability and enhancing adherence to emissions reduction measures (Kim, 2015; Talab *et al.*, 2023).

2.2.2 Carbon Emissions Practices in Nigeria

Carbon Emissions practices (CEP) comprises a set of policies and courses of action taken by people, firms, and in some instances, governments, to limit the amount of Green House Gases emitted in order to lessen the level of climate change impacts on the environment and society (Agbaje, 2024). These practices are operative across diverse industries and include market regulations, technological progress, and even ecological awareness. The changes represent major efforts toward sustainability. These practices include:

2.2.2.1 Gas Flaring Reduction: Due to her oil and gas industry, Nigeria has historically been recognized as a major gas flaring nation. More importantly, measures aimed at the reduction of gas flaring have gained traction with the introduction of some regulations, including the Nigerian

Gas Flaring Commercialisation Programme (NGFCP). This policy motivates oil firms not to flare associated gas, but to capture and use it for power generation, thus lessening carbon emissions.

2.2.2.2 Renewable Energy Adoption: The momentum of solar, wind and mini-grids is on the rise in Nigeria. More businesses and individuals are opting for solar panels and other renewable resources for energy needs especially in rural and off grid regions. Such efforts have reduced the reliance on diesel generators which are major contributors to carbon emissions (Osagie and Kolapo, 2023).

2.2.2.3 Energy Efficiency Programmes: It is the beginning of the implementation of energy saving strategies by firms, for instance, through replacement of production machinery with energy-efficient alternatives, replacing the old sodium lamps with LED lights, and refining of production cycle to lessen wastes and emissions (Chukwu and Adebajo, 2023). The Nigerian Energy Support Programme (NESP) facilitates energy efficiency and the use of renewable energy resources in industries and households.

2.2.2.4 Sustainable Agricultural Practices: Agriculture has been one of the major emitting sectors in Nigeria. It has made some steps in the direction of sustainability. Strategies such as agroforestry, organic farming as well as application of bio-fertilizers have a purpose of curtailing emissions due to conventional agricultural practices. Moreover, programmes to help capture emissions, in the form of methane from livestock wastes are being developed (Osagie and Kolapo, 2023).

2.2.2.5 Urban Green Initiatives: Urban areas have begun to look into green urban designs such as the implementation of campaigns for tree planting initiatives, urban greening schemes and public transport that are energy efficient (Yusuf and Ogundele, 2021). For example, in Lagos, there have also been initiatives that have sought to curb the level of traffic and use of cleaner means of public transport.

2.2.2.6 Waste Management and Recycling: Emissions-reducing waste management practices are on a gradual implementation. The biogas programme is based on the conversion of organic wastes into energy such as with some local authorities and private companies, which are adopting waste-to-energy schemes (Adebayo and Ibrahim, 2022). Land fill emissions are also being decreased with the implementation of recycling programmes.

2.2.2.7 Carbon Credit Projects: There are carbon credit schemes in which Nigeria is a party to, such programmes enable firms that can reduce the emission of carbon by undertaking projects to earn credits. The selling of these credits in the global market opens opportunities for funding associated with sustainability strategies (Olaoye and Fadeyi, 2020).

2.2.2.8 Public Awareness and Education Campaigns: Non-governmental organizations and environmental advocates are raising public awareness about carbon offsetting. Campaigns designed towards enhancing the understanding of the citizens on energy saving, biodiversity conservation, tree planting and related practices help in reducing the overall emissions in the country (Independent Newspapers Nigeria, 2024).

2.2.2.9 Industrial Emissions Monitoring: Some industries have started investing in emissions monitoring and control technologies. This involves fitting devices that measure the emissions of Green House Gases and adopting cleaner production technology (Adekunle and Lawal, 2022).

2.2.3 Carbon Emissions Practices Agencies

According to Elaigwu *et al.* (2024), there are a number of agencies and organizations in Nigeria which are effective in terms of prevention of carbon emissions with the help of policy directions, monitoring progress, and campaigns for better practices. These agencies include those from the government, the private sector, non-governmental organization and all work together or separately to reduce gas emissions. National Oil Spill Detection and Response Agency (NOSDRA), carbon-Limits Nigeria (CLN), Climate Change Network Nigeria (CCN) among others are initiatives targeted on carbon emissions in Nigeria and their actions in relation to the country. These agencies and organizations combined, demonstrate Nigeria's growing passion towards embracing efforts to reduce carbon emissions. But in order to be more impactful, issues like constrained funding, and a lack of awareness among the general public need to be resolved first (Talab *et al.*, 2023; Bahriansyah and Ginting, 2022). There is also the need for a broader focus on strengthening inter-agency relationships, international collaboration and having carbon emission strategies as part of national objectives.

2.2.3.1 Federal Ministry of Environment

The Federal Ministry of Environment is the main federal organ that is responsible for Nigeria's policies and strategies in environmental matters, including carbon emissions reduction strategies.

It takes the lead in the formulation and enforcement of legislations in aiming at achieving the reduction of green-house gases, increasing the use of renewable sources of energy and climate-smart solutions (Bello and Femi, 2021). The ministry is fully responsible for coordination of Nigeria's Nationally Determined Contributions (NDCs) on the Paris Agreement.

2.2.3.2 National Environmental Standards and Regulations Enforcement Agency (NESREA)

As one of the agencies of the Federal Government, NESREA has the responsibility of the implementation of environmental intervention, and compliance in Nigeria. The NESREA oversees industrial emissions, ensures that companies abide by the Environmental Impact Assessments, and sanctions companies that violate emission standards. It makes a significant contribution towards convincing the industry to go for less polluting technologies and methods (Egbetunde and Adefuye, 2020).

2.2.3.3 Nigerian Gas Flare Commercialization Programme (NGFCP)

It seeks to harness the associated gas that is currently flared, into productive energy and thus contributing to the reduction of carbon output from the petroleum and gas industry (Ajayi and Okafor, 2022).

2.2.3.4 Energy Commission of Nigeria (ECN)

The ECN has the responsibility to consolidate and implement energy related policies in Nigeria and works to enhance the use of renewable energy and energy effectiveness. According to Yusuf and Ogundele (2021), the commission provides mechanisms for the development of environmentally friendly energy systems and works with other agencies to promote the optimization of Nigeria's energy portfolio with renewable energy technologies.

2.2.3.5 Nigerian Energy Support Programme (NESP)

The Nigerian government has partnered with foreign entities like the European Union and the German Agency for International Development (GIZ) in a programme called NESP. The NESP aims to improve energy intake in Nigeria while broadening the scope of Nigerians to access renewable energy sources. Chukwu and Adebajo (2023) indicated that it also focuses on

enhancing legal capacity building, policy making, and practicing sustainable energy mechanisms for low carbon development.

2.2.3.6 Nigerian Sovereign Investment Authority (NSIA)

According to Ogbonna and Emodi (2021), NSIA has many devisable strategies to implement such carbon offset projects as waste-to-energy and green energy investment funds. Therefore, being engaged in such projects bounds NSIA to act in accordance with green financing principles.

2.2.3.7 Clean Energy and Climate Change Initiatives (CECCI)

The CECCI, a non-governmental organization, advocates for clean energy solutions and climate action in Nigeria. It promotes awareness of carbon emissions, supports renewable energy adoption, and collaborates with communities to implement sustainable practices (Agbaje, 2024).

2.2.3.8 Nigerian Upstream Petroleum Regulatory Commission (NUPRC)

Formerly the Department of Petroleum Resources, the NUPRC oversees the regulation of Nigeria's upstream petroleum activities. It ensures compliance with gas flaring reduction policies and encourages oil and gas companies to adopt sustainable practices that limit greenhouse gas emissions (Okoye and Adeleke, 2023).

2.2.3.9 Lagos State Environmental Protection Agency (LASEPA):

The LASEPA focuses on urban carbon emissions reduction in Lagos State, the nation's commercial hub. Adekunle and Lawal (2022) stated that it leads initiatives such as cleaner transportation programmes, waste-to-energy projects, and tree-planting campaigns to improve air quality and reduce the city's carbon footprint.

2.2.3.10 African Clean Energy Coalition (ACEC):

A regional organization with a strong presence in Nigeria, ACEC works to promote clean energy technologies and policies. It collaborates with businesses, governments, and civil society to advocate for reduced carbon emissions and sustainable development practices (Akinyemi *et al*, 2022).

2.2.4. Global Report Initiative Guidelines

2. 2.4.1 Climate Change: Risk and Opportunity

Both risks and rewards await organizations that operate in the light of climate change. On the one hand, a range of dangers presents itself, which include climate- inspired extreme weather events that would in the long run incur economic cost, geo- political disputes due to the inflow of greener policies, and most importantly, non-adherence penalties as well as economic disruptions for negative capitalization. On the contrary, organizations that are willing to embrace better carbon emission standards stand to gain competitively through the penetration of green business markets, continuing innovation of environment-friendly products, and enhancing their reputations in the marketplace. In Nigeria's case, companies from such sectors as manufacturing, property development, and construction can reduce uncertainties through compliance with external climate change strategies and utilization of climate-friendly technologies (Orjinta *et al.*, 2024; Okoye, 2021). Organizations that prioritize the address of climate-related risks will not only protect their company's performance but also place themselves in the best positions to pursue the marketability of green products and services.

2.2.4.2 Greenhouse Gas Emissions (GHGE)

The measure of GHG of an organization is an important indicator on the environmental status of the country and the world at large. For companies in Nigeria, implementing strategies to monitor, measure and manage GHG output will yield results that will enable increase in their profitability levels and ultimately enhance their image as a friend of the environment. For instance, with better targets to hit construction and manufacturing firms can use cleaner fuels and restructuring plants and increasing process efficiency by employing automation. Greenhouse gas reductions also actively improve one's corporate image, build up trust among stakeholders, and broaden windows of opportunity for international finance for green projects. Hence, there should be no conflict between the desire to reduce emissions and the desire to do business better (Ogbonna and Emodi, 2021).

2.2.4.3 Energy Consumption (EC)

Energy consumption is a particularly central factor within carbon emissions practices in the sense that the type and the amount of energy that is consumed emanates from the carbon footprint of an

organization. In Nigeria for instance, where there is a dependency on fossil fuels, firms are restricted in terms of energy efficiency management and operational productivity. Companies opting for renewable energy sources and using energy saving devices are able not only to cut cost but also to reduce carbon emission which improves profitability as well as environmental satisfaction. Real estate and construction companies which use energy-efficient design and materials are able to minimize energy consumption and at the same time attract more consumers who are environmentally conscious. The management of energy consumption, therefore, is critical in respect of both the sustainability objectives and the effectiveness of the organization.

2.2.4.4 GHG Reduction and Cost

For organizations, the deleveraging costs of reducing GHG emissions entails costs and risks exposure. On one hand, high capital commitments in investing in clean technology and best practices, are expected to pay off in the long run while on the contrary in the short term such costs could be high. Nigerian firms that adopt GHG reduction strategies can start saving by increasing energy efficiency, reducing waste and optimizing processes (Nguyen *et al.* 2021). For instance, construction companies that adopt green building codes may incur more expenses at the start but later on cost-cutting and increased demand will compensate. The equilibrium between reduction attempts and the cost incurred is important, as a company that achieves this is able to focus on both environmental and profit objectives.

2.2.4.5 Carbon Emission Accountability

Carbon emission accountability entails responsibility for the emissions as well as reporting on them and quantifiable reduction mechanisms. For Nigerian institutions, the compliance aspect raises the commitment to environmental sustainability and creates confidence among stakeholders. Through carbon disclosure and collaboration within frameworks like the GRI, companies can compare themselves against their industry and find areas of consolidation. Accountability also helps in mitigating the chances of greenwashing claims by ensuring that the reductions advocated are real and effective. In emerging markets including real estate and manufacturing, areas with strong accountability stand a better chance with international markets and do perform better as organizations (Hermawan, 2018; Chukwu, and Adebajo, 2023).

2.3 THEORETICAL REVIEW

The study would also rest on the following theories of which the core theory of the study is the Corporate Social Responsibility (CSR) theory.

Corporate Social Responsibility (CSR) Theory

The CSR theory can be credited to Howard Bowen, whose reputation rose as being the father of CSR. Bowen posed the idea in his book, ‘Social Responsibilities of the Businessman’ where he stated that businesses should not only be held responsible for the profit generated but also for the impact created within the society and environment. Rather than absolving these responsibilities, he argues, voluntary self-regulation or especially socially conscious business practices are cost-effective for both the economy and society (Kalu *et al.*, 2016; Javed, 2023). Numerous scholars and practitioners have contributed to the development of the CSR theory framework since Bowen’s time, but it has always been his publications that laid the groundwork of this theoretic category. In the words of Hidayat *et al.* (2022),” the global economy has been confronted with questions about CSR, which regard corporations as having social responsibilities and must as such give back to society.” Companies are expected to act in a socially responsible manner by discouraging carbon emission practices as this will ensure that their business practices reduce their negative impact on the environment. In this regard, tracking of carbon emissions is going to fulfil companies’ ethical requirement towards the environment and show that the business is not solely focused on profitability but also caring for the society. Moreover, there are those who even point out that CSR is a distraction that makes companies forget their primary role which is to thrive and make money for the shareholders of the company. It is also raised as a concern that programmes aimed at CSR such as carbon emission reduction may be expensive and involve considerable capital outlay which may discourage small or resource poor firms from such business strategies (Ding *et al.*, 2023; Haque and Ntim, 2020; Akbaş and Canikli, 2019). Enforcement of CSR should be the domain of the government because at the moment it is being dealt with voluntarily, hence no significant progress may be achieved. Although CSR is considered as one of the strategies that can yield long terms benefits for business and society, the absence of measures and guiding principles combined with the lack of transparency often make it hard to evaluate the success of such initiatives most especially in terms of carbon emissions. In spite of these shortcomings, the theory of CSR is still quite useful in explaining and determining the interrelationships among businesses, the environment, and the performance of the organization (Apaydin *et al.*, 2021). Organizations

which successfully incorporate the principle of CSR into their activities are said to be on the right path of improving their social and financial bottom line in their prudence in sustainability measures

2.4 EMPIRICAL REVIEW

The transition toward low-carbon operations among firms has become an increasingly urgent issue globally, with heightened attention in emerging economies like Nigeria. While previous research has extensively examined the impact of environmental regulation, stakeholder pressure, and firm size on the adoption of carbon emissions practices, recent empirical studies are focusing on internal organizational characteristics, notably professional qualifications of staff and organization type—as critical factors shaping these environmental decisions.

Professional qualifications of key personnel particularly in management, finance, engineering, and environmental sciences are often linked to improved environmental awareness and technical capacity within firms. Empirical studies suggest that firms with more professionally qualified staff are more likely to adopt carbon management practices due to increased competence in sustainability reporting, risk management, and strategic planning.

For example, Olumide and Chinedu (2023) conducted a survey of 300 Nigerian manufacturing firms and found a statistically significant relationship between the presence of chartered accountants and environmental compliance. Similarly, Adegoke *et al.*(2021) used structural equation modeling to analyze 152 SMEs in Lagos and showed that professional certification in fields like environmental management (e.g., NEBOSH, ISO 14001) significantly influenced the adoption of carbon tracking and reporting tools.

In addition, Sule and Ahmed (2022) showed that managers holding industry-recognized certifications in sustainability, such as CSR-P or GRI training, were more likely to champion emissions reduction programs. These findings corroborate the view that professional expertise enhances environmental strategic alignment and facilitates compliance with both voluntary and mandatory carbon standards. Furthermore, Olanrewaju and Asikhia (2020) found that qualifications were not only predictive of environmental action but also moderated the effect of external stakeholder pressure on carbon policy adoption, suggesting that professional training strengthens organizational responsiveness. The type of organization whether public or private, domestic or multinational, SME or large enterprise has emerged as a key determinant of

environmental behaviour. Multinational corporations (MNCs), for example, tend to adopt global best practices due to international compliance standards and pressure from global investors. In contrast, local SMEs may lack the capacity or incentive to implement carbon management systems. In a cross-sectional study of 120 companies in Lagos and Abuja, Eze and Nwosu (2023) observed that foreign-owned and multinational firms were significantly more likely to adopt carbon emission reduction practices than indigenous firms. The authors attributed this to the influence of parent-company policies, access to international capital markets, and stricter global reporting obligations. Similarly, Okonkwo and Salami (2022) found that government-owned enterprises in sectors like oil and gas and energy were more likely to adopt emission-reducing technologies than private SMEs, owing to greater regulatory oversight and budgetary capacity. However, they also observed inconsistencies in enforcement and political will.

Ameh *et al.* (2021) investigated the role of firm type in environmental policy adoption and found that listed companies on the Nigerian Exchange (NGX) were more likely to disclose carbon metrics and implement mitigation strategies, primarily due to pressure from institutional investors and sustainability reporting mandates. In the manufacturing sector, Uchenna and Edet (2020) documented that medium and large enterprises exhibited greater adoption rates of ISO 14001-compliant systems and internal carbon accounting tools, compared to micro-enterprises, due to differences in resources, organizational structure, and customer expectations. Some recent empirical works have begun to explore the interaction between organization type and professional qualifications. Ibrahim and Danjuma (2023) found that in larger firms, the influence of professional qualifications on environmental decisions was magnified due to clearer policy structures and decision-making hierarchies. Conversely, in small informal enterprises, even professionally qualified staff often lacked the authority or resources to implement environmental reforms.

Knowledge gap

Despite growing academic interest in corporate environmental responsibility and governance and carbon emissions management, several critical gaps remain in the existing body of literature, particularly in the context of developing economies like Nigeria. There is limited integration of human capital and organizational structure in carbon emissions practice studies. Various studies have examined the role of corporate governance, external regulation, and firm size in

environmental decision-making (Eze and Nwosu, 2023; Ameh *et al.*, 2021), few have simultaneously considered both internal human capital factors (e.g., professional qualifications) and organizational attributes (e.g., firm type, ownership, structure) as joint determinants of carbon emissions adoption. This fragmented approach limits understanding of how these variables interact to influence sustainability outcomes.

Furthermore, there is scarcity of sector-wide empirical evidence from Nigeria. Much of the available research has focused on specific sectors such as manufacturing (Olumide and Chinedu, 2023) or publicly listed companies (Ameh *et al.*, 2021), thereby excluding the broader landscape of SMEs, informal enterprises, and non-listed organizations, which make up a significant portion of the Nigerian economy. There is a notable lack of comprehensive, cross-sectoral empirical studies capturing firm diversity in carbon policy adoption. Although some studies acknowledge the importance of professional expertise (Adegoke *et al.*, 2021; Sule and Ahmed, 2022), they tend to treat it narrowly, often limiting it to academic qualifications. The specific influence of industry-recognized professional certifications and their application to carbon emissions strategies remains under-researched and underexplored, especially in non-Western and low-income settings, there is also weak contextualization of Nigerian Organizational realities. Existing international studies frequently fail to account for the unique institutional, regulatory, and infrastructural limitations in Nigeria, such as inconsistent enforcement of environmental policies, low data availability, and informal business practices. As a result, global models may not translate effectively to the Nigerian realities without empirical grounding.

At the moment, only few studies have explored how organizational type might moderate the relationship between professional qualifications and emissions adoption, or how professional qualifications may mediate the effect of regulatory pressure or customer demand. Exploring such interaction effects can yield a more nuanced understanding of adoption dynamics.

This study, therefore, seeks to address these gaps by empirically examining how professional qualifications and organizational type influence companies' decisions to adopt carbon emissions practices in Nigeria, using a cross-sectoral approach. By incorporating a broader range of firms and qualifications, and by investigating potential interactions between human capital and structural attributes, this research provides a more holistic and context-sensitive understanding of sustainability adoption in emerging economies.

2.5 Materials and Methods

2.5.1 Data

The questionnaire used was designed to gather data on the chosen topic of the carbon emission practice and organizational performance of companies in Nigeria. Self-structured questionnaire was developed for this study in order to see how the specific and common carbon emission practices by Global Reporting Initiative (GRI) as the elements of standards from GRI will influence the organizational performance of the selected sectors in Nigeria, the questions/statements in the questionnaire were carefully worded and focused on the sets of objectives to elicit relevant information regarding the proxies of the study

The questionnaire contained three sections: section A which was the cover page introducing the study and research philosophy. Section B of the questionnaire was designed to collect demographic data of the respondents, Section C, on the other hand, was concerned with statements / questions on the different dimensions of carbon emission practices and organizational performance 5-points Likert-type scale of Strongly Agreed, Agreed, Undecided, Disagreed and Strongly Disagreed were adopted. The targeted respondents where the questionnaires were administered were owners, management and employees of manufacturing, oil and gas, extractive, information technology, and construction/real estate companies in Nigeria.

2.6 Population of the Study

The population of this study was made up of manufacturing, oil and gas, extractive, information technology, and construction/real estate companies in Nigeria. Nigeria is the most populous country in Africa, and has one of the highest GDPs in the continent. In Nigeria, there are thirty-six states and a federal capital territory, Abuja, but the focus population of the study consists of business owners, managers and employees who understand carbon emission as an environmental variable of sustainability and organizational performance. The population type was infinite as the study did not know the actual number of manufacturing, oil and gas, extractive, information technology, and construction/real estate companies in Nigeria as at the time of this study. All efforts to retrieve the population size from corporate affairs commission (CAC) was abortive. The fact, however, remains that they number in thousands, considering the size, the cultural, socio-economic and environmental diversity of the country

2.7 Model of the study

The data obtained were analyzed using ordered probit model and quantile regression so as to make the analysis comprehensive enough. Ordered probit model was introduced to social sciences by McKelvey and Zavoina in 1975, it found its origin from bio-statistics (Aitchison and Silvey 1957). According to the ordered probit model, there is an unobservable (latent) continuous variable Y^* that represents the utility or underlying propensity for a person to fall into a specific group. This latent variable depends linearly on a vector of independent variables X plus an error term that has normal distribution

$$Y_i^* = X_i' \beta + \varepsilon_i \quad \varepsilon_i \sim N(0,1) \quad 1$$

However, we do not observe Y_i^* directly. Instead, we observe an ordinal variable Y_i that falls into one of J ordered categories based on where Y_i^* falls relative to a set of unknown threshold (cut-off) parameters μ_j :

$$Y_i = j \quad \text{if } \mu_{j-1} < Y_i^* \leq \mu_j, \quad j = 1, 2, \dots, j \quad 2$$

Where;

$$\mu_0 = -\infty$$

$$\mu_j = +\infty$$

$$\mu_{j-1} < \mu_j \text{ for all } j$$

The ordered probit model is estimated using maximum likelihood estimation (MLE). The probability that observation i falls into category j is:

$$P(Y_i=j) = \Phi(\mu_j - X_i' \beta) - \Phi(\mu_{j-1} - X_i' \beta) \quad 3$$

Where:

- $\Phi(\cdot)$ is the cumulative distribution function (CDF) of the standard normal distribution.
- $X_i^\top \beta$ is the linear index for observation i ,
- $\mu_0 = -\infty$, and $\mu_J = +\infty$ by definition.

The log-likelihood function for the ordered probit model over n observations is given by:

$$\text{LogL}(\beta, \mu) = \sum_{i=1}^n \sum_{j=1}^J 1(Y_i = j) \cdot \log[\Phi(\mu_j - X_i^\top \beta) - \Phi(\mu_{j-1} - X_i^\top \beta)] \quad 4$$

This is maximized over the parameters β and thresholds μ_1, \dots, μ_{j-1} .

where $1(Y_i = j)$ is an indicator function that equals 1 if $Y_i = j$ and 0 otherwise.

The model is estimated by maximizing the above log-likelihood function with respect to the parameter vector β and the threshold parameters $\mu_1, \mu_2, \dots, \mu_{j-1}$

Variables of the model

The variables of the model are identified based on the existing literature on the subject. Gender is included on the basis of Social Role Theory (Eagly, 1987) which posits that both men and women exhibit distinguishable managerial styles and patterns that influence companies' culture and results. A usual socio-economic characteristic used to account for diversity in the makeup of professional and management occupations is gender. According Adams and Ferreira (2009), diversity in gender might impact organizational performance by influencing their patterns and process of decision making. Gender incorporation to the model assures that when examining organizational performance, gender differences in professional qualification is being considered. Also, age is included due to fact that it is related with experience and professional qualifications in a unique way, age can be a reflection of maturity and knowledge. Its inclusion will guarantee the effects of qualifications on organizational financial performance and not just the result of age-related career advancement (Hambrick and Mason 1984).

