

GOVERNANCE DIMENSION AND SUSTAINABLE DEVELOPMENT IN NIGERIA'S TELECOMMUNICATION SECTOR: SOCIAL, ENVIRONMENTAL, AND ECONOMIC DECARBONIZATION PATHWAYS

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Abstract:

In response to growing global demands for sustainable development, this study explores how governance structures within the telecommunication sector influence organizational commitment to sustainability. Specifically, it examines the relationship between sustainable development efforts and three core governance dimensions: social governance, environmental governance, and economic decarbonization. Grounded in institutional theory, the study hypothesizes that stronger governance across these domains is positively associated with higher levels of sustainability commitment. Using Pearson correlation analysis on a sample of 95 telecommunication entities, the results reveal statistically significant positive correlations across all dimensions. The strongest association was observed between sustainable development and social governance ($r = 0.472$, $p < 0.001$), followed by economic decarbonization ($r = 0.437$, $p < 0.001$) and environmental governance ($r = 0.373$, $p < 0.001$). These findings suggest that while each governance domain contributes meaningfully to sustainability efforts, none alone serves as a dominant predictor. The moderate strength of these correlations underscores the importance of a holistic, integrated governance approach that simultaneously addresses social equity, environmental stewardship, and economic transformation. This research offers actionable insights for policymakers, corporate leaders, and sustainability practitioners aiming to align governance strategies with sustainable development goals in the telecommunication industry.

Keywords: Decarbonization, Emission, Governance, Sustainable. Telecommunication

INTRODUCTION

The escalating global urgency to mitigate climate change has intensified pressure on high-emission industries to adopt sustainable practices. Among these, the telecommunication sector—particularly in developing economies like Nigeria—has emerged as a significant contributor to greenhouse gas emissions due to its reliance on fossil fuel-powered infrastructure. As Nigeria aligns with the Paris Agreement and commits to achieving net-zero emissions by 2050, transforming the energy-intensive telecom sector into a low-carbon model is both a strategic necessity and a policy imperative.

Recent international climate dialogues, including the 27th Conference of the Parties (COP27) held in Sharm El-Sheik, Egypt, have underscored the critical role of corporate and national actors in controlling the environmental footprint of their operations. The telecom industry, responsible for approximately 2% to 3% of global energy consumption, faces mounting challenges as technological advancements—such as 5G deployments—drive increased energy demand through hardware densification and complex network operations (Devela et al., 2023). In regions with limited grid access, such as rural Nigeria, mobile network expansion has further entrenched dependence on



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diesel-powered generators, exacerbating carbon emissions and environmental degradation (Dar & Lone, 2022; Sivasakthivel et al., 2011).

Scholars and industry experts have advocated for the adoption of sustainable technologies and governance models to support a carbon-neutral agenda. According to Oliyide and Olugbemi (2024), the sector’s contribution to global CO₂ emissions—estimated between 1.8% and 3.9%—has prompted telecom organizations to set net-zero targets in alignment with the Paris Agreement’s goal of limiting global warming to below 2°C. Wesseling et al. (2017) observe that regulatory bodies are increasingly embedding Environmental, Social, and Governance (ESG) criteria into policy frameworks, thereby encouraging operators to integrate sustainability into corporate governance. Building on this, Pranugrahaning et al. (2020) warn that failure to adopt such practices may expose organizations to reputational damage and loss of competitive advantage.

Despite growing awareness, there remains a critical gap in empirical research examining how governance structures influence sustainability outcomes in the telecom sector, particularly within the Nigerian context. Existing studies have largely focused on technological solutions or policy directives in isolation, overlooking the integrated role of governance dimensions—social, environmental, and economic—in driving decarbonization.

This study addresses that gap by investigating the relationship between organizational commitment to sustainable development and three core governance dimensions within Nigeria’s telecommunication sector. Grounded in institutional theory, the research hypothesizes that stronger governance across these domains is positively correlated with sustainability commitment. Using Pearson correlation analysis on a sample of 95 telecom entities, the study evaluates the strength and significance of these relationships to determine which governance domains most effectively support decarbonization efforts.

The novelty of this research lies in its multidimensional governance approach, offering a holistic framework that bridges climate commitments with actionable strategies. The findings have both theoretical and practical implications: they contribute to governance and sustainability literature by empirically validating the role of integrated governance, and they provide policymakers and industry leaders with evidence-based insights to guide regulatory reforms and operational transitions toward a low-carbon telecom future.

Research questions.

- a) What are the barriers to implementing low-carbon technologies in telecom networks, especially in developing countries?
- b) How are telecom companies responding to global climate targets such as the Paris Agreement or Net Zero pledges?
- c) What policies or regulatory frameworks exist to encourage carbon neutrality in the telecom sector?

Research objectives.

- a) Research objective 1: To determine the barriers that thwart the Telecommunication industry from engaging in net-zero activities, based on empirical data analysis
- b) Research objective 2: To determine what the drivers for the Telecommunication industry to engage in net-zero activities are, based on empirical data analysis
- c) Research objective 3: To originate a conceptual framework to help the Telecommunication industries achieve net-zero capability in line with sustainable development goal on net zero.

Critical Success Factors. This study suggests the following as the critical success factors that need to be assured and adequately accommodated in the planning to achieve decarbonization in the telecommunication industry. Theses includes, but are not limited to:



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- a) Research commitment. A telecommunication company that is prepared to achieve the Net-Zero agenda should commence with the design of appropriate questionnaires that accommodate germane issues that need to be addressed prior to any other considerations on the decarbonization agenda. It should involve queries on "Why the company intends to subscribe to decarbonization" and "How the company intends to achieve the decarbonization program". Any telecommunication company that has proposed to embark on a decarbonization program must appraise its current operations to create an emission baseline and emission categories that will eventually lead to emissions reduction per capital invested, and also conduct a benchmarking exercise to determine competitors that have successfully addressed the sustainability programs that are important to all stakeholders.
- b) Proposal development. Further to the baseline information availability, the intended telecommunication company is now positioned to establish clear emission reduction goals that should align with Science-based Target initiatives standards. A clear business direction that is value-added can now be communicated to all interested parties in the business. It should include a combination of new services or products that will help business to inform customers to monitor, track, and subsequently reduce their own carbon emissions to the common objective of sustainable development goals.
- c) Transformation of the operating model. Effective sustainability planning and implementation demand strategic modifications to existing operational models. It includes aligning organizational processes, policies, and procedures with sustainability goals to address carbon emission challenges while actively involving all business stakeholders (Pranugrahaning et al., 2020).

Sustainable Framework to Navigate the Path to Net-Zero. Developing a transparent and detailed framework for reporting energy consumption and greenhouse gas emissions at the organizational level is imperative. Such reporting should encompass both direct and indirect emissions, enabling the telecommunications industry to identify gaps in its emission reduction strategies. This approach also facilitates the determination of baseline carbon footprints and the setting of data-driven, ambitious targets. Fankhauser et al. (2022) emphasize that once these gaps are identified, they should be transformed into strategic priorities aligned with the broader objectives of the Sustainable Development Goals. This alignment allows industry stakeholders to visualize how their actions contribute to long-term carbon neutralization. In support of this, Pranugrahaning et al. (2020) argue that telecommunications companies must establish key performance indicators (KPIs) related to energy consumption and efficiency. These KPIs empower stakeholders to assess the environmental performance of reporting companies and position their sustainability efforts competitively within the market.

