



Science Forum (Journal of Pure and Applied Sciences)

Journal Homepage: <https://atbuscienceforum.com.ng/index.php/jpas>



Assessment of the Effectiveness of Air Quality Regulations and Policies in Mitigating Climate Change Impacts in Nigeria

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Abstract

The integration of air quality management and climate change mitigation has emerged as a critical component of Nigeria's sustainable development agenda. This study evaluates the effectiveness of existing air quality regulations and policies in addressing atmospheric pollution and climate-related challenges within the country. A mixed-methods research design was adopted, combining quantitative and qualitative approaches to provide a comprehensive assessment of regulatory performance, stakeholder perceptions, and environmental outcomes. Primary data were obtained through structured questionnaires administered to staff of the National Environmental Standards and Regulations Enforcement Agency (NESREA). Quantitative data were analyzed using Microsoft Excel to generate descriptive statistics, while qualitative responses were subjected to thematic analysis to identify recurring themes, patterns, and key issues influencing regulatory implementation. The findings reveal significant concerns regarding ambient air quality, with 46% of respondents rating current air quality conditions as either poor or very poor. Major constraints affecting the effectiveness of air quality regulations include weak enforcement mechanisms (69.8%), inadequate funding (61.9%), and corruption (50%). Industrial emissions (28.2%) and vehicular exhaust emissions (25.8%) were identified as the principal contributors to air pollution. Although respondents demonstrated a moderate level of awareness of existing air quality regulations (Mean = 3.29), the perceived effectiveness of these policies in mitigating climate change impacts was relatively low (Mean = 2.65). Qualitative findings further underscore systemic institutional challenges, including insufficient technical capacity, governance deficiencies, and inadequate environmental infrastructure. The study concludes that Nigeria's air quality management framework is constrained by persistent structural and institutional barriers. Strengthening regulatory enforcement, enhancing institutional capacity, improving governance transparency, and increasing financial investment are imperative for achieving effective air quality management, climate change mitigation, and sustainable national development.

Keywords

Air Quality Regulations, Corruption, Greenhouse Gas Emissions, Sustainable Development, Weak Enforcement.

ISSN 1119-4618



1119 4618

JPAS



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1.0 INTRODUCTION

The interplay between air pollution and climate change is often described as "two sides of the same coin" (UNDP, 2019). Pollutants such as black carbon and methane are short-lived climate pollutants-gases or particles that remain in the atmosphere for a relatively short period but have a strong impact on warming. They have high global warming potential and simultaneously degrade local air quality (Oluwasegun, Gbenga, & Asaolu, 2023).

According to Health Effects Institute (HEI) (2019), air pollution caused about 1.1 million deaths across Africa in 2019. In Nigeria alone, more than 114,000 deaths were recorded in 2017. This health crisis is tied to climate change, as industrial activity, vehicle emissions, and use of fossil fuel, drive both air pollution and greenhouse gas emissions (Ritchie & Roser, 2020; Munsif et al., 2021). While the World Health Organisation estimates that 7 million premature deaths annually are linked to air pollution, Nigeria's specific regulatory landscape often struggles to bridge the gap between policy design and practical implementation (WHO, 2018; Auwal et al., 2023).

Nigeria, as a fossil-fuel-dependent economy with a large climate-sensitive agricultural sector, faces a dual threat: deteriorating urban air quality and increased vulnerability to climate-induced disasters (Monday, 2019). Major urban centres such as Lagos, Kano, and Port Harcourt experience extreme pollution levels due to industrial density and traffic congestion (Tawari & Abowei, 2012).

Nigeria has introduced several policies to tackle air pollution and climate change, including the National Climate Change Policy

(2021-2030), updated Nationally Determined Contributions (NDCs), and the National Action Plan to Reduce Short-Lived Climate Pollutants. Efforts also target gas flaring reduction and alignment with the Paris Agreement. The National Environmental Standards and Regulations Enforcement Agency (NESREA) plays a central role by enforcing environmental laws, setting emission standards, monitoring compliance, and coordinating with stakeholders to ensure these policies are implemented.