Academic qualification is selected based on Human Capital Theory (Becker, 1964) which summarizes that employees with higher levels of formal education typically make more significant contributions to organizations' results. Academic qualification can birth more resourcefulness and critical thinking in individuals. Inclusion of professional qualification is important for this study because it ascertains that industry-based proficiency and certifications that are related to

organizational performance are captured (Jackling and De Lange, 2009). Years of experience enhances proficiency (Tesluk and Jacobs, 1998). Going by Floyd and Wooldridge (1997), level in organization was selected as it determines sphere of influence, administrative and managerial power to take decisions. This variable makes it possible to separate the influence of professional certifications by decision-making hierarchy because strategic decisions made at higher levels are primarily responsible for organization performance. Organization type was included as different organizational types determines service delivery framework, working model and regulatory framework all of which affect firms' performance. The influence of professional certifications can also be regularized by industry-specific factors (Uwalomwa *et al.* 2015). Department/unit was selected based on Mintzberg (1979) contributions that employees' department or unit shows their job functions and the relevance of their qualifications.

2.8 Results

Table 1: Descriptive Statistics of the respondents

	N	Min	Max	Mean	Std. Dev
Gender	384	1.00	2.00	1.268	0.444
Age	384	25	60	55.42	6.57
Highest Academic Qualification	384	1.00	4.00	2.28	0.70
Highest Professional Qualification	384	1.00	5.00	2.64	0.97
Years of Experience	384	1.00	5.00	2.76	1.29
Level in Organization	384	1.00	3.00	2.12	0.75
Organization Type	384	1.00	6.00	2.47	1.88
Department or Unit	384	1.00	5.00	3.35	1.41
Valid N (listwise)	384				

Source: Survey and author's compilation 2024

Interpretation of Cross-Tabulation between Highest Professional Qualification and Organization Type

Table 2 presents a cross-tabulation of respondents' highest professional qualification (HPQ) against their organization type, disaggregated across five industry categories: Manufacturing, Oil and Gas, IT, Construction/Real Estate, and Other Extractives. Each cell includes two values: the row-wise percentage (i.e., distribution of each qualification across industries) and column-wise percentage (i.e., distribution of each industry across qualifications). The goal of this analysis is to explore whether professional qualifications are concentrated in specific sectors, and how sectoral differences might influence professional development and potentially carbon emissions practices.

Sectoral Distribution of Professionals

Manufacturing consistently reported the highest concentration of professional qualifications, accounting for: 42.67% of Technicians, 38.67% of Associates, 7.11% of Fellows, 6.67% of respondents with "Other" professional qualifications. This suggests that manufacturing firms prioritize technical and associate-level qualifications, potentially reflecting the operational nature of production environments that demand technical skills but not necessarily advanced certifications. The Oil and Gas sector, while only comprising 3.13% of total respondents, displays a disproportionate presence of Fellows (50% of industry total), indicating that this sector attracts or demands the highest levels of professional certification. This aligns with the highly regulated nature of Oil and Gas and the strategic importance of environmental compliance (Ameh *et al.*, 2021; Ibrahim and Danjuma, 2023).

Information Technology firms favor Associate-level qualifications, which represent 47.89% of respondents in that sector, while Technicians also form a significant proportion (35.21%). This reflects a balanced skills structure within IT firms, where both practical and semi-professional expertise is essential for operations and innovation.

The Construction/Real Estate sector shows a higher presence of those with no professional qualifications (21.95%) or Technicians (48.78%), possibly due to the sector's reliance on trade-based or vocational skills rather than formal professional certifications.

Other Extractive industries have a relatively small sample, but their staff are predominantly Technicians (62.86%), reflecting the operational and machinery-intensive nature of extractive work.

Table 2: Cross tabulation of highest professional qualification and organization type

Organization Type						
HPQ	Manufacturing	Oil and Gas	IT	Construction/real estate	Other Extractives	Total
None	37.93	17.24	13.79	31.03	0	100
	4.89	41.67	5.63	21.95	0	7.55
Technician	58.9	0	15.34	12.27	13.5	100
	42.67	0	35.21	48.78	62.86	42.45
Associate	64.93	0.75	25.37	2.99	5.97	100
	38.67	8.33	47.89	9.76	22.86	34.9
Fellow	48.48	18.18	18.18	0	15.15	100
	7.11	50	8.45	0	14.29	8.59
Others	60	0	8	32	0	100
	6.67	0	2.82	19.51	0	6.51
Total	58.59	3.13	18.49	10.68	9.11	100
	100	100	100	100	100	100

Source: Survey and author's compilation 2024

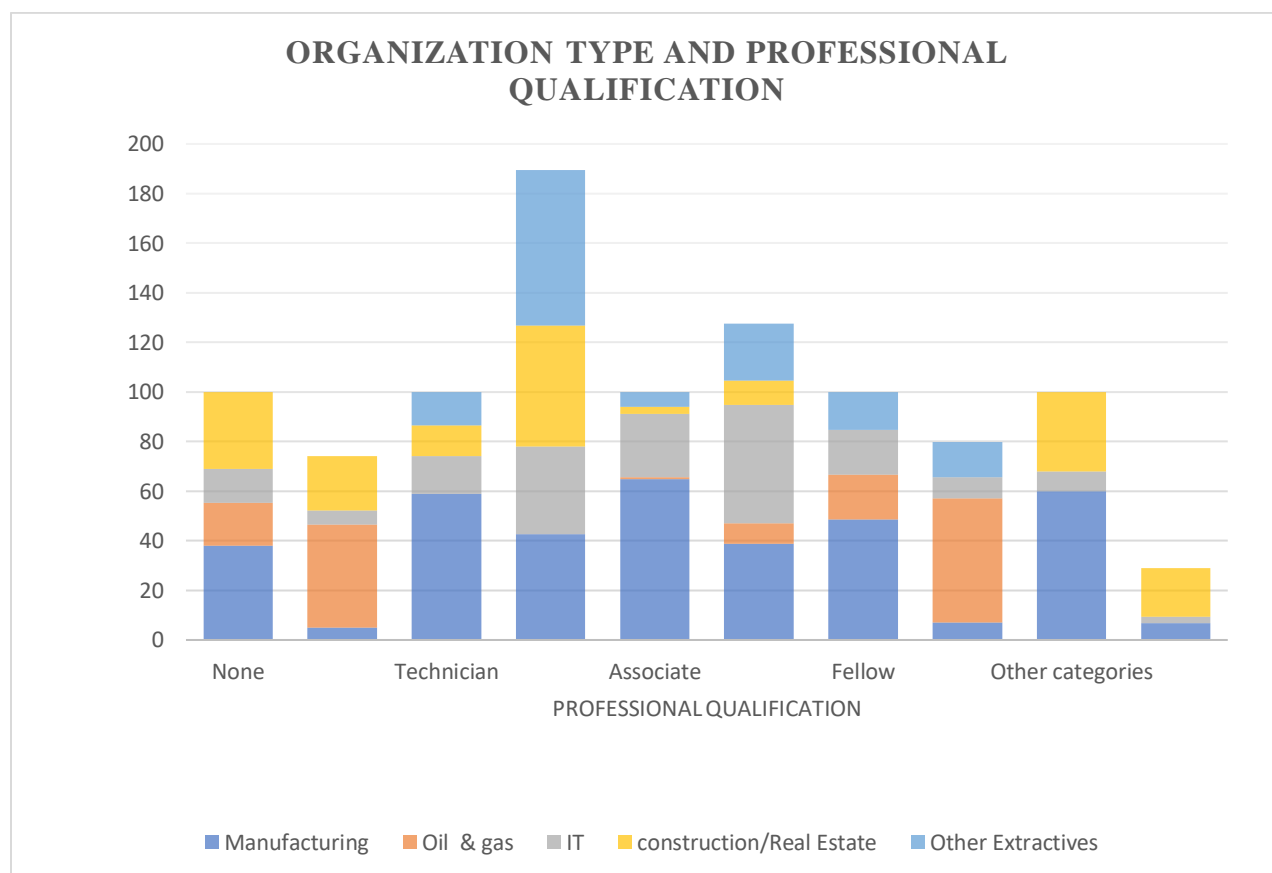


Figure 1: Cross tabulation graph of organization type and professional qualification

Source: Survey and author's compilation 2024

Multivariate Probit Results

The multivariate probit model was used to predict the drivers of five aspects of energy consumption behaviour from EC1 to EC5. When there are several, possibly associated binary responses as dependent variables, this modelling approach is applicable (Greene, 2018).

Sex is not statistically significant for all models, indicating that there is no proof of gender-based variations in energy-use patterns. This finding is consistent with research on energy behaviour, which shows that gender differences are frequently minor or situation-specific (Zhang *et al.*, 2018).

Age has positive and significant influence on EC3, EC4, and EC5. The tendency for older respondents to report their companies' activities comprehensively in terms of facility-level annual energy evaluations is higher. It is possible that this shows the influence of expertise on environmental monitoring behaviour strategies, which is in accordance with research by Aguilera *et al.* (2007) that found older staff were more likely to adopt sustainable practices.

Years of Experience is not statistically significant in any of the models, while being positively related with energy consumption signed from EC3 and EC5. This implies that, after controlling for other variables, years of experience is not a determinant of energy consumption.

As evidenced by the significant but negative likelihood of confirming EC2 and EC4 among staff in the HPQ (technician category), technicians may be connected with less involvement in facility-level consumption monitoring and renewable energy quantification. The associate category shows the same pattern, with significant and negative relationships for EC4, indicating that associate qualified workers might not be as involved in higher-order energy usage practices.

Level in organization does not have influence on carbon emissions practices, as it shows no significance on energy consumption.

For Organization type, manufacturing companies are much less likely to report total and segment-level energy consumption, as seen by their negative relationships with EC1 and EC5. This is in line with research showing manufacturing companies may be unwilling to reveal comprehensive environmental information because of regulatory concerns (Delmas and Toffel, 2008). Whereas, strong positive correlation between construction firms and EC1 and EC3 suggests that they are

more likely to report or participate in more comprehensive and type-specific energy evaluations. This could be an indication of increased conformity to standards in building as a result of environmental guidelines.

For department/unit, production unit has positive and statistically significant influence on both EC2 and EC4, implying that production staff are more committed in monitoring facility-level energy consumption and renewable energy.

These results show that the probability of energy consumption disclosures are highly influenced by organization type, department, age, and professional qualifications. It is noteworthy that workers in manufacturing companies seem unwilling, while those in construction companies are more eager to report specific energy consumption. This suggests variation in sustainability reporting by sector and organizational role and this is in line with findings of Clarkson *et al.*, (2008).

By taking into consideration linked error terms among the five aspects of energy consumption, the multivariate probit model provides an appropriate framework and yields more accurate estimates than ordinary probit regressions.

Table 3 : Multivariate probit (Energy Consumption Dimension)

VARIABLES	(1) EC1	(2) EC2	(3) EC3	(4) EC4	(5) EC5
SEX	0.001 (0.171)	-0.230 (0.170)	-0.370 (0.403)	-0.173 (0.302)	-0.221 (0.331)
AGE	0.029 (0.090)	0.070 (0.089)	0.257* (0.154)	0.399*** (0.128)	0.403*** (0.139)
YOE	-0.097 (0.062)	0.025 (0.061)	0.165 (0.115)	0.161 (0.104)	0.094 (0.109)
HPQ_Technician_Scheme_category	0.063 (0.219)	-0.427* (0.226)	-0.115 (0.392)	-0.671** (0.296)	-0.127 (0.291)
HPQ_Associate_category	0.229 (0.240)	-0.181 (0.246)	0.001 (0.418)	-0.663** (0.321)	-0.452 (0.352)
HPQ_Fellow_category	-0.510 (0.340)	0.225 (0.332)	-17.920 (0.000)	0.597 (0.411)	0.259 (0.422)
LOSenior_Management_Level	0.201	0.024	-0.017	-0.144	0.182

	(0.195)	(0.187)	(0.383)	(0.310)	(0.288)
LO Junior Management Level	0.165	0.191	-0.036	0.062	-0.133
	(0.210)	(0.205)	(0.396)	(0.292)	(0.328)
OT Manufacturing	-0.296*	0.063	-0.391	-0.385	-0.852***
	(0.167)	(0.166)	(0.330)	(0.252)	(0.259)
OT Construction	0.747***	0.218	0.665*	0.069	0.124
	(0.276)	(0.277)	(0.385)	(0.342)	(0.313)
DU Production	0.019	0.484**	0.118	0.715**	0.074
	(0.205)	(0.215)	(0.388)	(0.292)	(0.316)
DU Energy	-0.001	0.042	-0.189	-0.211	-0.209
	(0.220)	(0.219)	(0.420)	(0.365)	(0.321)
DU Construction	-0.636**	0.360	-3.902	-3.161	-3.489
	(0.261)	(0.239)	(97.900)	(115.424)	(310.033)
Constant	-0.158	0.364	-2.476***	-2.608***	-2.446***
	(0.410)	(0.413)	(0.764)	(0.553)	(0.563)
/arthro_i1		0.248***	0.543***	0.420***	0.406***
		(0.083)	(0.153)	(0.138)	(0.128)
/arthro_i2			0.089	0.156	-0.023
			(0.137)	(0.114)	(0.135)
/arthro_i3				1.713***	1.763***
				(0.293)	(0.275)
/arthro_i4					1.603***
					(0.232)
Observations	384	384	384	384	384

EC1: Total energy consumption is determined annually by our company; EC2: Our company quantifies the energy of renewable sources on yearly basis; EC3: The type of energy consumption is calculated yearly by our company; EC4: The facility of energy consumption is seen annually by our firm; EC5: The segment level of energy consumption is determined annually by our company.

Source: Survey and author's compilation 2024

Robustness analysis: Quantile Regression Model estimates

The main model used in this study is a multivariate probit regression which assumes homoscedastic and normally distributed error terms. A quantile regression was adopted in order to assess the robustness of the multivariate probit finding. Quantile regression accommodates heterogeneity and offers a more robust perspective on how covariate effects may change at different stages of the outcome distribution (Koenker and Bassett, 1978). The rationale behind this is to check whether multivariate probit regression and quantile regression results are consistent in

terms of statistical significance and signs of important variables, thereby reinforcing the results credibility.

Quantile Regression

Quantile regression, a statistical technique for conditional quantile function estimation, extended the classic linear regression model by Koenker and Bassett (1978). It reveals the conditional quantiles such as median, 25th percentile, 75th percentile of the dependent variable. It shows how predictor variables influence the outcome of the distribution at different points. Therefore, quantile regression is a good method with outliers or heteroskedasticity in data or the relationship between dependent and independent variables does not constancy across the distribution too. Quantile regression is especially relevant when investigation of the extremes or heteroscedastic variance of error terms is considered. For instance, while average treatment effect of carbon emissions on firm performance would be estimated by using mean regression, quantile regression makes it possible to examine how the effect differs at the low, median, or high value of performance.

The estimator is derived using linear programming techniques, and quantile regression does not presuppose a particular distribution for the error term. While there is an analytical solution for the OLS estimator, techniques like the Simplex Method or Interior Point Methods are usually used to get quantile regression answers (Koenker, 2005). In this study, quantile regression allows for a detailed investigation of the differences in carbon emission behaviours between quantiles of the distribution, including the 25th, 50th (median), and 75th percentiles, in addition to the average.

Model Specification

Let $Q_{\tau}(CEP_i | X_i)$ denote the τ – th conditional quantile of the dependent variable CEP_i (Carbon Emission Practices) given the vector of covariates X_i . The vector X_i contains the independent variables: *Age*, *Sex*, *HPQ*, *MGHGE*, and *YOE*. The quantile regression model can be expressed as:

$$Q_{\tau}(CEP_i | X_i) = \beta_0(\tau) + \beta_1(\tau)Age_i + \beta_2(\tau)Sex_i + \beta_3(\tau)HPQ_i + \beta_4(\tau)MGHGE_i + \beta_5(\tau)YOE_i + \epsilon_i(\tau) \quad (5)$$

Where:

$Q_{\tau}(CEP_i | X_i)$: The conditional quantile (*e. g.*, 0.25, 0.50, 0.75) of carbon emission practices for observation i

$\beta_j(\tau)$: The quantile-specific regression coefficients

$\epsilon_i(\tau)$: The quantile-specific error term

T : Quantile level ($0 < \tau < 1$), e.g., 0.25 for the 25th percentile

Age_i : Age of respondent

Sex_i : Gender of respondent (coded Male=1, Female=2)

HPQ_i : Highest Professional Qualification

$MGHGE_i$: Method of Green House Gases (GHG) measurement tool

YOE_i : Years of Experience

The coefficients $\beta_j(\tau)$ vary with τ , indicating that the effect of each predictor may differ at various points of the conditional distribution of the carbon emission practices variable.

Table 4 presents the result of quantile regression analysis; the dependent variable is an index of carbon emission practices (CEP) obtained from Principal Component Analysis (PCA) (see appendix) it is regressed against some independent variables. The coefficients for Highest Professional Qualification =2 (associate category) to Highest Professional Qualification =4 (fellow category) are small in all the models and their respective standard errors are also large. Highest Professional Qualification =5 (for other categories) is negatively significant at the lowest quantile. This implies that being in other professional qualifications might practice less carbon emission. Highest Professional Qualification does not significantly affect either the median or the upper quartile. The result is in line with Liu *et al.* (2023) that discovered that professional background and education level have a negative relationship with carbon emission performance and is in contrast with Li *et al.* (2021) who selected some enterprises in China's electronic information industry as a sample and reported that the professional background of members was significantly and positively related to corporate performance. Also, Kang *et al.* (2011) found that executive background characteristics such as age, years of service, professional background, and career experience can have an impact on managerial style, which affects corporate environmental efficiency indicators.

This insignificance at higher quantiles may suggest that CEP among mid- to high-level disclosers may be dominated by variables other than individual characteristics, such as organizational policy, industry conventions, and regulations.

Table 4: Impact of Highest Professional Qualification on carbon emission practices

	0.25	Quantile	Median	0.75	Quantile
--	------	----------	--------	------	----------

	regression	regressio n	regression
Highest Professional Qualification (base=1)			
Highest Professional Qualification =2	5.72e-15 (9.55e-15)	-5.50e-17 (0.572)	-5.50e-17 (0.763)
Highest Professional Qualification =3	4.57e-15 (9.37e-15)	-8.73e-17 (0.572)	-8.73e-17 (0.763)
Highest Professional Qualification =4	5.10e-15 (8.56e-15)	-8.34e-17 (0.853)	-8.34e-17 (0.763)
Highest Professional Qualification =5	-5.574** (2.197)	-1.01e-16 (1.385)	-1.01e-16 (0.763)
Years of Experience	2.38e-16 (2.39e-16)	3.46e-19 (1.56e-16)	3.46e-19 (1.53e-16)
SEX=2	-6.90e-16 (1.17e-15)	7.31e-18 (2.84e-16)	7.31e-18 (1.93e-16)
AGE	9.63e-17** (4.19e-17)	7.23e-19 (2.15e-17)	7.23e-19 (3.31e-17)
Method of GHG measurement tool (base=1)			
MGHGE=2	3.21e-15 (1.17e-14)	-1.42e-16 (2.40e-15)	-1.42e-16 (8.05e-16)
MGHGE=3	2.26e-15 (1.04e-14)	-1.54e-16 (2.04e-15)	-1.54e-16 (7.13e-16)
MGHGE=4	1.15e-15 (1.05e-14)	-1.80e-16 (2.23e-15)	-1.80e-16 (7.06e-16)
Constant	-0.325*** (1.94e-14)	-0.325 (0.572)	-0.325 (0.763)
Observations	383	383	383

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Survey and author's compilation 2024

Table 5 explains the result of effect of organization type on carbon emission disclosure. OT2 (oil and gas) shows a positive and statistically significant relationship with CEP in all the quantiles.

OT=5 is negatively significant at the lowest quantile. OT=6(construction/real estate) is positive and significant at the lowest quantile likewise variable like sex and age are significant at the lowest quantile, this indicates that sex and age only influence companies are that are low disclosers. It is worthy of note that some coefficients are significant statistically but have negligible significance because of the degree of smallness of their values.

Table 5: Organizational Type on Carbon Emission Practices

	0.25 Quantile regression	Median regression	0.75 Quantile regression
Organizational Type (base=1)			
OT=2	1.858*** (0.681)	1.858*** (0.572)	1.858*** (0.572)
OT=3	-2.07e-14*** (9.74e-16)	-1.62e-18 (0.934)	-1.62e-18 (0.934)
OT=4	-5.574*** (1.716)	9.14e-17 (1.716)	9.14e-17 (4.88e-16)
OT=5	2.84e-14*** (4.63e-15)	-1.06e-15 (3.29e-15)	-1.06e-15 (1.92e-15)
Years of Experience	-6.12e-15*** (4.28e-16)	-4.95e-16** (2.44e-16)	-4.95e-16*** (1.62e-16)
SEX=2	1.01e-14*** (8.24e-16)	-8.59e-18 (7.85e-16)	-8.59e-18 (6.53e-16)
AGE	5.84e-16*** (5.55e-17)	-1.89e-18 (2.20e-17)	-1.89e-18 (2.31e-17)
Method of GHG measurement tool (base=1)			
MGHGE=2	1.82e-14 (1.32e-14)	-2.73e-15 (9.41e-15)	-2.73e-15 (5.92e-15)
MGHGE=3	5.53e-15 (1.26e-14)	-2.35e-15 (8.64e-15)	-2.35e-15 (5.61e-15)
MGHGE=4	2.53e-14* (1.31e-14)	-2.48e-15 (9.49e-15)	-2.48e-15 (6.00e-15)

Constant	-0.325*** (1.51e-14)	-0.325*** (9.73e-15)	-0.325*** (6.60e-15)
Observations	383	383	383

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Survey and author's compilation 2024

Checking for robustness of the result, the multivariate probit results' validity is strongly supported by the quantile regression analysis. For instance, the adoption of carbon emission practices is still strongly predicted by organizational type. Also, professional qualification exhibits significance at specific quantiles. The consistency of these findings confirms the accuracy and robustness of the results.

Conclusion

This study looked at how highest professional qualification and organization type relate to carbon emission practices among companies in Nigeria. It used ordered probit, multivariate probit models and quantile regression within a strong methodological framework.

The findings show the variables that affect the quantity and quality of energy reporting include department/unit, professional qualification and organization type. The statistical importance of a number of demographic factors, such as age and experience, further indicates that human capital and internal capacity are important factors in determining carbon emission practices in Nigeria.

Due to the growing global and local awareness of environmental issues, Nigerian companies need to go beyond compliance and integrate sustainability strategically. Comprehensive reporting on energy use, particularly when it is applied across departments, monitored by trained staff, and customized by industry, provides more than simply reputational capital; it is the cornerstone of long-term growth, resilience, and innovation.

Policy Implications

The study presented empirical evidence on how organizational type and professional qualifications impact corporate decisions concerning carbon emissions practices in Nigeria, specifically with regard to the energy consumption dimension. Utilizing multivariate probit and quantile regression approaches strengthens the findings' resilience and confirms the importance of structural and firm-specific factors in influencing environmental behaviours.

Nigeria's climate goals and its commitment to the Paris Agreement are in line with the implications listed below, which are applicable to different industries, professional bodies, institutions, in promoting sustainability.

The results indicate that carbon emission practices are highly influenced by professional qualification and organizational type. Sectoral rules should therefore be specific because what suits a construction company might not be appropriate for a manufacturing company. Also, the institutionalization of sustainable practices can be improved by funding initiatives that increase the capability of each department and middle-level manager.

Industry-specific standards that address emission reporting commitments that put into consideration realities of each of the sectors should be endorsed by regulatory agencies like National Environmental Standards and Regulations Enforcement Agency (NESREA).