Gap analysis scope: Gap analysis is a noteworthy instrument needed to conduct Governance review, Social review and energy footprint audit in an organization. It enables the identification of the extent to which the organization can reduce its energy consumption and carbon emissions. The scope of the gap analysis for the energy footprint audit should include the following:

- a) Identification and analysis of the current organizational energy consumption: This will involve data collection on periodical energy consumption trends, energy bills and other metrics to oversee the company's current energy consumption levels.
- b) Surplus areas identification: This will involve the identification of areas where the company is consuming more energy than is required. It could encompass obsolete paraphernalia identifications, unproductive lighting, heating, ventilation and air conditioning systems and other similar inefficiencies.

- c) Identification of opportunities for improvement: This should involve commitment to renewable energy resources investment, implementation of energy-efficient technologies, and optimization of maintenance practices to control energy consumption.
- d) Action plan development: This should involve creating a roadmap to achieve a reduction in energy consumption that would lead to carbon neutralization in the organizational activities. The action plan should involve activities such as setting targets for carbon footprint reduction, implementing energy-saving measures, and progress monitoring.
- e) Examination of compliance level: This should involve investigating the company's level of compliance with national and universal energy regulatory standards. Ensure compliance with carbon emission reduction targets and allied environmental obligations.
- f) Cost-benefit analysis: This should involve proper identification and analysis of the areas of inefficiency and opportunities for improvement to bring about cost savings in the organization.
- g) Assessing employees and other stakeholders' interest in sustainability: This should address commitment and involvement of employees, customers, suppliers, board members, investors and regulatory authorities and all other stakeholders such as customers and suppliers in the telecommunication industry.
- h) Assessment of the existing organizational culture: This should involve assessing the mission and vision developed by the leadership of the company towards the realization of a sustainable paradigm.
- i) Document examination: This should involve a checkup on all existing policies, processes and procedures used in driving the organizational targets to achieve the objective of the company on a yearly basis.
- j) Technology and Services enterprise: This should involve an assessment of existing technologies in relation to services offered to ensure proactive commitment to business sustainability.
- k) Governance model assessment: The existing governance model needs to be assessed to ensure that all stakeholders in the business are involved in carbon emission reduction strategies. There might be some stakeholders who might not have had opportunities to be involved in carbon reduction activities, which could pose a challenge during the implementation phase.
- l) Intelligent data gathering administration: Presently, most telecommunication companies in Nigeria lacks appropriate data gathering mechanism to provide real-time information on issues of sustainability concerns. There is a need for the availability of genuine data with integrity for analysis to navigate the path to a successful decarbonization.

Regulatory and Institutional Barriers. Lack of political will by governments and allied institutions to support emission reduction initiatives has contributed to the continued use of fossil fuel-powered equipment by the global telecommunications industry. Jenkins et al. (2021) and Papadis and Tsatsaronis (2020) highlight that this reliance undermines progress toward sustainability goals. In Nigeria, the telecommunications industry's commitment to achieving net-zero emissions by 2050 has been significantly hampered by the following factors:

- 1) Absence of regulatory clear emission reduction expectation and /or targets from the telecommunication sectors of the Nigerian economy.
- 2) Lack of carbon credit facilities to telecommunication and allied industries to promote carbon emission reduction strategies, Stringent regulation on capital requirement and uncertainty around energy security have prevented access to green loans.
- 3) Information communication gap on sustainability and decarbonization. It is often difficult to access actionable information on government formal media platforms in Nigeria.
- 4) Resistance to the existing structures, which are based on the fossil fuel policy and economy.

- 5) Inadequate professional, human and institutional capacities to manage the transition process
- 6) There is currently no sectoral “1.5°” trajectory for the telecommunication industry in Nigeria,

Seasonal Variability Barriers. Seasonal variations and undesirable weather patterns across Nigeria’s geopolitical zones—especially during prolonged cold spells—have hindered the telecommunications industry’s investment in renewable energy generation. Solar and wind power are both adaptable sources capable of meeting the sector’s energy supply and demand. Cell towers offer height advantages for wind energy and optimal exposure for solar power generation. However, Papadis and Tsatsaronis (2020) note that a high degree of weather forecast accuracy is essential to overcome the limitations in solar and wind energy potential.

Social Ecological Impasse. Renewable energy supply within the context of the NetZero agenda (decarbonization) requires focused attention on social and ecological factors over profit-driven motives. Datta et al. (2015) emphasize that prioritizing these considerations is essential for promoting sustainability in the telecommunications sector, driving decarbonization value, and fulfilling the objectives of Sustainable Development Goal 7: “affordable and clean energy.”

Psycho-Social Challenges. Psychological and cultural biases can pose serious challenges during the transition to low-carbon programs, particularly in rural areas where educational levels among host communities of telecommunications infrastructure are relatively low. Papadis and Tsatsaronis (2020) note that modifications in energy use may take a longer period to gain full acceptance among stakeholders in the telecommunications sector, as such changes demand a significant shift in cultural beliefs and values. To overcome resistance to energy transition and ensure inclusive progress, Jenkins et al. (2021) emphasize the need for top-level awareness campaigns focused on the impacts of climate change, especially within the Nigerian telecommunications industry.

Diverse Global Interest. Divergence of opinion regarding the carbon-neutral technology needs of the telecommunications industry—particularly between power supply equipment manufacturers and telecommunications operators—poses a significant challenge to achieving the net-zero agenda. Tillekeratne et al. (2020) observe that while renewable power supply equipment manufacturers have developed various innovative solutions to support global decarbonization efforts, the telecommunications industry’s adoption of such technologies in Nigeria remains at an early stage due to high upfront costs.

Suppliers and Partners Interest Misalignment. Suppliers and partners in the telecommunications sector account for over 95% of the industry’s carbon emissions, primarily due to fossil fuel-based power generation. Their commitment to decarbonization is therefore critical to achieving broader emission reduction goals. Jenkins et al. (2021) emphasize that transitioning existing power supply technologies from fossil fuels to renewable sources will require costly restructuring and retrofitting.

The Drivers. The telecommunications industry can achieve zero carbon emissions, as outlined in the Paris Agreement, through active collaboration with all relevant stakeholders. A multiparty approach—supported by decisive and coordinated action—can accelerate the development of a clear pathway to net-zero emissions by focusing on the following action-oriented strategies.

Enabling Policy Framework by the Industry Regulators. The various tiers of government—including the executive, legislative, and judicial arms—need to evolve sector-specific, realistic clean development mechanism policies that include, but are not limited to, emission targets, carbon pricing, compliance incentives, and enforcement support. Jenkins et al. (2021) emphasize that such coordinated policy frameworks are essential for driving meaningful progress toward decarbonization.