Despite Nigeria's ambitious plans to reduce greenhouse gas emissions and improve air quality, implementation is hindered by a substantial financing gap, as government budgets for environmental protection remain limited and heavily reliant on international donors (Ajayi & Dosunmu, 2019). The country also lacks adequate air quality monitoring stations and reliable data systems, restricting regulators' ability to track pollution levels, enforce compliance, and evaluate policy effectiveness (Nwachukwu et al., 2019). Furthermore, corruption and political interference undermine environmental governance, with underfunded agencies often compromised by bribery, thereby weakening the enforcement of air quality regulations and climate change policies (Ogunjobi, 2020).

The objectives of this study are to: (i) Assess the current state of air quality in Nigeria and identify primary pollution sources; (ii) Analyze the effectiveness of air quality regulations; (iii) Identify systemic barriers hindering policy success; (iv) Evaluate the alignment of Nigerian regulations with global climate mitigation goals; and (v) Explore the potential of renewable energy as a mitigation strategy.

2.0 MATERIALS and METHODS

2.1 Research Design and Study Area

A mixed-methods approach was adopted, combining quantitative survey data with qualitative analysis of policy document. The study area covers the six geopolitical zones of Nigeria. Questionnaires were administered to the technical staff of the National Environmental Standards and Regulations Enforcement Agency (NESREA) in the 6 zonal offices of the Agency involved in air quality management in Nigeria. Their job cut across the entire management of air quality, including development, monitoring implementation and enforcement of air quality regulations among other environmental regulations. The questionnaires were used to collect both quantitative and qualitative data from the respondents. Quantitative data were analysed using excel for descriptive statistics to summarize the key findings and characteristics of the sample population.

2.2 Population and Sampling

The population included 152 NESREA technical staff were evaluated using Yamane's formula: $n = N / (1 + Ne^2)$ Where: n = sample size, N = population size, e = margin of error (0.05). 139 were sampled. Purposive and stratified sampling ensured representation from the six zones.

2.3 Data Collection and Analysis

Structured questionnaires were developed to gather qualitative and quantitative data from participants. The questions include closed-

ended questions (e.g., Likert scale, multiple choice) to assess their perceptions of air quality regulations, effectiveness, awareness, and personal experiences with air quality issues and open-ended questions to gain more insight on the study. This mixed-methods approach provided a comprehensive understanding of the research questions.

Quantitative data were analysed using excel for descriptive statistics to summarize the key findings and characteristics of the sample population. This included measures such as frequencies, percentages, means, and standard deviations. Responses on a 5-point Likert scale (ranging from 1=Strongly Disagree to 5=Strongly Agree) were converted to mean scores, while the standard deviation (SD) was calculated to measure the variability or dispersion of the responses around the mean. Thematic analysis was employed to analyse qualitative data. This involved identifying recurring themes, patterns, and categories within data set.

3.0 RESULTS AND DISCUSSION

3.1 Perception of the Current State of Air Quality

A significant proportion of the respondents in table 1 perceive Nigeria's air quality as "poor" and "very poor". - suggesting that the country's air quality is below acceptable levels. The findings in table 1 are consistent with global reports indicating that Nigeria recorded over 114,000 air pollution-related deaths in 2017—the highest on the continent (HEI, 2019).

Table 1: Perception of the Current State of Air Quality

Air Quality	Respondents	Percentage (%)
Very poor	16	12.9
Poor	41	33.1
Fair	62	50
Good	5	4
Excellent	0	0
Total	124	100

Author's Field Work: 2025

3.3 Primary Sources of Air Pollution in Nigeria

Table 2 provides a clear picture of the major sources of air pollution contributing to climate change, highlighting key areas for regulatory intervention and sustainable solutions. Industrial emissions were identified as the leading contributor (28.2%), followed by vehicular emissions (25.8%) and waste burning (16.9%). Beyond the above sources of air pollution, other sources like residential Cooking, construction or mining dust, bush burning and fugitive emissions accounted for 13%. These sources can significantly degrade air quality.