The significance of sustainability education and training is further emphasized by the influence of professional qualification on energy usage reporting. Environmental literacy needs to be incorporated into continuing professional development (CPD) programs by regulatory organizations and professional associations like the Nigerian Environmental Society (NES), the Council for the Regulation of Engineering in Nigeria (COREN), and the Chartered Institute of Purchasing and Supply Management of Nigeria (CIPSMN).

Priority should be given to competency enhancement programmes designed for manufacturing and extractive industries so as to remove hinderances to carbon emissions tracking and energy consumption accountability.

Compulsory coursework on carbon accounting and emissions disclosure should be introduced to certification syllabus of professional bodies. Also, Continuing Professional Development (CPD) training that majors on tools for quantifying and reporting greenhouse gas (GHG) emissions should be encouraged.

The National Universities Commission (NUC) should introduce into academic curriculum interdisciplinary degrees that combine environmental science with engineering, finance, and accounting so as to close the gap between environmental governance and technical competence. Likewise, emissions tracking software should be integrated into the curriculum. Carbon emissions disclosure should be made mandatory for big companies using GRI framework.

Chapter 2: impact of carbon emission practices on financial performance among firms in Nigeria

3.1 Introduction

Global warming and climate-related disruptions are largely caused by carbon emissions, which are mostly caused by the use of fossil fuels (IPCC, 2021). In this sense, the corporate sector is important since businesses are both major emitters and potential mitigators of greenhouse gases like carbon dioxide (CO₂). Climate change is related to the decreasing environmental quality along with industrial development, carbon retention, and increasing carbon emission from the entities and other human activities that accumulate over time (Iswati, 2017). Extensive media coverage on this issue, as well as growing awareness from the government, consumers, financial institutions, and the public; drive companies to consider strategic decisions upon climate change (Sprengel and Busch, 2011; Weinhofer and Hoffmann, 2010; Yunus *et al.*, 2016). Previous authors have established the fact that companies voluntarily disclosed their carbon emissions as a form of responsibility to stakeholders and this ensures their operational continuity (Collier, 2008). Companies' duty in mitigating climate change and environmental impacts is by analyzing, measuring, recording, and reporting the carbon emission rate (Kalu *et al.*, 2016).

One crucial factor in increasing carbon emission disclosure is companies' environmental committee. Companies' environmental committees shall apply strategies and practices to measure and report the greenhouse gas emission rate (Ashforth and Gibbs, 1990). Companies establish environmental committees as their responsibility to manage the environmental risk, including reputation risk and stakeholder's legitimacy threat (Ferreira *et al.*, 2013; Rankin *et al.*, 2011; Yunus *et al.*, 2016). The primary responsibility of the environmental committee is to report the company's sustainability report and other information related to environmental impacts. Environmental committees can be a predictor for carbon emission rate disclosure because companies with environmental committees can give more information and increase the quality of carbon emission disclosure. When companies raise their awareness of the environmental management system, environmental performance, and environmental committees, the quality of their carbon emission reports also improves (Yunus *et al.*, 2016). Usually, companies invest more

in green innovations (Luo *et al.*, 2013). Companies' initiative is also important in improving carbon emission disclosure. Companies put more effort into establishing environmental committees (Yunus *et al.*, 2016). Although many past researchers think carbon emission is important (Liao *et al.*, 2015), many also argue that companies report carbon emission only to improve their images without proper attention to environmental sustainability (Aerts and Cormier, 2009).

A lot of scholarly and practical attention has been paid to the relationship between environmental performance and financial performance as the need for climate action grows. While some academics contend that implementing carbon emission practices may result in lower short-term profitability and higher operating costs (Porter and van der Linde, 1995; Clarkson *et al.*, 2015), others maintain that these practices can result in long-term financial gains, innovation, cost savings, and investor confidence (Bui and de Villiers, 2017; Fatemi *et al.*, 2018).

Stakeholder and institutional theories have been applied in recent years to explain why businesses might incorporate carbon emission strategies into their operations. Stakeholder theory states that companies are more likely to gain credibility, lower reputational risks, and provide better financial results if they pay attention to the environmental concerns of their stakeholders, including investors, regulators, and customers (Freeman *et al.*, 2010; Khan *et al.*, 2022). According to institutional theory, companies may be compelled by normative, mimetic, or coercive pressures to adhere to environmental standards and laws (DiMaggio and Powell, 1983; Luo *et al.*, 2022). The idea that financial performance and environmental sustainability are not mutually exclusive but rather may even be complementary is supported by these theoretical stances.

3.2 Literature Review

3.2.1 Theoretical Review

3.2.2 Triple Bottom Line (TBL) Theory

Popoola (2014) asserts that the concept of an environmentally friendly economy as a whole can be seen as an alternative concept for growth and development, one that can produce improvements and growth in people's lives in ways that are compatible with sustainable development. Maintaining and enhancing social, environmental, and financial well-being is the triple bottom line

that an environmentally friendly economy fosters. By virtue of John Elkington's 1994 publication titled *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*, it establishes the essence of the Triple Bottom Line theory. Elkington was the first to highlight the need for companies to care more than just on profit and instead their general impact on the environment and society moving towards a more integrated view of business responsibility. This framework is called the 'three P's' which are people, planet and profit/prosperity and each of them corresponds to human resources, environmental resources and financial resources respectively. The TBL theory is related to practices of reducing carbon emissions because it advocates for the concern of the environment in business activities. In adopting TBL, organizations are being called to cut down on their carbon footprints as part of their obligation for looking after the environment. In the study of Siddique *et al.*, (2021) they say that the companies which target the reduction of their global carbon emissions through their business integration are trying to have a positive impact on the "earth" part of the TBL which is very crucial to the entire organizational effectiveness. In the case of investments into new and efficient environmentally friendly technologies, these are often costly financially, laying a burden on the companies especially those based in developing countries like Nigeria. Rowland (2023) pointed out that this commercial pressure could make it difficult for small or medium-sized enterprises to completely embrace TBL principles. Other critics of TBL, however, blame the emergence of this new approach for offering more profits and believe that the other two pillars may be neglected. However, the criticisms on the TBL framework which is now widely being enforced by firms across the globe as a means to enhance the performance of the society alongside the environment and the business are in most cases misplaced. The focus of these businesses is to see return on investment over the scarification of the world. This suggests that most societies would be ruined in the quest for financial success (Jouvenot and Krueger, 2019; Habitzreuter and Koenigstorfer, 2021; Cohen *et al.*, 2023). The financial result achieved in this fashion by the positive spin-off effects on other activities may, thus, be viewed as an excessive achievement strategy. It is only through this broader perspective that companies can achieve more balanced and integrated business for organizational performance and sustainable development.

3.2.3 Institutional Theory

There are various impositions now introduced into the country in the form of regulations and standards that are not only driven by social expectations, but also legal requirements, and that is where the legitimacy window comes in. Broadly stated, these external influences of 'norms,'

‘values,’ ‘regulations’ and ‘legitimacy’” assist the firm in attaining long term stability and survival. The theory of institutions stresses the need for organizations to comply with any and every standard set drop by society. Such standards may be deemed appropriate as long as they guarantee the goals of the organization (Wang *et al.*, 2019). The relevance of this theory in the Nigerian context is that, with carbon emissions reduction practices being integrated by firms, it is less difficult to balance these initiatives alongside the changing societal expectations and international standards. For example, if potential customers are willing to pay a premium for environmentally-friendly products, firms may find sufficient motivation or incentive to integrate carbon management into the business practice with sufficient motivation. This approach seems to help enhance a firm’s profitability and enhance its market share. In relation to sustaining businesses in today’s market characterized by extreme competitiveness, institutions are perceived as being restrictive. By contrast, these constructs are seen as facilitating by other theorists, explaining the focus on creativity.

3.2.4 Stakeholder theory

An important concept in contemporary management practices, stakeholder theory finds its origins in the 1984 book; *Strategic Management: A Stakeholder Approach* authored by R. Edward Freeman. The idea is that an organization must expand its mission from a focus on maximizing the wealth of its owners to include the interests and needs of customers, employees, investors, suppliers, communities, governments and all those affected by its activities. In consideration of carbon emissions practices, this theory highlights that there has to be no compromise between the environmental desires of stakeholders and the performance objectives of the organization (Tiamiyu *et al.*, 2021). In addressing the stakeholders’ expectations on sustainability, the firms can enhance loyalty, build trust and improve the reputation, all of which lead to better financial and market performance. This is especially applicable to Nigeria as stakeholders are becoming more vocal about the need for firms to tackle climate change through environmentally friendly methods. As an example, the application of carbon reduction strategies can assist businesses to satisfy the demands of climate-focused consumers, gain investors and meet compliance standards which is beneficial for organizational performance. On the contrary, some researchers have alleged that stakeholder theory is too loose and positioning between stakeholders’ interests is vague when there are conflicts.

3.3 Empirical review

According to Ngwakwe (2022), Nigerian manufacturing companies that implemented emission-reducing technologies recorded increases in their return on equity (ROE) and return on assets (ROA). It was demonstrated that carbon reduction strategies boost profitability. Chapple *et al.* (2021) discovered with examination of data from 350 Asian listed companies that carbon performance positively influences profitability. The findings emphasized that financial performance has a direct and statistically significant relationship with environmental accountability

Employing a panel dataset of European businesses, Zhang *et al.* (2020) found that businesses with evident carbon management procedures gained more investors and experienced more profit margins than their counterparts with little to no emissions reporting. Notwithstanding, Ahmed *et al.* (2021) emphasized that adopting green technologies can be expensive in the immediate, particularly for small and medium-sized businesses (SMEs), the relationship between CEP and financial performance may be adverse in the short term. The CEOs with more than ten years' work experience have probability of adding sustainability practices into their financial performance leading to more financial stability. (Okafor and Ugwuegbu 2023). According to a study by Li and Wang (2020) on Chinese industrial companies, older CEOs adopted more sustainable methods to carbon management, which resulted in increase in asset and profitability in the long-run.

Research by Post, Rahman, and Rubow (2021) showed that companies with a larger percentage of female leaders had more probability of engaging in carbon emissions disclosure. Better financial performance in terms of income and increased trust of their investors was also recorded by these companies. Senior executives with more professional and academic credentials were better equipped to comprehend and apply sustainable financial strategies, which increased profitability (Adebayo and Oni 2021). Workers with professional environmental management qualifications were better at converting emission-reduction efforts into observable financial profits, according to Mensah and Boateng's (2022) analysis of Ghanaian financial institutions. Nigerian publicly traded companies were more willing to practice emission disclosure, according to Ogunleye *et al.* (2023), which had a favourable impact on income and asset growth. On the other hand, companies run by families took longer time to embrace carbon emission practices, which resulted in poorer financial results in industries that are sensitive to carbon.

Due to incentives for regulatory compliance, oil and gas companies benefited financially from emissions control more at the instant than manufacturing companies, according to Adediran and Bello (2022). However, empirical results on this topic are still inconsistent and context-specific. Due to better risk management, innovation, and investor appeal, companies with proactive carbon plans frequently have better financial performance, according to studies conducted in industrialized nations (Ganda, 2022; Liesen *et al.*, 2015). However, due in part to differences in institutional frameworks, regulatory enforcement, and market expectations, evidences from emerging economies like Nigeria are still few and equivocal. Although several companies in Nigeria have implemented carbon reporting and emission-reduction programmes, especially in the manufacturing, extractive, and oil and gas sectors, the degree to which these practices affect their financial performance is still not well understood in academic research. Furthermore, organizational characteristics such as years of experience, ownership structure, professional qualifications of staff, organizational level, and industry type may significantly influence both the adoption of carbon emission practices and their financial outcomes. These moderating and mediating factors warrant rigorous empirical investigation to uncover nuanced relationships in the Nigerian context.

This study aims to fill this critical knowledge gap by examining the impact of carbon emission practices on the financial performance of firms operating in Nigeria. By employing robust econometric techniques such as Two-Stage Least Squares (2SLS) to address potential endogeneity, the research will provide evidence-based insights into whether and how sustainable practices align with economic performance. The findings will have practical relevance for corporate managers, policymakers, regulators, and investors interested in promoting sustainability without compromising profitability.

3.4 Materials and methods

3.4.1 Two-Stage Least Squares (2SLS)

The data were analyzed with Two-Stage Least Squares (2SLS). The sample size is computed using the Cochran's method or formula and was categorized into six major sectors which were manufacturing, agriculture, oil and gas, extractive, information technology, and construction/real estate.

The 2SLS helps in obtaining consistent estimators by using instruments variables that affect the endogenous regressor but do not directly affect the dependent variable. It is worthy of note that for this study we only used instrumental approach not instrumental variable. Instrumental approach was used in the sense that there are two stages involved. The first stage is the use of quantile regression in the first objective of this study and the second stage with the use of two stage least square.

Financial performance indicators used are profitability, income taxes, assets and net-worth. Principal Component Analysis (PCA) was used to get an index for financial performance. Independent variables used include: emission practices index which was also obtained by PCA, years of experience, sex, age, level in organization, highest professional qualification, organization type and highest academic qualification.

3.4.2 Model variables

Dependent Variable

FPi: Financial Performance (a composite index of profitability, income tax, total assets and net-worth) for firm *i*

Independent variables

CEPi: Carbon Emission Practices

YOEi: Years of Experience

SEXi: Sex of respondent

AGEi: Age of respondent

LOi: Level in Organization

HPQi: Highest Professional Qualification

OTi: Organization Type

HAQi: Highest Academic Qualification

3.4.3 Model Specification

Stage One: Predicting Carbon Emission Practices

$$CEPi = \pi_0 + \pi_1 YOE_i + \pi_2 SEX_i + \pi_3 AGE_i + \pi_4 LO_i + \pi_5 HPQ_i + \pi_6 OT_i + \pi_7 HAQ_i + v_i \quad (6)$$

Where:

- $CEPi$ = Independent variable (carbon emission practices)
- π_j : First-stage parameters
- v_i : First-stage error term

We estimate this model to obtain predicted values $CEPi$, which are free of endogeneity.

Stage Two: Estimating Financial Performance

$$FPi = \beta_0 + \beta_1 \hat{CEPi} + \beta_2 YOE_i + \beta_3 SEX_i + \beta_4 AGE_i + \beta_5 LO_i + \beta_6 HPQ_i + \beta_7 OT_i + \beta_8 HAQ_i + \epsilon_i \quad (7)$$

Where:

- \hat{CEPi} : Predicted (instrumented) values of carbon emission practices
- FPi : Financial performance
- β_j : Structural parameters to estimate
- ϵ_i : Second-stage error term

This second-stage model estimates the **causal impact** of carbon emission practices on financial performance, controlling for other covariates.

3.4.4 Assumptions and Diagnostic Tests

- **Instrument relevance:** Instruments must be correlated with the endogenous regressor (test using F-statistic in first stage).

- **Instrument exogeneity:** Instruments should not be correlated with the second-stage error term (test using over-identification tests like Sargan or Hansen J).
- **No perfect multi-collinearity** among instruments and exogenous regressors.

Results in Table 6 shows that financial performance has a positive and statistically significant relationship with carbon emission practices. After controlling for other factors, financial performance is predicted to increase by 1.549 units for every unit increase in the adoption or quality of emissions practices. The idea that open environmental policies could increase business value by lowering risk exposure or fostering more stakeholder trust is supported by this. Also, the coefficient for OT = 3 (Information Technology) is negative and has statistical significance, suggesting that poorer financial performance is linked with being in Information Technology. Financial success is positively correlated with OT = 4 (Construction/real estate), indicating that being in construction or real estate firm may improve financial performance. Higher academic qualification may not always translate into better financial performance; in some cases, they may even be linked to worse performance. HAQ = 3 (HND/BSc) and HAQ = 4 (Master's) exhibit statistically significant negative relationship with financial performance.

The findings confirm the beneficial economic effects of carbon emissions practices. The notion that openness in environmental impact favorably contributes to financial outcomes, possibly through improved reputation, investor credence, or operational efficiency is supported by the positive and statistically significant effect of carbon emissions practices.

Contrary findings about academic qualification and financial performance imply that, in some organizational contexts, practical competence may have a greater influence than higher academic qualification. As higher educational attainment may be linked to lower financial performance, this unexpected outcome might also be a mismatch between academic education and real-world financial prowess and this calls for more research on the skill-performance gap in organizational settings. These results emphasize the significance of environmental openness in contemporary business strategy and the complex influence of human capital on financial results. By reducing endogeneity issues, 2SLS provides more reliable causal explanations for the relationship between emissions practices and financial performance. It is advised that future studies do further robustness tests and investigate sector-specific dynamics.

Table 6: Two-Stage Least Squares 2SLS: impact of emissions practices on financial performance

Variables	Coeff.
Emission practices	1.549* (0.902)
Years of Experience	0.0591 (0.0729)
SEX=2	0.401 (0.249)
AGE	0.000930 (0.00768)
Level in Organization (base=1)	
LO=2	0.157 (0.169)
LO=3	0.174 (0.171)
Highest Professional Qualification (base=1)	
HPQ=2	0.0950 (0.286)
HPQ=3	0.489 (0.499)
HPQ=4	0.0438 (0.325)
HPQ=5	3.163 (2.002)
Organizational type(base=1)	
OT=2	-1.307 (0.883)
OT=3	-0.841** (0.401)
OT=4	2.203*

	(1.248)
OT=5	0.464
	(0.386)
Highest Academic Qualification (base=1)	
HAQ=2	-0.331
	(0.208)
HAQ=3	-0.414*
	(0.225)
HAQ=4	-1.190***
	(0.343)
Constant	-0.593
	(0.802)
<hr/>	
Observations	384
<hr/>	

Source: Survey and author's compilation 2024

3.5 Conclusion

This chapters analyses the impact of emissions practices on financial performance among companies in Nigeria. The result offered empirical support on the relationship between carbon emission practices and financial performance as determined by profitability, income, and total assets and net-worth are related among Nigerian companies.

The results show that carbon emission practices have a statistically significant and direct influence on financial performance of the companies. This is achieved by using the Two-Stage Least Squares (2SLS) regression approach to handle any endogeneity difficulties. This supports the idea that sustainability practices can be economically profitable by indicating that companies that adopt carbon emission practices typically record greater financial results.

This result is in line with new international studies that highlight the benefits of environmental responsibility for the economy. According to Kumar and Firoz (2023) and Amacha and Elum (2022) companies that implement carbon emissions practices recorded higher financial benefits because they are more efficient, have a better reputation, and can obtain green financing. Such approaches can result in a competitive advantage in Nigeria, where environmental restrictions are increasingly becoming stricter and investor awareness is rising.

Nonetheless, a few independent variables pertaining to organizational type and educational background are statistically significant; for instance, organization type 4 (construction company) has positive and significant effect on CEP, suggesting that a construction company might have capacity to implement carbon emission practices.

On the contrary Organizational Type 3 (information technology) exhibits a substantial negative influence, which might be suggesting unwillingness to adopt sustainability practices

In terms of the highest level of education, financial performance shows a negative relationship with post degree education i.e, HAQ=4 (M.Sc.). It means that higher academic qualification may not always translate into better financial performance; in some cases, they may even be linked to worse performance. These contrary findings about academic qualification and financial performance imply that, in some organizational contexts, practical competence may have a greater influence than higher academic qualification. As higher educational attainment may be linked to lower financial performance, this unexpected outcome might also be a mismatch between academic education and real-world financial prowess and this calls for more research on the skill-performance gap in organizational settings.

These results add to the growing body of studies on corporate environmentalism and financial results, supporting the notion that environmental investments can promote stability and growth rather than conflict with financial benefits (Nguyen and Tu, 2021; Duque-Grisales *et al.*, 2020).

Notably, the Porter Hypothesis, which contends that ecologically conscious strategies can birth innovation and efficiency improvements that eventually promote competitiveness, is supported by the positive and statistically significant correlation between carbon emission practices and financial performance (Porter and Van der Linde, 1995).

3.6 Policy implications

The findings imply that governments and regulatory bodies ought to persuade companies to implement quantifiable carbon reduction plans, possibly by means of tax breaks or mandatory disclosures. Furthermore, CEO's and companies' managers must see investment in sustainability practices as a strategic driver of profitability rather than a mere mandatory activity.

Promoting Carbon Emissions Reduction Techniques to improve financial outcomes by providing financial incentives to businesses that adopt provable carbon reduction techniques or technology,

such as tax breaks or subsidies. Also, green finance tools like green bonds, climate funds and the rest should be made more accessible in order to promote investments in sustainable practices. Enhancing Technical and Professional skills by stirring up management staff to enroll for courses that will enable them get professional certifications in environmental compliance audit and carbon finance should be encouraged. Furthermore, professional associations should incorporate sustainability courses into their curricula.

In the study area, academic qualification seems inadequate or not in line with organizational needs for controlling emissions, this suggests gap between the practical requirements of managing emission practices for financial benefit and academic knowledge. To this end it is important to revise curricula for environmental management courses to reflect real business-world case studies and line-of-business applications for different industries. Also, industry-university partnerships should be given more attention through internship, research and sustainability reporting.

Using organization-specific assistance depending on the impact of each organization is also encouraged. Since, it is not all the sectors that have the capacity of translating sustainability initiatives to profits, it is expedient to use regulations designed to meet different organization's requirements for carbon reporting

Inclusive involvement of staff irrespective of their position, gender or age should be encouraged in executing sustainability projects. We recommend that businesses should establish multidisciplinary sustainability teams and organize inclusive training to encourage collective learning among all members of staff. Also, promoting green initiatives and giving acknowledgement and backing for concepts that enhance carbon tracking and energy consumption efficiency should be encouraged.

Chapter 3: Impact of carbon emission practices on non-financial performance among firms in Nigeria

4.1 Introduction

Governments, investors, and civil society are clamoring that companies should be held more accountable for their environmental impacts, especially their greenhouse gas (GHG) emissions, as a result of the growing global concern over climate change. It is globally acknowledged that carbon emissions, a major contributor to GHGs, are the main cause of anthropogenic climate change (IPCC, 2021). The Global Carbon Project (2023) estimates that in 2022, industry and fossil fuels contributed 36.8 billion metric tonnes of CO₂ emissions worldwide, a 1.1% rise from the year before. With 11.47 billion tonnes (31.2%) from China, 5.01 billion tonnes (13.6%) from the US, 2.71 billion tonnes (7.4%) from India, 2.29 billion tonnes (6.2%) from the EU, and 1.88 billion tonnes (5.1%) from Russia. These five were the top emitters. It is noteworthy that 63% of worldwide emissions came from just five countries only, emphasizing the stark differences between advanced and developing nations.

Energy consumption continues to be the leading source of emissions worldwide, according to the International Energy Agency (IEA, 2023), with coal accounting for 40.4%, oil for 32.6%, and gas for 19.7%. Increased energy consumption, particularly in emerging nations, is the reason why emissions are still rising despite the expansion of renewable energy deployment.

Nigeria, the most populated and economically significant nation in Africa, makes up a small proportion of global emissions, yet it is extremely vulnerable to climate change. Around 135.9 million metric tonnes (MtCO₂e) of CO₂ were released by Nigeria in 2022, accounting for roughly 0.4% of world emissions (World Bank, 2023; EDGAR Database, 2023). In Nigeria, according to FAO (2023), energy sector contributes about 60.3%, agriculture 18.1%, Industry 11.4%, waste 6.7%, land use and forestry 3.5% of CO₂. Oil and gas industry continues to be the biggest emitter of CO₂ because of flaring, and ineffective energy infrastructure. Nigeria was among the top 10 flaring countries in the world in 2022, with gas flaring alone responsible for an estimated 7.6 billion cubic meters (bcm) of natural gas emissions, according to the National Bureau of Statistics (NBS, 2023). Figures 1 to 3 show comparable patterns in Nigeria's rising CO₂ emissions during the previous decades. Nigeria ranks 162 out of 180 countries in environmental performance indices, having performed badly with respect to sustainability and environmental protection, scoring 39.2% in 2014, 45.4% in 2015, and 28.3% in 2022 (Sreedhar *et al.*, 2016; Wolf *et al.*, 2022).

