

CARBON EMISSION ACTION DISCLOSURE AND SUSTAINABILITY REPORTING QUALITY OF MANUFACTURING FIRMS IN NIGERIA

Wilson Adebayo ADEPITI
Professor Muyiwa Ezekiel ALADE

Department of Accounting
Adekunle Ajasin University
Akungba-Akoko, Ondo State
Corresponding Author: adebayo.adepiti@aaau.edu.ng

DOI: <https://doi.org/10.63725/jarat.v1.i2.08>

Abstract

Sustainability reporting quality among listed firms in developing countries remains inconsistent, with variations in the completeness, comparability, reliability and relevance of sustainability information disclosed to stakeholders. In Nigeria, although listed manufacturing firms increasingly provide sustainability-related information, the quality and usefulness of such disclosures remain a concern, particularly regarding carbon emission reduction targets, carbon governance structures and external carbon assurance. This raises questions about whether specific dimensions of carbon emission action disclosure are associated with the quality of sustainability reporting among listed manufacturing firms in Nigeria. This study investigates the effect of carbon emission action disclosure on sustainability reporting quality among listed manufacturing firms in Nigeria with focus on carbon emission reduction targets (CERT), carbon governance structure (CGOV) and external carbon assurance (ECAS). The study used ex-post facto research design. Data for the study were obtained from secondary sources through annual reports and sustainability reports of selected listed firms for the period 2015 to 2024. The population comprises 59 listed manufacturing firms, from which a sample of 46 firms was selected using purposive sampling technique. The study employs panel data techniques, including pooled OLS, fixed effects and random effects models. Findings show that CERT ($\beta = 0.536$, $p < 0.01$), CGOV ($\beta = 0.2447$, $p < 0.01$), and ECAS ($\beta = 0.3539$, $p < 0.01$) have positive and significant effects on sustainability reporting quality. The study concludes that action oriented carbon disclosure practices improve the quality and credibility of sustainability reporting among listed manufacturing firms in Nigeria. It is recommended that firms should focus more on projection of clear carbon emission reduction targets, strengthen governance structures for climate oversight, and adopt independent third party assurance for carbon disclosures in order to promote transparency and credibility of sustainability reporting quality.

Keywords: Carbon emission, emission reduction, governance structure, reporting quality, sustainability reporting.

1.0 Introduction

Globally, sustainability reporting quality has become a major research and regulatory focus in global corporate governance discourse due to increasing risks of climate change, stakeholder agitation, and regulatory interventions. Investors all over the world are demanding for more transparent, comparable, decision-useful environmental performance and policy shifts toward mandatory climate disclosures, particularly on carbon emissions and climate related risks (PwC, 2023). Recent literature identifies that while sustainability reporting rates have increased, reporting quality particularly the comparability and reliability of environmental disclosures remain uneven across firms and jurisdictions (Rivo-López et al., 2025; Wedari et al., 2025).

In South Africa for instance, a country who institutionalized sustainability reporting via the Johannesburg Stock Exchange (JSE). In this country, the quality of disclosure is relatively higher (Ioannou & Serafeim, 2020). However, in several other African countries, including Nigeria, sustainability disclosure performance remains fragmented and less consistent (Afolabi &

Olaniran,2021). Weak implementation structures and limited pressure from the stakeholder pave way to variations inequality of disclosure among listed firms.

Among Nigeria listed firms, sustainability reporting has grown recognition following regulatory initiatives by the Nigerian Exchange Group (NGX), Financial Reporting Council of Nigeria (FRC) including roadmaps for implementing global standards such as the International Sustainability Standards Board (ISSB) sustainability disclosure requirements (FRC progress report, 2024). However, empirical studies consistently find that environmental and sustainability disclosures among Nigerian listed firms are predominantly narrative and lack quantification, especially for key climate metrics (Alabi et al., 2024). Consequently, the overall quality of sustainability reports remains limited in terms of comparability, completeness, and assurance (Blay et al., 2024).

Moussa and Elmarzouky (2024) highlight the moderating role of carbon disclosure in market responses to sustainability reports, signifying that richer carbon information can reduce market uncertainty. This implied that carbon disclosures can reduce information asymmetry and market volatility. The studies by Bin-Nashwan (2026); Akinleye & Owoniya (2024); Anaeye et al. (2025); Waked (2025) advance carbon disclosure research by integrating internal sustainability competencies and digital reporting infrastructures as determinants of disclosure quality. These empirical studies underscore that sustainability reporting quality is increasingly viewed as multi-faceted, encompassing governance, quantification, and strategic climate actions. Mohammed et al.(2024) and Eduviere and Jeroh (2025) describe disclosure content and examine performance associations without deeply integrating carbon action disclosure as a determinant of overall sustainability reporting quality.

This study contributes to the existing studies by examining three main aspects of Carbon Emission Action Disclosure (CEAD) which are Carbon Emission Reduction Targets (CERT), Carbon Governance Structure (CGOV), and External Carbon Assurance (ECAS) in relation to sustainability reporting quality. Unlike studies that focus mainly on the extent or presence of sustainability disclosure, this study focuses on the quality of sustainability information disclosure using a Sustainability Reporting Quality Index (SRQI). It also provides empirical evidence from manufacturing firms listed on Nigerian Stock Exchange Group, thereby extending the limited literature on the relationship between specific carbon-related disclosure practices and sustainability reporting quality in developing countries. This study empirically examined the relationship between carbon emission action disclosure and sustainability reporting quality to fill the gap by employing rigorous content analysis techniques and quantitative metrics to examine disclosure quality in annual and sustainability reports of listed firms in Nigeria. Sustainability Reporting quality (SRQ) was measured as the dependent variable of the study using index based on the criteria of comparability, quantitative dept, understandability, timeliness and reliability of climate and sustainability disclosures, aligned with ISSB and GRI frameworks.

The key independent variable, carbon emission action disclosure (CEAD) was quantified using an index that captures carbon emission reduction targets (CERT), Carbon governance Structure (CGOV), and external Carbon assurance (ECAS). Firm size (FSIZE), Firm Age (FAGE) and Leverage (LEV), were introduced as a Control variables to enables a robust multivariate regression analysis consistent with contemporary empirical sustainability research.

The broad objective is to examine the effect of carbon emission action disclosure on sustainability reporting quality among listed manufacturing firms. While study specifically seeks to: examine the association between carbon emission reduction target disclosure and sustainability reporting quality among listed manufacturing firms in Nigeria; examine the association between carbon governance structure disclosure and sustainability reporting quality among listed manufacturing firms in Nigeria; and examine the association between external carbon assurance disclosure and sustainability reporting quality among listed manufacturing firms in Nigeria. In study seeks to raise the following questions which were answered in the study; what is the relationship between carbon emission reduction target disclosure and sustainability reporting quality? How does carbon governance structure disclosure affect sustainability reporting quality? What is the relationship between external carbon assurance disclosure and sustainability reporting quality?

The following hypothesis were formulated; H01: Carbon emission reduction target disclosure has no significant association with sustainability reporting quality among listed manufacturing firms in Nigeria. H02: Carbon governance structure disclosure has no significant association with sustainability reporting quality among listed manufacturing firms in Nigeria. H03: External carbon assurance disclosure has no significant association with sustainability reporting quality among listed manufacturing firms in Nigeria.

The findings provide the management, government, regulators, policymakers, and investors with evidence on enhancing climate disclosure practices in emerging markets to strengthen sustainability reporting practices. The remainder of this paper is organized as follows; section two reviews relevant literature; section three outlines methodology; section four presents empirical results and discussion of findings; and section five concludes with implications and recommendations.

2.0 Literature Review

This section explains key concepts, examines relevant theories, and reviews related empirical study and identified gap in literature.

Conceptual Review

The conceptual review explains the main variables of the study and describes how they are defined and measured in this study.