Table 2: Primary sources of pollution contributing to climate change

Source	Frequency	Percentage (%)
Industrial emissions	35	28.2
Vehicle emissions	32	25.8
Agricultural activities	20	16.1
Waste burning	21	16.9
Others	16	13
Total	124	100

Author's Field Work 2025

3.4 Effectiveness of Air Quality Regulations

Figure 1 (bar chart) on a scale of 1 (lowest) - 5 (highest) depict the effectiveness of air quality regulations and policy in mitigating the impact of climate change in Nigeria.

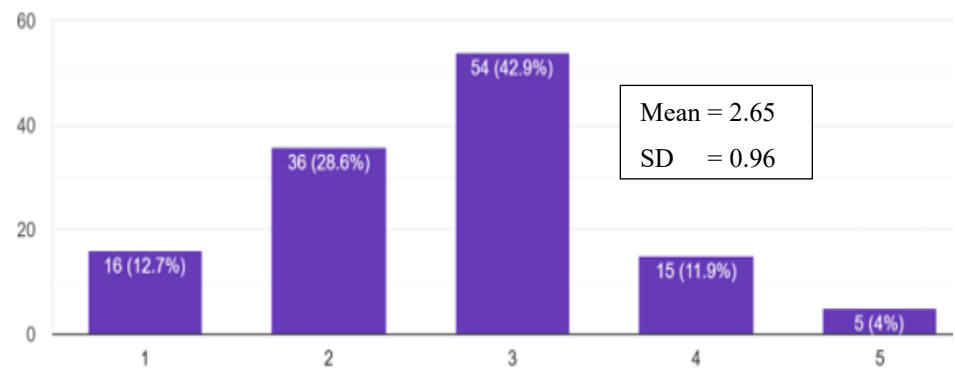


Figure 1: Effectiveness of Air Quality Regulations and Policy

With a mean score of 2.65 as shown in figure 1, and a standard deviation of 0.96, there is mixed appraisal among NESREA staff regarding the effectiveness of air quality regulations. While a minority of the respondents expressed confidence in the regulations, a notable 28.6% disagreed, and 42.9% remained neutral. This distribution suggests that, despite some acknowledgement

of progress, there is substantial skepticism about whether current measures effectively reduce emissions and mitigate climate change

3.5 Barriers to Effectiveness of air Quality Regulations and Policy

The challenges and barriers hindering the implementation of air quality regulations and policies are presented in Table 3.

Table 3: Barriers to Effectiveness of air Quality Regulations and Policy

Barrier	Count (out of 124)	Percentage (%)
Weak enforcement	88	70.9
Lack of funding	78	62.9
Corruption	62	50
Lack of political will	62	50
Inadequate infrastructure	61	49.1
Inadequate manpower/enforcement	2	1.6
Lack of knowledge of regulations	1	0.8
Lack of air quality monitoring data	1	0.8
Poor sensitization on the population	1	0.8
Lackadaisical attitude about the regulations	1	0.8

These perceptions closely mirror existing literature, which identifies financing gaps due to limited government budgets and reliance on international donors (Ajayi & Dosunmu, 2019), inadequate monitoring infrastructure that restricts compliance tracking (Nwachukwu et al., 2019), and corruption coupled with political interference that undermine governance and enforcement (Ogunjobi, 2020).

3.6 Alignment of Nigerian Regulations with Global Climate Mitigation Goals

A substantial number of the respondents believe that Nigeria's air quality regulations are aligned with global climate change efforts as shown in figure 2.

This substantial majority suggests that most respondents perceive the country's policies to be in sync with international objectives.

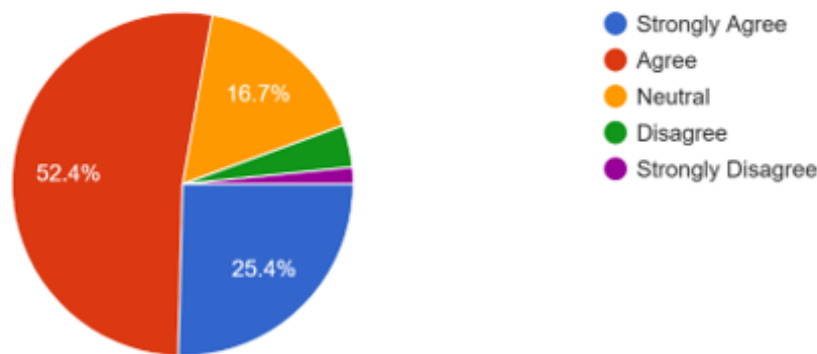


Figure 2: Alignment of Nigerian Regulations with Global Climate Mitigation Goals

It reflects a confidence, possibly rooted in Nigeria's commitments to international agreements like the Paris Agreement and corresponding national action plans that the existing regulatory framework supports global climate initiatives.