According to Lin *et al.*, (2015) the demand for environmentally friendly building materials to lower carbon emissions is aggravated by the high temperatures and sun radiation in developing nations, like Nigeria. One of the biggest sources of carbon emissions in Nigeria is the building industry, which has a major negative influence on both the environment and public health (Liu *et al.*, 2020). Machinery and equipment used in the building industry emit GHG emissions (Reijnders, 2022). By 2035, CO₂ emissions are predicted to rise by roughly 42.7%, surpassing 2007 levels, according to the U.S. Energy Information Administration (Shi *et al.*, 2015). Almost 40% of the CO₂ emissions are from construction industry. This industry contributes a huge proportion of the global energy consumption and it is predicted to increase more as years go by (Huang *et al.*, 2017; Lin *et al.*, 2015). United Nations Environment Programme (UNEP) research estimates that the cement industry contributes about 8% of global carbon dioxide emissions (Liu *et al.*, 2020).

In order to fully represent the wider societal and ecological effects of organization behaviour, non-financial performance factors are crucial. Non-financial performance is one of the techniques of performance measurements system invented by companies to assess the performance of entrepreneurial activities, the performance measurements system techniques are financial performance and non-financial performance (Ahmad and Zabri (2016). Performance of a business might not be fully captured by using only financial metrics, which can also conceal important early warning signs of risk or opportunity (Eccles and Krzus 2010). Non-financial performance measurements are measures that are not obtained from financial reporting template as their database. It is used to assess economic activities of businesses such as product quality, customer satisfaction among others (Krstić, 2006). Non-financial performance, according to Norton (1996), includes metrics like employee morale, internal process efficiency, customer satisfaction, corporate social responsibility, and innovation capacity. These metrics are all crucial for comprehending business success beyond immediate financial gains. A company's strategic posture can be assessed using these metrics, which frequently serve as leading predictors of financial performance. Non-financial performance metrics, according to Van Beurden and Gössling (2008), are good indicators of stakeholder responsiveness and firm-level ethics, particularly when assessing the results of sustainability strategies.

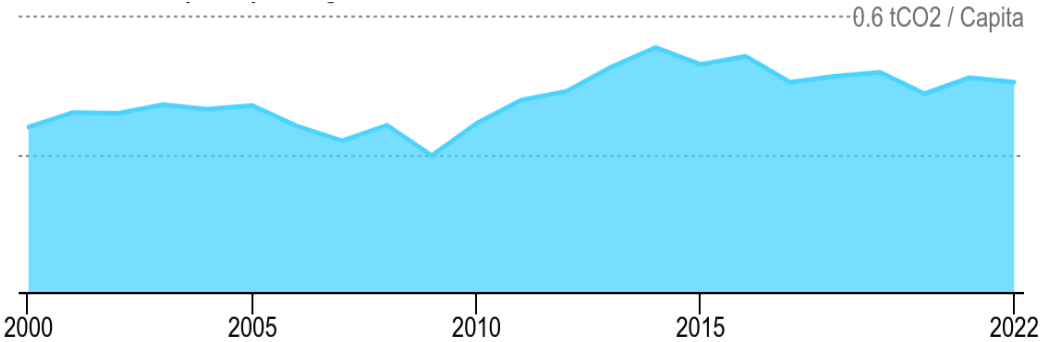
Non-financial performance indicators measure essential components of deliberate and planned success, including innovation and customer satisfaction. It highlights qualitative aspects that serve

as pointers for future financial performance (Ittner and Larcker 1998). Businesses that are committed to controlling their carbon emissions always notice improvements in their reputation and more innovative results (Wieland, 2017; Hart and Dowell, 2011). Despite not being visible in the immediate in financial accounts, these results are becoming more widely recognized as key markers of resilience and long-term financial performance (Clark *et.al.* 2015). Monitoring, reporting, and greenhouse gas (GHG) emissions reduction is part of carbon management, and they have evolved from a side project to a key component of business strategy. Investors, consumers, and regulatory bodies frequently hold companies that implement proactive carbon emission practices in a high esteem (CDP, 2023). Studies have shown that companies that have strong and effective carbon reduction plans frequently outshine their competitors on crucial non-financial indicators (Clark *et. al.* 2015, Roth *et. al.*2020).

The relationship between carbon emission practices and some non-financial performance indicators are supported by signaling impact of carbon transparency which shows the stakeholders the company's dedication to environmental conservation and sustainability practices (Grewatsch and Kleindienst, 2017). Although, according to Liesen *et al.* (2015) the type and the degree of relationship that exist between carbon emission practices and non-financial performance is dependent on the strength of the organization, industry attributes and regulatory framework. The demand for emissions reduction in carbon-intensive industries like manufacturing hinges on stakeholder legitimacy. Whereas, innovation and employee engagement are likely to have connection with carbon emissions reduction in other industries like technology. Non-financial performance (NFP) metrics are obtained from metrics that enhance financial statements. Some of them are customer satisfaction and organizations activities (Kaplan and Norton 1992). The importance of NFP in informing investor decisions has been mentioned repeatedly in literature. Companies that have sound CSR practices get good recommendations from the analysts suggesting the connection between social responsibility and long-term performance (Ioannou and Serafeim 2015). The focus on NFP indicators has got a lot of attention in the changing structure of corporate performance evaluation. In the past, scholars have used financial measures like return on investment (ROI), shareholder value and revenue to capture corporate success. However, in recent time, some scholars and policy makers have been questioning this financial measure arguing that it does not present full and true picture of organization performance, especially when long-term sustainability, stakeholder engagement, and corporate responsibility are under consideration (Kaplan and Norton, 2001; Eccles *et al.*, 2014).

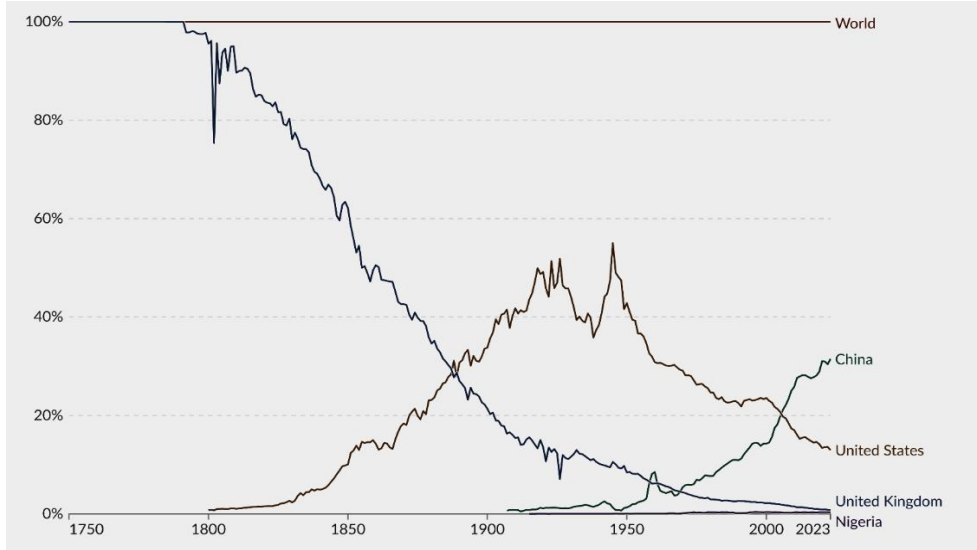
Global crisis like climate change has heightened the importance of non-financial performance which actually uncovers the weaknesses of using only financial statements. Companies have now been saddled with the responsibility to display resilience and act responsibly. This has led to the expansion of integrated reporting framework such as Sustainability Accounting Standards Board (SASB), Global Reporting Initiative (GRI) and the International Integrated Reporting Council (IIRC) (Adams, 2017). According to Kotsantonis *et. al.* (2016) environmental stewardship, social responsibility, corporate governance, innovation, customer satisfaction, employee engagement, and brand reputation are just a few of the many aspects of non-financial performance that show companies’ contribution to stakeholders apart from shareholders which consists of employees, customers, communities and the environment. The increasing significance of Environmental, Social, and Governance (ESG) emphasizes the move towards a more comprehensive strategy for organizational performance that is in line with the objectives of sustainable development and wider social norms. Furthermore, studies have shown that comprehensive NFP is not only useful but also has a positive relationship in the long run with financial performance. Companies that perform better in terms ESG benefit greater operational efficiencies, lower capital cost and better investor trust (Eccles *et. al.* 2014). Additionally, stakeholders such as investors, employees, and customers are progressively incorporating NFP information in to the decision-making processes in order to control company’s strategies (Clark *et. al.*, 2015).

Figure 2: Trend of increasing CO2 emissions per capita, Nigeria



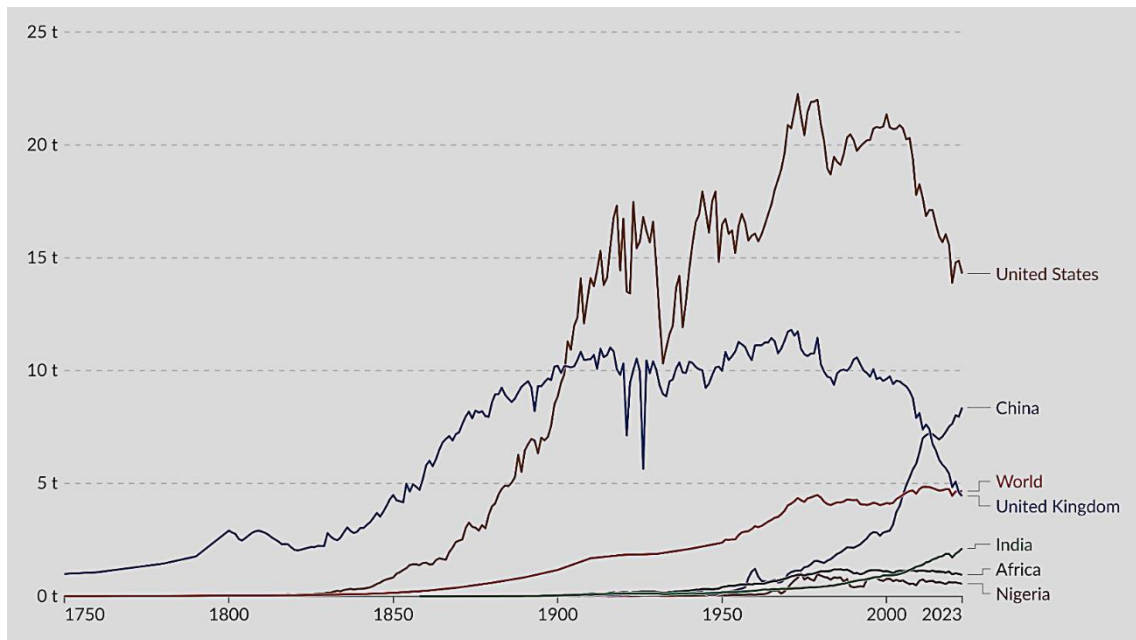
Source: International Energy Agency

Figure 3: Share of global CO2 emissions from fossil fuel and industry. Land-use change is not included



Source: adapted from Global Carbon Budget (2024)

Figure 4: Per capital CO2 emissions



Source: Adapted from Global Carbon Budget (2024)

Research Objective

The main objective of this study is to determine the effect of carbon emission practices on organizational performance of firms in Nigeria.

The specific objective is:

- i. estimate the impact of carbon emission practices on non-financial performance among firms in Nigeria

Research Hypothesis

H₀₁ There is no significant impact of carbon emission practices on non-financial performance among firms in Nigeria

4.2 Literature review

4.2.1 Theoretical review

➤ Legitimacy Theory

A social contract that binds organizations to societal norms is known as legitimacy (Loewe and Zintl 2021). A company uses its sustainability disclosure strategies to try to uphold the social contract. Noah (2017) emphasized that companies can use Corporate Social Responsibility (CSR) to satisfy the demands and expectations of the public. Engaging in (CSR) can help a business to acquire legitimacy. Otherwise, it will probably face reputational risk and other forms of risks (Filatotchev and Nakajima, 2014; Gangi *et al.*, 2018). According to Guthrie *et al.* (2006), legitimacy theory was derived from organizational and social system theory, which sees organizations as intricate parts that need to interact with their surroundings in order to thrive. Legitimacy theory highlights that an organization must continue to integrate its personal values with those of the social system in which it functions in order to achieve legitimate status, which is the acceptance and support of society and the removal of any threat to its existence (Dowling and Pfeffer, 1975; Guthrie *et al.*, 2006; Noah, 2017). Among the theoretical frameworks most frequently mentioned in studies on social, environmental, and sustainability accounting is legitimacy theory. Perhaps, it is the most popular theory for explaining sustainable, social, and environmental disclosure (Campbell *et al.* 2003). According to legitimacy theory, businesses use socially conscious strategies to win or keep the favour of society (Suchman, 1995). Practices for reducing and disclosing carbon emissions work as a means of coordinating organizational activities with environmental ideals held by society. Legitimacy theory serves as the foundation for current studies on social and environmental disclosures since it is the most effective framework for describing the two concepts (Guthrie *et al.* 2006).

➤ **Signalling Theory**

This theory was introduced by Spence (1973). In order to address information asymmetries, signalling theory proposes methods for communicating information to a different party (Spence, 1973). Reducing and explaining information asymmetries between a signaller (business) and the signal receiver (in this case, customers) is the focus of signaling theory (Bergh *et al.*, 2014). When two actors have an information asymmetry, one party (the sender) must choose which information (the signal) to communicate to the other party (the receiver) (Connelly *et al.*, 2011). This is the core of signaling theory (Spence 1973). The theory takes into account how well five different signal components work to lessen information asymmetries. These five elements consist of the signal's frequency, consistency, credibility, cost, and observability (Connelly *et al.*, 2011).

The signaling theory states that companies can communicate their environment-friendly strategies to stakeholders by revealing emissions and demonstrating their carbon performance. The information gap between companies and investors is successfully closed by such act (Adhikari and Zhou, 2022). As stated by Mukhibad (2018) in signal theory, signals, signal senders, signal receivers, and feedback are the four primary components. The information gathered by management to fulfil the investors' wishes is contained in the signal. One type of information disclosure that could be included in the signal is the company's carbon emissions. The value of the company can be raised by using this information to let investors know that the company is environmentally conscious (Hapsoro and Falih 2020).

➤ **Resource-Based View (RBV) Theory**

Renowned Strategic Management scholar JB Barney of the University of Utah created the idea in 1991. According to the RBV theory, a company's capabilities and resources are what provide it a long-term competitive edge (Barney, 1991; Barney, 2012). Utilising a firm's distinctive resources—which are valued, uncommon, unique, and non-substitutable—gives it a competitive edge, according to RBV (Barney, 1991; Peteraf, 1993; Teece, Pisano & Shuen, 1997, 2016; Barney, 2012). A resource or capacity (a bundled set of resources and capabilities) that a firm holds, controls, or accesses preferentially is the unit of study in resource-based theories, which are defined as "theories of the nature, behaviour, and/or performance of firms" by Peteraf (2016).

4.3 Carbon Emissions Practices

Carbon emission practices are referred to as methods and actions that companies adopt for measurement and reduction of their GHG emissions. These methods are investments in clean technologies, compliance with emission trading systems (ETS), carbon offsetting and mandatory or voluntary disclosure (Kolk *et al.*, 2008; Luo *et al.*, 2012). Businesses with good environmental performance are more likely to implement comprehensive emission reduction plans and freely disclose such actions, claim Clarkson *et al.* (2008). In the meantime, institutional forces, such as stakeholder scrutiny and legal frameworks, are highlighted by Delmas and Toffel (2008) as key factors influencing the adoption of CEP.

According to Luo and Tang (2016) carbon disclosure promotes stakeholder views and enhances ties with investors and the community. By enhancing brand equity, reducing risk, and fostering regulatory goodwill, these non-monetary gains frequently result in competitive advantages. Ebrahim *et al.* (2014) emphasized that environmental practices are being utilized more and more as performance indicators in governance and legitimacy evaluations in both public and non-profit organization.

4.3.1 Regulatory frameworks on carbon emission practices

Regulatory frameworks are referred to as legally enforceable regulations created by governments or international organizations. By establishing legally binding regulations, compliance procedures, and sanctions for non-compliance, regulatory frameworks play a crucial role in institutionalizing carbon reduction commitments. There are national, regional, and international versions of these frameworks. Some of these frameworks include:

➤ Market-Based mechanisms

Market based tools are generally acknowledged for their cost-effectiveness in lowering emissions. They include such tools as carbon taxes, cap-and-trade schemes, and baseline-and-credit initiatives (Stavins, 2019). These tools internalize GHG emissions' externality and promote low-carbon technology innovation by placing a price on carbon.

➤ International Regulatory Frameworks

Establishing the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 was one of the first and most important international initiatives, and it served as the foundation for

international collaboration on climate change mitigation (UNFCCC, 2022). Leveraging on this basis, the Kyoto Protocol (1997) established market-based systems like the Clean Development Mechanism (CDM) and Emissions Trading Systems (ETS) and gave developed nations legally binding carbon reduction objectives (Bodansky, 2016).

A major change was brought about by the 2015 adoption of the Paris Agreement, which required all signatory countries to submit Nationally Determined Contributions (NDCs) and pledge to keep the increase in global temperatures well below 2°C, ideally 1.5°C (Rogelj *et al.*, 2016). The Paris Agreement, which depends on voluntary national commitments and recurring reviews, stresses a bottom-up strategy in contrast to the Kyoto Protocol.

➤ **Regional and National Frameworks**

Regionally, the largest carbon market in the world is the European Union Emissions Trading System (EU ETS), which was created in 2005. A cap on emissions is set, and businesses are able to purchase or sell emission allowances under the cap-and-trade system (European Commission, 2021). Monetary incentives for reducing emissions are offered by this market-based strategy.

China's National ETS, which was introduced in 2021 and initially targeted the power industry with plans to expand, is set to surpass all other ETSs in Asia in terms of emissions coverage (ICAP, 2022). Similarly, there are a number of subnational initiatives in North America, even though the US does not have a federal carbon pricing policy. Two prominent examples that target emissions from the electricity and industrial sectors are California's Cap-and-Trade Programme and the Regional Greenhouse Gas Initiative (RGGI) (Burtraw *et al.*, 2018). Likewise, Canada has instituted a federal carbon pricing scheme that permits provinces to choose between a cap-and-trade model or a carbon tax (Government of Canada, 2022).

➤ **Regional Climate Strategy (RCS) And Action plan (2022-2030)**

According to ECOWAS Regional Climate Strategy (RCS), the best approaches to help people, public and private establishments, and governments in the ECOWAS countries to get prepared and equipped to handle the effects of climate change are through adaptation actions and strategies. West African nations can work together to address climate change through 2030 by following the ECOWAS Regional Climate Strategy (RCS), which aims to increase ambition by 2050. It reconciles priorities of the region into an Action Plan (2022–2030) with effective programmes, budgets, responsibilities, and indicators for the Paris Agreement, national climate

pledges/Nationally Determined Contributions (NDCs), and the Sustainable Development Goals (SDGs).

The adaptation actions are targeted towards:

- agriculture, livestock farming, fisheries and aquaculture
- health
- energy
- water resources
- milieux, naturel ecosystems, biodiversity
- transports and mobility,
- climate services, Disaster Risk Management, early warning systems, human mobility
- coastal zones

Mitigation actions are planned towards:

- Agriculture, Forests and Other Land Uses
- Transports and mobility
- Energy
- Industrial processes and product use (IPPU)
- Waste

This is implemented through CSR policy, Climate mainstreaming in the Commission: climate unit, dialogue with Member States on the Paris Agreement. The Institutional arrangements: IDEC*, Directorate of Environment, Transversal directorates, Member States, Climate donors group, Regional institutions.

General objective of regional climate strategy supports the Member States in overcoming the challenge of the fight against climate change, in particular for the achievement of their commitments under the Paris Agreement

This general objective is broken down into six specific objectives:

SO1.Ensure that the regional policy framework is compatible and consistent with the global objectives of the Paris Agreement

SO2. Develop the ability to anticipate and to take informed decisions to manage current and future climate risks.

SO3. Encourage an institutional and organizational paradigm shift regarding climate change.

SO4. Build the capacities of ECOWAS and its Member States for the implementation of policies and actions to combat climate change.

SO5. Strengthen cooperation and solidarity among Member States vis-à-vis climate change.

SO6. Promote new approaches to mobilizing internal and external financial resources.

4.3.2 Voluntary initiatives for carbon emission practices

Voluntary initiatives are optional programmes or tactics used by businesses to show leadership and responsibility towards environmental protection. Companies are increasingly turning to voluntary activities in an effort to go above and beyond compliance, improve their brand, and satisfy stakeholder needs. These programmes frequently follow global reporting guidelines and conventions. These include:

➤ Corporate-Led Climate Initiatives

An increasing number of businesses are taking part in climate efforts that are transparent and grounded in research. Business can set carbon reduction targets that align with the objectives of the Paris Agreement with the help of the Science-Based Targets initiative (SBTi) (CDP *et al.*, 2023). A worldwide platform for carbon disclosure is also offered by the Carbon Disclosure Project (CDP), which assists businesses in managing climate risks and opportunities by promoting transparency and benchmarking (CDP, 2022). Other non-profit business affiliations are EP100, EV100 and RE100.

➤ Voluntary Carbon Markets

Companies can offset their emissions by buying carbon credits from projects like energy efficiency, renewable energy, or reforestation. Standards like the American Carbon Registry (ACR), Gold Standard, and Verified Carbon Standard (VCS) guarantee the quality and legitimacy of offset projects (Kreibich and Hermwille, (2021)). Voluntary carbon markets are important because they encourage private investment in emission-reduction projects even though they are not governed by the government.

➤ Internal Carbon Pricing

Commencement of internal carbon pricing is a new voluntary strategy in which companies place a financial value on carbon emissions to sway investment choices; this can be done through an internal carbon fee imposed on companies' units or a shadow price applied to project evaluation (World Bank, 2022).

➤ **Environmental Reporting Standards**

Corporate governance now includes sustainability disclosure as a fundamental component. Comprehensive criteria for reporting carbon emissions and climate-related risks are provided by frameworks including the Task Force on Climate-related Financial Disclosures (TCFD), the Sustainability Accounting Standards Board (SASB), and the Global Reporting Initiative (GRI) (Eccles and Krzus, 2018).

4.3.3 Non-financial performance

According to Eccles *et. al.* (2014) non-financial performance is the qualitative elements of a company's activities that promote its long-term value but are not represented in financial accounts. Some of the measures are customer satisfaction, human capital development, employee morale, product quality, environmental, social, and governance (ESG) performance and corporate social responsibility (CSR). Non-financial performance refers to qualitative aspects of a firm's operations that contribute to its long-term value creation but are not directly captured in financial statements. These include metrics related to environmental, social, and governance (ESG) performance, corporate social responsibility (CSR), customer satisfaction, brand image, and human capital development (Eccles, Ioannou and Serafeim, 2014). These elements, while intangible, have become increasingly material in stakeholder decision-making, particularly in investment, partnership, and talent acquisition contexts.

According to O'Connell and O'Sullivan (2014), the executive compensation contract design incorporates Non-Financial Performance Measures (NFPM) that are associated with customer satisfaction and loyalty. Among the indicators that can be used to measure non-financial performance are growth in the number of customers or partners, the average duration of the relationship with the customer, customer loyalty, and customer profitability (Raval *et al.*, 2019).

Going by literature non-financial performance are captured using indicators like customer loyalty, product quality, employee morale (Drury *et al.*, 1993, CIMA (1993), Drury and Tayles (1993)).

demonstrated a rising attention on non-financial metrics, with a particular emphasis on marketing initiatives and quality concerns.

4.4 Empirical Review

Research has repeatedly demonstrated that CEP and NFP are positively associated. According to Eccles *et al.* (2014) and Luo and Tang (2016), companies that implement cautious environmental initiatives frequently experience improved organizational culture, stronger stakeholder relationships, and increased legitimacy. These enhancements show up as higher stakeholder trust, consumer loyalty, and employee engagement which are all important aspects of non-financial performance. Carbon disclosure enhances stakeholder views and builds regulatory trust, according to Luo and Tang (2016). Environmental responsibility improves institutional legitimacy and goal alignment, according to Ebrahim *et al.* (2014).