Network Design Optimization. The time is now for telecommunications operators to revolutionize their network infrastructure by phasing out obsolete and legacy systems to reduce both operational costs and environmental impact. Maintaining multiple layers of network technologies—such as 2G, 3G, 4G, and 5G—can be financially burdensome and environmentally unsustainable. Devela et al. (2023) emphasize that achieving a climate-compatible network design requires integrating network components onto a single pole to enhance power efficiency. It can be accomplished through the deployment of modernized power systems, including dedicated AC/DC configurations, lithium-ion batteries, and the utilization of solar and wind energy at operational sites.

Adaptive Technology Transformation. The telecommunications industry must swiftly adapt its network design to accommodate emerging technologies that support low carbon emissions, helping to bridge the digital divide and advance a decarbonized economy. Devela et al. (2023) highlight that deploying artificial intelligence for data analysis, integrating Internet of Things (IoT) devices, and utilizing cloud-based systems accelerated by 5G—managed at the software layer—can significantly reduce the number of physical devices required, thereby lowering energy consumption and associated carbon emissions.

Operational Model Redesign Governance. One of the most critical factors in achieving a transition to a low-carbon economy in the telecommunications sector is building governance around an administrative model that supports sustainability across the entire business value chain. Stern and Valero (2021) emphasize that this requires restructuring administrative processes to embed sustainability into all aspects of development, approving contracts that reflect environmental commitments, and fostering accountability and ownership from the base to the top of the organization. Additionally, promoting ecosystem thinking and co-creation with suppliers and partners is essential to address carbon emission challenges collectively.

Enterprise Green Financing Commitment. The telecommunications sector's commitment to achieving net-zero emissions should include accessing green funding opportunities that are not only economically attractive but also aligned with low-emission technology financing. Bisbey et al. (2020) emphasize that telecommunications businesses must seek funding specifically designed to support green initiatives, ensuring that such funds are not diverted from clean development mechanisms due to service-level agreements with financial institutions.

Enterprise Sustainability Business Case Conception. The telecommunications industry needs to develop a robust business case for sustainability—one that recognizes benefits beyond commercial gain while also considering people, the planet, and the company's bottom line. Stern and Valero (2021) emphasize that integrating sustainability into core business strategy is essential for long-term value creation and environmental responsibility.

Design of Tools. To investigate the pathways toward achieving sustainable net-zero emissions in Nigeria's telecommunication industry, the study employed a mixed-methods approach using structured questionnaires and semi-structured interviews as primary data collection instruments.

a) **Questionnaire Tool.** A structured questionnaire was developed to quantitatively assess the awareness, commitment, and involvement of organizational leadership in decarbonization efforts. The instrument comprised five-point Likert-scale items designed to capture perceptions across five impact categories: strongly agree, agree, neutral, disagree, and strongly disagree. Drozd et al. (2021) emphasize that such tools are effective in evaluating leadership engagement in sustainability initiatives.

b) Interview Tool. Complementary interview guides were created to qualitatively explore gaps, barriers, and enabling factors influencing the transition to net-zero emissions. These tools targeted key informants within the industry to elicit deeper insights beyond the scope of the questionnaire.

Justification of tools.

a) Questionnaire

- Ideal for collecting standardized data across a large sample.
- Facilitates quantitative analysis of perceptions, awareness, and commitment levels.
- The Likert scale enables nuanced measurement of attitudes and impact perceptions.

b) Interview

- Allow for exploration of complex issues that cannot be captured through closed-ended questions.
- Provide contextual insights into organizational behavior, strategic challenges, and cultural factors influencing sustainability.

Together, these tools offer a robust mixed-methods approach, enabling triangulation of data and enhancing the reliability and validity of the research findings.

METHODS

Target Population and Sampling. The study focused on personnel from ten leading telecommunication companies in Nigeria. These organizations were selected due to their significant market share, infrastructure footprint, and strategic influence on sustainability practices within the country. From each company, ten respondents were selected, totaling 100 participants. The population of interest comprised middle-level managers and senior management personnel, as these groups are directly involved in policy implementation, strategic planning, and operational decision-making relevant to environmental sustainability and decarbonization efforts.

Sample Design. A purposive sampling design was employed to ensure the inclusion of respondents possessing relevant expertise and decision-making authority. This targeted approach strengthens the validity of insights into organizational commitment and awareness regarding net-zero strategies. Sampling techniques

- Purposive sampling: Targeted selection of companies and personnel based on their relevance to the research objectives.
- Quota sampling: Ten respondents were selected from each of the ten companies, ensuring equal representation across organizations and managerial levels.
- Total sample size: 100 respondents (10 per company × 10 companies)

This technique was justified by the need to gather informed perspectives from individuals who are actively engaged in sustainability-related decision-making within their organizations.

Questionnaire administration.

- A “drop-off and pick-up later” strategy was adopted to maximize response quality and completion rates.
- Each respondent received a personal briefing to clarify questionnaire content and ensure informed participation.
- Responses were collected anonymously to uphold data privacy and ethical standards.

Measurement Scale. A five-point Likert scale was used for all questionnaire items:

1 - Strongly Disagree

2 - Disagree

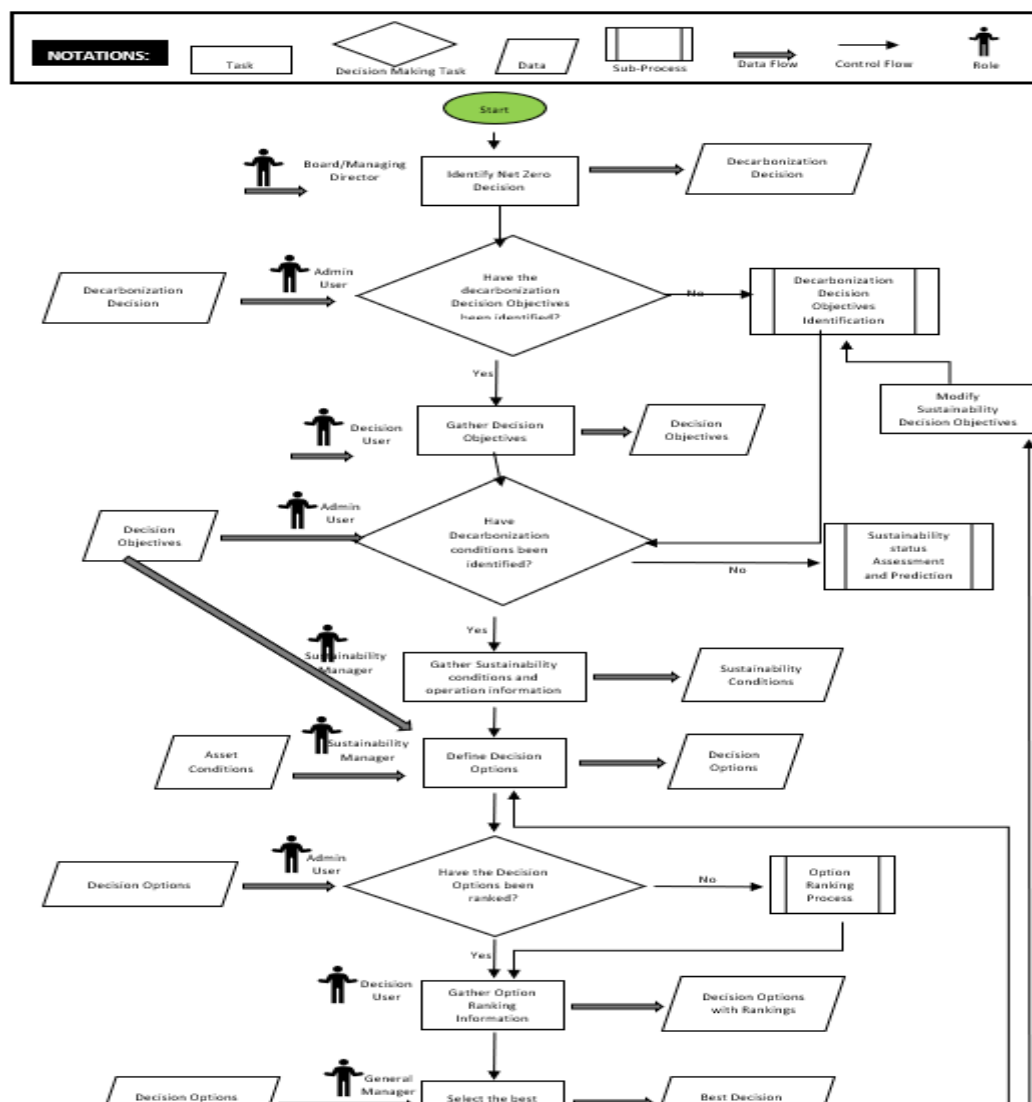


- 3 - Neutral
- 4 - Agree
- 5 - Strongly Agree

Literature Integration. To contextualize findings and identify existing research gaps, a systematic literature review was conducted. Relevant scholarly works on decarbonization, sustainable practices, and emission reduction strategies in the telecom sector were synthesized to support empirical insights.

Data Analysis.

- Quantitative analysis using descriptive statistics and Likert-scale aggregation was employed to evaluate trends in leadership awareness and organizational commitment. Atchike et al. (2022) emphasize that such methods are effective for capturing perceptual data and identifying behavioral patterns within organizational contexts.
- Qualitative Analysis: Thematic coding of interview transcripts was conducted to extract recurring patterns related to barriers and enablers of net-zero transition.



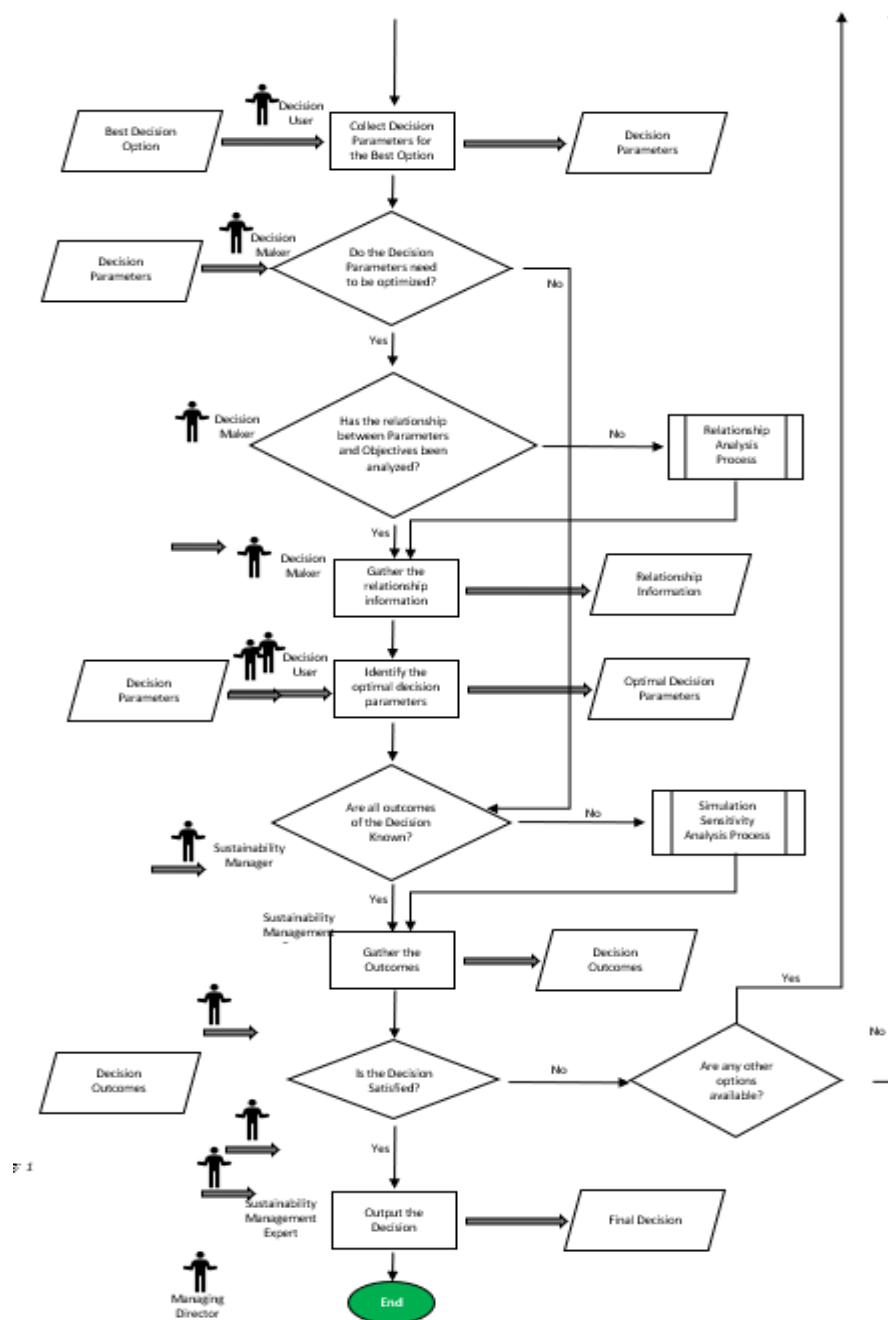


Figure 1. Path to Sustainable Decarbonization Governance Framework - Implementation Process Flow Analysis