Sustainability Reporting Quality

Moussa and Elmarzouky (2024) waived sustainability reporting quality as the extent to which ESG disclosures provide useful decision, reliable and comparable information that reduces market uncertainty. Amatullah et al. (2025) conceptualize sustainability reporting quality as the degree of completeness, accuracy, and governance integration embedded in sustainability disclosures. Bin-Nashwan (2026) defines sustainability reporting quality as the credibility and transparency of sustainability information, supported by internal competencies and digital reporting systems. From these descriptions, sustainability reporting quality can be understood as a multidimensional construct encompassing comparability, quantitative dept, understandability, timeliness and reliability of sustainability disclosures.

This study describes sustainability reporting quality as the extent to which sustainability disclosures of listed firms provide stakeholders with complete, specific, verifiable, comparable and

comprehensive picture of its sustainability (ESG) performance in alignment with recognized reporting standards towards its sustainable development goals. Waked (2025), emphasizes that sustainability reporting quality goes beyond disclosure volume. High quality reports contain quantified metrics, forward looking targets, third party assurance, and clear governance accountability. Mohammed et al., (2024); Eduviere and Jeroh (2025) show that governance mechanisms such as board independence and committee diversity influence reporting quality. Furthermore, sustainability reporting quality is positively associated with firm value and investor confidence when disclosures are credible and carbon specific. In emerging markets, reporting quality is often constrained by weak enforcement and voluntary disclosure frameworks, leading to normatively heavy sustainability reports with limited climate metrics (Ong et al., 2025).

This study measures sustainability reporting quality using a Sustainability Reporting Quality Index (SRQI) constructed through content analysis. The index will assess; completeness of environmental disclosures, comparability of climate metrics, understandability of information disclosed, credibility of disclosed information and relevance of environmental information disclosed align with recognized standards (such as ISSB S1 & S2; GRI 305). Each item was scored using a binary and weighted scoring method, consistent with recent sustainability accounting methodologies (Amatullah et al., 2025; Moussa & Elmarzouky, 2024).

Carbon Emission Action Disclosure

Carbon emission action disclosure (CEAD) has been conceptualized in different ways within recent sustainability and environmental accounting literature. Ramadhan and Hartikayanti (2026) view carbon emission disclosure as the extent to which firms report specific greenhouse gas (GHG) emission data, mitigation strategies, and climate governance structures that demonstrate environmental responsibility. According to Sharaf-Addin (2025) carbon sustainability disclosure denotes corporate communication of quantifiable emission reduction initiatives and evolution policies associated with net zero assurances.

Moussa and Elmarzouky (2024) viewed carbon disclosure as climate related reporting which offers quantified emissions information and onward observing carbon risk organization data that reduces information irregularity in capital markets. From these accounts, carbon emission disclosure action could be eminent from general environmental disclosure. While overall disclosure could include narrative sustainability declarations, carbon emission action disclosure precisely underscores measured emission indicators, reduction targets, mitigation initiatives, and governance mechanisms.

This study expresses carbon emission action disclosure as the degree to which quoted companies divulge precise, quantifiable, and confirmable actions undertaken to lessen greenhouse gas emissions, including emission targets, carbon emission governance structure and external assurance mechanism. This view underlines action driving transparency, rather than figurative or purely descriptive reporting. Sharaf-Addin, (2025) concluded that Carbon action reporting has grown beyond basic emission disclosure toward deliberate information on climate action, such as science based targets, transition planning, and risk management.

According to Ramadhan and Hartikayanti (2026) firms with improved environmental performance with adequate governance structures have a tendency to offer more detailed carbon reporting. Carbon emission action disclosure is measured in this study using a Carbon Emission Action

Disclosure Index (CEADI) structured using systematic content analysis of annual reports and sustainability reports of listed firms. For the purpose of this study, three key dimensions of CEAD which are carbon emission reduction targets, carbon governance structure and carbon external assurance are considered. Each of this dimension comprises specific disclosure items which are scored using a weighted average scoring system to assess both presence and depth of disclosure.

Carbon Emission Reduction Targets (CERT)

Carbon emission reduction targets indicate firms' publicly stated commitments made by firms to reduce greenhouse gas emissions within defined time frames. This dimension measures whether firms disclose; quantified GHG reduction targets such as percentage reduction, baseline year and target year for short-term and long-term reduction goals and carbon neutrality commitments. Sharaf-Addin (2025) stresses that clearly separate and time bound emission targets are fundamental to reliable carbon sustainability reporting. Companies that disclose quantified targets establish forward-looking accountability and quantifiable climate commitment. However, CERT was measured by allocating "1" if quantified carbon emission targets with timelines are disclosed if otherwise "0" were allocated.

Carbon Governance Structure (CGOV)

Carbon emission governance structure is a set of processes and systems established by firms to ensure that carbon-related problems are addressed, controlled, and reported. Such structures may include board-level oversight, sustainability committees, executive compensation and incentives based on carbon performance, and incorporation of climate risk into enterprise risk management (Michelon et al., 2020; Nuber & Velte, 2021; Zhang et al., 2022). This aspect of governance determines the credibility and quality of carbon action disclosure by firms through the types of information generated, verified, and delivered (Al-Shaer & Zaman, 2021).

The effectiveness of carbon governance structures can be evaluated based on whether they promote accountability for carbon emission control at the level of corporate decision-making. From an institutional theory perspective, firms adopt climate governance structures to respond to coercive, normative, and mimetic institutional pressures and enhance legitimacy and disclosure of climate-related information (Amatullah et al., 2025; Al-Shaer & Zaman, 2021). For instance, the presence of environmental expertise and sustainability committees promotes the production of decision-useful carbon emission disclosure as opposed to window dressing by Choi et al. (2021) and Nuber & Velte (2021).

Several studies provide evidence in support of the argument that governance structures influence carbon emission disclosure by firms. According to Choi et al. (2021), board independence and environmental expertise promote higher levels of carbon emission disclosure. Similarly, Al-Shaer & Zaman (2021) concludes that firms with sustainability committees provide more extensive sustainability information disclosure. On the same note, Nuber & Velte (2021) found that audit committee effectiveness promotes higher level of sustainability reporting and disclosure by firms.

Studies conducted in emerging economies suggest that carbon governance structures are even more critical in promoting carbon emission disclosure by firms. Sustainability reporting is mostly voluntary in emerging economies, meaning that firms are only willing to report climate-related information when they perceive some benefits. Amatullah et al. (2025) found that governance structures predicted the level of sustainability reporting and disclosure by firms in emerging

economies. In the same way, Zhang et al. (2022) concludes that firms with effective governance structures were able to improve their carbon performance and report climate-related actions more effectively after the implementation of new regulations.

External Carbon Assurance

External Carbon Assurance (ECAS) refers to the independent verification or assurance of a company's disclosed carbon or greenhouse gas (GHG) information by a qualified external assurance provider. External assurance enhances the credibility, reliability and decision usefulness of carbon-related disclosures by providing independent verification of information reported by firms (Simnett et al., 2009; Velte, 2021). It also provides an important monitoring mechanism through which firms demonstrate transparency and accountability in their carbon-related reporting.

In this study, ECAS is conceptualised along four dimensions: external assurance, level of assurance, assurance provider credibility, and scope of assurance. External assurance captures whether the firm's carbon-related information is independently verified or assured by an external party. The level of assurance reflects the degree of assurance provided by the assurance engagement, such as limited or reasonable assurance. Assurance provider credibility considers the characteristics and professional standing of the independent assurance provider, while the scope of assurance captures the extent of carbon-related information covered by the assurance engagement.

These dimensions distinguish ECAS from Carbon Governance Structure (CGOV). While CGOV focuses on the governance structures, responsibilities and mechanisms established within the firm for managing carbon-related matters, ECAS focuses specifically on the characteristics and extent of independent external assurance of carbon-related information. External assurance can enhance confidence in reported carbon information and may reduce concerns about the credibility of such disclosures (Ong et al., 2025).

