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EVOLUTION OF CARBON ACCOUNTING IN NIGERIA: A CRITICAL REVIEW

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Abstract
Carbon accounting is the recognition of the non-financial and financial evaluation and monitoring of GHG on all levels of the value chain and the effects of these emissions on the carbon cycle of the environment. This study critically reviews the evolution of carbon accounting in Nigeria. The specific objectives include to Investigate the evolution; Assess the accounting methods and Analyze the challenges faced in carbon accounting practices in Nigeria. The study adopted descriptive research design. Extant works were reviewed and observations made includes amongst orders that there is weak institutional capacity in carbon accounting practices. Also, there is inadequate quality data that has made it difficult to establish accurate emission baseline. Moreso there is an identified technical capacity gap. The study therefore recommends that the federal government through its agencies should strengthen institutional frameworks by establishing a centralized national carbon accounting authority. Also, the government should improve in data collection and management and finally engage in building technical capacity by training government staff, academics etc.

1.0. Introduction.

According to the Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report (2021), the dramatic warming observed over the past five decades is directly linked to human activities, especially the release of carbon emissions and other harmful pollutants. This trend marks an unparalleled increase in global surface temperatures not seen in the last 2,000 years (Miklautsch & Woschank, 2022), primarily fueled by rising levels of greenhouse gases caused by human actions. The report emphasizes the critical necessity for immediate and effective climate measures.

Carbon accounting therefore refers to the process of measuring, recording, and reporting the amount of carbon dioxide (CO2) and other greenhouse gas emissions generated directly or indirectly by an organization, product, service, or activity. It involves quantifying emissions from various sources, such as energy consumption,

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transportation, manufacturing processes, and waste management, and often involves assessing the carbon footprint of an entity or activity. (IPCC (2006)

It can be further described as an asset like fossil fuel and soil carbon, carbon related ecosystems services which include stock like store in soil, water and biomass; and sequestration that is removal from the atmosphere and carbon as a characteristic of ecosystem asset condition (condition account) like biomass accumulation which is an indicator of productive ecosystem (UN Statistical Division).

The goal of carbon accounting is to provide organizations and individuals with a clear understanding of their carbon emissions so they can develop strategies to reduce them. This may include implementing energy efficiency measures, transitioning to renewable energy sources, optimizing supply chains, and offsetting remaining emissions through activities such as reforestation or investing in carbon offset projects. WRI (World Resources Institute).

Carbon accounting enables the quantification of the amount of GHG produced by the organizations so as to enable them disclose its climate impact effectively; communicate their environmental, social and corporate governance (ESG) strategy and facilitate informed decision making as the world races to net zero (Persefoni team, 2022).

It has become increasingly important as businesses and governments seek to mitigate climate change and transition to a low-carbon economy to enable organizations track their progress towards emission reduction targets, comply with regulations, and demonstrate environmental responsibility to stakeholders, customers, and investors.

These increased carbon concentrations are closely linked to climate changes such as global temperature rise, shifting precipitation patterns, and sea-level rise. Carbon accounting entails examining carbon stocks and flows to understand how changes in land use, land cover, and management practices influence carbon storage and the ability of ecosystems to sequester carbon. It also involves evaluating how environmental regulations—such as mandated reductions in fossil fuel emissions—affect key sectors like mining, manufacturing, and agriculture. Moreover, improved coherence and consistency across various data sources is essential, requiring more robust information systems to address existing gaps and enhance the quality of primary data (United Nations Statistics Division, n.d.).

Evolution of carbon accounting in Nigeria

The history of carbon accounting in Nigeria has evolved through a series of legislative, institutional, and policy developments aimed at addressing climate change and promoting sustainable environmental practices. This progression reflects Nigeria's commitment to international climate agreements and its efforts to integrate carbon accounting into national governance.

Nigeria's engagement with carbon accounting began with its participation in international climate agreements. As a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement, Nigeria has been involved in reporting greenhouse gas (GHG) emissions and implementing measures to reduce its carbon footprint. The country's initial efforts focused on establishing a national inventory of GHG emissions, which is a fundamental component of carbon accounting.