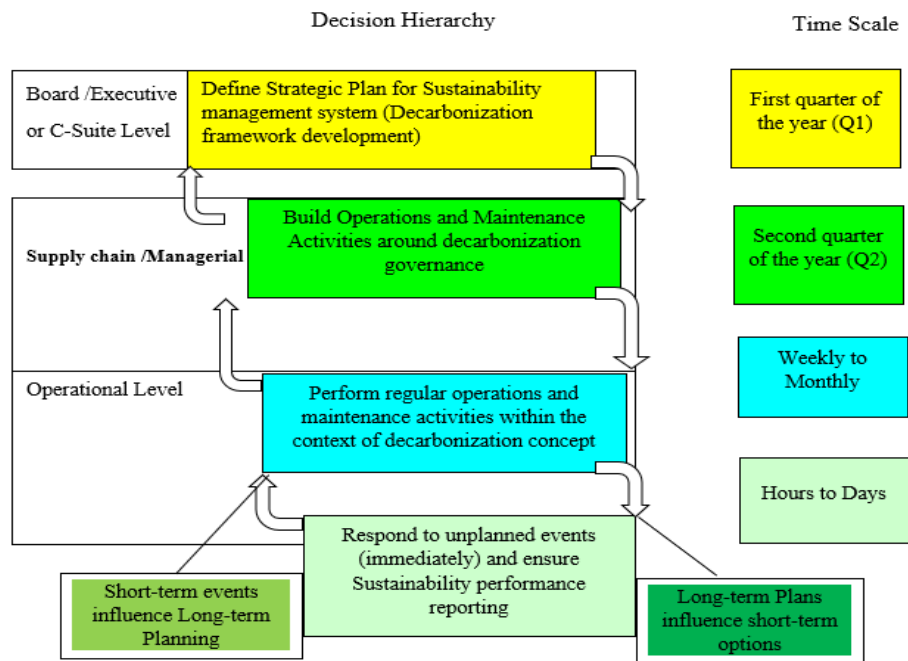


Figure 2. A Multi-Scale Decision-Making Framework for Enterprise Decarbonization Sustainability Governance

The Nigerian telecommunications industry acknowledges its responsibility to implement operational management processes aligned with the Paris Agreement. To achieve this objective, regulatory bodies must establish frameworks that ensure telecommunications operators and allied service providers are aware of operational activities that promote maximum efficiency. The flowchart outlines a sequence of governance activities for effectively managing business operations. The energy efficiency management implementation process ensures that organizations continuously cycle through policy development, action planning, implementation, performance review, and policy updates – ultimately driving total decarbonization. This workflow enhances operational efficiency, coordination, and collaboration among stakeholders involved in the process. Papadis and Tsatsaronis (2020) further corroborate that such structured approaches are essential for achieving sustainability goals in energy-intensive sectors.

RESULT AND DISCUSSION

The data obtained from the questionnaire were subjected to descriptive analysis methods, and results were presented in tables signifying frequencies and percentages, and these were further analyzed to determine the mean and standard deviation, respectively. The study targeted 100 respondents from amongst the ten telecommunication companies consulted for the questionnaire administration. Only 95 respondents completed and returned the questionnaires. It represents a 95% response rate and was considered satisfactory for the study since it was more than 50%, as advocated by Gebrehiwet (2022), who emphasized that 50% response rates are acceptable for analysis and publication, 60% are good, while 70% are excellent. Table 1 shows the response rate results.

Descriptive statistics (Mean \bar{x}) were used to assess the "Environmental, Social and Governance dynamics of sustainability". Five-point Likert scaling was used as it was widely employed by researchers, and they all agreed that it diminishes bias-related issues and simplifies

data manipulation and analysis (Gebrehiwet, 2022). The response options to the five-point Likert scale of the questionnaire were categorized and rated as expressed below.

- Strongly Agree (SA) = 5
- Agree (A) = 4
- Moderately Agree (MD) = 3
- Disagree (D) = 2
- Strongly Disagree (SD) = 1.

To calculate the mean response mode (weighted mean):

$$\text{Mean response mode (X)} = \sum fx/N = 1+2+3+4+5/5 = 15/5 = 3.00$$

The cut-off point of 3.00 was used as a benchmark in interpreting the results. Hence, any component with a mean (\bar{x}) value of 3.00 or above was regarded as Agreed (accepted) while those with less than 3.00 were regarded as Disagreed (rejected).

Table 1. Response Rate Result

Responses	Frequency	Percentage (%)
Returned questionnaires	95	95
Unreturned questionnaires	5	5
Total	100	100

Source: Field Survey, 2023

Demographic distribution of Respondents based on Gender. To ensure fair and equitable involvement of male and female respondents, questionnaires were administered to both genders, and participants were required to indicate their gender class. The majority (78.95%) of the respondents were male, while (21.05%) were females. It indicates that both genders are involved in different forms of organizational sustainability functions within the telecommunications industry in Nigeria; thus, they are fairly involved in the study. The results are presented in Table 2

Table 2. Gender of Respondents

Genders	Frequency	Percentage (%)
Male	75	78.95
Female	20	21.05
Total	95	100

Source: Field Survey, 2022

Demographic distribution of Respondents based on Age. The largest percentage (73.68%) of respondents is within the age bracket of 30-39years, whereas none of the respondents falls within the 18-29years age group. It is presented in Table 3.

Table 3. Age Brackets of Respondents

Age Group (Years)	Frequency	Percentage (%)
18 - 29	0	0.0
30 - 39	70	73.68
40 - 49	20	21.05



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50 - 59	5	5.26
60 and above	0	0.0
Total	95	100

Source: Field Survey, 2023

Demographic Distribution of Respondents Based on Years of Employment in the Organization. Most (68.42%) of the respondents have been employed in their organization for a period of 1 - 10 years, and 31.58% have stayed in the organization for a period of 11 - 20 years. The results are presented in Table 4.

Table 4. Period of Respondents' years in employment with the organization

Duration of employment within the organization (Years)	Frequency	Percentage (%)
1 - 10	65	68.42
11 - 20	30	31.58
21 - 30	0	0.0
31 - 40	0	0,0
40 and above	0	0,0
Total	95	100

Source: Field Survey, 2023

Demographic Distribution of Respondents Based on Leadership Position in the Organization. The largest number (47.37%) of the respondents are managers, while 31.58% are senior managers, and associate directors and directors accounted for 5.26% and 10.53% respectively, and only 5.26% of the respondents are Vice presidents. It is presented in Table 5.

Table 5. Leadership Position of Respondents

Family Structures	Frequency	Percentage (%)
Manager	45	47.37
Senior Manager	30	31.58
Associate Director	5	5.26
Director	10	10.53
Vice president	5	5.26
Total	95	100

Source: Field Survey, 2023

Distribution of Respondents by the highest level of Educational Attainment. To evaluate the participants' ability to respond to research questions, all the respondents were required to indicate their highest educational qualification. The results, as presented in Table 6, show that all the respondents are educated beyond Secondary School. The majority (89.47%) of them hold a Bachelor's degree (Graduate), while 10.53% are holders of a Postgraduate degree. It indicates that all the respondents could easily respond to the research questions.

Table 6. Educational Level of Respondents

Educational Levels	Frequency	Percentage (%)
Primary School	0	0.0
Secondary School	0	0.0
Diploma	0	0.0
Graduate	85	89.47



Postgraduate	10	10.53
Total	95	100

Source: Field Survey, 2023

Assessment of the Overall commitment to Sustainable Development Concepts within the Telecommunication industries in Nigeria. The majority of the respondents (68.42%) affirmed that the level of commitment by the management of the organization to overall sustainability concepts is to a very low extent. Whereas, 21.05% and 10.53% of respondents declared that their organization's commitment to the overall sustainability concept is to a "low extent" and "moderate extent" respectively. The outcomes of the assessment of the level of commitment towards sustainability dynamics by the Telecommunication industries in Nigeria are presented in Table 7. The results showed that fourteen of the sixteen research questions under commitment to sustainability dynamics have a mean score that was less than 3.0, meaning that respondents disagreed with them. However, two of the sixteen research questions under the organization's commitment to sustainability dynamics have a mean score that is greater than 3.0, which indicates that some respondents agreed that their company has established a clear and convincing short-term commercial case for sustainability efforts, with the availability of resources necessary to execute the sustainability program.