Accordingly, the measurement of ECAS considers the disclosure of these four dimensions. The scoring captures whether external assurance is present and the extent to which the assurance engagement provides information regarding the level of assurance, credibility of the assurance provider and scope of the assurance. The coding and weighting procedures are applied consistently across the four dimensions based on the study's disclosure measurement framework.

Theoretical Review

This study reviewed two relevant theories which are institutional theory and resource-based view (RBV) theory. After reviewing these theories, the study is primarily anchored on institutional theory, while RBV provides complementary explanatory support.

Institutional Theory

Institutional Theory was developed by Meyer and Rowan (1977) and later expanded by DiMaggio and Powell (1983). DiMaggio and Powell (1983) introduced the concept of institutional isomorphism; coercive, normative, and mimetic pressures that shape organizational practices. Institutional Theory assumes that organizational structures and practices are shaped by external institutional pressures. Firms conform to regulations, norms, and industry expectations to gain legitimacy and stability. Institutional pressures arise from coercive forces such as laws and regulatory bodies, normative forces such as the professional standards and Mimetic forces such as

imitation of successful firms. The theory posits that organizations adopt practices not only for efficiency but to conform to socially accepted rules and standards. In the context of this study, institutional pressures arise from global sustainability standards such as IFRS, Sustainability Disclosure Standards (ISSB S1 and S2), stock exchange sustainability reporting guidelines, International investor ESG expectations, regulatory encouragement by national financial reporting authorities. These represent coercive and normative institutional pressures encouraging firms to adopt carbon emission action disclosure.

Mimetic pressures may also influence Nigerian firms to imitate multinational corporations or industry leaders that disclose comprehensive carbon data. Current research provides backing for the institutional viewpoint. Rohmah and Murtini (2026) demonstrate that regulatory and governance frameworks have a substantial impact on carbon emission disclosure. Bin-Nashwan (2026) discovers that digital sustainability structures arise in part as a reaction to changing reporting standards. Moussa and Elmarzouky (2024) show that high-quality carbon disclosures lower market uncertainty, which mirrors institutional demand for credible climate reporting. Institutional theory is highly pertinent to this study, since the sustainability reporting environment in Nigeria is evolving amid growing regulatory and global pressure.

Companies adopt carbon emission action disclosure partly because of institutional expectations rather than purely voluntary reasons. Enhancements in sustainability reporting quality can be understood as responses to stronger institutional demands for transparency and comparability. Accordingly, this study is mainly anchored on Institutional Theory, as it best explains how external pressures shape carbon emission action disclosure and sustainability reporting quality among listed firms in Nigeria.

Resource-Based View (RBV) Theory

The Resource Based View (RBV) Theory was introduced by Barney (1991), expanding upon prior contributions from Wernerfelt (1984). Barney (1991) contended that firms attain sustained competitive advantage via resources that are valuable, rare, inimitable, and non-substitutable (VRIN). RBV presupposes that; firms hold heterogeneous resources and capabilities, internal resources shape competitive advantage and performance, strategic capabilities affect how firms react to environmental pressures, and sustainable advantage hinges on the effective deployment of unique resources.

Within sustainability reporting, such resources can encompass environmental expertise, governance competence, digital reporting systems, and carbon management capabilities. Even when facing comparable institutional pressures, firms vary in their capacity to generate high-quality sustainability reports. RBV accounts for these variations through differences in internal capabilities. Firms with; solid sustainability governance structures, proficient environmental management teams, sophisticated carbon accounting systems, and dependable digital reporting platforms, are more inclined to disclose detailed carbon emission actions and deliver higher-quality sustainability reports.

Amatullah et al. (2025) concluded that a governance framework strengthens the reliability of sustainability reporting quality. Bin-Nashwan (2026) opined that internal sustainability competencies considerably enhance the quality of carbon disclosure. These findings give support to the RBV perspective. RBV extends Institutional Theory by clarifying how variations at the level

affect reporting quality. While Institutional Theory explains why firms disclose because of pressures RBV explains how firms can respond effectively using their internal capabilities. Therefore, RBV serves as a view in this study.

Empirical Review

Ioannou and Serafeim (2020) studied how mandatory sustainability disclosure regulations influence reporting practices. The study measured sustainability reporting quality with indices that evaluate how comprehensive and comparable the disclosures are. The results revealed that mandatory regulations greatly improve the comparability and depth of reporting. This study strongly supports the idea of institutional pressure. However, it does not separate the parts of carbon disclosure. Chaudhry et al. (2020) Examined how carbon emissions affect country risk in the G7 economies. Their study found that carbon emissions significantly influence country risk though the relationship is complex and shaped by factors. These results align with the research of Qingquan et al. (2020) who also found a link between carbon emissions and country risk. That study focused only on the G7 economies and future research could look at other countries.

Shen et al. (2020) carried out research on how carbon emission trading affects carbon emissions in China. The study found that carbon trading reduces emissions. This effect occurs only in certain industries. This finding is in tandem with the work of Zhang et al. (2025) who also found a link between carbon trading and emissions. This study was limited to China and future work could examine other countries. Yusuf et al. (2020) studied the relationship between greenhouse gas emissions, energy use and economic growth in some African nations. It was found that greenhouse gas emissions heavily influence growth though the relationship is intricate and shaped by many factors. These results agree with Bagadeem et al. (2024) who also identified a link between greenhouse gas emissions and economic growth. However, that study looked at African countries and further research could examine other regions.

Wan et al. (2022) Studied how natural resource abundance, green financing and government environmental concerns affect the environment in China and found that natural resource abundance and green financing have an impact on the environment while government concerns have only a limited effect. These results echo research by Chaudhry et al. (2020) who also found a link between natural resource abundance and the environment. Still that study focused on China and future research could look at other countries. Baratta et al. (2023) Examined how ESG practices influence carbon emissions in industry. Using a panel data approach and found that ESG practices significantly reduce carbon emissions. This effect is limited to certain industries. These results are consistent with Cassel (2023) who also found a link between ESG practices and carbon emissions. However, that study focused on the industry and future research could investigate other sectors.

Ye et al. (2023) studied the carbon-reduction effect of ESG in listed manufacturing firms in China and found that ESG significantly lowers carbon emissions. Again, this effect applies only to certain industries. These findings match the work of Cao et al. (2024) who also found a link between ESG and carbon emissions. Still that study was limited to listed manufacturing firms and future research could explore types of companies. Moussa and Elmarzouky (2024) explored how high-quality carbon disclosure relates to market uncertainty. They used a fixed-effects panel regression. The results showed that high-quality carbon disclosure greatly reduces market uncertainty and boosts investor confidence. This supports the idea that pressure from investors encourages better reporting

quality. Still the study focused on developed markets with regulations, which may limit how far the findings can be applied to Nigeria.

Sun et al. (2024) Examined how environmental, social and governance performance relates to green innovation in Chinese enterprises. The study found that environmental and social performance has an effect on green innovation while governance performance has only a limited influence. These results line up with research by Sun et al. (2021) who also found a strong link between environmental and social performance and green innovation. However, that study was confined to China and future work could investigate countries. Yang et al. (2024) Studied how enterprise ESG ratings affect carbon emissions from a perspective. They found that ESG ratings significantly affect carbon emissions. Spatial factors shape this relationship. These results echo work by Wan et al. (2022) who also found a link between ESG ratings and carbon emissions. Still that study was limited to a viewpoint and future research could examine other perspectives.

Kong et al. (2024) Examined how ESG performance influences carbon emissions through green credit and found that ESG performance has an effect on carbon emissions though the relationship is complex and shaped by many factors. These results match research by Koseoglu et al. (2024) who also found a link between ESG performance and carbon emissions. Nevertheless, that study focused on the green credit view and future research could explore other perspectives. Koseoglu et al. (2024) Examined how environmental, social and governance assets and diversity scores relate to carbon emissions in companies. They found that environmental and social assets greatly lower carbon emissions while governance assets have a limited effect. These results align with Setiani et al. (2024) who also found a link between environmental and social assets and carbon emissions. However, that study covered only global companies and future research could investigate types of companies.