Introduction of the Climate Change Act, 2021

A major development in Nigeria’s approach to carbon accounting was the passage of the Climate Change Act in 2021. This law offers a structured legal basis for tackling climate change, incorporating elements such as carbon budgeting and the creation of a carbon market. It requires the formulation of a national carbon budget that defines allowable greenhouse gas (GHG) emission limits over set timeframes. Additionally, the Act introduces systems

for carbon pricing and emissions trading, supporting the adoption of carbon accounting methods across multiple sectors (Wikipedia; Mondaq; GLOBE).

Establishment of the National Council on Climate Change (NCCC)

In 2022, Nigeria created the National Council on Climate Change (NCCC), an agency responsible for developing and executing climate-related policies. The Council is charged with supervising carbon accounting activities, ensuring the precise reporting of emissions data, and aligning national strategies aimed at lowering greenhouse gas (GHG) emissions (Abolade et al 2020).

Development of the Energy Transition Plan

As part of its pledge to reach net-zero emissions by 2060, Nigeria introduced the Energy Transition Plan, detailing approaches to cut carbon emissions across critical sectors like energy, transport, and industry. The plan underscores the vital role of carbon accounting in tracking progress toward emission reduction goals and promoting transparency in the execution of climate-related policies (Wikipedia).

Recent Initiatives and Future Directions

As of 2025, Nigeria is steadily enhancing its carbon accounting framework. One of the latest efforts is the rollout of the Upstream Petroleum Decarbonization Template, which mandates oil and gas companies to prove low carbon emissions and incorporate renewable energy initiatives as a condition for obtaining licenses. Moreover, stakeholders have highlighted the urgency of establishing a robust carbon market policy to tackle issues like regulatory shortcomings and inadequate infrastructure (Reuters; efdinitiative.org).

These developments indicate Nigeria's ongoing efforts to integrate carbon accounting into its national policies and practices, aiming to achieve sustainable environmental outcomes and contribute to global climate goals.

1.1 Statement of Problem

As the world grapples with the challenges of climate change, Nigeria, like many other countries, is exploring innovative ways to reduce greenhouse gas emissions and transition to a low-carbon economy. One such mechanism is carbon credit trading, which has gained significant attention globally.

Nigeria has made significant strides in tackling climate change, and its commitment to reducing emissions is commendable. The country's Net Zero commitment announcement at COP26 in Glasgow in 2021 marked a crucial turning point. This pledge was reinforced by the passage of Nigeria's Climate Change Act of 2021, which established the National Council on Climate Change (NCCC) to spearhead climate change mitigation efforts. The Climate Change Act applies to all Ministries, Departments, Agencies, and public and private entities within Nigeria, demonstrating the government's dedication to a comprehensive approach.

The natural balance of the ecosystem involves animals inhaling oxygen and exhaling carbon dioxide, while plants absorb carbon dioxide during photosynthesis and release oxygen, creating a mutually beneficial exchange between the two. However, carbon emissions—mainly in the form of carbon dioxide (CO_2)—have become a serious environmental issue due to their harmful impacts. Unlike emissions from animals, a significant portion of CO_2 comes from human activities, especially industrial operations, which emit far more carbon than plants can absorb. This imbalance has led to numerous environmental and social challenges, including climate change, ocean acidification, health problems, ecosystem damage, sea-level rise, and significant economic consequences. The scale of these industrial impacts is difficult to quantify (United Nations Statistical Division).

It is against these backdrops that the study examines the emergence of carbon accounting in Nigeria with specific interest on the evolution, accounting methods adopted, challenges of carbon accounting and ways forward.

1.2 Objectives of the Study

The main objective of this study is to examine the evolution of carbon accounting in Nigeria. In specific terms, the study wants to:

1.Investigate the evolution of carbon accounting in Nigeria.

2.Assess the accounting methods adopted for carbon accounting in Nigeria.

3. Analyze the challenges faced in carbon accounting.

1.3 Research Questions

1.What are the steps taken as regards carbon accounting in Nigeria?

2.What are the methods of carbon accounting in Nigeria?