Table 7. Assessment of the Overall commitment to Sustainable Development Concepts within the Telecommunication industries in Nigeria.

S/N	Assessment of the Overall Commitment to Sustainable Development Concepts	N	Minimum	Maximum	Mean (\bar{x})	Standard Deviation	Remarks
1	The businesses, and especially telecommunication companies, are well informed about the energy transition and its effects on their operation	95	1	4	1.37	0.93	<i>Disagree</i>
2	Employees are well informed about the situation in the energy/power sector and about the challenges and opportunities of implementing the energy transition.	95	1	4	1.41	0.75	<i>Disagree</i>
3	The short, medium and long-term horizon is used to set intermediate decarbonization objectives and targets (2030) in accordance with Eni's pathway towards carbon neutrality and in line with business ambitions.	95	1	2	1.21	0.41	<i>Disagree</i>
4	Deep Decarbonization Pathways Project have a chance of succeeding where other global carbon-cutting initiatives have failed?	95	1	5	1.58	1.23	<i>Disagree</i>
5	My company has a separate stand-alone Environment, Social and Governance policy (i.e., in addition to an environmental or safety policy)	95	1	5	1.84	1.43	<i>Disagree</i>



	which provides details of our approach and commitments to management of key Environment, Social and Governance risks and opportunities.						
6	Effective transition to carbon-neutral operations is hampered by restrictions on the use of interconnection lines, which are imposed to protect the current privileged position of the public power companies	95	1	4	1.84	1.19	<i>Disagree</i>
7	Our company has carried out an in-depth assessment of the drivers of sustainability that present the greatest opportunities and potential risks to our business	95	1	2	1.21	0.41	<i>Disagree</i>
8	When implementing a decarbonization pathway, climate mitigation and adaptation actions should be carefully evaluated and monitored using indicators, such as the Sustainable Development Goals (SDGs), among others (IPCC, 2022).	95	4	5	4.32	0.47	<i>Agree</i>
9	To help build capabilities, we offer our suppliers free access to our Sustainability Academy with numerous training sessions on sustainability and decarbonization aspects	95	1	2	1.26	0.44	<i>Disagree</i>
10	Our company has defined targets and objectives for our sustainability efforts, together with metrics for measurement, tracking, and reporting	95	1	4	1.32	0.73	<i>Disagree</i>
11	Our company's sustainability agenda receives satisfactory attention from the executive management team, with clear responsibilities and accountabilities assigned.	95	1	4	1.63	0.88	<i>Disagree</i>
12	Our sustainability agenda has been fully integrated into all our operational and corporate processes and procedures	95	1	4	1.32	0.73	<i>Disagree</i>
13	We paved the way for the Supplier Decarbonization Program through questionnaires and other media. In 2022, we have integrated the new decarbonization strategy into procurement's regular work	95	1	4	1.26	0.72	<i>Disagree</i>

14	Decarbonization involves projecting, prioritizing, implementing, coordinating, monitoring, and regularly updating short to long-term pathways.	95	1	5	3.11	1.45	Agree
15	My organization is on sustainability transformation, we embed meaningfully as a future supplier selection and performance evaluation criterion that suppliers must provide product carbon footprint data.	95	1	5	1.58	1.10	Disagree
16	My organization has made provision for monitoring and reporting Environment, Social and Governance issues and performance to senior management/the Board.	95	1	2	1.16	0.37	Disagree

Benchmark = 3.0; Source: Field Survey, 2023

Assessment of the Existing Sustainability Governance model within the Telecommunication industries in Nigeria. This study further assessed the existing sustainability governance model, and the results were presented in Table 8. According to the study, all of the three assessed statements regarding the existing sustainability governance model across the Ten Telecommunication companies had a mean score that was lower than 3.00 and hence were rejected. It means that respondents disagreed with the three statements. The rejected statements with their respective mean values include:

- The board ensures ESG is incorporated in the organization's purpose, mission, vision, values and Corporate Code of Conduct. (\bar{x} = 1.63)
- The Board ensures that the Board and Director roles and responsibilities include reference to ESG and that governance policies/manuals embed the Board's ESG philosophy and commitment. The scope of the board's oversight on sustainability issues is well-defined, comprehensive and encompasses the entire value chain, product life-cycle and the company's jurisdictions. (Example: "The board is accountable to shareholders and [other] relevant stakeholders and responsible for protecting and generating sustainable value over the long term. (\bar{x} = 1.67)
- Board adopts and regularly reviews an ESG policy/s and ensures ESG commitments are integrated into existing corporate policies and routinely integrated into new corporate policies. (\bar{x} =1.89)

Table 8. Assessment of the Existing Sustainability Governance model within the Telecommunication industries in Nigeria

S/N	Assessment of the Existing Governance Structure	N	Minimum	Maximum	Mean (\bar{x})	Standard Deviation	Remarks
1	The board ensures ESG is incorporated in the organization's purpose, mission, vision, values and Corporate Code of Conduct	95	1	4	1.63	0.99	Disagree

2	The Board ensures that the Board and Director roles and responsibilities include reference to ESG and that governance policies/manuals embed the Board's ESG philosophy and commitment. The scope of the board's oversight on sustainability issues is well-defined, comprehensive and encompasses the entire value chain, product life-cycle and the company's jurisdictions. (Example: "The board is accountable to shareholders and [other] relevant stakeholders and responsible for protecting and generating sustainable value over the long term	95	1	5	1.67	1.06	<i>Disagree</i>
3	Board adopts and regularly reviews an ESG policy/s and ensures ESG commitments are integrated into existing corporate policies and routinely integrated into new corporate policies	95	1	5	1.89	1.17	<i>Disagree</i>

Benchmark = 3.0; Source: Field Survey, 2023

Assessment of the social governance model in the telecommunication industry in Nigeria.

The majority (73.38%) of respondents were of the opinion that the existing social governance structure promotes and incorporates effective occupational health and safety consideration to a "Great extent", while another 10.53% of respondents revealed that the existing social governance structure promotes effective occupational health and safety to a "Very Great extent". The remaining 5.26% and 10.53% believed that the existing social governance structure only promotes good social life to a "Low extent" and "Very Low extent" respectively. Other critical social governance concepts were further examined, and the results are presented in Table 9. The respondents accepted fifty percent of the research questions in this section. Respondents agreed that:

- Their organization has a clearly communicated procedure for measuring compliance with legislation, social, economic and environmental benefits and limitations ($\bar{x} = 3.84$)
- In their own view, all interested parties to the business are aware of the clearly defined values and rules of conduct in relation to diversity, equity and inclusion. ($\bar{x} = 3.47$);

The respondents rejected the remaining fifty percent of the research questions. Respondents disagreed that:

- Their organizations have efforts in place to measure/reduce their carbon footprint. ($\bar{x} = 1.84$);

- There is a trust and a cooperation between governmental institutions and the private sector (Telecommunication) that enables the achievement of social consensus on key issues of the energy transition. ($\bar{x} = 2.05$);