According to Eccles *et al.* (2014), businesses with integrated sustainability cultures perform noticeably better than control groups when it comes to non-financial performance. Also, Lo *et al.* (2017) reported that reputation-based performance and carbon reduction plans are positively correlated in UK companies. Environmental innovation and compliance in Spanish enterprises are positively influenced by carbon disclosure, according to Gallego-Alvarez *et al.* (2014). Lo *et al.* (2017) reported that UK companies with strong carbon management plans claimed higher market share as a result of their distinctive brands. Furthermore, Owolabi and Olu-Owolabi (2020) showed that companies that prioritize sustainability have positive influence on customer base and market share in Nigeria, especially in the manufacturing and oil sectors. Uwuigbe *et al.* (2019) demonstrated that Nigerian businesses that incorporate carbon reduction tactics into their branding and messaging have an edge over rivals in urban marketplaces where environmental awareness is rising.

However, Nigeria's varied carbon disclosure systems and data paucity make it difficult to track direct market share consequences, indicating a critical empirical gap. Companies with robust sustainability strategies perform better in terms of customer loyalty and employee satisfaction (Eccles *et al.* 2014). Odoemelam and Okafor (2018) discovered that listed firms in Nigeria have inconsistent and few carbon reporting methods, which suggests that their carbon management systems are not yet mature. Akinpelu *et al.'s.* (2020) investigation into the connection between

reputation and sustainability practices showed that businesses with stronger environmental disclosures were more trusted by the public. The impact of environmental disclosures on corporate value was studied by Nwaiwu and Oluka (2018), who also suggested that stakeholder confidence and company image are negatively influenced by environmental disclosure. Customers in developing countries display their loyalty by choosing brands with environmental commitments and this brings increase in the purchase and recommendation of those brands (Yusoff *et al.* 2020). In Nigerian manufacturing companies, Iredele and Akinlo (2021) found a favourable relationship between employee engagement and emission disclosure. Workers expressed greater pride in working for companies that are seen as environmentally conscious.

Companies with environmental strategies have been found to have reduced turnover rates and better levels of motivation, particularly among professionals that are young (Ajibolade and Uwuigbe, 2016). Around the world, Dangelico *et al.* (2016) showed that employees' organizational commitment and innovative culture are strengthened by green practices. According to Gallego-Alvarez *et al.* (2014), carbon reduction tactics encourage businesses to use greener technologies, which consequently raises their product quality. Companies in Nigeria that have proactive carbon strategies typically incorporate quality and compliance procedures into their daily operations, according to Odoemelam and Okafor (2018). Zhou and Ahmad (2020) highlighted the risk of greenwashing, where firms exaggerate or misrepresent their environmental achievements. When stakeholders perceive carbon disclosures as insincere or superficial, the firm may suffer reputational damage and customer skepticism, undermining non-financial performance.

Tang *et al.* (2023) found that in highly competitive and resource-constrained industries, the short-term cost of implementing carbon reduction technologies can reduce investment in product quality and employee welfare, potentially eroding short-term non-financial performance. Han *et al.* (2022) argued that the benefits of carbon practices on non-financial outcomes are contingent upon stakeholder engagement and institutional support. In contexts where environmental awareness is low or regulatory frameworks are weak—as in many developing countries—carbon initiatives may have a muted effect on customer perception or employee motivation. Okonkwo and Eze (2022) found that although carbon practices improved product perception in some Nigerian firms, the relationship was not uniform across all sectors. Firms with inconsistent implementation or poor communication strategies saw limited non-financial returns despite their environmental investments. Akinwale and Obafemi (2022) revealed that firms in Sub-Saharan Africa that

practised proactive environmental reporting gained significant reputational capital and regulatory goodwill, enhancing their market positioning and long-term viability. Rashid *et al.* (2023) conducted a cross-sectoral analysis and observed that in both manufacturing and service sectors, carbon mitigation practices contributed positively to brand reputation, customer trust, and innovation perception—all strong components of non-financial performance. Drury and Tayles (1993) discovered the significance of non-financial performance indicators, specifically indicators of product quality, customer satisfaction etc on UK small and medium enterprises.

4.5 Research Gap

The literature analysed in this study and the development of regulatory frameworks for carbon emissions practices and organizational performance enable us to understand how carbon emissions practices such as sustainability reporting affects KPIs. However, major knowledge gaps still exist. Several Authors, however, including Tiamiyu *et al.* (2021) and Uadiale and Fagbemi (2019) have tried to address this gap in their studies by seeking to investigate the implications of sustainability reporting on a firm and its performance although they tend to look at financial performance of the firm, including profitability and operational efficiency. Nonetheless there are significant weaknesses in these analyses of such authors, as they mostly fail to focus on other non-financial aspects of performance including but not limited to customer loyalty, product quality, market share and even employee morale, all of which are also vulnerable to carbon emissions practices.

The interaction of green manufacturing processes and their resulting output quality has not been looked at in detail previously in the context of Nigerian industries. And there are those who continue to operate within carbon-based production, but still, little is known about the degree to which changing towards sustainability practices on product quality and what consumers think. Similarly, the impact of carbon emissions practices on market share is unclear, especially in competitive sectors like real estate and construction, where green building and eco-friendly designs could serve as market differentiators. Employee morale is another area where knowledge is lacking. There is insufficient research on whether employees in Nigerian firms feel more motivated or engaged when their organizations adopt carbon reduction strategies, which could signal commitment to broader corporate social responsibility. The relationship between carbon emissions practices and NFP in Nigeria remains inconsistent in findings, as the upfront costs of adopting

sustainable technologies are often viewed as burdensome for businesses in an economy with infrastructural deficits.

4.6 Materials and methods

4.6.1 Data

To analyse the effect of carbon emission practices on non-financial performance in Nigeria, primary cross-sectional data were used and to this end the questionnaire was designed to gather data on the chosen topic of carbon emission practice and organizational performance of companies in Nigeria. Self-structured questionnaire was developed for this study in order to align the specific and common carbon emission practices by Global Reporting Initiative (GRI) as the elements of standards from GRI will influence the non-financial performance of the selected sectors in Nigeria. The questions/statements in the questionnaire were carefully worded and focused on the objective to elicit relevant information regarding the proxies of the study. The questionnaire contained three sections: section A which was the cover page introducing the study and research philosophy; section B of the questionnaire was designed to collect demographic data of the respondents, while section C, on the other hand, was concerned with statements / questions on the different dimensions of carbon emission practices and organizational performance using 5-points Likert-type scale of *Strongly Agreed, Agreed, Undecided, Disagreed and Strongly Disagreed*. The targeted respondents where the questionnaires were administered were owners, management and employees of manufacturing, oil and gas, extractive, information technology, and construction/real estate companies in Nigeria. Statistical tests, and estimation of the model were finally performed with STATA software.

4.6.2 Methodology

The technique known as two-stage least squares (2SLS) was first put forth to estimate the parameters of a single structural equation in a system of linear simultaneous equations. It was established by Basman (1957), Sargan (1958), and Theil (1953), who all presented it more or less separately. Because it is straightforward, simple to use, and interpretable in linear regression frameworks, 2SLS is still widely used. In studies on business sustainability such as Barnett and Salomon (2006), Waddock and Graves (1997), 2SLS was frequently used to eliminate bias caused by endogeneity. It has been suggested that econometric methods like two-stage least squares

(2SLS) can be used to estimate causal effects when endogenous regressors are present (Wooldridge, 2010; Angrist and Pischke, 2009).

The approach uses both exogenous and appropriate instruments to substitute the projected values from a first-stage of the analysis which serve as a replacement for the endogenous variable(s) which seem(s) problematic. The first stage involves regression of endogenous variable(s) on the entire exogenous variables with instruments inclusive, while the second stage involves using as regressor, the predicted value from the first stage in the structural equation,

Instrument quality has a major impact on 2SLS's performance. The risk of weak or unfit instruments is mentioned by Staiger and Stock (1997) who emphasized that use of weak instrument might lead to biased results and wrong inference. A number of tests such as F-test in the first stage regression (a value larger than 10 is frequently advised) have been established to evaluate the strength of the instrument. The Hansen J test (for heteroskedasticity-robust contexts) and Sargan (1958) are two over-identification tests that are frequently used to evaluate the validity of instruments. These aid in confirming that instruments do not correlate with the error term.

Two-Stage Least Squares method is important in empirical studies and it solves endogeneity issues and is also a mainstay of applied econometrics due to its theoretical correctness and practicality. However, it has some limitations

Two-Stage Least Squares Limitations

- Biased result can result from using unfit instruments
- Introduction of finite sample bias due to overfitting in the initial step
- In complex systems, the linearity assumption may not be true.
- Finding appropriate tools is frequently difficult.

Therefore, instrument selection must be done with a lot of carefulness.

$$NFP = \beta_0 + \beta_1 CEP_i + \beta_2 X_i + \varepsilon_1 \quad (8)$$

NFP: Non- financial performance for company i

CEP: Predicted carbon emission practices from the first stage

X_i: vector of control variables

ϵ_i : Error term

4.6.3 Variables of the model

The variables of the model are identified based on the existing literature on the subject. Going by Stakeholder Theory established (Freeman, 1984), the use of carbon emission practices included as environmental and sustainability practices strengthens stakeholders' reputation and involvement and other determinants of non-financial performance. Nwaiwu and Oluka (2018) reported that image of the company is negatively influenced by environmental disclosure. Also, sustainability practices are reported to have influence on non-financial performance (Ambec and Lanoie, 2008; Eccles *et al.*, 2014). Years of experience is used in this study based on human capital theory (Becker, 1964) that postulated that skills and decision-making quality are enhanced by experience. According to Ng and Feldman (2012) experienced staff exhibit good customer service which is one of the indicators of non-financial performance. Its inclusion would help adjust for staff productivity aspect of non-financial performance. Sex is included on the basis of Social Role Theory (Eagly, 1987) which posits that both men and women exhibit distinguishable managerial styles and patterns that influence companies culture and results. This is emphasized by findings of Dezsö and Ross (2012) that non-financial performance is impacted by gender diversity. Age is included based on lifecycle theory (Levinson, 1986) which shows that workplace ethics and adaptability is determined by age which can impact organizational cohesiveness and involvement. Hilsen and Olsen (2021) have shown the importance and value of older employees. On the other hand, level in organization is used based on Organizational Role Theory (Katz and Kahn, 1978). The theory states the varied responsibilities that different levels in organization play in impacting the performance and behaviour of an organization. Yukl (2013) reported that employees in managerial position have influence on the subordinates and on some important aspects of the organization such as employee motivation, innovation among others that is essential for non-financial performance results; for example, Eisenbeiss *et al.* (2008) found that workers are less likely to take the initiative to learn new skills and advance their careers when they perceive their bosses to be harsh. Wu (2014) discovered that superiors who openly recognized their subordinates' efforts and accomplishments inspired and encouraged them more. Professional qualification is selected based on Resource-Based View (Barney, 1991) which states that certifications are special resources that affect a company's capacity. Organizational type is used based on institutional theory (DiMaggio and Powell, 1983) asserts that various industries are subject to various influences and norms that affect performance results. Non-financial performance results are

impacted by differences in stakeholder expectations, sector-specific legislation, and environmental awareness (Porter and Van der Linde, 1995). Academic qualification is used based on Human Capital Theory (Becker, 1964), which highlights that higher academic qualification fosters the development of analytical and social abilities, which fosters innovation. According to Crook *et al.*, (2011) different organizations operate in different capacities due to human capital, which has been seen as an important asset. Predictors of human capital include academic qualification, level of training, intellect among others (El Nemar, *et. al.* 2022). Consequently, a company gains a competitive edge that is both temporary and long-lasting (Gerhart and Feng, 2021; Shaw, 2021; Wright *et al.*, 2001, Battour *et al.*, 2021).

$$NFP_i = \beta_0 + \beta_2 CEP + \beta_2 YOE + \beta_3 sex + \beta_4 age + \beta_5 LO + \beta_5 HPQ + \beta_6 OT + \beta_7 HAQ + \epsilon_i \quad (9)$$

Table 7: Description of variables

Variables	Description
Dependent variable	
NFP	Non-financial performance index (It is derived from principal component analysis)
Independent variables	
CEP	Carbon emission practices index (It is derived from principal component analysis) CEP index is obtained from five indicators established by Global Reporting Initiative (GRI). The indicators include: Climate Change (CC), Green House Gases Emission (GHGE), Energy Consumption (EC), Green House

Gases Emission Reduction (GHGER) and
Carbon Emission Accountability (CEA)

YOE	Years of experience
LO	Level in Organization
HPQ	Highest Professional Qualification
OT	Organization Type
HAQ	Highest Academic qualification

4.7 Results and discussion

4.7.1 Two-Stage Least Squares 2SLS estimates analysis

Non-financial performance index which is the dependent variable is obtained from four indicators, which are customer loyalty, market share, product quality and employee morale with principal component analysis

Table 8: Two-Stage Least Squares 2SLS: impact of emissions practices on non-financial performance

VARIABLES	coefficient
emissionpracticeshat	-0.404*** (0.048)
YOE	-0.104* (0.055)
2.SEX	-0.167*** (0.019)

AGE	0.066 (0.054)
LO (Senior management)	0.094*** (0.005)
LO (Junior management)	0.001 (0.006)
HPQ (Technician)	-0.057 (0.171)
HPQ (Associate)	-0.025 (0.033)
HPQ (Fellow)	-0.084** (0.035)
HPQ (Others)	-0.878*** (0.112)
OT (Oil and gas)	-0.265*** (0.062)
OT (IT)	-0.157*** (0.005)
OT(construction/real estate)	-0.992*** (0.207)
OT (Other extractives)	-0.087 (0.054)
HAQ (ND)	-0.235* (0.127)
HAQ (HND/BSc)	-0.111 (0.179)
HAQ (Masters (MSc.))	-0.043 (0.297)
Constant	0.451*** (0.093)
Observations	384
R-squared	0.052

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: survey and author's computation 2024

Table 8 presents the result of effect of carbon emission practices on non-financial performance among firms in Nigeria. The dependent variable, non-financial performance, is constructed using Principal Component Analysis (PCA) to extract key components from measures such as employee morale, product quality, customer loyalty, and market share. The regression model employed a cross-sectional dataset comprising 384 observations. The explanatory variables included carbon emission practices (measured through predicted values from an instrumental variable model),

YOE, sex, age, LO, HPQ, OT, and HAQ. The model R-squared value of 0.052, indicates that approximately 5.2% of the variation in non-financial performance is explained by the independent variables.

The CEP coefficient is negative and statistically significant. This result suggests that firms engaging more in carbon emission practices are associated with lower non-financial performance. One tenable reason for this is that companies might engage in CEP in response to stakeholder or regulatory demand, rather than as a component of a comprehensive, integrated sustainability system. Therefore, it is possible that the internal value and perception of such practices will not result in increased non-financial performance. Years of Experience is negative and significant statistically. This suggests that workers with more years of experience might find it harder to adjust to new sustainability strategies, which could lessen their impact on initiatives for innovation, employee engagement, or quality improvement.

Sex which is being female as coded as 2 is negatively and significantly associated with non-financial performance. Systemic biases in workplace dynamics in Nigeria may be indicated by this outcome, which could imply gendered differences in influence or opportunity to make strategic efforts. Age is positive but statistically insignificant implying no relationship between respondent age and firm-level non-financial performance.

For Level in Organization (LO), coefficient of staff in Senior Management Level has a positive and significant association with non-financial performance. This might probably be as a result of their active participation in the daily execution of policies that impact customer relations and employee morale. Nevertheless, junior management level staff demonstrates no significance

The HPQ (fellow category) is significantly negative HPQ (other category) shows a negative and statistically significant relationship with non-financial performance. This suggests that individuals with higher professional qualifications may not be effectively translating their expertise into non-financial gains. A possible interpretation is that these qualifications focus more on technical or compliance aspects rather than the relational or strategic skills needed for improving morale, quality, or customer relations.

Organization Type (OT) such as Oil and gas, IT, construction/real estate are significantly negative. These results imply that organizational type may limit the companies' ability to foster strong internal non-financial performance. This possibly reflects rigid structures or lack of flexibility

Highest Academic Qualification (ND) is statistically significant while higher academic qualification demonstrates no significant influence. This indicates that academic qualification alone does not guarantee improved non-financial performance, potentially due to disconnects between academic training and practical application in performance-enhancing strategies.

To make the findings comprehensive and perform robustness check, endogenous switching probit regression is used to analyze the impacts of carbon emission practice on Non-Financial Performance

4.8 Robustness analysis: Endogenous Switching Regression Model estimates

An essential stage in empirical research is a robustness check, which guarantees that findings are valid, dependable, and unaffected by any model assumptions. It is a methodological process that evaluates the validity of empirical results using different model definitions, estimating methods, or data subsets.

The main model used in this study is a 2SLS regression that accounts for endogeneity between non-financial performance (NFP) and carbon emission practices (CEP). An Endogenous Switching Regression (ESR) model was developed in order to assess the robustness of the 2SLS findings. The ESR model distinguishes between adopters and non-adopters of carbon emission practices, allowing for heterogeneous treatment effects and self-selection bias correction. The logic behind this is to check whether 2SLS and ESR results are similar in terms of statistical significance and signs of important variables, thereby, reinforcing the results' credibility.

Endogenous Switching Regression Model

Let T^* be a variable that captures the expected benefits from adoption of CEP, indeed the companies would adopt CEP only if it would benefit them

$$T_i^* = Y_i\delta + \mu_i \quad \text{With } T_i = \begin{cases} 1 & \text{if } T_i^* \succ 0 \\ 0 & \text{if } T_i^* \prec 0 \end{cases} \quad (10)$$

Y is the $(n \times m)$ matrix of variables which explain the decision of adoption or not

δ is the $(1, \dots, m)$ vector of model parameters to be estimated,

μ is an $n \times 1$ vector of error terms. μ follows a normal distribution with mean equal to zero

Y represents the factors which determine the expected benefits of adoption of CEP. Going by existing literature, these variables include age, professional qualification, academic qualification, level in organization

4.8.1 Estimation of the impact of CEP on NFP: Endogenous Switching Probit Regression

The outcome equation (non-financial performance) is switched into two. Each group (participants group and non-participants group) with its regression in order to capture the potential effects of the unobservable factors among individuals. The ESP implements a Maximum likelihood method to estimate parameters of binary choice models with endogenous regressors. It estimates simultaneously the selection equation and the binary outcome equation. The error terms are assumed to follow the normal distribution.

1st regime: Companies that adopted carbon emission practices

$$p_{1i} = X_{1i}\alpha_1 + v_{1i} \quad \text{if } T_i = 1 \quad (11)$$

2nd regime: Companies that did not adopt the carbon emission practices

$$p_{2i} = X_{2i}\alpha_2 + v_{2i} \quad \text{if } T_i = 0 \quad (12)$$

p_i represents the adoption condition (adopted, not adopted)

X_i is a vector of variables related to the characteristics of the employees of the companies.

α_i is the estimated parameter of the impact of carbon emission practices on non-financial performance of companies.

The error terms of three equations are assumed to follow a trivariate normal distribution, with zero mean and covariance matrix Ω , i.e., $(\mu_i, v_{1i}, v_{2i})' \sim N(\mathbf{0}, \Omega)$

with $\Omega = \begin{bmatrix} \sigma_\mu^2 & \sigma_{\mu 1} & \sigma_{\mu 2} \\ \sigma_{1\mu} & \sigma_1^2 & \cdot \\ \sigma_{2\mu} & \cdot & \sigma_2^2 \end{bmatrix}$ σ_μ , σ_1^2 and σ_2^2 the variance of the error term in the selection

equation 3 and the production equations 4 and 5. σ_η^2 is assumed equal to 1 as the coefficients are estimable only up to a scale factor (Lokshin & Sajaia, 2011).

$\sigma_{i\mu}$ is the covariance of the error term in the selection equation with each error term in () and (). In the same, the covariance between v_{1i} of () and v_{2i} of (), is not defined since the two situations are not observed simultaneously. We assume that $\sigma_{12} = 1$ (δ is estimable only up to a scalar factor)

μ_i , is correlated to v_{1i} and v_{2i} due to the omitted variables and unobservable factors that are not accounted in the selection equation. So, the expected values of v_{1i} and v_{2i} conditional on the sample selection are different from zero.

The log-likelihood function for the simultaneous system of equations [(0)-(0)] is given by (Lokshin and Sajaia, 2011):

$$\begin{aligned} \ln(l(X_i, Y_i, \alpha, \delta, \sigma)) = & \sum_{T_i \neq 0, P_i \neq 0} \omega_i \ln \left\{ \Phi_2(X_{1i}\alpha_1, Y_i\delta, \sigma_{\mu 2}) \right\} \\ & + \sum_{T_i \neq 0, P_i = 0} \omega_i \ln \left\{ \Phi_2(-X_{1i}\alpha_1, Y_i\delta, -\sigma_{\mu 2}) \right\} \\ & + \sum_{T_i = 0, P_i \neq 0} \omega_i \ln \left\{ \Phi_2(X_{0i}\alpha_0, -Y_i\delta, -\sigma_{\mu 1}) \right\} \\ & + \sum_{T_i = 0, P_i = 0} \omega_i \ln \left\{ \Phi_2(-X_{0i}\alpha_0, -Y_i\delta, \sigma_{\mu 1}) \right\} \end{aligned} \quad 13$$

Φ_2 represents the cumulative function of a bivariate normal distribution ω_i is a chosen weight affected to the observation i. The maximum likelihood estimates the atanh (σ):

$$\text{atanh } \sigma_j = \frac{1}{2} \ln \left(\frac{1 + \sigma_j}{1 - \sigma_j} \right) \quad j=0,1$$

The parameters of the model estimated, the following statistics are derived (Heckman et al., 2001). The endogenous switching probit regression command allow to compute the average and marginal effects of the treatment on the treated and the untreated (Lokshin & Sajaia, 2011).

Treatment effects

F designs the cumulative function of the univariate normal distribution.

- The expected effect of the treatment on the treated individuals with observed characteristics x:

$$TT(x) = \Pr(P_1 = 1 | T = 1) - \Pr(P_0 = 1 | T = 0)$$

$$= \frac{\Phi_2(X_1\alpha_1, y\delta, \sigma_{\mu 2}) - \Phi_2(X_0\alpha_0, y\delta, \sigma_{\mu 1})}{F(y\delta)} \quad 14$$

- The expected effect of the treatment on the untreated individuals with observed characteristics x (TU):

$$TU(x) = \Pr(P_1 = 1 | T = 0) - \Pr(P_0 = 1 | T = 0)$$

$$= \frac{\Phi_2(X_1\alpha_1, -y\delta, -\sigma_{\mu 2}) - \Phi_2(X_0\alpha_0, -y\delta, -\sigma_{\mu 1})}{F(-y\delta)} \quad 15$$

- The expected effect of the treatment on a randomly selected individual from the population with observed characteristics x (TE):

$$TE(x) = \Pr(T = 1) - \Pr(T = 0) = F(X_1\alpha_1) - F(X_0\alpha_0) \quad 16$$

- The effect of the treatment on a randomly selected individual from the population with observed characteristics x and unobserved characteristics μ : (MTE):

$$MTE(x, \bar{\mu}) = \Pr(T = 1 / X = x, \mu = \bar{\mu}) - \Pr(T = 0 / X = x, \mu = \bar{\mu})$$

$$= F\left(\frac{X_1\alpha_1 + \sigma_{\mu 2}\bar{\mu}}{\sqrt{1 - \sigma_{\mu 2}^2}}\right) - F\left(\frac{X_0\alpha_0 + \sigma_{\mu 1}\bar{\mu}}{\sqrt{1 - \sigma_{\mu 1}^2}}\right) \quad 17$$

The respective average treatments ATT, ATU, and ATE, respectively corresponding to the treated, untreated, and randomly selected individuals from the population are obtained by averaging the treatment effects computed for each subgroup

The statistical significance of $\sigma_{1\mu}$ and $\sigma_{2\mu}$ would mean that there is a correlation between the decision of engagement into off-farm activities and the poverty condition of the farm household. Hence, the evidence of the endogenous switching regression and the rejection of the null hypothesis that absence of sample selectivity bias (Maddala & Nelson (1975) cited in Endiris *et al.* (2021)).