3. What are the challenges faced in carbon accounting in Nigeria.

2.0 Review of Related literatures

2.1 Conceptual Review

2.1 .1 Carbon Accounting

Carbon accounting refers to the systematic process of calculating, analyzing, measuring, and reporting an organization's greenhouse gas (GHG) emissions in a way that is transparent and auditable (Persefoni Team, 2022). It is also commonly referred to as carbon auditing, carbon inventory, GHG inventory, or GHG accounting. This practice enables both public and private organizations to quantify the volume of greenhouse gases they emit. In a similar vein, Tang (2017) describes carbon accounting as a framework that applies accounting principles and techniques to record, gather, analyze, and verify climate-related data, and to report on key elements such as assets, liabilities, expenses, and revenues that are linked to climate change. Schaltegger and Custora (2012) research reveals that there is a rapid development in carbon accounting and that it is one of the important aspects in the development of sustainability management due primarily to the requirements of climate change, which search for modern methods and mechanisms and its development through scientific research. In their own view, Hartmann et al., (2013) opine that the expansion of programs to reduce carbon emission following demands for institutions to develop carbon accounting to meet environmental changes that can be used in preparation of reports and decision making which contributes in crating values for the institution. 'Thus, carbon accounting practices prevails on management to take stock of carbon emissions and adopt measures towards reduction of such in line with UNFCCC which Nigeria participates in her conventions.

2.1.2: Approaches adopted in Carbon Accounting

Various approaches are adopted in carbon accounting which includes the following

Input-Output Analysis: This method tracks carbon emissions throughout the entire supply chain of a product or service. It involves analyzing the inputs (e.g., materials, energy) and outputs (e.g., products, waste) of a system to estimate the carbon footprint. Input-output analysis can provide a comprehensive view of emissions associated with various stages of production and consumption.

Life Cycle Assessment (LCA): LCA evaluates the environmental impacts of a product, process, or activity throughout its entire life cycle, from raw material extraction to end-of-life disposal. It considers all stages, including production, transportation, use, and disposal, to assess carbon emissions and other environmental indicators. LCA provides insights into hotspots of emissions and helps identify opportunities for emissions reduction.

Carbon Intensity Accounting: This method calculates the amount of carbon emitted per unit of economic output, such as GDP or revenue. It allows for comparisons of emissions efficiency between different sectors or companies and helps identify opportunities for decoupling economic growth from carbon emissions.

Sectoral Accounting: Sectoral carbon accounting focuses on estimating emissions within specific sectors of the economy, such as energy, transportation, agriculture, or industry. It involves collecting data on fuel consumption, production processes, and other relevant factors to quantify sector-specific emissions. Sectoral accounting helps policymakers and industry stakeholders develop targeted mitigation strategies.

Carbon Capture and Storage (CCS) Accounting: CCS accounting evaluates the amount of carbon dioxide captured from industrial processes or power plants and stored underground to prevent it from entering the atmosphere. It involves measuring the capture, transportation, and storage of CO2 and assessing the effectiveness of CCS as a mitigation strategy.

Carbon Offsetting Accounting: Carbon offsetting involves investing in projects that reduce or remove carbon emissions to compensate for emissions elsewhere. This method requires quantifying the emissions reductions achieved by offset projects, such as reforestation, renewable energy, or methane capture. Carbon offsetting accounting ensures that offset credits are accurately calculated and verified.

2.1.3. Challenges of Carbon Accounting.

Though carbon accounting is recognized across the board as a vital sustainability tool, its use in developing nations such as Nigeria is still limited. Challenges to adoption involve weak regulatory frameworks, organizational capacities, and stakeholder awareness (Cortés et al., 2023; Crous, 2022). Other challenges faced by Carbon accounting in Nigeria includes institutional, technical, economic, and political barriers. These challenges hinder the accurate measurement, reporting, and verification (MRV) of greenhouse gas (GHG) emissions, which is essential for climate mitigation and compliance with international frameworks like the Paris Agreement. Nevertheless, international best practices have useful lessons in translating carbon accounting approaches to fit specific contexts. For example, the Lao PDR Community Carbon Accounting (CCA) project demonstrates the capacity of carbon accounting and monitoring forest biomass to mobilize local people (Boutthavong et al., 2014).

2.1.4. Ways forward to improve carbon accounting practice.

To improve carbon accounting in Nigeria, several strategic and policy-driven actions can be taken. These focus on strengthening institutions, improving data quality, building technical capacity, and fostering stakeholder engagement. Below are key ways forward, each supported by references:

i. Strengthen Institutional Frameworks

-Establish a centralized national carbon accounting authority or strengthen existing institutions like the National Council on Climate Change (NCCC) for coordination.