Setiani et al. (2024) analysed the connection between ESG scores, financial performance, and carbon emissions among Southeast Asian companies. The study revealed that ESG scores have a significant effect on carbon emissions, though this relationship is shaped by financial performance. These results align with the research of Yang et al. (2024), who likewise identified a significant link between ESG scores and carbon emissions. Nevertheless, the study covered only Southeast Asian companies, and future research might investigate other regions. Wang et al. (2025) analyzed how peer firms' ESG performance influences reductions in carbon emissions. The study revealed that peer firms' ESG performance has a significant effect on carbon emissions, though the relationship is complex and shaped by various factors. These results align with earlier research by Sun et al. (2024), who likewise identified a significant link between peer firms' ESG performance and carbon emissions. Nevertheless, the study covered only peer firms, and future research might investigate other kinds of firms.

Radulescu et al. (2025) analysed the connection between emission trading systems, green technology, and environmental governance in the European Union. The study revealed that emission trading systems and green technology considerably lower CO₂ emissions, whereas environmental governance has only a limited effect. These results align with earlier research by Shen et al. (2020), who likewise identified a significant link between emission trading systems and CO₂ emissions. Nevertheless, the study covered only the European Union, and future research might investigate other regions. Zhang et al. (2025) analyzed how the digital economy influences

carbon emission performance in the Yangtze River Delta, China. The study revealed that the digital economy has a significant effect on carbon emissions, though this effect is confined to certain industries. These results align with earlier research by Ye et al. (2023), who likewise identified a significant link between the digital economy and carbon emissions. Nevertheless, the study covered only the Yangtze River Delta, and future research might investigate other regions.

Amatullah et al. (2025) analyzed the factors that determine sustainability reporting quality in emerging economies. The study measured sustainability reporting quality using an index based on compliance with the Global Reporting Initiative (GRI). The results showed that having sustainability expertise on the board a sustainability committee and institutional ownership all positively affect reporting quality. This study focuses more on governance mechanisms. It does not provide a detailed analysis of carbon-specific disclosures.

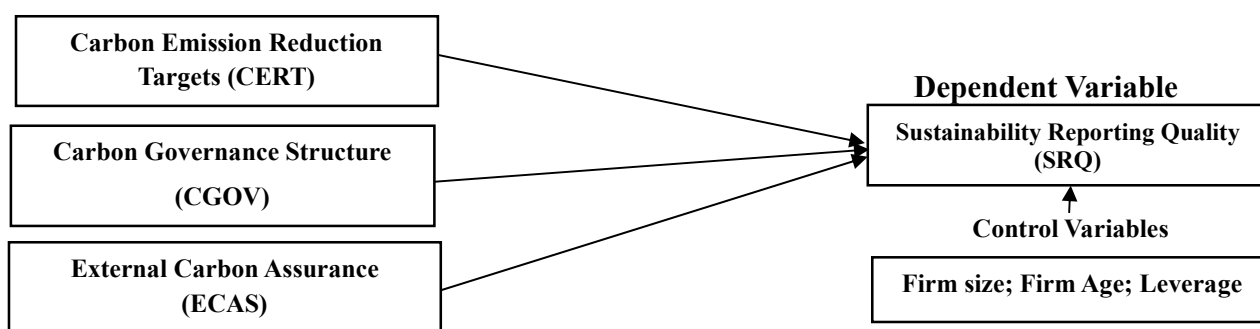
Gap in Literature

The empirical studies reviewed while assessing the extent of sustainability reporting practice and carbon disclosure, in both advanced and developing countries showed significant progress; however, there are research gaps, particularly in the case of African and Nigerian manufacturing organizations. First, most of the studies reviewed investigated the level of overall sustainability disclosure and not the quality of the disclosures. African studies mostly used quantitative approaches of measurement by considering the presence or absence of specific items without emphasizing the depth, quantification, forward-looking aspects, and verification of the disclosures. Additionally, many researchers have treated carbon emissions action disclosure as part of the overall environmental or ESG (Environmental, Social, and Governance) disclosure and have not examined it as a separate multidimensional phenomenon. Most of the studies on carbon emissions action disclosure combined all the aspects of environmental disclosure into one index without specifically highlighting the different indicators of carbon emission target, measurement, and assurance.

Conceptual Framework

The conceptual framework expounds how Carbon Emission Action Disclosure influences Sustainability Reporting Quality in the Nigerian manufacturing listed companies.

Independent Variable



Source: Author's Conceptualization, 2026.

3.0 Methodology

The study adopts an ex post facto research design. The study utilizes secondary data obtained from annual and sustainability reports of listed manufacturing firms on the Nigerian Exchange Group (NGX) for the period 2015-2024. The population of the study comprises all the 59 manufacturing firms listed on the Nigerian Exchange Group (NGX) as at 31 December 2025. Manufacturing firms are selected because they are environmentally sensitive and carbon-intensive relative to service-based industries. Their operations involve production processes that generate greenhouse gas emissions, making them highly relevant for carbon emission action disclosure analysis. A sample of 46 firms was selected using purposive sampling where all listed manufacturing firms that meet the study criteria are included. However, firms were included only if they meet the following conditions: Continuous listing on the NGX between 2016 and 2025, availability of complete annual reports for the study period, availability of environmental or sustainability disclosure. Based on preliminary screening, an estimated sample size of 46 firms was expected after excluding 13 firms with incomplete data.

Sustainability Reporting Quality is measured using a structured disclosure index adapted from the Global Reporting Initiative (GRI Standards). Carbon emission action disclosure variables such as; carbon emission reduction targets, carbon governance structure, and external carbon assurance were operationalized using disclosure items adapted from the Task Force on Climate-related Financial Disclosures (TCFD) framework and GRI 305 on emissions standard. The TCFD framework provides guidance on climate-related governance, strategy, and targets, while GRI 305 offers standardized metrics for emissions reporting and disclosure practices.

Carbon emission reduction targets were operationalized using GRI emission indicators (EN15–EN19), particularly emission intensity and reduction metrics. The carbon governance structure was consistent with the disclosure on management approach (DMA), mirroring the oversight of environmental performance. External carbon assurance was implemented for all emission indicators (EN15–EN21) in order to reflect the credibility and verification of the carbon information disclosed. Firm size, leverage, and firm age serve as control variables.

The study applies panel data regression methods, namely pooled Ordinary Least Squares (OLS), Fixed Effects (FE), and Random Effects (RE) models, to investigate the relationship among the variables. Diagnostic procedures including Spearman correlation, Variance Inflation Factor (VIF), Breusch–Pagan, Chow, Hausman, and Lagrange Multiplier tests were carried out. Due to the presence of heteroscedasticity, robust standard errors were applied to ensure the reliability and validity of the results.