4.9 Results

Table 9: Endogenous switching regression results of impacts of carbon emission practice on Non-Financial Performance

VARIABLES	(1)	(2)	(3)
	Endogenous switching		Selection
	Non-financial adopters	Non-financialnon-adopters	Adaptation
YOE	-0.102 (0.319)	-0.044** (0.022)	-0.107*** (0.024)
SEX	-0.375 (0.330)	0.025 (0.040)	-0.352*** (0.064)
AGE	-0.058 (0.208)	0.082*** (0.009)	0.228*** (0.041)
LO	0.210*** (0.071)	-0.059 (0.048)	-0.156 (0.170)
HPQ	0.044 (0.191)	0.006 (0.046)	-0.136 (0.204)
OT	-0.001 (0.029)	-0.076*** (0.016)	0.015*** (0.003)
HAQ	0.111 (0.212)	0.005 (0.032)	-0.051 (0.046)
MGHGE			0.212* (0.128)
Constant	0.400 (0.372)	0.119*** (0.008)	-0.574 (0.484)
σ_A	0.082*** (0.023)		
σ_N		-0.056 (0.067)	
ρ_A	-0.149 (0.222)		
ρ_N		0.203*** (0.043)	
Observations	384	384	384

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: survey and author's computation 2024

Table 9 presents the findings of an Endogenous Switching Regression model used to estimate the impact of carbon emission practices on non-financial performance of companies among adopters and non-adopters of carbon emission practices. Column 1 is for adopters, column 2 is for non-adopters and column 3 is the selection equation showing the factors influencing companies'

decisions to adopt carbon emission practices. Maximum likelihood estimation is used to account for selection bias using σ and ρ values to capture error terms and their correlation across regimes, with this unobservable heterogeneity in the decision to adopt and its effect is captured.

Going by non-financial performance for adopters, years of experience, sex, HPQ, HAQ, and OT are not significant statistically, implying that they have no influence on non-financial performance of companies. On the other hand, LO shows a significant and positive relationship with NFP, suggesting that top-level employee report higher NFP results when their companies adopt carbon emission practices.

The NFP for non-adopters YOE shows negative and statistical significance, suggesting that more seasoned workers believe that companies without carbon emissions practices do worse non-financially. Age shows positive and significant relationship with NFP, implying that older employees are likely to connect better NFP results with non-adopting companies probably because they feel less pressure to adopt. OT shows negative and statistically significant relationship with NFP indicating that some companies may perform worse non-financially if they don't adopt CEP.

For selection adaptation, YOE and sex are negative and statistically significant showing that more experienced staff and women exhibit less likelihood to work for companies that adopt CEP. This might be due to gender inequality in decision making process. Meanwhile, age is positive and statistically significant implying that older employees have tendency to be employed in companies that adopt CEP probably because of their leadership attributes or employment history. Also, OT is positive and significant suggesting that some industries have likelihood to adopt CEP.

The adopters group's σ_A shows a significant variance which implies that the variation is non-random in results, emphasizing the validity of the model. Both σ_N and ρ_A are insignificant statistically, suggesting that adopters are subject to lesser or inestimable selection effects. While, ρ_N shows a significant and positive association for non-adopters suggesting that unobserved characteristics have a positive impact on better NFP and the chance of non-adoption, which could skew naive comparisons. Using ESR is justified by the existence of selection bias. The estimations of how CEP influences NFP would have been incorrect if selection had been ignored.

Table 10: Conditional Expectations, Treatment, and Heterogeneity Effects

Sub-samples	Decision stage		Treatment effects
	To adapt	Not to adapt	
Firms that adapted	(a) 0.050	(c) 0.268	-0.218***
Firms that did not adopt	(d) 0.301	(b) -0.020	-0.321***
Heterogeneity effects	-0.251***	0.288***	

Source: survey and author's computation 2024

Table 10 presents the result of estimation of treatment effect obtained from ESR. Conditional expectations, Average Treatment Effects (ATE), and Heterogeneity Effects (HE) are displayed on the table to estimate causal effect of implementing carbon emission practices on companies' NFP. This is to evaluate counterfactual i.e. what might have occurred if adopters did not adopt, and vice versa. From the table, (a) represents predicted NFP benefits for companies who implemented CEP, considering that they adopted CEP, while (b) stands for the predicted NFP for non-adopters, provided they did not adopt. In the same vein, (c) represents counterfactual for adopters anticipated outcome if adopters did not adopt and (d) stands non-adopters counterfactual i.e. predicted result provided non-adopters did adopt the practices. Also, treatment effect on the treated (TT) is a minus c and treatment effect on the untreated (TU) is (d) minus (b). For the heterogeneity effects $TT - TU$ is the variations in the effects of treatment among groups, (a - d) and (b - c) demonstrate a comparative advantage or disadvantage.

Companies that adopted CEP have score of 0.050 whereas, they should have performed 0.268 if they hadn't adopted. With a Treatment Effect on the Treated (TT) of -0.218, adoption is likely to bring a significant drop in non-financial performance. However, non-adopters average NFP is -0.02,0 although they would have done better (0.301) if they had adopted. It is evident from the treatment effect on the Untreated (TU) of -0.321 that adoption would have made their performance any worse. The implication of this findings is that adoption of CEP results in decreased NFP for both adopters and non-adopters. The statistical significance of these findings indicates that, in the Nigerian context, CEPs in their current form are unfavourable to NFP outcomes.

The heterogeneity effect suggests that if non-adopters adopted, their losses would be even greater than that of existing adopters. The implication is that the capacity to adopt or gain from environmental measures may be interfered with by firm-specific attributes, such as internal structure or stakeholder alignment. The second heterogeneity effect demonstrates the systematic

differences between adopters and non-adopters. That is, non-adopters perform worse than the adopters' counterfactual, even when carbon activities are absent. This could mean that even though adopters are typically larger or better-positioned companies, they nevertheless incur net losses when implementing CEP. The examination of heterogeneity and treatment effect shows that carbon emission practices have a definite and statistically significant detrimental influence on non-financial performance. It would be advantageous for both real adopters and hypothetical adopters (non-adopters in the counterfactual scenario) to refrain from reducing carbon emissions. These results demonstrate that existing carbon emission measures are not providing the anticipated organizational benefits in the Nigerian business environment, particularly in resource-sensitive sectors. Rather, they seem to impose costs that hinder businesses' capacity to acquire or preserve non-financial assets.

Checking for robustness of the result, 2SLS model took care of endogeneity problem while endogenous switching regression addressed the issue of selection bias. The result 2SLS for OT for industry like oil and gas, IT and construction exhibits negative significance. It was emphasized by endogenous switching regression result for OT (non-adopters) which shows negative significance. Likewise, YOE and sex show negative significance for 2SLS also for selection adaptation under endogenous switching regression the both show negative significance. The consistency of these findings reinforces the accuracy and robustness of the results.

4.10 Conclusion

This chapter analysed the impact of carbon emission practices on non-financial performance among firms. It demonstrates that carbon emission practices, as currently practised in Nigerian companies, may not positively influence non-financial performance. This result is in line with the findings of Zhou and Ahmad (2020), Han *et al.* (2022) and is contrary to Rashid *et al.* (2023) and Akinwale and Obafemi (2022). This emphasizes the need for companies not to only engage in sustainability practices but to also do so as part of a broader strategic vision that engages employees, satisfies customers, and supports brand equity.

Demographic and organizational characteristics such as gender, level in organization, and organization type significantly influence non-financial performance, reinforcing the need for inclusive leadership and organizational adaptability in achieving sustainable development goals. It also highlights the complex interplay between organizational demographics and non-financial performance, emphasizing the role of senior managers and the limitations of formal academic

qualifications in fostering non-financial performance. These results contribute to the emerging literature on corporate sustainability and stakeholder engagement in developing economies, emphasizing the practical tensions that firms face when balancing environmental accountability with internal performance goals.

4.11 Policy Implication

The findings challenge the assumption that carbon emission practices inherently drive positive stakeholder-oriented outcomes. The study underscores the need for firms to embed carbon management within broader organizational culture and strategy. It also highlights the complex interplay between organizational demographics and non-financial success, emphasizing the role of middle management and the limitations of formal qualifications in fostering non-financial performance.

The negative relationship established from the findings between carbon emission practices and non-financial performance calls for policy response. Carbon Emission Practices are expected to bring improvements in non-financial performance of companies, but on the contrary they may be bringing some burdens in terms of operations. This contrary finding emphasizes the importance of companies' executives and policymakers to appraise the means through which carbon emission practices are modelled, disclose and incorporated into their sustainability strategy.

Policymakers are to check if the existing emission practices are comprehensive enough. It is evident from the result that CEP is likely being undertaken just for conformity sake not as practices driven by importance. Impact assessments should be carried out to ascertain if the policies are generating fruitful results. Inadequate technological capacity, inconsistent regulatory enforcement, and insufficient environmental data infrastructure may result in ineffective or misaligned carbon emission policies. Policymakers must invest in stronger institutional structures, such as standardized emission reporting processes, independent audits, and explicit guidelines for

emission targets.

5.0 GENERAL CONCLUSION

Throughout the world, businesses are faced with serious challenges due to climate change, but Nigeria is much affected because of its reliance on climate-relevant industries such as oil and gas. Different regulatory frameworks have been developed as a result of climate change and its negative impacts, such as climate disclosure guidelines and Nigeria's Energy Transition Plan (2021–2060). To this end, companies are to follow strictly carbon reporting standards which come with financial responsibility such as fees for collection of data, monitoring and emission reduction. Although, these strategies are likely to have long-term gain but they exert financial stress on companies particularly, small and medium-sized enterprises (SMEs). This study evaluates the effects of carbon emission practices on organization performance of companies in Nigeria. Oil and gas and other industries are parts of key sectors of Nigeria's Energy Transition Plan. Companies that do not engage in sustainability practices tend to lose their reputation among investors and eco-friendly customers. As Nigeria moves towards net-zero emissions by 2060, companies are put under pressure to strike a balance between profitability and environmental sustainability. Hence, the motivation for this study is birthed from the link between sustainability and economy growth. The objectives are divided into three, which are as follows; Objective one discusses the effect of professional qualification and organization type on companies' decisions to adopt carbon emissions practices. The results from the study show that professional qualification (technician category) has a negative relationship with carbon emission practices, suggesting that technicians may be connected with less involvement in facility-level consumption monitoring and renewable energy quantification. The associate category shows the same pattern, with significant and negative relationships for seeing energy consumption facility annually (EC4), indicating that associate qualified workers might not be as involved in higher-order energy usage practices. Furthermore, the adoption of carbon emission practices is strongly predicted by organizational type. It was also shown in the result that demographic variables like sex and age are significant at the lowest quantile. Objective two: impact of carbon emission practices on financial performance among firms in Nigeria. The study found out that financial performance is predicted to increase by 1.549 units for every unit increase in the adoption or quality of emissions practices. The idea that open environmental policies could increase business value by lowering risk exposure or fostering more stakeholder trust is supported by this. Also, the

coefficient for OT = 3 (Information Technology) is negative and has statistical significance, suggesting that poorer financial performance is linked with being in Information Technology sector. We also discovered that financial success is positively correlated with OT = 4 (Construction/real estate), indicating that being in construction or real estate firm may improve financial performance. However, we discovered that more academic qualifications may not always translate into better financial performance; in some cases, they may even be linked to worse performance. The third objective is Impact of carbon emission practices on non-financial performance among firms in Nigeria. The results show that firms engaging more in carbon emission practices are associated with lower non-financial performance.

In the empirical results, sex and years of experience negatively influence non-financial performance of firms. The study further highlights that professional qualifications and organization type exhibit negative and significant effect on non-financial performance of firms. Generally, the study reveals a subtle picture in which carbon emission practices encourage financial performance whereas, they enact some difficulties on non-financial performance in Nigeria. This highlights the importance of industry-specific strategies. This study contributes to knowledge on corporate social responsibility by reflecting that the success and productiveness of carbon emission practices is hinged on which firms adopt them, how the implementation is done and in what company's context. These results serve as pointers to the government on necessary steps to be taken such as giving of incentives, providing more robust institutional frameworks and capacity-building strategies so as to help the companies surmount the first trade-offs of the practices' adoption.

References

- Adams, C. (2017). The Sustainable Development Goals, integrated thinking and the integrated report.
- Adediran, A., & Bello, A. (2022). Environmental accounting and financial performance in Nigeria's oil sector. *Journal of Sustainable Development in Africa*, 24(1), 55–67.
- Adegoke, T. A., Ogunleye, F. A., & Bamidele, R. (2021). Professional competence and environmental management practices in Nigerian SMEs. *Journal of Sustainable Development in Africa*, 23(4), 45–62.
- Aguilera, R. V., Rupp, D. E., Williams, C. A., & Ganapathi, J. (2007). Putting the S back in corporate social responsibility: A multilevel theory of social change in organizations. *Academy of Management Review*, 32(3), 836–863.
- Ahmad, K., & Zabri, S. M. (2016). The application of non-financial performance measurement in Malaysian manufacturing firms. *Procedia Economics and Finance*, 35, 476-484.
- Ahmed, M., Mahmood, R., & Islam, R. (2021). Green investment and short-term financial performance of SMEs: Evidence from Bangladesh. *Asian Journal of Business Ethics*, 10(1), 1–18.
- Amacha, E., & Elum, Z. A. (2022). Environmental sustainability practices and firm performance in Africa: Empirical evidence from Nigeria. *Environment, Development and Sustainability*, 24, 13988–14012. <https://doi.org/10.1007/s10668-021-02022-1>
- Ambec, S., & Lanoie, P. (2008). Does it pay to be green? A systematic overview. *The Academy of Management Perspectives*, 45-62.
- Amberg, N., & Friberg, R. (2016). Three approaches to risk management—and how and why Swedish companies use them. *Journal of Applied Corporate Finance*, 28(1), 86-94.
- Ameh, M., Okoye, O., & Omotola, T. (2021). Determinants of environmental reporting in Nigerian listed companies. *Environmental and Sustainability Indicators*, 10, 100125. <https://doi.org/10.1016/j.indic.2021.100125>
- Angrist, J. D., & Pischke, J. S. (2009). *Mostly harmless econometrics: An empiricist's companion*. Princeton university press.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of*

management, 17(1), 99-120.

Barney, J. B. (2012). Purchasing, supply chain management and sustained competitive advantage: The relevance of resource-based theory. *Journal of supply chain management*, 48(2), 3-6

Battour, M., Barahma, M., & Al-Awlaqi, M. (2021). The relationship between HRM strategies and sustainable competitive advantage: testing the mediating role of strategic agility. *Sustainability*, 13(9), 5315.

Bergh, D. D., Connelly, B. L., Ketchen Jr, D. J., & Shannon, L. M. (2014). Signalling theory and equilibrium in strategic management research: An assessment and a research agenda. *Journal of management studies*, 51(8), 1334-1360.

Bodansky, D., & Van Asselt, H. (2024). *The art and craft of international environmental law*. Oxford University Press.

Bui, B., & de Villiers, C. (2017). Business strategies and management accounting in response to climate change risk exposure and regulatory uncertainty. *The British Accounting Review*, 49(1), 4–24. <https://doi.org/10.1016/j.bar.2016.10.006>

Campbell, D., Craven, B., & Shrives, P. (2003). Voluntary social reporting in three FTSE sectors: a comment on perception and legitimacy. *Accounting, Auditing & Accountability Journal*, 16(4), 558-581.

Chapple, L., Clarkson, P. M., & Gold, A. (2021). Carbon disclosure, emissions performance, and firm value in Asian markets. *Accounting & Finance*, 61(2), 331–359.

Chartered Institute of Management Accountants. (1993). *Performance measurement in the manufacturing sector*.

Clark, G. L., Feiner, A., & Viehs, M. (2015). From the stockholder to the stakeholder: How sustainability can drive financial outperformance. *Available at SSRN 2508281*.

Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2008). Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis. *Accounting, Organizations and Society*, 33(4–5), 303–327.

- Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2015). Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis. *Accounting, Organizations and Society*, 38(1), 1–25.
- Coen, D., Herman, K. S., & Pegram, T. (2023). Market masquerades? Corporate climate initiative effects on firm-level climate performance. *Global Environmental Politics*, 23(4), 141-169.
- Connelly, B. L., Certo, S. T., Ireland, R. D., & Reutzel, C. R. (2011). Signaling theory: A review and assessment. *Journal of management*, 37(1), 39-67.
- Crook, T. R., Todd, S. Y., Combs, J. G., Woehr, D. J., & Ketchen Jr, D. J. (2011). Does human capital matter? A meta-analysis of the relationship between human capital and firm performance. *Journal of applied psychology*, 96(3), 443.
- Delmas, M. A., & Toffel, M. W. (2008). Organizational responses to environmental demands: Opening the black box. *Strategic Management Journal*, 29(10), 1027–1055.
- Dezsö, C. L., & Ross, D. G. (2012). Does female representation in top management improve firm performance? A panel data investigation. *Strategic management journal*, 33(9), 1072-1089.
- DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality. *American Sociological Review*, 48(2), 147–160.
- Drury, C. (1993). A survey of management accounting practices in UK manufacturing companies. (*No Title*).
- Duque-Grisales, E., Aguilera-Caracuel, J., & Teixeira, A. (2020). The link between environmental, social and governance practices and financial performance in the context of the Latin American market: The moderating effect of firm size. *Business Strategy and the Environment*, 29(3), 1410–1424. <https://doi.org/10.1002/bse.2433>
- Dowling, J., & Pfeffer, J. (1975). Organizational legitimacy: Social values and organizational behavior. *Pacific sociological review*, 18(1), 122-136.
- Ebrahim, A., Battilana, J., & Mair, J. (2014). The governance of social enterprises: Mission drift and accountability challenges in hybrid organizations. *Research in organizational behavior*, 34, 81-100.
- Eccles, R. G., & Krzus, M. P. (2010). Integrated reporting for a sustainable strategy. *Financial*

executive, 26(2).

Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). The impact of corporate sustainability on organizational processes and performance. *Management science*, 60(11), 2835-2857.

Emissions Database for Global Atmospheric Research (EDGAR). (2023). European Commission, Joint Research Centre. <https://edgar.jrc.ec.europa.eu>

Eisenbeiss, S. A., Van Knippenberg, D., & Boerner, S. (2008). Transformational leadership and team innovation: integrating team climate principles. *Journal of applied psychology*, 93(6), 1438.

El Namar, S., El-Chaarani, H., Dandachi, I., & Castellano, S. (2022). Resource-based view and sustainable advantage: a framework for SMEs. *Journal of Strategic Marketing*, 1-24.

Eze, B. E., & Nwosu, A. (2023). Corporate ownership and environmental sustainability practices in Nigeria: A cross-sectoral study. *African Journal of Business and Economic Research*, 18(1), 112–130.

Fatemi, A., Glaum, M., & Kaiser, S. (2018). ESG performance and firm value: The moderating role of disclosure. *Global Finance Journal*, 38, 45–64. <https://doi.org/10.1016/j.gfj.2017.03.001>

Filatotchev, I., & Nakajima, C. (2014). Corporate governance, responsible managerial behavior, and corporate social responsibility: organizational efficiency versus organizational legitimacy?. *Academy of Management Perspectives*, 28(3), 289-306.

Food and Agriculture Organization (FAO). (2023). *FAOSTAT Emissions Database*. <https://www.fao.org/faostat>

Freeman, R. E., Harrison, J. S., & Wicks, A. C. (2010). *Stakeholder theory: The state of the art*. Cambridge University Press.

Ganda, F. (2022). The relationship between greenhouse gas emissions and firm financial performance in sub-Saharan Africa. *Environmental Science and Pollution Research*, 29(12), 17583–17595. <https://doi.org/10.1007/s11356-021-17032-4>

Gangi, F., Mustilli, M., Varrone, N., & Daniele, L. M. (2018). Corporate social responsibility and banks' financial performance. *International Business Research*, 11(10), 42-58.

Gerhart, B., & Feng, J. (2021). The resource-based view of the firm, human resources, and human capital: Progress and prospects. *Journal of management*, 47(7), 1796-1819.

Global Carbon Project. (2023). *Global Carbon Budget 2023*. Retrieved from

<https://www.globalcarbonproject.org>

Greene, W. H. (2018). *Econometric analysis* (8th ed.). Pearson Education.

Grewatsch, S., & Kleindienst, I. (2017). When does it pay to be good? Moderators and mediators in the corporate sustainability–corporate financial performance relationship: A critical review. *Journal of Business Ethics, 145*, 383-416.

Guthrie, J., Cuganesan, S., & Ward, L. (2007, July). Legitimacy theory: A story of reporting social and environmental matters within the Australian food and beverage industry. In *Asia Pacific Interdisciplinary Research in Accounting Conference (5th: 2007)* (pp. 1-35). APIRA 2007 Organizing Committee.

Hart, S. L., & Dowell, G. (2011). Invited editorial: A natural-resource-based view of the firm: Fifteen years after. *Journal of management, 37*(5), 1464-1479.

Hapsoro, D., & Falih, Z. N. (2020). The effect of firm size, profitability, and liquidity on the firm value moderated by carbon emission disclosure. *Journal of Accounting and Investment, 21*(2), 240-257.

Hilsen, A. I., & Olsen, D. S. (2021). *The importance and value of older employees: Wise workers in the workplace* (p. 98). Springer Nature.

Huang, W., Li, F., Cui, S. H., Huang, L., & Lin, J. Y. (2017). Carbon footprint and carbon emission reduction of urban buildings: a case in Xiamen City, China. *Procedia Engineering, 198*, 1007-1017.

Ibrahim, A., & Danjuma, M. (2023). Human capital and environmental sustainability practices in sub-Saharan Africa: The mediating role of organizational capacity. *Management of Environmental Quality, 34*(2), 305–325. <https://doi.org/10.1108/MEQ-08-2022-0217>

International Energy Agency (IEA). (2023). *World Energy Outlook 2023*. <https://www.iea.org/reports/world-energy-outlook-2023>

IPCC. (2021). *Climate Change 2021: The Physical Science Basis*. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. <https://www.ipcc.ch/report/ar6/wg1/>

IPCC. (2021). *Climate change 2021: The physical science basis*. Intergovernmental Panel on Climate Change. <https://www.ipcc.ch/report/ar6/wg1/>

- Ittner, C. D., & Larcker, D. F. (1998). Innovations in performance measurement: Trends and research implications. *Journal of management accounting research*, *10*, 205.
- Jaiswal, A. (2017). World Employment and Social Outlook–Trends 2017.
- Kaplan, R. S., & Norton, D. P. (2002). *The strategy-focused organization: How balanced scorecard companies thrive in the new business environment* (Vol. 1). Boston, MA: Harvard Business school press.
- Khan, M., Serafeim, G., & Yoon, A. (2022). Corporate sustainability: First evidence on materiality. *The Accounting Review*, *97*(4), 61–85.
- Kreibich, N., & Hermwille, L. (2021). Caught in between: credibility and feasibility of the voluntary carbon market post-2020. *Climate Policy*, *21*(7), 939-957.
- Krstić, B. (2006). *Merenje nekih dimenzija nefinansijskih performansi preduzeća*.
- Koenker, R., & Bassett, G. (1978). Regression quantiles. *Econometrica*, *46*(1), 33–50.
- Kumar, R., & Firoz, M. (2023). Green business strategy and financial performance: An integrated sustainability perspective. *Journal of Cleaner Production*, *401*, 136765. <https://doi.org/10.1016/j.jclepro.2023.136765>
- Le Luo, Y. C. L., & Tang, Q. (2012). Corporate Incentives to Disclose Carbon Information: Evidence from the CDP Global 500 Report. *Journal of International Financial Management & Accounting*, *23*(2), 93-120.
- Levinson, D. J. (1986). A conception of adult development. *American psychologist*, *41*(1), 3.
- Li, F., & Wang, L. (2020). Executives' demographic characteristics and corporate environmental strategy. *Journal of Cleaner Production*, *262*, 121320.
- Liesen, A., Hoepner, A. G. F., Patten, D. M., & Figge, F. (2015). Does stakeholder pressure influence corporate GHG emissions reporting? Empirical evidence from Europe. *Accounting, Auditing & Accountability Journal*, *28*(7), 1047–1074.
- Lin, B., Omoju, O. E., & Okonkwo, J. U. (2015). Impact of industrialisation on CO2 emissions in Nigeria. *Renewable and Sustainable Energy Reviews*, *52*, 1228-1239.
- Liu, G., Chen, R., Xu, P., Fu, Y., Mao, C., & Hong, J. (2020). Real-time carbon emission monitoring in prefabricated construction. *Automation in Construction*, *110*, 102945.
- Lo, S. F., & Sheu, H. J. (2007). Is corporate sustainability a value-increasing strategy for

- business?. *Corporate Governance: An International Review*, 15(2), 345-358.
- Loewe, M., & Zintl, T. (2021). State fragility, social contracts and the role of social protection: Perspectives from the Middle East and North Africa (MENA) region. *Social Sciences*, 10(12), 447.
- Luo, L., Tang, Q., & Lan, Y.-C. (2022). Is corporate environmental performance related to corporate financial performance? *Business Strategy and the Environment*, 31(1), 249–268.
- Mensah, K., & Boateng, H. (2022). Professional training and financial returns on green practices. *Journal of Business and Environmental Studies*, 9(2), 89–101.
- Mukhibad, H. (2018). Carbon emission disclosure and profitability—evidence from manufacture companies in Indonesia. *KnE Social Sciences*, 53-67.
- National Bureau of Statistics (NBS). (2023). *Gas Production and Utilization Report*.
- Ng, T. W., & Feldman, D. C. (2012). Employee voice behavior: A meta-analytic test of the conservation of resources framework. *Journal of Organizational behavior*, 33(2), 216-234.
- Noah, A. O. (2017). *Accounting for the environment: The accountability of the Nigerian cement industry* (Doctoral dissertation, University of Essex).
- Norton David, P. (1996). *The balanced scorecard: translating strategy into action*. Harvard Business School Press.
- Nguyen, H., & Tu, C. A. (2021). Corporate carbon performance and financial performance: Evidence from emerging markets. *Journal of Sustainable Finance & Investment*, 11(3), 197–212. <https://doi.org/10.1080/20430795.2020.1724865>
- Ngwakwe, C. C. (2022). Green management accounting and sustainable financial performance: Evidence from Nigeria. *International Journal of Energy Economics and Policy*, 12(4), 376–382.
- Ogunleye, O. O., Adeyemi, S. B., & Salami, A. O. (2023). Carbon emission disclosure and firm performance: Evidence from Nigeria. *African Journal of Business Management*, 17(3), 42–56.
- Okafor, L. E., & Ugwuegbu, O. G. (2023). Managerial experience and environmental sustainability in Nigeria’s manufacturing firms. *Nigerian Journal of Business Research*, 15(1), 33–47.
- Okonkwo, R., & Salami, K. (2022). Public and private firms’ responses to carbon emission regulation in Nigeria. *Journal of African Environmental Policy*, 5(2), 78–95.