-Clarify roles and responsibilities among ministries, departments, and agencies to avoid duplication.

ii. Improve Data Collection and Management

-Develop a national greenhouse gas (GHG) inventory system with sector-specific data input (especially for AFOLU, energy, and waste).

-Use digital technologies such as remote sensing, GIS, and blockchain to track emissions accurately.

iii. Build Technical Capacity

-Train government staff, academics, and private sector actors in carbon accounting methodologies, such as IPCC Guidelines and ISO 14064.

-Establish partnerships with universities and international organizations for knowledge exchange.

iv. Mobilize Sustainable Finance

-Leverage climate finance opportunities from the Green Climate Fund, the Clean Development Mechanism (CDM), and carbon markets.

-Create incentives for private-sector reporting and investment in low-carbon technologies.

v. Enhance Legal and Regulatory Frameworks

-Enforce the Climate Change Act (2021) by mandating annual carbon reporting for high-emitting sectors.

-Develop sector-specific emission standards and penalties for non-compliance.

vi. Promote Public-Private Partnerships and Stakeholder Engagement

-Involve NGOs, civil society, and private companies in data reporting and climate action projects.

-Encourage community-based monitoring, especially in land use and forestry sectors.

vii. Increase Public Awareness and Education

-Conduct nationwide awareness campaigns to promote understanding of carbon footprints and the importance of emissions data.

-Integrate climate change and carbon literacy into school curricula.

viii. Participate in Regional and International Reporting Mechanisms

-Align Nigeria's MRV systems with frameworks like the Enhanced Transparency Framework (ETF) under the Paris Agreement.

-Collaborate with ECOWAS and African Union climate bodies for harmonized reporting

2.2 Theoretical Review

This study is anchored in the Voluntary Disclosure Theory (VDT), developed by Verrecchia in 1983 and 1990 (Spencer & Weird, 2014). According to the theory, the drivers of voluntary disclosure are classified into two main categories: Motivation (M) and Constraints (Cs). Motivational factors include capital market transactions and information asymmetry, corporate control contests, stock-based compensation, increased analyst coverage, signaling of managerial competence, and the limitations of mandatory disclosures (Robert & Wagner, 2017). On the other hand, constraints to voluntary disclosure consist of prior disclosure practices, proprietary costs, agency costs, and political or legal risks (Graham et al., 2005). Among these factors, the most influential motivator is capital market transactions and the need to reduce information asymmetry. As proposed by Myers and Majluf (1984), when managers intend to raise capital through debt or equity, it becomes essential to eliminate the perception of information asymmetry among investors. Doing so helps mitigate adverse selection, allows firms to seize investment opportunities, and promotes more efficient resource allocation in the capital markets. This aspect of the theory is particularly applicable to the Nigerian context, where Carbon Accounting Information Disclosure (CAID) remains voluntary. In practice, only well-performing firms in Nigeria tend to reduce information asymmetry by voluntarily reporting their carbon emissions, whereas many others choose not to disclose (Egbuna & Ike, 2023; Nurudeen & Salawu, 2023).

2.3 Empirical Review

Galama & Scholtens (2024), studied a meta-analysis of greenhouse gas emissions and financial performance. The study included 74 effect sizes from 34 studies, consisting of 107605 observations for the period 1997–2019. The study suggested a significant relationship between GHG emissions and financial performance of listed companies. Consequently, the study revealed that firms with lower emissions have enhanced financial performance. The study found that the type of emission or financial performance measurement is not significant and sector to which the

firms in the study sample belong does not matter. Hence, the study suggested that the relationship between GHG emissions and financial performance is particularly obvious for firms operating in nations with the strictest carbon emission policies.

Lestari et al (2024) analyzed carbon emission disclosures and firm financial performance of IDX firms in Indonesia from 2020 – 2022. The study population consisted of energy sector firms listed on BEI 2020 – 2022 and purposive sampling technique was used to arrive at a sample of 54 observations of 18 firms for 3 years. The study used secondary data collected from the publications of financial reports, annual reports and sustainability reports for each energy firm listed on the Indonesia Stock Exchange (BEI) and the data collected were analyzed using descriptive statistics and SEM PLS method. The SEM PLS analysis suggested that a positive and significant association between carbon performance and green product innovation on carbon emissions disclosure; a negative and insignificant association between environment cost on carbon emissions disclosure; a negative and significant influence of carbon performance and financial performance; a positive and significant association between environmental cost and financial performance; a negative and insignificant association between green product innovation and financial performance; a positive and significant association between disclosure of carbon emissions and financial performance; a positive and significant association between carbon performance and green product innovation on financial performance through greenhouse gas emission disclosure and a negative and insignificant association between environmental cost on financial performance through greenhouse gas emission disclosure of listed energy sectors firms on IDX from 2020 – 2022.