3.7 The Potential of Renewable Energy in Addressing Climate Change

As shown in Figure 3, the study highlights strong confidence in renewable energy as a viable solution to Nigeria's air pollution challenges, with many perceiving it capable of addressing a significant share of emissions. Such optimism reflects broader recognition of clean energy's role in reducing dependence on fossil fuels and mitigating urban pollution.

The significance of these findings lies in their policy relevance: they reinforce calls for Nigeria to integrate renewable energy expansion into its climate and air quality strategies, as emphasized in national energy transition plans. By aligning public perceptions with policy frameworks, renewable energy adoption can serve as both an environmental and developmental lever, advancing effective air quality regulation and sustainable development.

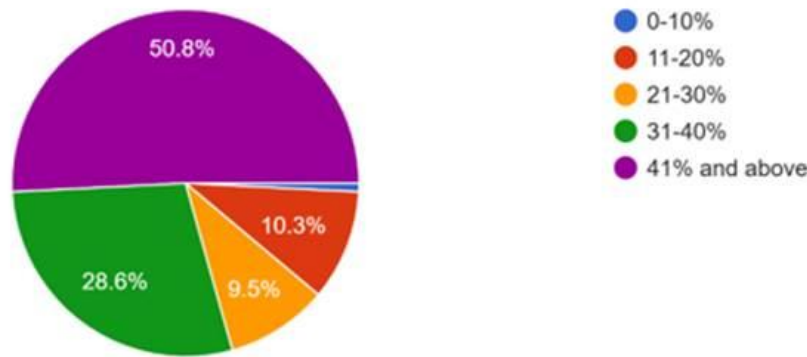


Figure 3: Potential of renewable energy in addressing climate change

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

Results show that, despite robust frameworks like the National Environmental Regulations and the Climate Change Act, barriers remain. Nigeria possesses a comprehensive array of air quality regulations and climate policies, yet their effectiveness is severely hampered by a "policy-implementation gap." While the frameworks align with international standards, the reality on the ground is characterised by rising emission levels and inadequate monitoring.

The high reliance on fossil fuels and weak institutional capacity remains the primary obstacles to achieving meaningful climate change mitigation through air quality control. This study will also contribute to the achievement of multiple Sustainable Development Goals (SDGs) (Goal 11: Sustainable Cities and Communities, Goal 3: Good Health and Well-being, Goal 12: Responsible Consumption and Production, Goal 13: Climate Action, Goal 15: Life on Land, and Goal 17: Partnerships for the Goals) and promoting

sustainable development and environmental protection.

4.2 Recommendations

- i. Strengthen NESREA's regulatory capacity, increase funding to ensure strict compliance with air quality laws and deploy real-time air monitoring technologies to monitor pollution.
- ii. Organize periodic training for regulators and industries and foster community participation in air pollution management through education and advocacy.
- iii. Promote renewable energy policies (solar, wind) and encourage electric vehicle adoption to reduce vehicular emissions.
- iv. Address bureaucratic delays and corruption in environmental governance.
- v. Ban open waste burning and expand recycling and waste-to-energy programs.
- vi. Strengthen collaboration between NESREA and state governments and

develop customized regulations to addressing local pollution sources.

5.0 ACKNOWLEDGEMENTS

The authors express sincere appreciation to the Department of Sustainable Environmental Studies, SPESSCE, Abubakar Tafawa Balewa University, Bauchi, for providing an enabling academic environment that supported the conduct of this study, the technical staff of NESREA whose responses provided valuable insights to the study. Appreciation is also extended to scholars and institutions whose published works served as important references for this research.

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