Model Specification

This study adapts and extends the institutional disclosure model of Ioannou and Serafeim (2020) in a study aimed to investigate the effect of institutional pressure on sustainability disclosure quality. The study modeled sustainability disclosure quality as a function of institutional pressure and firm-level controls using a fixed-effects panel structure. The model is presented thus:

$$SDQ_{it} = \beta_0 + \beta_1 MANDATORY_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 AGE_{it} + e_{it}$$

The present study modifies this model by reconceptualizing carbon emission action disclosure (CEAD) in place of Mandatory as a strategic institutional response that enhances sustainability reporting quality (SRQ). The baseline panel regression model for this study is stated as:

$$SRQ = f(CEAD) \dots\dots\dots 1$$

$$SRQ = f(CERT, \beta_2 CGOV, ECAS) \dots\dots\dots 2$$

The baseline panel regression model for this study is specified in econometric form as:

$$SRQ_{it} = \beta_0 + \beta_1 CEAD_{it} + \beta_2 FSIZE_{it} + \beta_3 LEV_{it} + \beta_4 FAGE_{it} + e_{it} \dots\dots\dots 3$$

To examine dimensional effects, the expanded model is presents econometrically as:

$$SRQ_{it} = \beta_0 + \beta_1 CERT_{it} + \beta_2 CGOV + \beta_3 ECAS_{it} + \beta_4 FSIZE_{it} + \beta_5 LEV_{it} + \beta_6 FAGE_{it} + e_{it} \dots\dots 4$$

Where:

SRQ_{it} = Sustainability Reporting Quality of firm i at time t

$CEAD_{it}$ = Carbon Emission Action Disclosure Index

$CERT_{it}$ = Carbon emission reduction targets

$CGOV$ = Carbon governance structure

$ECAS$ = External carbon emission assurance

$FSIZE_{it}$ = Firm size

$FAGE_{it}$ = Firm age

LEV_{it} = Leverage

$\beta_0 - \beta_4$ = Coefficients

e_{it} = Idiosyncratic error term

$\beta_1 - \beta_4 > 0$, CEAD is expected to positively influence SRQ.

Table 1:

Measurement of Variable

S/N	Variable	Description	Measurement	Source of Data
Dependent variable				
1	Sustainability Reporting Quality (SRQ)	SRQ is measured using a structured disclosure index adapted from the GRI Standards.	Each disclosure item is scored 1 if disclosed otherwise 0. Total score divided by maximum obtainable score.	Soysa et al. (2023); Zhang et al. (2025); Wang et al (2025)
Independent variable				
2	Carbon Emission Reduction Targets (CERT)	It discloses presence of targets; quantitative targets; time-bound targets and progress disclosure	Each disclosure item is scored 1 if disclosed otherwise 0. Total score divided by maximum obtainable score.	Soysa et al. (2023); Ramadhan and Hartikayanti (2026)
3	Carbon Governance Structure (CGOV)	It captures the presence of governance mechanisms for managing carbon related issues	Each disclosure item is scored 1 if disclosed otherwise 0. Total score divided by maximum obtainable score.	Amatullah, et al (2025)
4	External Carbon Assurance (ECAS)	It measures whether firms obtain independent	Each disclosure item is scored 1 if disclosed otherwise 0.	Ezekiel et al (2024)

Control variable		verification of carbon-related disclosures.	Total score divided by maximum obtainable score.	
5	Firm Size(FSIZE)	Firm visibility, resource availability, and exposure to pressure.	Natural logarithm of total assets.	Dang and Yang (2021)
6	Firm Age (FAGE)	Number of years since the firm's incorporation	Measured as the number of years since incorporation	(Hassan et al., (2018); Khan et al., (2020)
7	Leverage	Leverage is measured as the ratio of total debt to total assets.	Total debt / Total Assets	(Uwuigbe et al. (2020); Adegbite et al.,(2020)

Source: Author's Compilation, 2026.

4.0 Results and Discussions

This study examines the effect of carbon emission action disclosure on sustainability reporting quality among listed manufacturing firms in Nigeria over the study period. In this study, carbon emission reduction targets (CERT), carbon governance structure (CGOV), and external carbon assurance (ECAS) serve as the measures of the independent variables representing carbon emission action disclosure (CEAD). Sustainability reporting quality (SRQ), measured using a structured disclosure quality index capturing the completeness, specificity, comparability, and verifiability of sustainability information disclosed by firms, represents the dependent variable of the study. To enhance the robustness and explanatory power of the model, firm size (SIZE), Leverage (LEV) and Firm age (FAGE) are incorporated as a control variable. This section presents the pre-regression analyses, including descriptive statistics and correlation analysis. Furthermore, the regression estimations, comprising pooled Ordinary Least Squares (OLS), Fixed Effects (FE), and Random Effects (RE) models, together with the associated diagnostic tests and hypothesis testing, are also discussed in this section.

Descriptive Statistics

The summary of carbon emission reduction targets (CERT), carbon governance structure (CGOV), external carbon assurance (ECAS), and sustainability reporting quality (SRQ), together with the selected control variables firm size (FSIZE), leverage (LEV), and firm age (FAGE), are presented using their mean, standard deviation, minimum, and maximum values to provide an overview of the distributional characteristics and variability of the variables across the sampled Nigerian listed manufacturing firms. Table 1 presents the descriptive statistics for the study.

Table 2:
Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
SRQ	460	0.276	0.224	0.000	1.000
CERT	460	0.339	0.233	0.000	1.000
VGOV	460	0.348	0.233	0.000	1.000
ECAS	460	0.176	0.299	0.000	1.000
SIZE	460	7.238	1.009	4.620	9.590
FAGE	460	33.870	13.261	4.000	60.000
LEV	460	71.031	47.669	2.010	424.170

Source: Author's Computation, 2026.

Table 2 presents the descriptive statistics for the variables employed in examining the relationship between carbon emission action disclosure and sustainability reporting quality among listed manufacturing firms in Nigeria. The table reports the mean, standard deviation, minimum, and maximum values for each variable based on 460 firm year observations. The results show that sustainability reporting quality (SRQ) has a mean value of 0.276 with a standard deviation of 0.224. This suggests that, on average, the level of sustainability reporting quality among the sampled manufacturing firms is relatively low, as firms disclose only about 27.6 percent of the maximum expected sustainability reporting quality indicators. The minimum value of 0.000 and the maximum value of 1.000 indicate substantial variation across firms, suggesting that while some firms provide no measurable sustainability disclosures, others provide very comprehensive sustainability reports aligned with reporting frameworks. The relatively moderate standard deviation further indicates considerable differences in reporting practices across firms.

The mean value of 0.339 for carbon emission reduction target (CERT), indicates that on average 33.9 percent of the sampled firms disclose a measurable carbon emission reduction target. This suggests that while certain firms are beginning to communicate their climate commitments, the uptake of the clearly defined emission reduction targets by Nigerian manufacturing firms is still moderately low. The standard deviation of the variables implies moderate variation in the disclosure of carbon reduction targets among firms as some companies report detailed reduction commitments while others do not give any information. Similarly, carbon governance structure (CGOV) has the mean value of 0.348 and a standard deviation of 0.233. This implies that approximately 34.8 percent of the firms disclose governance mechanisms related to carbon management such as board level oversight of climate issues, sustainability committees or the inclusion of climate risks into corporate governance structures. The minimum and maximum values of 0.000 and 1.000 respectively suggest that while some firms do not give any governance disclosure on carbon management, others fully disclosure governance arrangements which promote climate accountability.

External carbon assurance (ECAS) has a relatively low mean value of 0.176 and a standard deviation of 0.299. This result implies that a small proportion of firms obtain independent third party verification of their carbon emission disclosures. The low average suggests that external assurance of carbon related information is still largely underdeveloped among Nigerian manufacturing firms. The comparatively higher standard deviation implies significant variation in assurance practices which reflects differences in firms' commitment to strengthening the credibility of their environmental disclosures.

As for the control variables, firm size (SIZE) has the mean value of 7.238 and a standard deviation of 1.009 implies moderate variability in the asset base of the sampled firms. The minimum value of 4.620 and maximum value of 9.590 indicates that the sample represents both relatively small and large manufacturing firms implying that firms of differing operational scale are included in the analysis. Firm age (FAGE) has the mean value of 33.870 years and a standard deviation of 13.261. This shows that the sampled firms are relatively mature organizations with considerable operational history.

The minimum firm age of 4 years and maximum of 60 years reflect a wide variation in the longevity of firms indicating that both relatively younger and established firms are part of the

study. Leverage (LEV) has a mean of 71.03 and a comparatively high standard deviation of 47.669 implying significant differences in firms' capital structures. The minimum of 2.010 and the maximum of 424.170 indicate that firms vary considerably in how much they utilize debt financing. This broad spread implies that while some firms have a relatively low leverage, others employ debt financing to a large extent which can affect disclosure incentives and exposure to financial risk.