Siddique et al (2021) carried out an investigation of carbon disclosure, carbon performance and financial performance using international dataset. The study employ ex post factor research design and secondary sources of data were used while univariate and multivariate analysis was employed with the regression analysis indicated that carbon disclosure positively affects carbon performance and carbon disclosure negatively (positively) influence financial performance in the short term (long term).

Mildawati, Agustia, and Soewarno (2018) examined the effect of climate change strategy on company's performance, and the mediating role of climate change disclosure in Indonesia. The sample comprised 266 firm years from the Indonesia Stock Exchange over the period 2010 to 2016. The study relied on secondary data obtained from annual reports, sustainability reports, and corporate website. The results showed that both a proactive and reactive climate change strategy have a positive influence on company's performance (ROA, ROE, and Tobin's Q), secondly, climate change strategy has a positive influence on climate change disclosure, and, thirdly, climate change disclosure has a positive influence on company's performance. Lastly, climate change disclosure mediated the influence of climate change strategy on company's performance.

Egbunike and Emudainohwo (2017) investigated the role of carbon accountant in the corporate carbon management system in Nigeria. The study employed mixed method of research design with the use of qualitative and quantitative methods. The population consisted of listed firms on the Nigeria Exchange Group (NGX) from 2011 to 2016 and purposive sampling technique was used. The study used ROE as dependent variable while environmental social disclosure as independent variable with community involvement, employee health and safety, corporate governance, research and development with other related environmental information as dimensions and firm size as control variable. The mixed data collected was analysed using univariate analysis, and multivariate analysis. The results indicated a significant relationship between carbon accounting and corporate financial performance of manufacturing firms listed on the NGX from 2011 to 2016.

3.0 Methodology

The study extensively reviewed published works to interrogate the evolution of carbon accounting in Nigeria and also discover methods of carbon accounting, challenges and way forward in the practice. Secondary materials which includes articles, peer reviewed publications and journals were extensively and intensively reviewed to provide the ground for observations and conclusion.

4.0 Observations and Discussions

Nigeria having evolved through a series of legislative, institutional, and policy developments aimed at addressing climate change and promoting sustainable environmental practices has demonstrated strong commitment to international climate agreements and its efforts to integrate carbon accounting into national governance. Incidentally from the study it is observed that challenges faced remains enormous. The country continues to play gallery instead of addressing the observed challenges to carbon accounting. This is highly noticeable in the environmental degradation noticeable in Oil prone areas of the country. Companies has consistently ignored and give an abysmal attention to gas flaring as established in

The study highlighted the weak institutional capacity as the country lacks a centralized and well-coordinated institutional framework for carbon accounting. There is limited inter agency collaboration and unclear mandates among governmental bodies responsible for climate and environmental data. (Akinnyele & Oladipo, 2021).

Though the study established the emergence of carbon accounting in Nigeria in response to research question number one. Also, the research questions two and three were investigated and established to exist but the weak institutional capacity and inadequate quality data availability has made it difficult to establish accurate emissions baseline.

Finally, while interrogating research question three, the study identified one major challenge of technical capacity gap indicating that there is a shortage of skilled personnel and technical know how to implement robust carbon accounting practices including the use of International methodologies like the IPCC guidelines and the advance MRV systems.

5.0. Recommendations

In line with the objectives of the study and observations made the Federal Ministry of Environment should strategize and strengthen Institutional Frameworks by establishing a centralized national carbon accounting authority or strengthen existing institutions like the National Council on Climate Change (NCCC) for coordination.

The Ministry should also improve in Data Collection and Management by developing a national greenhouse gas (GHG) inventory system with sector-specific data input (especially for AFOLU, energy, and waste). Finally, the Government should engage in building technical capacity by training government staff, academics and private sector actors in carbon accounting methodologies.

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