Table 9. Assessment of the social governance model in the telecommunication industry in Nigeria

S/N	Assessment of the social governance structure in the telecommunication industry in Nigeria	N	Minimum	Maximum	Mean (\bar{x})	Standard Deviation	Remarks
1	My organization has a clearly communicated procedure for measuring compliance with legislation, social, economic and environmental benefits and limitations.	95	1	5	3.84	1.50	Agree
2	My organization has efforts in place to measure/reduce its carbon footprint.	95	1	4	1.84	1.19	Disagree
3	All interested parties to the business are aware of the clearly defined values and rules of conduct in relation to diversity, equity and inclusion.	95	1	5	3.47	1.19	Agree
4	There is a trust and a cooperation between governmental institutions and the private sector (Telecommunication) that enables the achievement of social consensus on key issues of the energy transition	95	1	5	2.05	1.48	Disagree

Benchmark = 3.0; Source: Field Survey, 2023

Assessment of the Environmental Governance status within the Telecommunication companies in Nigeria. The majority (73.68%) of respondents affirmed that the existing environmental governance structure in the various telecommunication companies examined promotes good environmental conditions to a “very great extent”, while the remaining 26.63% opined that the existing environmental governance structure in the telecommunication companies in Nigeria promotes good environmental conditions to a “Great extent”. The results of the study carried out to evaluate the environmental conditions within the ten telecommunication companies examined are presented in Table 10.

The respondents accepted all four research questions presented in this section and agreed that:

- The business leadership of my organization has tried to determine the environmental aspect of the business and reduce the business's environmental impact in terms of: Renewable energy system, waste minimization, recycling and pollution prevention (e.g. emission to air, water, effluent discharges and noise) ($\bar{x} = 3.37$);



- In their opinion, they believed that their company can save money by reducing its environmental impact (e.g., through recycling, energy conservation, pollution prevention) ($\bar{x} = 4.00$);
- Their organization could use the sustainability of its products and services to gain an advantage over competitors (e.g., energy efficiency, pollution prevention, etc.) ($\bar{x} = 4.53$);
- Sustainable development demands that we humans reduce all sorts of waste. ($\bar{x} = 4.84$);

Table 10. Assessment of the Environmental Governance status within the Telecommunication companies in Nigeria

S/N	Assessment of the Environmental Governance Status within and around the Farm Settlements	N	Minimum	Maximum	Mean (\bar{x})	Standard Deviation	Remarks
1	The business leadership of my organization has tried to determine the environmental aspect of the business and reduce the business's environmental impact in terms of: Renewable energy system, waste minimization, recycling and pollution prevention (e.g. emission to air, water, effluent discharges and noise)	95	1	5	3.37	1,35	Agree
2	My company can save money by reducing its environmental impact (e.g., through recycling, energy conservation, pollution prevention).	95	1	5	4.00	1.49	Agree
3	Do you agree that your organization could use the sustainability of its products and services to gain an advantage over competitors (e.g., energy efficiency, pollution prevention, etc.)?	95	2	5	4.53	0.89	Agree
4	Sustainable development demands that we humans reduce all sorts of waste.	95	3	5	4.84	0.49	Agree

Benchmark = 3.0; Source: Field Survey, 2023

Assessment of the Economy of Decarbonization within the ten telecommunication companies examined in Nigeria. The majority (63.16%) of respondents admitted that the leadership of their organizations promotes economic development objectives in alignment with the global sustainability agenda to a "very great extent". The results of the study carried out to evaluate the environmental conditions within the ten telecommunication companies examined are presented in Table 11.



The respondents accepted all four research questions presented in this section, and they all agreed that:

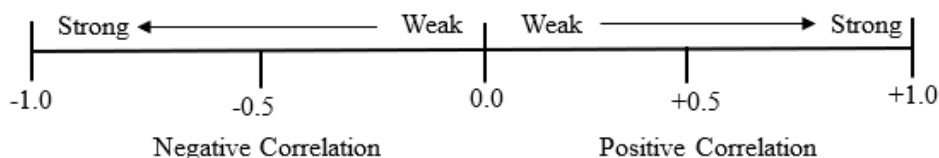
- Decarbonization and the energy transition will imply economic restructuring, particularly in the fossil fuel-producing countries ($\bar{x} = 4.74$);
- Getting to Net zero is technically and politically feasible; what governments need is guidance on making decarbonization policies politically and economically acceptable. ($\bar{x} = 4.68$);
- Technical capacities to identify and galvanize financial support are required to enable the decarbonization process ($\bar{x} = 4.63$);
- The consumption of a large amount of fossil energy in economic development leads to an increase in global greenhouse gas emissions ($\bar{x} = 4.68$).

Table 11. Assessment of the Economy of Decarbonization within the ten telecommunication companies examined in Nigeria

S/N	Assessment of the economy of decarbonization within the telecommunication industries in Nigeria	N	Minimum	Maximum	Mean (\bar{x})	Standard Deviation	Remarks
1	Decarbonization and the energy transition will imply economic restructuring, particularly in the fossil fuel-producing countries	95	4	5	4.74	0.44	Agree
2	Getting to Net zero is technically and politically feasible; what governments need is guidance on making decarbonization policies politically and economically acceptable	95	4	5	4.68	0.47	Agree
3	Technical capacities to identify and galvanize financial support are required to enable the decarbonization process	95	4	5	4.63	0,48	Agree
4	The consumption of a large amount of fossil energy in economic development leads to an increase in global greenhouse gas emissions	95	3	5	4.68	0.57	Agree

Benchmark = 3.0; Source: Field Survey, 2023

Correlation Coefficient Statistics. The correlation coefficient (r) shows the strength and direction of correlations between two variables in a study. Usually, it is interpreted as follows:



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Figure 3. Correlation Coefficient of the Overall Commitment of Nigerian Telecommunication Industries’ Sustainable Development Concepts and their Social Governance Model

Table 12. Correlation Coefficient Statistics

Correlations			
		Overall commitment to Sustainable Development	Social Governance Model
Overall commitment to Sustainable Development	Pearson Correlation	1	.472**
	Sig. (2-tailed)		.000
	N	95	95
Social Governance Model	Pearson Correlation	.472**	1
	Sig. (2-tailed)	.000	
	N	95	95

** . Correlation is significant at the 0.01 level (2-tailed).

Interpretation.

- 1) Pearson correlation coefficient ($r = 0.472$):
 - a. It indicates a moderate positive correlation between Overall Commitment to Sustainable Development and Social Governance Model.
 - b. In practical terms, organizations or entities that score higher on social governance also show stronger commitment to sustainable development.
- 2) Statistical significance ($p < 0.001$):
 - a. The p-value of 0.000 means the correlation is highly statistically significant.
 - b. It suggests that the observed relationship is unlikely to be due to chance and reflects a real association in the population.
- 3) Sample size ($N = 95$): A sample of 95 is reasonably robust for correlation analysis, lending confidence to the reliability of the results.
- 4) Implications
 - a. The moderate correlation implies that while social governance is an important factor in sustainable development, it is not the sole driver. Other dimensions – such as environmental policies, economic strategies, or leadership commitment – may also play significant roles.
 - b. Organizations aiming to improve sustainability should consider strengthening their social governance frameworks, including transparency, stakeholder engagement, and ethical practices.
- 5) Limitations
 - a. Correlation does not imply causation. We cannot conclude that improving social governance will directly cause better sustainability outcomes.
 - b. The strength of the correlation (0.472) suggests room for improvement in aligning governance models more closely with sustainability goals.