Correlation Analysis

The Spearman's correlation matrix is particularly suitable for this study as it detects monotonic relationships between variables and decreases the effect of possible outliers which can arise in disclosure in panel datasets. Table 4.2 presents the results of the correlation analysis.

Table 3:
Correlation Results

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) SRQ	1.000						
(2) CERT	0.842	1.000					
(3) CGOV	0.678	0.458	1.000				
(4) ECAS	0.498	0.400	0.165	1.000			
(5) SIZE	0.405	0.456	0.262	0.490	1.000		
(6) FAGE	0.140	0.066	0.082	0.384	0.089	1.000	
(7) LEV	-0.132	-0.153	-0.214	0.025	-0.024	0.024	1.000

Source: Author's Computation, 2026.

Table 3 presents the Spearman rank correlation matrix showing the correlation of the dependent and independent variables. The results reflect the strength and direction of the association of each pair of variables. The results provide preliminary evidence on the associations between the different variables prior to conducting the regression analysis. For instance, the results show a significant positive correlation coefficient of 0.842 between sustainability reporting quality (SRQ) and carbon emission reduction targets (CERT) indicating that firms that disclose carbon emission reduction targets tend to exhibit higher levels of sustainability reporting quality. This finding suggests that the presence of explicit carbon emission reduction targets improves the likelihood of firms reporting high levels of sustainability reporting quality. This observation corroborates the notion that firms that communicate forward-looking climate commitments are likely to be inclined to provide structured and comprehensive sustainability disclosures.

Sustainability reporting quality (SRQ) also exhibits a significant positive correlation with carbon governance structure (CGOV) with a correlation coefficient of 0.678. This suggests that firms that have effective governance structures to oversee carbon emission-related activities such as those of the board of directors, tend to report higher levels of sustainability reporting quality. Governance structures such as the mentioned above serve as important assurance mechanisms that improve the reliability of sustainability disclosure practices of firms. On the same note, external carbon assurance (ECAS) exhibits a positive correlation with sustainability reporting quality with a correlation coefficient of 0.498. This suggests that firms that employ external assurance for their carbon emission-related information tend to report higher levels of sustainability reporting quality. External assurance enhances the credibility and veracity

of the disclosed carbon emission information and alleviates concerns regarding the presence of 'green' reports.

In terms of the control variables, firm size (SIZE) exhibits a positive correlation with sustainability reporting quality (0.405). This suggests that larger firms report higher levels of sustainability reporting quality as compared to their smaller counterparts. Larger firms tend to be more visible to stakeholders and are subject to more stringent regulatory and public scrutiny and therefore, have greater incentives to embrace quality sustainability disclosure practices than their smaller counterparts. In terms of firm age (FAGE), the results suggest the presence of a weak but positive correlation with sustainability reporting quality (0.140). This suggests that older firms tend to exhibit higher levels of sustainability reporting quality than younger firms. Older firms are likely to have developed more sophisticated corporate governance structures and reporting procedures than younger firms.

Leverage (LEV) exhibits no significant correlation with sustainability reporting quality (-0.132). This suggests that leverage does not exhibit a significant association with sustainability reporting quality. Firms with higher levels of leverage are likely to prioritize short-term performance concerns over long-term sustainability reporting considerations. The correlation coefficients between the independent variables are generally moderate suggesting that multicollinearity is not of concern. For instance, the correlation between carbon emission reduction targets and carbon governance structure is 0.458 whereas, the correlation between carbon governance structure and external carbon assurance is relatively low at 0.165.

Regression Analyses

Specifically, the study employed panel regression analysis techniques to examine the influence of carbon emission action disclosure variables on sustainability reporting quality by testing the aforementioned research hypotheses. Initial diagnostic tests indicated the presence of heteroscedasticity and therefore robust standard errors were employed to ensure reliability of the estimated coefficients. The pooled Ordinary Least Squares (OLS) findings as well as the robust panel regression analysis results of the Fixed Effects (FE) and Random Effects (RE) are presented and discussed below to provide comprehensive evidence on the relationship between carbon emission action disclosure variables and sustainability reporting quality among listed manufacturing firms in Nigeria.

Table 4:
Regression Results

VARIABLES	(1) Pool OLS	(2) FE	(3) RE
CERT	0.5494*** (0.019)	0.5363*** (0.021)	0.5340*** (0.020)
CGOV	0.2731*** (0.016)	0.2447*** (0.022)	0.2804*** (0.018)
ECAS	0.3083*** (0.015)	0.3539*** (0.019)	0.3179*** (0.017)
SIZE	-0.0153*** (0.004)	0.0286** (0.013)	-0.0103 (0.006)
FAGE	-0.0006** (0.000)	-0.0101*** (0.001)	-0.0014*** (0.000)

LEV	0.0001 (0.000)	0.0002** (0.000)	0.0001 (0.000)
Constant	0.0638** (0.032)	0.0681 (0.106)	0.0550 (0.049)
Observations	460	460	460
R-squared	0.893	0.825	
Year FE	Yes	Yes	Yes
p(F-Stat)	0.000	0.000	
R-Squared	0.893	0.825	0.805
Mean VIF	1.355		
Breuch-Pagan	0.000		
Chow F-Test		0.000	
Hausman Test		0.000	
p(Chi2)			0.000
LM Test			0.000

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Author's Computation, 2026.

Table 4 presents the results of the pooled Ordinary Least Squares (OLS), Fixed Effects (FE) and Random Effects (RE) regression models. The regression results explore the influence of carbon emission action disclosure on sustainability reporting quality of listed manufacturing firms in Nigeria. Firstly, in the case of pooled OLS, an R-squared value of 0.893 indicates that approximately 89.3 percent of the variance in the dependent variable across entities and time is explained by the independent variables included in the model. This high explanatory power suggests that the carbon emission action disclosure variables together with the firm-level controls substantially explain variations in sustainability reporting quality among the sampled firms. The F-statistical probability value of 0.000 confirms that the pooled regression model is jointly statistically significant, implying that the explanatory variables collectively have significant explanatory power. However, the Breusch Pagan test result ($p = 0.000$) indicates the presence of heteroscedasticity, thereby justifying the use of robust standard errors to ensure reliable statistical inference. Furthermore, the mean Variance Inflation Factor (VIF) of 1.355 suggests that multicollinearity is not a concern, as the value is far below the conventional threshold of 10, indicating that the explanatory variables are not excessively correlated.

Turning to the panel estimations, the Fixed Effects model reports an R-squared value of 0.825, indicating that about 82.5 percent of the variation in sustainability reporting quality within firms over time is explained by the explanatory variables after controlling for unobserved firm-specific characteristics. The Chow F-test result ($p = 0.000$) confirms that the Fixed Effects specification is statistically significant and appropriate relative to the pooled OLS model. Similarly, the Random Effects model also produces statistically significant results, as indicated by the Chi-square probability value of 0.000, with an R-squared of 0.805, which is slightly lower than that of the Fixed Effects model but still indicates substantial explanatory power.

To determine the most appropriate panel estimator, the Hausman specification test was conducted. The Hausman test result ($p = 0.000$) is statistically significant, indicating that the null hypothesis that the Random Effects estimator is consistent cannot be accepted. This implies that the Fixed Effects model is more appropriate for interpretation in this study, as it effectively controls for unobserved firm-specific heterogeneity that may influence sustainability reporting practices.

Additionally, the result of Lagrange Multiplier test (LM)($p = 0.000$) confirms further the incidence of panel effects, which suggest the preference of using panel regression models to pooled OLS specification. Subsequently, the Fixed Effects model is preferred as the most reliable estimator for interpreting the relationship between carbon emission action disclosure and sustainability reporting quality among the sampled Nigerian manufacturing firms.