- Olanrewaju, A., & Asikhia, O. (2020). Environmental responsiveness and leadership qualification in Nigerian firms. *Nigerian Journal of Management Studies*, 20(3), 19–36.
- Olumide, K., & Chinedu, F. (2023). Environmental accounting competencies and the adoption of carbon disclosure in Nigeria. *Accounting and the Public Interest*, 23(1), 56–75. <https://doi.org/10.2308/api-2023-005>
- Peteraf, M. (2016). Resource-based theories. In *The Palgrave encyclopedia of strategic management* (pp. 1-4). Palgrave Macmillan, London.
- Porter, M., & Linde, V. (1995). Green and Competitive, *Harvard Business Review*. Sep/Oct.
- Raval, S. J., Kant, R., & Shankar, R. (2019). Benchmarking the Lean Six Sigma performance measures: a balanced score card approach. *Benchmarking: An International Journal*, 26(6), 1921-1947.
- Reijnders, L. (2022). Life cycle assessment of greenhouse gas emissions. In *Handbook of climate change mitigation and adaptation* (pp. 313-347). Cham: Springer International Publishing.
- Rogelj, J., Den Elzen, M., Höhne, N., Fransen, T., Fekete, H., Winkler, H., ... & Meinshausen, M. (2016). Paris Agreement climate proposals need a boost to keep warming well below 2 C. *Nature*, 534(7609), 631-639.
- Roth, A., Boix, M., Gerbaud, V., Montastruc, L., & Etur, P. (2020). Impact of taxes and investment incentive on the development of renewable energy self-consumption: French households' case study. *Journal of Cleaner Production*, 265, 121791.
- Porter, M. E., & van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. *Journal of Economic Perspectives*, 9(4), 97–118. <https://doi.org/10.1257/jep.9.4.97>
- Post, C., Rahman, N., & Rubow, E. (2021). Gender diversity and environmental performance: Evidence from global firms. *Journal of Business Ethics*, 170(3), 425–440.
- Shi, Q., Yu, T., & Zuo, J. (2015). What leads to low-carbon buildings? A China study. *Renewable and Sustainable Energy Reviews*, 50, 726-734.
- Shaw, J. D. (2021). The resource-based view and its use in strategic human resource management research: The elegant and inglorious. *Journal of Management*, 47(7), 1787-1795.

- Suchman, M. C. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of management review*, 20(3), 571-610
- Sreedhar, S., Jichkar, P., & Biligiri, K. P. (2016). Investigation of carbon footprints of highway construction materials in India. *Transportation Research Procedia*, 17, 291-300.
- Spence, M. (1978). Job market signaling. In *Uncertainty in economics* (pp. 281-306). Academic Press
- Staiger, D. O., & Stock, J. H. (1994). Instrumental variables regression with weak instruments.
- Stock, J. H., & Watson, M. W. (2020). *Introduction to econometrics* (4th ed.). Pearson.
- Sule, A., & Ahmed, R. (2022). Managerial environmental awareness and carbon reduction in Nigerian firms. *African Journal of Management Research*, 11(2), 87–103.
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic management journal*, 18(7), 509-533.
- Van Beurden, P., & Gössling, T. (2008). The worth of values—a literature review on the relation between corporate social and financial performance. *Journal of business ethics*, 82, 407-424.
- Wieland, J. (2017). Shared value—theoretical implications, practical challenges. *Creating Shared Value—Concepts, Experience, Criticism*, 9-26.
- Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.
- Wolf, M. J., Emerson, J. W., Esty, D. C., Sherbinin, A. D., & Wendling, Z. A. (2022). 2022 Environmental Performance Index: ranking country performance on sustainability issues [full report].
- World Bank. (2023). *CO₂ emissions (metric tons per capita)*. Retrieved from <https://data.worldbank.org/indicator/EN.ATM.CO2E.PC>
- Wright, P. M., Dunford, B. B., & Snell, S. A. (2001). Human resources and the resource based view of the firm. *Journal of management*, 27(6), 701-721.
- Yukl, G. A. (2013). *Leadership in organizations* (Global ed.). Essex: Pearson.
- Yusoff, H., Darus, F., & Ibrahim, M. D. (2020). Environmental disclosure and customer loyalty in emerging markets. *International Journal of Business and Society*, 21(S1), 123–137.
- Wooldridge, J. M. (2021). *Introductory econometrics: A modern approach* (7th ed.). Cengage Learning.

Zhang, Y., Zhu, Q., & Zhou, D. (2020). Carbon disclosure and financial performance: Evidence from European listed firms. *Business Strategy and the Environment*, 29(8), 3423–3437.ces

Appendices

Appendix i: Questionnaire

Universite Cheikh Anta Diop, Dakar
WASCAL PhD in Climate Change Economics
FASEG
Senegal

Dear Respondent,

REQUEST TO FILL IN A QUESTIONNAIRE

I am **Fadeke Omolabake Adeoye** a Doctor in Philosophy (PhD) student of the above-mentioned institution in the department of Economics.

I am currently conducting research on “**Carbon Emission Practices and Organisational Performance among Companies in Nigeria**”.

You have been considered an expert in (Carbon Emission Practices and Organisational Performance) your opinions on the following questions are needed.

Your responses to the questions shall be treated strictly as confidential and not traceable to you, rather they shall be used to generate applicable information and policies for usage by managers, policymakers, relevant institutions and other stakeholders.

The variables are rated based on the following scales: SA=Strongly Agree =5, A=Agree=4, UN=Undecided=3, D=Disagree=2, SD=Strongly Disagree=1.

This research is in partial fulfillment of an award of (PhD) Degree in Economics

Thank you.

Fadeke Omolabake Adeoye

Email: fadadeoye@gmail.com

SECTION A: Bio Data

Please tick as appropriate

1	Gender	Male	
		Female	

2	Age	17 years below	
		18 - 25 years	
		26 - 35 years	
		36 - 45 years	
		46 - 55 years	
		56 – 65 years	
		65 years and above	

3	Highest Academic Qualifications	O Level/SSCE/GCE	
		ND/NCE	
		HND/HSc/BSc	
		Masters (MSc.)	
		Doctorate in Philosophy (PhD)	

4	Highest Professional Qualifications	None	
		Technician Scheme category	
		Associate category	
		Fellow category	
		Other categories	

5	Years of Experience	1 - 5 years	
		6 - 10 years	
		11 -15 years	
		16 - 20 years	
		21 years and above	

6	Level in Organization	Executive Level	
		Senior Management Level	
		Junior Management Level	

	Organization Type	Manufacturing	
		Oil and Gas	

7		Information Technology	
		Construction /Real Estate	
		Other Extractives	

8	Department or unit	Production/Extraction	
		Energy	
		Quality and Assurance	
		Construction	
		Others	

9	Method of Green House Gases(GHG) measurement tool	GHG Protocol Only	
		ISO Only	
		GHG Protocol and ISO (Both)	
		Other Method	

Section B: Statements/Questions to answer the hypotheses to be tested.

Please tick as appropriate

	Independent Variables – Carbon Emission Disclosure	Strongly Agreed	Agreed	Undecided	Disagreed	Strongly Disagreed
	Dimension of Climatic Change					
10	The regulatory risk associated with climatic change affects our business from time to time.					
11	The physical risk associated with climatic change enhances our operation on a yearly basis.					
12	The general risk associated with climatic change influences our practices from time to time.					
13	The regulatory risk associated with climatic change provides opportunities for our line of business.					
14	The physical risk associated with climatic change opportunities for our business on a yearly basis.					
15	The general risk associated with climatic change enhances opportunities for our from time to time.					
	Dimension of Green House Gases (GHG) Emission					
16	Our company has an external expert who verifies the GHG emission					
17	Total GHG Emissions metric tons CO2-e emitted is measured year in year out by our company.					
18	Our company's source of GHG emission is known on a yearly basis.					
19	Our firm's facility of GHG emission used is determined annually.					
20	The segment level of GHG emission is disclosed year in year out.					

21	There is a detailed comparison of GHG emission on a yearly basis					
Dimension of Energy Consumption						
22	Total energy consumption is determined annually by our company.					
23	Our company quantifies the energy of renewable sources on yearly basis.					
24	The type of energy consumption is calculated yearly by our company.					
25	The facility of energy consumption is seen annually by our firm.					
26	The segment level of energy consumption is determined annually by our company.					
Dimension of Green House Gases Emission Reduction						
27	Our company has detail strategies to reduce GHG emission.					
28	Our firm has specification of GHG emissions reduction target year					
29	Our company has specification of GHG emissions reduction target level.					
30	There is future plan to reduce cost as a result of GHG emission					
31	Cost of future emissions are factored into capital expenditure planning in our company.					
Dimension of Carbon Emission Accountability						
32	Our company has a board committee whose responsibility is for climatic changes.					
33	There are carbon emission committee who report GHG, carbon emission and climatic change and their effects in our company.					
34	Our company has the mechanism by which the board reviews the company's progress regarding climate change.					
35	Our firm has the device by which the directors reviews the company's progress regarding carbon emission.					
Dependent Variable – Organisational Performance						
36	Our firm's customer loyalty has improved over the years as a result of carbon emission practices.					
37	The quality of our product has upgraded over the years as a result of carbon emission practices.					
38	The market share of our entity has increased as a result of carbon emission practices.					
39	The morale of our employees has increased over the years as a result of carbon emission practices.					
40	The profitability of our company has increased years in years out because of carbon emission practices.					
41	The total assets and net-worth of our company has increased from time to time as a result of carbon emission practices.					
42	The income taxes paid annually by our firm has improved over the years as a result of carbon emission practices.					
Thank You and God Bless You for filling in this questionnaire						

Appendix ii: Principal Component Analysis output

Rotation: (unrotated = principal) Rho = 1.0000

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	12.8709	10.6728	0.4950	0.4950
Comp2	2.19804	.721255	0.0845	0.5796
Comp3	1.47679	.264997	0.0568	0.6364
Comp4	1.21179	.0843479	0.0466	0.6830
Comp5	1.12744	.140917	0.0434	0.7263
Comp6	.986522	.0861719	0.0379	0.7643
Comp7	.900351	.130649	0.0346	0.7989
Comp8	.769702	.110012	0.0296	0.8285
Comp9	.65969	.0769293	0.0254	0.8539
Comp10	.58276	.120227	0.0224	0.8763
Comp11	.462534	.0422489	0.0178	0.8941
Comp12	.420285	.0280907	0.0162	0.9103
Comp13	.392194	.060339	0.0151	0.9253
Comp14	.331855	.0410514	0.0128	0.9381
Comp15	.290804	.052418	0.0112	0.9493
Comp16	.238386	.019591	0.0092	0.9585
Comp17	.218795	.0251029	0.0084	0.9669
Comp18	.193692	.024656	0.0074	0.9743

Comp19	.169036	.0238276	0.0065	0.9808
Comp20	.145208	.0226099	0.0056	0.9864
Comp21	.122598	.0476602	0.0047	0.9911
Comp22	.0749382	.0151159	0.0029	0.9940
Comp23	.0598223	.00732362	0.0023	0.9963
Comp24	.0524987	.00908127	0.0020	0.9983
Comp25	.0434174	.0434174	0.0017	1.0000
Comp26	0	.	0.0000	1.0000

Principal components (eigenvectors)

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7	Comp8
Comp9	Comp10	Comp11	Comp12					

-----+

cc1	0.2236	-0.1200	0.3878	-0.0269	0.0510	-0.0495	0.1299	-0.1194	-0.0540
0.0026	-0.2280	0.0342							
cc1	0.2236	-0.1200	0.3878	-0.0269	0.0510	-0.0495	0.1299	-0.1194	-0.0540
0.0026	-0.2280	0.0342							
cc2	0.2047	-0.1067	0.3830	-0.1047	0.0674	0.0427	0.1004	-0.0785	0.0731
0.0167	0.2351	-0.0647							
cc3	0.2302	-0.1040	-0.0909	-0.1604	0.0374	-0.1827	0.1266	-0.1462	0.0810
-0.1596	0.2576	0.0451							
cc4	0.2235	-0.1379	0.1511	-0.1349	0.0574	-0.1809	0.1800	-0.2355	0.0085
-0.0351	0.0716	-0.0083							

cc5 | 0.2009 -0.1806 0.2114 -0.0267 -0.0107 0.0662 -0.2032 0.0083 -0.1962
0.4635 0.2141 -0.0738

ghge1 | 0.0717 -0.1976 -0.1439 0.4257 -0.3000 0.2537 0.4944 -0.1179 0.4491
0.2901 0.0553 0.1581

ghge2 | 0.2167 -0.1054 -0.0525 0.0527 -0.0913 0.1719 -0.3072 0.1260 0.0136
0.3691 0.0309 -0.2231

ghge3 | 0.2305 -0.0796 -0.1900 -0.0300 -0.0456 0.1044 -0.2010 0.0478 -
0.0440 0.2196 0.0894 -0.1313

ghge4 | 0.2403 -0.0827 -0.2442 -0.0466 -0.0367 -0.0552 -0.0917 0.0570
0.0052 0.0081 -0.1898 -0.0788

ghge5 | 0.0541 -0.0679 -0.0997 0.3929 0.5531 0.0533 -0.3974 -0.5252 0.2392
-0.0981 -0.0147 -0.0193

ghge6 | 0.0552 0.1214 0.0428 -0.4019 0.3909 0.6308 0.1507 0.2160 0.3516
-0.0898 -0.0469 -0.1461

ec1 | 0.1144 -0.1725 -0.1416 0.2971 0.2030 0.4159 0.2487 0.0459 -0.6824
-0.2198 0.1450 0.1057

ec2 | 0.0718 -0.0079 0.0880 0.3627 0.4802 -0.3869 0.1613 0.6301 0.1080
0.1396 0.0000 -0.0341

ec3 | 0.2439 -0.0496 -0.1821 -0.1262 0.0279 -0.0995 0.0020 0.1109 0.0869
-0.1720 0.2252 0.0052

ec4 | 0.2391 -0.0587 -0.2562 -0.0870 -0.0058 -0.1155 0.0307 0.0372 0.0916
-0.1125 0.1630 0.0320

ec5 | 0.2403 -0.0715 -0.1923 -0.1166 -0.0071 -0.1125 -0.0174 0.0565 0.0497
-0.1113 0.2938 0.1400

ghgrc1 | 0.2535 -0.0276 -0.1438 -0.0517 -0.0432 -0.0711 0.0335 -0.0026 -
0.0070 -0.1626 -0.3226 0.1116

ghgrc2 | 0.2482 -0.0271 -0.0701 -0.0095 -0.0617 0.0870 -0.1311 0.1373 -
0.0178 0.0009 -0.3706 0.1244

ghgrc3 | 0.2532 -0.0303 -0.1035 -0.0102 -0.0516 0.0369 -0.0397 0.0326 -
0.0309 -0.0202 -0.4135 0.0434

ghgrc4 | 0.1761 0.2455 0.2003 0.2034 -0.1157 0.1083 -0.2289 0.1296 0.1580
-0.1324 0.0419 0.5590

ghgrc5 | 0.1519 0.1491 0.3148 0.2074 -0.2838 0.1497 -0.2728 0.1766 0.0672
-0.3581 0.2469 -0.0975

cea1 | 0.1925 0.3633 -0.0153 0.2099 -0.0916 0.0018 0.1058 -0.0609 -0.0612
-0.0701 -0.0238 -0.2670

cea2 | 0.1892 0.3251 -0.0201 0.1832 -0.0925 -0.0747 0.1599 -0.1037 0.0231
-0.1029 -0.0476 -0.5607

cea3 | 0.1501 0.4636 -0.0499 -0.0462 0.0657 0.0107 0.1575 -0.1073 -0.1416
0.2061 0.0770 0.1166

cea4 | 0.1171 0.4862 -0.0600 -0.1268 0.1696 -0.0411 0.0290 -0.1437 -0.0905
0.3447 0.0670 0.2861

Variable | Comp13 Comp14 Comp15 Comp16 Comp17 Comp18 Comp19
Comp20 Comp21 Comp22 Comp23 Comp24

-----+-----

cc1 | -0.1835 0.1030 0.2066 -0.0785 0.1187 0.0002 0.2044 0.0386 0.0237
0.1261 0.1346 0.0726

cc1 | -0.1835 0.1030 0.2066 -0.0785 0.1187 0.0002 0.2044 0.0386 0.0237
0.1261 0.1346 0.0726

cc2 | -0.2667 0.2699 -0.4187 0.0937 0.0552 -0.0742 -0.4665 -0.1344 -0.0592
-0.1184 -0.2934 -0.0026

cc3 | 0.2845 -0.1081 -0.4467 -0.0210 -0.0626 -0.2564 0.1458 0.0901 0.0783
0.4084 0.2574 0.3118

cc4 | 0.4134 -0.3161 -0.0479 0.0053 0.0632 0.2684 0.1125 0.0709 -0.2024
-0.5296 0.0022 -0.2661

cc5 | 0.1530 -0.3550 0.2931 0.1135 -0.3437 -0.0311 -0.2322 -0.1074 0.2532
0.1696 -0.0400 0.0392

ghge1 | 0.0802 0.0773 0.0965 0.0348 -0.0082 -0.0265 -0.0286 -0.0355 -
0.0239 0.0127 0.0266 0.0118

ghge2 | -0.0789 0.2114 -0.3918 -0.0698 -0.0793 0.3602 0.4427 0.0217 -
0.1401 0.0723 -0.0341 -0.0998

ghge3 | -0.0598 -0.1457 0.0981 -0.1760 0.5597 -0.5406 -0.0081 0.2197 -
0.1708 -0.1376 -0.0663 -0.0121

ghge4 | 0.0784 -0.0669 0.0737 0.0587 0.3547 0.4765 -0.3172 -0.1993 -0.1374
0.1672 0.1770 0.3046

ghge5 | 0.0135 0.0649 0.0616 -0.0540 -0.0614 -0.0122 -0.0457 -0.0288
0.0127 -0.0076 -0.0035 0.0046

ghge6 | 0.0753 -0.1455 0.0775 -0.0015 -0.0150 0.0284 0.0734 -0.0125 0.0486
0.0272 -0.0049 0.0297

ec1 | -0.0037 0.0137 -0.0630 0.0950 0.0340 0.0685 0.0235 0.0592 -0.0346
0.0073 0.0061 -0.0078

ec2 | 0.1142 0.0040 -0.0321 -0.0283 0.0369 -0.0450 0.0102 0.0089 0.0003
-0.0132 -0.0306 0.0070

ec3 | -0.2236 0.1081 0.2198 0.0724 -0.1558 -0.0245 -0.1987 -0.1653 -0.3715
0.1367 0.3731 -0.4064

ec4 | -0.1935 0.0972 0.0629 0.0054 0.1809 0.2400 -0.0462 0.1451 0.7091
-0.1960 -0.0643 0.0101

ec5 | -0.1993 0.0750 0.2784 -0.0633 -0.2960 -0.0513 0.3606 -0.0337 -0.0753
-0.1210 -0.2479 0.1106

ghgrc1 | 0.1810 -0.0148 0.0580 0.0165 -0.0492 -0.0386 -0.0159 -0.1659 -
0.1648 0.2281 -0.6935 0.0516

ghgrc2 | 0.0107 0.1298 -0.0895 0.0767 -0.3851 -0.1791 -0.1595 0.1328 -
0.0753 -0.4809 0.2471 0.4044

ghgrc3 | 0.1585 0.0824 -0.1675 0.0057 -0.0820 -0.2066 -0.0544 -0.0049
0.3192 0.1124 0.0803 -0.6019

ghgrc4 | -0.2436 -0.4630 -0.1652 0.0337 0.0598 0.1348 -0.0201 0.1879 -
0.0554 0.0916 -0.0106 -0.0685

ghgrc5 | 0.4743 0.3391 0.2012 -0.0050 0.1131 -0.0194 0.0160 -0.0410 0.0575
-0.0169 0.0279 0.0295

cea1 | -0.1728 -0.2755 -0.1179 -0.0938 0.0099 -0.1427 0.1715 -0.6641 0.1300
-0.1785 0.0903 0.0654

cea2 | -0.1338 -0.1202 0.0620 0.2827 -0.1622 0.0495 -0.0691 0.5136 -0.0765
0.1170 -0.0898 0.0021

cea3 | 0.1083 0.1629 0.0343 -0.6993 -0.1244 0.1313 -0.2248 0.1382 -0.0389
0.0533 0.0013 -0.0022

cea4 | 0.1267 0.2636 0.0535 0.5639 0.1746 -0.0517 0.1400 -0.0661 -0.0176
-0.0135 0.0294 0.0061

Variable | Comp25 | Unexplained

-----+-----+-----

cc1	-0.0426	0
cc1	-0.0426	0
cc2	0.1596	0
cc3	-0.0383	0
cc4	-0.0239	0
cc5	-0.0480	0
ghge1	-0.0004	0
ghge2	-0.1529	0

ghge3	-0.0233	0
ghge4	0.3628	0
ghge5	-0.0031	0
ghge6	0.0082	0
ec1	-0.0015	0
ec2	0.0150	0
ec3	-0.3319	0
ec4	-0.3032	0
ec5	0.5544	0
ghgrc1	-0.3598	0
ghgrc2	-0.1276	0
ghgrc3	0.3842	0
ghgrc4	0.0158	0
ghgrc5	0.0018	0
cea1	-0.0477	0
cea2	0.0729	0
cea3	-0.0020	0
cea4	-0.0093	0