Correlation Coefficient of the Overall Commitment of Nigerian Telecommunication Industries’ Sustainable Development Concepts and their Environmental Governance Status.

Table 13. Correlation Coefficient

Correlations		
	Overall commitment to Sustainable Development	Environmental Governance Model
Pearson Correlation	1	.373**



Overall commitment to Sustainable Development	Sig. (2-tailed)		.000
	N	95	95
	Pearson Correlation	.373**	1
Social Governance Model	Sig. (2-tailed)	.000	
	N	95	95

** . Correlation is significant at the 0.01 level (2-tailed).

Interpretation

- 1) Pearson correlation coefficient ($r = 0.373$):
 - a. It indicates a moderate positive correlation between Overall Commitment to Sustainable Development and Environmental Governance Status.
 - b. Organizations with stronger environmental governance tend to show greater commitment to sustainable development, though the relationship is not particularly strong.
- 2) Statistical significance ($p < 0.001$):
 - a. The p-value of 0.000 confirms that the correlation is statistically significant.
 - b. It means the observed relationship is unlikely to be due to random chance and reflects a meaningful association in the data.
- 3) Sample size ($N = 95$): A sample of 95 provides a solid basis for statistical analysis and supports the reliability of the correlation.
- 4) Implications:
 - a. The moderate correlation implies that environmental governance is an important – but not dominant – factor in driving sustainable development.
 - b. Organizations may need to integrate environmental governance with other dimensions (e.g., social responsibility, economic resilience, leadership commitment) to achieve stronger sustainability outcomes.
- 5) Strategic Insight:
 - a. Strengthening environmental governance – such as compliance with environmental regulations, pollution control, and resource efficiency – can contribute to sustainability goals.
 - b. However, the moderate strength of the correlation suggests that a holistic approach is necessary for meaningful progress.
- 6) Limitations:
 - a. Correlation does not imply causation. We cannot conclude that improving environmental governance will directly cause increased commitment to sustainable development.
 - b. The correlation value (0.373) indicates that other variables may be influencing the relationship and should be explored.

Correlation Coefficient of the Overall Commitment of Nigerian Telecommunication Industries' Sustainable Development Concepts and their Economy of Decarbonization.

Table 14. Correlation Coefficient

		Overall commitment to Sustainable Development	Economy of Decarbonization
Overall commitment to Sustainable Development	Pearson Correlation	1	.437**
	Sig. (2-tailed)		.000
	N	95	95
Social Governance Model	Pearson Correlation	.437**	1



Sig. (2-tailed)	.000	
N	95	95

** . Correlation is significant at the 0.01 level (2-tailed).

Interpretation

- 1) Pearson correlation coefficient ($r = 0.437$):
 - a. It reflects a moderate positive correlation between Overall Commitment to Sustainable Development and Economy of De-carbonization.
 - b. It suggests that entities with stronger economic strategies for decarbonization show greater commitment to sustainable development.
- 2) Statistical significance ($p < 0.001$):
 - a. The p-value of 0.000 indicates the correlation is highly statistically significant.
 - b. It means the relationship is unlikely to be due to random chance and is meaningful within the sample.
- 3) Sample size ($N = 95$): A sample of 95 is adequate for correlation analysis, supporting the reliability of the findings.
- 4) Implications:
 - a. The moderate correlation implies that economic decarbonization efforts—such as investments in clean energy, carbon pricing, and green innovation—are important contributors to sustainable development.
 - b. However, since the correlation is not very strong, it also suggests that economic decarbonization alone is not sufficient. A broader strategy involving social and environmental governance is likely necessary.
- 5) Strategic insights:
 - a. Policymakers and organizations should recognize the economic dimension of sustainability as a key driver, but not the only one.
 - b. Integrating decarbonization with social equity and environmental stewardship may yield more robust sustainability outcomes.
- 6) Limitations:
 - a. Correlation does not imply causation. We cannot conclude that improving the economy of decarbonization will directly cause increased commitment to sustainable development.
 - b. The moderate strength ($r = 0.437$) suggests other factors—such as political will, technological capacity, or public awareness—may also influence the relationship.

This study explored the relationships between Overall Commitment to Sustainable Development and three key governance dimensions:

1. Social Governance Model
2. Environmental Governance Status
3. Economy of Decarbonization

Each dimension was analyzed using Pearson correlation, with a sample size of 95 and statistically significant results across all three relationships.

- a. Social Governance Model ($r = 0.472$) A moderately strong positive correlation suggests that organizations with robust social governance—such as ethical leadership, stakeholder engagement, and transparency—tend to be more committed to sustainable development. It highlights the social dimension as a foundational pillar in sustainability strategies.
- b. Environmental Governance Status ($r = 0.373$). A moderate correlation indicates that environmental governance practices—such as pollution control, resource efficiency, and



regulatory compliance – are positively associated with sustainability commitment. However, the relatively lower strength suggests that environmental governance, while important, may not be the dominant driver.

- c. Economy of De-carbonization ($r = 0.437$). This moderate correlation reflects the growing importance of economic strategies in sustainability, including investments in clean energy, carbon pricing, and green innovation. It underscores the role of economic transformation in achieving long-term sustainability goals.

Strategic Recommendations.

- a. Holistic Integration: Organizations should adopt a balanced approach that integrates social equity, environmental responsibility, and economic innovation.
- b. Policy Design: Policymakers should craft sustainability policies that reflect this multidimensionality, ensuring that governance structures support cross-sectoral collaboration.
- c. Future Research: To advance the understanding of sustainability governance, future research should:
 - 1) Expand Governance Dimensions: Incorporate social, economic, ethical, and environmental governance variables to develop a more holistic sustainability framework.
 - 2) Apply Advanced Analytical Techniques: Utilize regression analysis and structural equation modeling to uncover causal relationships and mediating factors influencing sustainability outcomes.
 - 3) Evaluate Economic Policy Impacts: Investigate the correlation between targeted economic policies – such as renewable energy subsidies and carbon taxation – and sustainability performance metrics.
 - 4) Conduct Multivariate Analysis: Identify optimal combinations of governance, economic, and environmental factors that most effectively predict sustainable development.
 - 5) Integrate Additional Variables: Include financial performance and environmental governance indicators to enrich the sustainability model.

Comparative Insights. All three governance dimensions show statistically significant and positive correlations with sustainable development commitment. However, none of them individually exhibit a strong correlation ($r > 0.5$), suggesting that sustainable development is a multidimensional construct that requires integrated efforts across social, environmental, and economic domains.

CONCLUSION

The findings affirm that social governance, environmental stewardship, and economic decarbonization are all essential components of a sustainable development framework. While each dimension contributes meaningfully, their moderate correlation levels imply that no single factor is sufficient on its own.

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