Discussion of Results

The regression results presented in Table 4.3 show that the three aspects of carbon emission action disclosure; carbon emission reduction targets (CERT), carbon governance structure (CGOV), and external carbon assurance (ECAS) are positively associated with sustainability reporting quality (SRQ) across all estimation techniques. In particular, the coefficient for carbon emission reduction targets (CERT) is positively and highly significant at the 1 percent level in the pooled OLS ($\beta = 0.5494$), Fixed Effects ($\beta = 0.5363$), and Random Effects ($\beta = 0.5340$) models. The size of these coefficients suggests that greater disclosure of measurable carbon emission reduction targets is linked to a considerable enhancement in sustainability reporting quality among Nigerian manufacturing firms. It can be concluded from the results that companies that openly disclose their commitments to reduce emissions with specific targets and dates tend to provide more complete and well-organized reports on sustainability. Sustainability reporting quality is improved by the presence of verifiable disclosure of such information from an institutional perspective. These results indicate that the companies researched reacted to the increasing regulatory and stakeholder demands for climate transparency by reporting concrete commitments to addressing climate change. The disclosure of these targets enhances the depth, comparability, and forward-looking nature of sustainability reports.

The results agree with previous studies that indicate climate target disclosure as a source of information about firms' environmental performance and enhance the informativeness of sustainability reports (Moussa & Elmarzouky, 2024; Sharaf-Addin, 2025). Similarly, Ramadhan and Hartikayanti (2026) found that the disclosure of detailed carbon emission reduction targets generally leads to the provision of more structured environmental information by firms. It can be argued from an institutional perspective that organizations feel pressured to meet the rising regulatory and stakeholder climate disclosure requirements. Institutional theory therefore guides this study and explains the motivation behind climate change disclosure practices among firms (DiMaggio & Powell, 1983).

The analysis also reveals that carbon governance (CGOV) has a positive effect on the level of quality of sustainability reporting in all the models. The effect was positive and significant at the 1% level of significance with coefficients of 0.2731, 0.2447, and 0.2804 for the pooled OLS, FE, and RE models respectively. These results suggest that firms with effective governance policies regarding climate governance tend to produce higher-quality sustainability reports. It can be argued that governance mechanisms such as board oversight and management involvement in climate governance processes enable firms to generate high-quality reports on sustainability performance. Additionally, such structures allow firms to ensure the reliability of the information contained in their sustainability reports. Effective governance in climate change management therefore increases report transparency and enhances the credibility of the information provided regarding environmental performance. It should be noted that this conclusion is based on RBV

theory which argues that internal core competence such as governance and managerial skill enables firms to perform activities such as preparing high-quality reports better than others (Barney, 1991).

The results therefore agree with prior studies that indicate the positive effect of board and committee oversight on the production of high-quality sustainability reports by firms (Amatullah et al., 2025; Al-Shaer & Zaman, 2021; Nuber & Velte, 2021). Carbon governance structures therefore appear to play a critical role in promoting carbon disclosure practices in emerging economies such as Nigeria. Externally verified carbon assurance also showed a positive association with the level of quality of sustainability reporting and was statistically significant at the 1% level of significance. All the three statistical models used indicate a positive effect of the externality of carbon assurance on the level of quality of sustainability reporting. The coefficients for pooled OLS, FE, and RE were 0.3083, 0.3539, and 0.3179 respectively.

The size of these coefficients suggests that independent verification of carbon emission disclosures considerably boosts the credibility and reliability of sustainability reports. Firms that put their carbon emission information through third-party assurance are more inclined to generate sustainability disclosures that are transparent, verifiable, and trusted by stakeholders. External assurance lowers the risk of greenwashing and bolsters stakeholder confidence in the authenticity of reported environmental performance. Theoretically, this finding is in line with Institutional Theory, which proposes that firms adopt assurance mechanisms to secure legitimacy and strengthen stakeholder trust in their reporting practices (Suchman, 1995).

The result further corroborates the findings of Ong et al. (2025) which show that independent verification improves the credibility of sustainability information and reduces opportunistic reporting. In a similar vein, Velte (2022) reports that using external sustainability assurance increases the reliability and improves the quality of sustainability reporting. Therefore, based on the evidence, it can be concluded that assurance is critical to enhancing the credibility and transparency of carbon reporting disclosure in the Nigerian manufacturing sector.

5.0 Conclusion and Recommendation

Although sustainability reporting practices are becoming more widespread, the quality of these disclosures remains uneven, particularly in emerging economies such as Nigeria, where the frameworks and enforcement mechanisms are comparatively weak. A significant number of firms report sustainability data, which is often of a narrative nature and contains only a modest amount of measurable climate-related information. This study explored the impact of carbon emission action disclosure on the quality of sustainability reporting of listed manufacturing firms.

The findings suggest that carbon emission reduction targets substantially enhance reporting quality, as firms that disclose more clearly defined carbon related targets, governance arrangements and externally assured carbon information tends to exhibit higher sustainability reporting quality. Carbon governance structures also improve reporting quality, as firms with formal oversight mechanisms tend to generate more reliable information. Moreover, external carbon assurance has a positive effect on reporting quality by improving credibility. Overall, action-oriented climate disclosures enhance sustainability reporting.

The study highlighted a number of important implications. Managers should consider going beyond superficial disclosures and pursue meaningful climate action, such as setting emission

targets, strengthening governance mechanisms, and seeking independent assurance. Investors may treat these disclosures as credibility signals and indicators of environmental responsibility. The study also provided a theoretical contribution by integrating institutional theory and the resource-based view perspectives to explain sustainability reporting practices. The study revealed an urgent need for regulators to require carbon emission disclosure, which can raise the quality of sustainability reporting, through well-established governance structures and effective external assurance engagement. These measures are expected to promote transparency and green washing mitigation, which will facilitate improved sustainability reporting quality and informed investment decisions and sustainable development in Nigeria.

CERT, CGOV and ECAS may share conceptual boundaries with some dimensions of SRQI, Judgment may be involved in determining whether a disclosure satisfies an index item, the purposive sample is based partly on availability of information, Reverse causality, omitted variables and simultaneity cannot be completely ruled out by the observational design. The study measures reported information, not independently verified environmental performance or actual reductions in emissions. The study focuses only on listed manufacturing firms in Nigeria, which limits its applicability. Further research should explore other sectors and countries. The content analysis approach may not fully capture the nuances of actual environmental performance, and other indicators, such as ESG ratings, could be considered. Additionally, factors such as carbon risk management, green innovation and digital reporting systems might also influence reporting quality. Future studies could further investigate the moderating role of institutional factors and use longitudinal or cross-country designs to obtain a clearer picture of how sustainability reporting practices develop over time.

References

- Al-Shaer, H., & Zaman, M. (2021). Board gender diversity and sustainability reporting assurance: Evidence from the UK. *Journal of Business Ethics*, 171(2), 291-311.
- Afolabi, A. O., & Olaniran, Y. O. (2021). Sustainability reporting practices and environmental disclosure in Nigerian listed companies. *Journal of Accounting and Sustainability Reporting*, 8(2), 45–61.
- Akinleye, G. T., & Owoniya, B. O. (2024). Carbon disclosure practices and climate governance in emerging markets: Evidence from African firms. *Journal of Environmental Accounting and Management*, 12(1), 55–73.
- Alabi, O. F., Adegboye, A., & Adebayo, S. A. (2024). Environmental disclosure and climate reporting practices of listed companies in Nigeria. *African Journal of Accounting, Finance and Management*, 9(1), 87-104.
- Amatullah, F., Rahman, M., & Hasan, R. (2025). Sustainability governance and disclosure quality: Evidence from emerging economies. *International Journal of Sustainability Accounting and Management*, 16(2), 140-158.
- Anaage, M., Nwobu, O., & Okafor, T. (2025). Digital reporting infrastructure and sustainability disclosure quality in developing economies. *Journal of Corporate Reporting and Accountability*, 7(1), 33–49.
- Bagadeem, S., Al-Homaidi, E., & Tabash, M. (2024). Firm-specific and macroeconomic determinants of environmental expenditures in manufacturing firms. *Environmental Economics and Policy Studies*, 26(1), 95-112.