. rotate

Principal components/correlation Number of obs = 383

Number of comp. = 25

Trace = 26

Rotation: orthogonal varimax (Kaiser off) Rho = 1.0000

Component	Variance	Difference	Proportion	Cumulative
Comp1	2	1	0.0769	0.0769
Comp2	1	1.01951e-07	0.0385	0.1154
Comp3	1	2.61779e-12	0.0385	0.1538
Comp4	1	-8.29314e-12	0.0385	0.1923
Comp5	1	6.27942e-13	0.0385	0.2308
Comp6	1	1.21845e-10	0.0385	0.2692
Comp7	1	-1.24516e-10	0.0385	0.3077
Comp8	1	4.41913e-12	0.0385	0.3462
Comp9	1	7.22844e-12	0.0385	0.3846
Comp10	1	-4.77929e-12	0.0385	0.4231
Comp11	1	5.98961e-11	0.0385	0.4615
Comp12	1	-5.56077e-11	0.0385	0.5000
Comp13	1	-6.22540e-11	0.0385	0.5385
Comp14	1	-3.94490e-10	0.0385	0.5769
Comp15	1	4.37979e-10	0.0385	0.6154
Comp16	1	-1.39540e-10	0.0385	0.6538
Comp17	1	2.91656e-10	0.0385	0.6923
Comp18	1	-1.47168e-10	0.0385	0.7308
Comp19	1	4.33342e-12	0.0385	0.7692
Comp20	1	4.71179e-13	0.0385	0.8077

Comp21	1	1.16007e-12	0.0385	0.8462
Comp22	1	-1.74342e-11	0.0385	0.8846
Comp23	1	1.89899e-11	0.0385	0.9231
Comp24	1	1.02085e-07	0.0385	0.9615
Comp25	1	.	0.0385	1.0000

Rotated components

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7	Comp8
Comp9	Comp10	Comp11	Comp12					
cc1	0.7071	0.0000	0.0000	0.0000	0.0000	-0.0000	-0.0000	0.0000
-0.0000	0.0000	0.0000						
cc1	0.7071	0.0000	0.0000	0.0000	0.0000	-0.0000	-0.0000	0.0000
-0.0000	0.0000	0.0000						
cc2	-0.0000	0.0000	0.0000	-0.0000	0.0000	0.0000	-0.0000	-0.0000
0.0000	-0.0000	-0.0000						
cc3	-0.0000	-0.0000	-0.0000	0.0000	-0.0000	-0.0000	-0.0000	0.0000
-0.0000	0.0000	0.0000						
cc4	-0.0000	0.0000	-0.0000	0.0000	0.0000	-0.0000	0.0000	-0.0000
0.0000	0.0000	0.0000						
cc5	0.0000	0.0000	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	0.0000
1.0000	0.0000	0.0000						
ghge1	0.0000	0.0000	-0.0000	-0.0000	0.0000	0.0000	1.0000	-0.0000
0.0000	0.0000	0.0000						

ghge2 | -0.0000 1.0000 -0.0000 -0.0000 0.0000 0.0000 -0.0000 -0.0000 -
 0.0000 -0.0000 -0.0000 -0.0000

ghge3 | -0.0000 -0.0000 0.0000 0.0000 -0.0000 0.0000 -0.0000 0.0000 -
 0.0000 0.0000 -0.0000 -0.0000

ghge4 | -0.0000 0.0000 -0.0000 0.0000 0.0000 0.0000 0.0000 -0.0000 0.0000
 0.0000 0.0000 -0.0000

ghge5 | -0.0000 -0.0000 -0.0000 0.0000 1.0000 -0.0000 -0.0000 0.0000 -
 0.0000 0.0000 0.0000 0.0000

ghge6 | 0.0000 -0.0000 -0.0000 -0.0000 0.0000 1.0000 -0.0000 0.0000 -
 0.0000 0.0000 -0.0000 -0.0000

ec1 | 0.0000 0.0000 -0.0000 0.0000 0.0000 0.0000 -0.0000 -0.0000 1.0000
 -0.0000 0.0000 0.0000

ec2 | -0.0000 0.0000 -0.0000 -0.0000 -0.0000 -0.0000 0.0000 1.0000 0.0000
 -0.0000 -0.0000 -0.0000

ec3 | -0.0000 0.0000 1.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 -0.0000 0.0000 0.0000

ec4 | -0.0000 0.0000 0.0000 0.0000 -0.0000 0.0000 -0.0000 -0.0000 0.0000
 -0.0000 -0.0000 0.0000

ec5 | 0.0000 0.0000 -0.0000 0.0000 -0.0000 0.0000 -0.0000 0.0000 0.0000
 -0.0000 0.0000 0.0000

ghgrc1 | -0.0000 0.0000 0.0000 0.0000 -0.0000 0.0000 -0.0000 0.0000 -
 0.0000 0.0000 0.0000 0.0000

ghgrc2 | -0.0000 0.0000 -0.0000 -0.0000 -0.0000 0.0000 -0.0000 0.0000 -
 0.0000 -0.0000 1.0000 -0.0000

ghgrc3 | 0.0000 -0.0000 0.0000 -0.0000 0.0000 -0.0000 0.0000 -0.0000
 0.0000 0.0000 -0.0000 0.0000

ghgrc4 | -0.0000 0.0000 -0.0000 0.0000 -0.0000 0.0000 -0.0000 0.0000 -
 0.0000 -0.0000 0.0000 -0.0000

ghgrc5 | 0.0000 -0.0000 0.0000 0.0000 -0.0000 0.0000 0.0000 0.0000 -0.0000
 -0.0000 0.0000 -0.0000

cea1 | -0.0000 0.0000 -0.0000 0.0000 -0.0000 0.0000 -0.0000 0.0000 -0.0000
-0.0000 0.0000 -0.0000

cea2 | -0.0000 0.0000 -0.0000 0.0000 -0.0000 0.0000 -0.0000 0.0000 -0.0000
-0.0000 0.0000 1.0000

cea3 | 0.0000 -0.0000 -0.0000 -0.0000 0.0000 -0.0000 -0.0000 0.0000 -0.0000
-0.0000 0.0000 0.0000

cea4 | -0.0000 0.0000 -0.0000 1.0000 -0.0000 0.0000 0.0000 0.0000 -0.0000
0.0000 0.0000 -0.0000

Variable | Comp13 Comp14 Comp15 Comp16 Comp17 Comp18 Comp19
Comp20 Comp21 Comp22 Comp23 Comp24

-----+-----

cc1 | -0.0000 0.0000 0.0000 -0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 -0.0000 -0.0000

cc1 | -0.0000 0.0000 0.0000 -0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 -0.0000 -0.0000

cc2 | 0.0000 -0.0000 0.0000 0.0000 -0.0000 0.0000 -0.0000 0.0000 -0.0000
0.0000 0.0000 0.0000

cc3 | -0.0000 0.0000 1.0000 0.0000 -0.0000 -0.0000 0.0000 0.0000 0.0000
-0.0000 -0.0000 0.0000

cc4 | -0.0000 0.0000 -0.0000 -0.0000 0.0000 0.0000 0.0000 -0.0000 1.0000
0.0000 -0.0000 0.0000

cc5 | 0.0000 0.0000 0.0000 0.0000 -0.0000 -0.0000 0.0000 0.0000 -0.0000
-0.0000 -0.0000 0.0000

ghge1 | -0.0000 0.0000 0.0000 0.0000 0.0000 -0.0000 0.0000 0.0000 -0.0000
0.0000 -0.0000 0.0000

ghge2 | 0.0000 -0.0000 0.0000 0.0000 0.0000 -0.0000 -0.0000 -0.0000 -
0.0000 -0.0000 0.0000 -0.0000

ghge3 | 0.0000 -0.0000 0.0000 -0.0000 1.0000 -0.0000 -0.0000 0.0000 -
0.0000 -0.0000 -0.0000 0.0000

ghge4 | 0.0000 0.0000 0.0000 0.0000 0.0000 1.0000 -0.0000 -0.0000 -0.0000
-0.0000 -0.0000 0.0000

ghge5 | 0.0000 0.0000 0.0000 -0.0000 0.0000 -0.0000 0.0000 0.0000 -0.0000
0.0000 -0.0000 0.0000

ghge6 | -0.0000 -0.0000 0.0000 0.0000 -0.0000 -0.0000 -0.0000 -0.0000
0.0000 -0.0000 0.0000 -0.0000

ec1 | 0.0000 0.0000 -0.0000 0.0000 0.0000 -0.0000 0.0000 -0.0000 -0.0000
0.0000 -0.0000 -0.0000

ec2 | -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 0.0000 -0.0000 0.0000 0.0000
-0.0000 0.0000 -0.0000

ec3 | -0.0000 0.0000 0.0000 0.0000 -0.0000 0.0000 0.0000 -0.0000 0.0000
-0.0000 -0.0000 0.0000

ec4 | -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 0.0000 0.0000 1.0000 0.0000
-0.0000 -0.0000 -0.0000

ec5 | -0.0000 0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 0.0000 -0.0000
0.0000 -0.0000 1.0000

ghgrc1 | 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 -0.0000 0.0000 -0.0000
1.0000 0.0000 -0.0000

ghgrc2 | -0.0000 -0.0000 -0.0000 -0.0000 0.0000 -0.0000 -0.0000 0.0000 -
0.0000 -0.0000 0.0000 -0.0000

ghgrc3 | 0.0000 0.0000 0.0000 -0.0000 0.0000 0.0000 -0.0000 0.0000 0.0000
-0.0000 1.0000 0.0000

ghgrc4 | 0.0000 1.0000 -0.0000 0.0000 0.0000 -0.0000 0.0000 0.0000 -0.0000
-0.0000 -0.0000 -0.0000

ghgrc5 | 1.0000 -0.0000 0.0000 0.0000 -0.0000 -0.0000 -0.0000 0.0000
 0.0000 -0.0000 -0.0000 0.0000

cea1 | 0.0000 -0.0000 -0.0000 0.0000 0.0000 0.0000 1.0000 -0.0000 -0.0000
 0.0000 0.0000 0.0000

cea2 | 0.0000 0.0000 -0.0000 -0.0000 0.0000 0.0000 0.0000 -0.0000 -0.0000
 -0.0000 -0.0000 -0.0000

cea3 | -0.0000 -0.0000 -0.0000 1.0000 0.0000 -0.0000 -0.0000 0.0000 0.0000
 -0.0000 0.0000 0.0000

cea4 | -0.0000 -0.0000 -0.0000 0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000
 -0.0000 0.0000 -0.0000

 Variable | Comp25 | Unexplained

-----+-----+-----

cc1	0.0000	0
cc1	0.0000	0
cc2	1.0000	0
cc3	-0.0000	0
cc4	0.0000	0
cc5	-0.0000	0
ghge1	0.0000	0
ghge2	-0.0000	0
ghge3	0.0000	0
ghge4	-0.0000	0
ghge5	-0.0000	0

ghge6		-0.0000		0
ec1		0.0000		0
ec2		0.0000		0
ec3		-0.0000		0
ec4		-0.0000		0
ec5		-0.0000		0
ghgrc1		-0.0000		0
ghgrc2		0.0000		0
ghgrc3		-0.0000		0
ghgrc4		0.0000		0
ghgrc5		-0.0000		0
cea1		0.0000		0
cea2		0.0000		0
cea3		-0.0000		0
cea4		0.0000		0

Component rotation matrix

		Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7	Comp8
Comp9		Comp10	Comp11	Comp12					

-----+

Comp1 | 0.3163 0.2167 0.2439 0.1171 0.0541 0.0552 0.0717 0.0718
 0.1144 0.2009 0.2482 0.1892

Comp2 | -0.1698 -0.1054 -0.0496 0.4862 -0.0679 0.1214 -0.1976 -0.0079 -
 0.1725 -0.1806 -0.0271 0.3251

Comp3 | 0.5484 -0.0525 -0.1821 -0.0600 -0.0997 0.0428 -0.1439 0.0880 -
 0.1416 0.2114 -0.0701 -0.0201

Comp4 | -0.0380 0.0527 -0.1262 -0.1268 0.3929 -0.4019 0.4257 0.3627
 0.2971 -0.0267 -0.0095 0.1832

Comp5 | 0.0722 -0.0913 0.0279 0.1696 0.5531 0.3909 -0.3000 0.4802
 0.2030 -0.0107 -0.0617 -0.0925

Comp6 | -0.0699 0.1719 -0.0995 -0.0411 0.0533 0.6308 0.2537 -0.3869
 0.4159 0.0662 0.0870 -0.0747

Comp7 | 0.1837 -0.3072 0.0020 0.0290 -0.3974 0.1507 0.4944 0.1613
 0.2487 -0.2032 -0.1311 0.1599

Comp8 | -0.1689 0.1260 0.1109 -0.1437 -0.5252 0.2160 -0.1179 0.6301
 0.0459 0.0083 0.1373 -0.1037

Comp9 | -0.0763 0.0136 0.0869 -0.0905 0.2392 0.3516 0.4491 0.1080 -
 0.6824 -0.1962 -0.0178 0.0231

Comp10 | 0.0036 0.3691 -0.1720 0.3447 -0.0981 -0.0898 0.2901 0.1396 -
 0.2198 0.4635 0.0009 -0.1029

Comp11 | -0.3225 0.0309 0.2252 0.0670 -0.0147 -0.0469 0.0553 0.0000
 0.1450 0.2141 -0.3706 -0.0476

Comp12 | 0.0484 -0.2231 0.0052 0.2861 -0.0193 -0.1461 0.1581 -0.0341
 0.1057 -0.0738 0.1244 -0.5607

Comp13 | -0.2595 -0.0789 -0.2236 0.1267 0.0135 0.0753 0.0802 0.1142 -
 0.0037 0.1530 0.0107 -0.1338

Comp14 | 0.1457 0.2114 0.1081 0.2636 0.0649 -0.1455 0.0773 0.0040
 0.0137 -0.3550 0.1298 -0.1202

Comp15 | 0.2922 -0.3918 0.2198 0.0535 0.0616 0.0775 0.0965 -0.0321 -
 0.0630 0.2931 -0.0895 0.0620

Comp16 | -0.1111 -0.0698 0.0724 0.5639 -0.0540 -0.0015 0.0348 -0.0283
0.0950 0.1135 0.0767 0.2827

Comp17 | 0.1679 -0.0793 -0.1558 0.1746 -0.0614 -0.0150 -0.0082 0.0369
0.0340 -0.3437 -0.3851 -0.1622

Comp18 | 0.0003 0.3602 -0.0245 -0.0517 -0.0122 0.0284 -0.0265 -0.0450
0.0685 -0.0311 -0.1791 0.0495

Comp19 | 0.2891 0.4427 -0.1987 0.1400 -0.0457 0.0734 -0.0286 0.0102
0.0235 -0.2322 -0.1595 -0.0691

Comp20 | 0.0546 0.0217 -0.1653 -0.0661 -0.0288 -0.0125 -0.0355 0.0089
0.0592 -0.1074 0.1328 0.5136

Comp21 | 0.0335 -0.1401 -0.3715 -0.0176 0.0127 0.0486 -0.0239 0.0003 -
0.0346 0.2532 -0.0753 -0.0765

Comp22 | 0.1783 0.0723 0.1367 -0.0135 -0.0076 0.0272 0.0127 -0.0132
0.0073 0.1696 -0.4809 0.1170

Comp23 | 0.1904 -0.0341 0.3731 0.0294 -0.0035 -0.0049 0.0266 -0.0306
0.0061 -0.0400 0.2471 -0.0898

Comp24 | 0.1027 -0.0998 -0.4064 0.0061 0.0046 0.0297 0.0118 0.0070 -
0.0078 0.0392 0.4044 0.0021

Comp25 | -0.0603 -0.1529 -0.3319 -0.0093 -0.0031 0.0082 -0.0004 0.0150 -
0.0015 -0.0480 -0.1276 0.0729

| Comp13 Comp14 Comp15 Comp16 Comp17 Comp18 Comp19 Comp20
Comp21 Comp22 Comp23 Comp24

-----+-----

Comp1 | 0.1519 0.1761 0.2302 0.1501 0.2305 0.2403 0.1925 0.2391
 0.2235 0.2535 0.2532 0.2403

Comp2 | 0.1491 0.2455 -0.1040 0.4636 -0.0796 -0.0827 0.3633 -0.0587 -
 0.1379 -0.0276 -0.0303 -0.0715

Comp3 | 0.3148 0.2003 -0.0909 -0.0499 -0.1900 -0.2442 -0.0153 -0.2562
 0.1511 -0.1438 -0.1035 -0.1923

Comp4 | 0.2074 0.2034 -0.1604 -0.0462 -0.0300 -0.0466 0.2099 -0.0870 -
 0.1349 -0.0517 -0.0102 -0.1166

Comp5 | -0.2838 -0.1157 0.0374 0.0657 -0.0456 -0.0367 -0.0916 -0.0058
 0.0574 -0.0432 -0.0516 -0.0071

Comp6 | 0.1497 0.1083 -0.1827 0.0107 0.1044 -0.0552 0.0018 -0.1155 -
 0.1809 -0.0711 0.0369 -0.1125

Comp7 | -0.2728 -0.2289 0.1266 0.1575 -0.2010 -0.0917 0.1058 0.0307
 0.1800 0.0335 -0.0397 -0.0174

Comp8 | 0.1766 0.1296 -0.1462 -0.1073 0.0478 0.0570 -0.0609 0.0372 -
 0.2355 -0.0026 0.0326 0.0565

Comp9 | 0.0672 0.1580 0.0810 -0.1416 -0.0440 0.0052 -0.0612 0.0916
 0.0085 -0.0070 -0.0309 0.0497

Comp10 | -0.3581 -0.1324 -0.1596 0.2061 0.2196 0.0081 -0.0701 -0.1125 -
 0.0351 -0.1626 -0.0202 -0.1113

Comp11 | 0.2469 0.0419 0.2576 0.0770 0.0894 -0.1898 -0.0238 0.1630
 0.0716 -0.3226 -0.4135 0.2938

Comp12 | -0.0975 0.5590 0.0451 0.1166 -0.1313 -0.0788 -0.2670 0.0320 -
 0.0083 0.1116 0.0434 0.1400

Comp13 | 0.4743 -0.2436 0.2845 0.1083 -0.0598 0.0784 -0.1728 -0.1935
 0.4134 0.1810 0.1585 -0.1993

Comp14 | 0.3391 -0.4630 -0.1081 0.1629 -0.1457 -0.0669 -0.2755 0.0972 -
 0.3161 -0.0148 0.0824 0.0750

Comp15 | 0.2012 -0.1652 -0.4467 0.0343 0.0981 0.0737 -0.1179 0.0629 -
 0.0479 0.0580 -0.1675 0.2784

Comp16 | -0.0050 0.0337 -0.0210 -0.6993 -0.1760 0.0587 -0.0938 0.0054
0.0053 0.0165 0.0057 -0.0633

Comp17 | 0.1131 0.0598 -0.0626 -0.1244 0.5597 0.3547 0.0099 0.1809
0.0632 -0.0492 -0.0820 -0.2960

Comp18 | -0.0194 0.1348 -0.2564 0.1313 -0.5406 0.4765 -0.1427 0.2400
0.2684 -0.0386 -0.2066 -0.0513

Comp19 | 0.0160 -0.0201 0.1458 -0.2248 -0.0081 -0.3172 0.1715 -0.0462
0.1125 -0.0159 -0.0544 0.3606

Comp20 | -0.0410 0.1879 0.0901 0.1382 0.2197 -0.1993 -0.6641 0.1451
0.0709 -0.1659 -0.0049 -0.0337

Comp21 | 0.0575 -0.0554 0.0783 -0.0389 -0.1708 -0.1374 0.1300 0.7091 -
0.2024 -0.1648 0.3192 -0.0753

Comp22 | -0.0169 0.0916 0.4084 0.0533 -0.1376 0.1672 -0.1785 -0.1960 -
0.5296 0.2281 0.1124 -0.1210

Comp23 | 0.0279 -0.0106 0.2574 0.0013 -0.0663 0.1770 0.0903 -0.0643
0.0022 -0.6935 0.0803 -0.2479

Comp24 | 0.0295 -0.0685 0.3118 -0.0022 -0.0121 0.3046 0.0654 0.0101 -
0.2661 0.0516 -0.6019 0.1106

Comp25 | 0.0018 0.0158 -0.0383 -0.0020 -0.0233 0.3628 -0.0477 -0.3032 -
0.0239 -0.3598 0.3842 0.5544

| Comp25

-----+-----

Comp1 | 0.2047

Comp2 | -0.1067

Comp3 | 0.3830

Comp4 | -0.1047

Comp5 | 0.0674

Comp6 | 0.0427

Comp7 | 0.1004

Comp8 | -0.0785

Comp9 | 0.0731

Comp10 | 0.0167

Comp11 | 0.2351

Comp12 | -0.0647

Comp13 | -0.2667

Comp14 | 0.2699

Comp15 | -0.4187

Comp16 | 0.0937

Comp17 | 0.0552

Comp18 | -0.0742

Comp19 | -0.4665

Comp20 | -0.1344

Comp21 | -0.0592

Comp22 | -0.1184

Comp23 | -0.2934

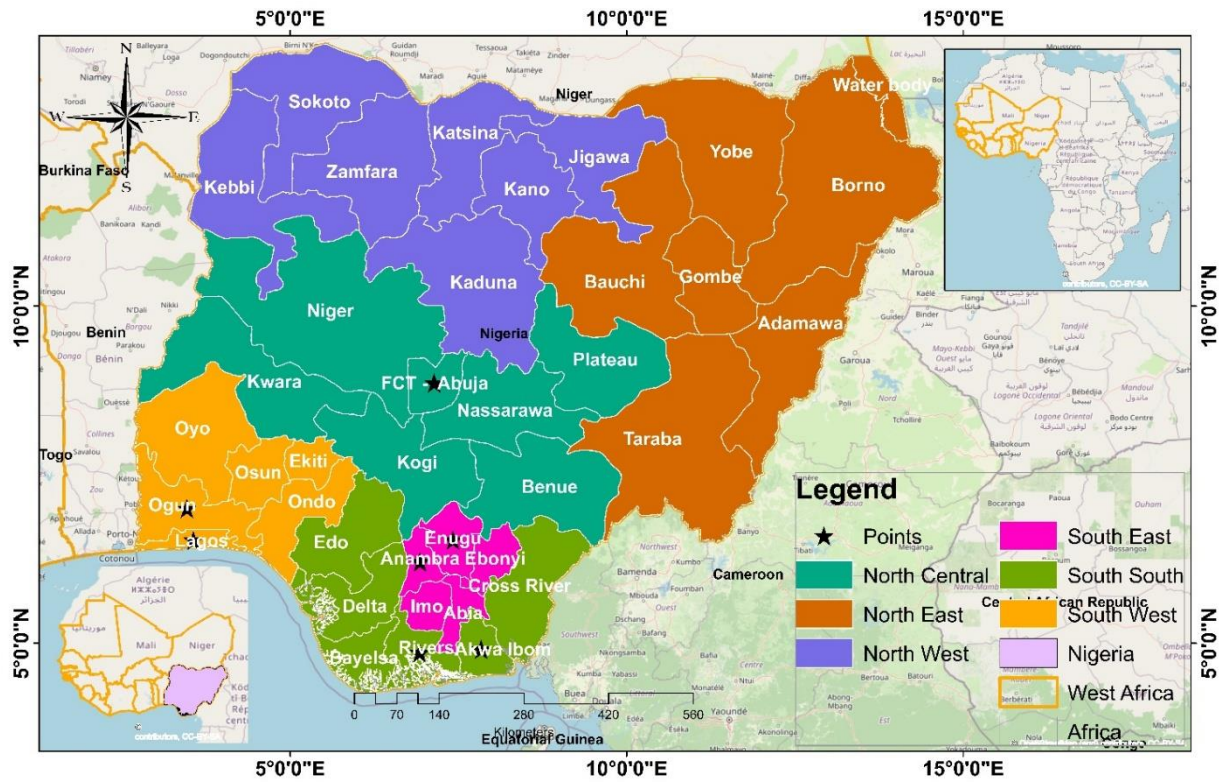
Comp24 | -0.0026

Comp25 | 0.1596

end of do-file

Appendix iii

Fig 5: Map of Nigeria showing the geopolitical zones and the study Area



Source: Authors' representation using shape file data