- Baratta, A., De Luca, F., & Zampella, A. (2023). ESG practices and carbon emission reduction in industrial sectors: Evidence from panel data analysis. *Journal of Cleaner Production*, 385, 135623.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120.
- Bin-Nashwan, S. (2026). Internal sustainability capabilities and climate disclosure quality: Evidence from emerging markets. *Journal of Sustainable Finance & Investment*, 16(1), 1–20.
- Blay, A., Adams, C., & Abhayawansa, S. (2024). Sustainability reporting in developing economies: Institutional pressures and disclosure quality. *Accounting, Auditing & Accountability Journal*, 37(2), 421-448.
- Cao, Y., Zhang, L., & Li, H. (2024). Environmental protection tax, green innovation and environmental performance in China. *Environmental Science and Pollution Research*, 31(4), 5150-5165.
- Cassel, C. (2023). Product stewardship and environmental sustainability: Evidence from industrial sectors. *Business Strategy and the Environment*, 32(6), 3290-3304.
- Chaudhry, S. M., Ahmed, R., & Shahbaz, M. (2020). Carbon emissions and country risk: Evidence from G7 economies. *Environmental Science and Pollution Research*, 27(28), 35726-35737.
- Choi, B., Lee, D., & Psaros, J. (2021). An analysis of Australian company carbon emission disclosures. *Pacific Accounting Review*, 33(2), 219-239.
- Dang, C., Li, Z., & Yang, C. (2021). Measuring firm size in empirical corporate finance. *Journal of Banking & Finance*, 86, 159-176.
- DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48(2), 147-160.
- Eduviere, E., & Jeroh, E. (2025). Board committee diversity and environmental information disclosure among Nigerian non-financial firms. *Cogent Business & Management*, 12(1), 1–18.
- Hassan, A. (2018). Corporate environmental accountability, disclosure and sustainable development in Nigeria. *International Journal of Business and Social Science*, 3(17), 205-214.
- Ioannou, I., & Serafeim, G. (2020). The consequences of mandatory corporate sustainability reporting. *Harvard Business School Research Working Paper*, 11-100.
- Kong, Y., Liu, Y., & Dai, J. (2024). ESG performance and carbon emissions: The moderating role of green credit. *Journal of Environmental Management*, 345-118642.
- Koseoglu, M. A., Yildiz, M., & Parnell, J. (2024). ESG assets, diversity scores and carbon emissions in global firms. *Corporate Social Responsibility and Environmental Management*, 31(2), 1012-1026.
- Matuszak, Ł., & Róžańska, E. (2021). Corporate environmental disclosure and sustainability reporting practices: Evidence from emerging markets. *Sustainability*, 13(3), 1–19.
- Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American Journal of Sociology*, 83(2), 340-363.
- Michelon, G., Pilonato, S., & Ricceri, F. (2020). CSR reporting practices and the quality of disclosure: An empirical analysis. *Critical Perspectives on Accounting*, 61, 102-110.
- Mohammed, A., Gugong, B. K., & Aliyu, A. A. (2024). Corporate governance mechanisms and sustainability disclosure quality of listed firms in Nigeria. *International Journal of Accounting and Finance Research*, 13(2), 76–95.

- Moussa, T., & Elmarzouky, M. (2024). Carbon disclosure, sustainability reporting and market reactions: Evidence from international markets. *Business Strategy and the Environment*, 33(1), 112-128.
- Nuber, C., & Velte, P. (2021). Board gender diversity and carbon emissions disclosure: Evidence from European companies. *Journal of Cleaner Production*, 313, 127784.
- Ong, T., Trireksani, T., & Djajadikerta, H. (2025). Sustainability reporting assurance and the credibility of ESG disclosures. *Sustainability Accounting, Management and Policy Journal*, 16(1), 90-110.
- Qingquan, T., Khattak, S., & Ahmad, M. (2020). Monetary policy and CO₂ emissions: Evidence from Asian economies. *Environmental Science and Pollution Research*, 27(15), 18816-18830.
- PwC. (2023). Global investor survey on ESG reporting and transparency. Pricewaterhouse Coopers International Limited.
- Radulescu, M., Serbanescu, L., & Sinisi, C. (2025). Emission trading systems, green technology and environmental governance in the European Union. *Energy Policy*, 188, 113873.
- Ramadhan, M., & Hartikayanti, H. (2026). Carbon emission disclosure and environmental governance: Evidence from Asian emerging markets. *Environmental Accounting and Management Journal*, 14(1), 45-63.
- Rivo-López, E., Villanueva-Villar, M., & Otero-González, L. (2025). Sustainability disclosure comparability and reporting quality in global capital markets. *Journal of Cleaner Production*, 418, 139002.
- Rohmah, E.F., & Murtini, H. (2026). Carbon Emission Disclosure from a legitimacy perspective: Financial, Regulatory and environmental dimensions. *JABKO: Jurnal Akuntansi dan Bisnis Kontemporer*, 6(1).
- Sharaf-Addin, H. (2025). Corporate climate disclosure and net-zero transition strategies: Evidence from global firms. *Business Strategy and the Environment*, 34(2), 455-470.
- Shen, L., Wu, Y., & Zhang, X. (2020). Carbon emission trading and carbon reduction: Evidence from China's pilot ETS. *Energy Economics*, 92, 104968.
- Setiani, E., Sari, R., & Wijaya, H. (2024). ESG scores, financial performance, and carbon emissions in Southeast Asian companies. *Journal of Cleaner Production*, 412, 137421.
- Simnett, R., Vanstraelen, A., & Chua, W. F. (2009). Assurance on sustainability reports: An international comparison. *The Accounting Review*, 84(3), 937-967.
- Sun, Y., Zhao, X., & Chen, H. (2024). ESG performance and enterprise green innovation in China. *Journal of Cleaner Production*, 412, 137458.
- Velte, P. (2021). Determinants and consequences of corporate sustainability assurance: A systematic review. *Journal of Cleaner Production*, 314, 128060.
- Velte, P. (2022). Board diversity, sustainability reporting quality and firm performance: Evidence from European firms. *Corporate Social Responsibility and Environmental Management*, 29(2), 298-314.
- Wachira, M., & Berndt, T. (2019). The adoption of sustainability reporting by listed companies in Africa. *Journal of Accounting in Emerging Economies*, 9(3), 363-387.
- Waked, S. (2025). Climate governance structures and the quality of corporate sustainability reporting. *Sustainability Accounting, Management and Policy Journal*, 16(4), 690-710.
- Wan, Q., Li, R., & Zhang, J. (2022). Natural resource abundance, green financing and environmental quality: Evidence from China. *Resources Policy*, 74, 102284.

- Wedari, L. K., Darmawan, I., & Istiqomah, N. (2025). Determinants of sustainability reporting quality in emerging markets. *Journal of Environmental Management and Accounting*, 14(1), 88-103.
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171-180.
- Yang, X., Zhang, S., & Liu, J. (2024). Enterprise ESG ratings and carbon emissions: A spatial analysis. *Ecological Economics*, 216-107990.
- Ye, J., Li, W., & Wang, L. (2023). ESG performance and carbon reduction in Chinese listed manufacturing companies. *Journal of Environmental Management*, 330, 117122.
- Yusuf, S., Suleiman, A., & Ibrahim, M. (2020). Greenhouse gas emissions, energy consumption and economic growth in African economies. *Energy Reports*, 6, 2124-2131.
- Zhang, F., Zhu, L., & Ding, X. (2022). Corporate governance, carbon performance and climate disclosure quality. *Journal of Environmental Management*, 312, 114892.