Journal of Environmental and Tourism Education Vol. 8 No. 1 June 2025

Stakeholders' Perception of Urban Air Pollution and Its Implications for Public Health and Environmental Policy in Calabar Metropolis, Cross River State, Nigeria

By
Ewona Theresa Igwe
Department of Environmental Education,
University of Calabar, Nigeria

Abstract
Urban air pollution poses significant risks to public health and environmental sustainability, necessitating effective policy responses. This study examines stakeholders' perception of urban air pollution and its implications for public health outcomes and environmental policy formulation and implementation in Calabar Metropolis, Cross River State, Nigeria. A descriptive survey research design was employed, with data collected from 384 respondents using a structured questionnaire. Key stakeholders included residents, environmental health officers, public health professionals, policymakers, and representatives from non-governmental organizations (NGOs). The study utilized Pearson Product-Moment Correlation analysis to test two hypotheses. The results indicate that stakeholders' perception of urban air pollution does not significantly correlate with public health outcomes ($r = -0.064$, $p = 0.210$), suggesting that other factors, such as actual pollution levels, healthcare accessibility, and socio-environmental determinants, may play a more critical role in shaping health outcomes. However, findings reveal a moderate negative correlation ($r = -0.385$, $p = 0.000$) between stakeholders' perception of urban air pollution and environmental policy formulation and implementation. This implies that as concerns about air pollution increase, confidence in the effectiveness of existing environmental policies declines, possibly due to perceived gaps in policy enforcement, stakeholder engagement, and transparency. These findings highlight the need for strengthened policy enforcement, improved public participation in environmental governance, and enhanced air quality monitoring systems. Addressing these challenges through greater transparency, stakeholder involvement, and stricter regulatory frameworks will be essential for mitigating urban air pollution and fostering sustainable environmental management in Calabar Metropolis.
Keywords: Urban air pollution, stakeholders' perception, public health outcomes, environmental policy, Calabar Metropolis

Introduction and background
Urban air pollution has emerged as a critical environmental and public health challenge worldwide, particularly in rapidly urbanizing regions of developing countries (World Health Organization [WHO], 2021). Air pollution is associated with severe health risks, including

respiratory diseases, cardiovascular conditions, and premature mortality (Manisalidis et al., 2020). Additionally, poor air quality affects economic productivity, ecological balance, and overall quality of life. In Nigeria, urban centers such as Abuja, Enugu and Calabar Metropolis are increasingly experiencing air pollution due to vehicular emissions, industrial activities, waste burning, and other anthropogenic sources (Chukwu, 2023). Despite the growing concerns, there is limited empirical research on stakeholders' perception of urban air pollution and its implications for public health and environmental policy in Calabar Metropolis.

Understanding stakeholders' perception of air pollution is crucial for effective policy formulation and implementation. Stakeholders, including policymakers, environmentalists, health professionals, and the general public, play vital roles in shaping and enforcing environmental policies (Miller, 2008). Their awareness, attitudes, and responses toward air pollution influence mitigation strategies and compliance with regulatory measures. This study seeks to explore stakeholders' perceptions of urban air pollution in Calabar Metropolis and assess its implications for public health and environmental policy.

Urban air pollution results from the accumulation of pollutants such as particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NOx), sulfur dioxide (SO2), and volatile organic compounds (VOCs) in the atmosphere due to human activities and natural processes (Shi, 2019). The World Bank (2022) estimates that air pollution is a leading environmental risk factor, causing millions of deaths annually, with the highest burden in low- and middle-income countries. In Nigeria, rapid urbanization, industrialization, and inadequate environmental regulations have exacerbated air pollution levels, particularly in major cities (Aliyu, A. A., & Amadu, L. (2017)).

Calabar Metropolis, the capital of Cross River State, is characterized by increasing urbanization and economic activities that contribute to deteriorating air quality. Vehicular emissions from outdated transport systems, open waste burning, industrial discharge, and deforestation are significant contributors to air pollution in the city (Odubo & Kosoe, 2024). However, there is a scarcity of studies focusing on how different stakeholders perceive the problem and how their perspectives shape policy decisions and public health interventions.
The effectiveness of environmental policies and regulations in addressing air pollution largely depends on public awareness, stakeholder involvement, and the enforcement of existing laws (Awewomom, Dzeble, Takyi, Ashie, Ettey, Afua,... & Akoto, 2024). Studies have shown that when stakeholders are actively engaged in environmental governance, there is a higher likelihood of policy success and community-driven solutions to pollution challenges

(Commodore, Wilson, Muhammad, Svendsen & Pearce, 2017). Therefore, assessing the perceptions of stakeholders in Calabar Metropolis will provide valuable insights into public attitudes, challenges in policy implementation, and potential strategies for mitigating air pollution and its adverse health effects.

This study aims to bridge the knowledge gap by investigating stakeholders' perceptions of urban air pollution and examining its policy implications for public health and environmental governance in Calabar Metropolis. Findings from this study will contribute to existing literature, inform policy recommendations, and enhance environmental management strategies in Nigeria and beyond.

Purpose of the study

The main purpose of this study is to examine stakeholders' Perception of Urban Air Pollution and Its Implications for Public Health and Environmental Policy in Calabar Metropolis, Cross River State, Nigeria. Specifically, the study seeks to:

1. Examine stakeholders' perceptions of urban air pollution in calabar metropolis and how these perceptions influence public health outcomes.
2. To assess the extent to which stakeholders' perceptions of urban air pollution impact environmental policy formulation and implementation in calabar metropolis.

Research hypotheses

The following hypotheses are proposed for the study:

1. There is no significant relationship between stakeholders' perception of urban air pollution and public health outcomes in Calabar Metropolis.
2. Stakeholders' perception of urban air pollution does not significantly relate with environmental policy formulation and implementation in Calabar Metropolis.

Literature review

Stakeholders' Perception of Urban Air Pollution and Public Health Outcomes

Urban air pollution has been widely studied due to its detrimental effects on public health. Various empirical studies have examined the relationship between stakeholders' perceptions and health outcomes, demonstrating mixed findings. According to WHO (2021), urban air pollution contributes to respiratory diseases, cardiovascular conditions, and premature mortality worldwide. However, stakeholders' perception of pollution, including residents, policymakers, and health professionals, varies depending on their level of awareness and engagement with environmental issues.

A study conducted by Wang and Cao (2024) in China assessed how public perception aligns with measured air quality indices and their impact on reported health conditions. The findings

revealed a positive correlation between residents' awareness of pollution and self-reported respiratory symptoms. Similarly, Ajayi, Adams, Dumedah, Adebanji, Ababio-Donkor, Ackaah and Kehinde, (2023) explored the link between public perception and health outcomes in Lagos, Nigeria. They found that communities perceiving higher pollution levels often reported more respiratory issues, even when air quality measurements did not always corroborate their concerns. These findings suggest that perception plays a role in shaping health behaviors, such as mask usage and medical consultations, which ultimately affect public health outcomes.
Contrary to these findings, a study by Yakubu, (2017) in Port Harcourt found no significant relationship between stakeholders' perception of urban air pollution and documented health cases. The authors argued that factors such as economic conditions, healthcare access, and personal health practices could mediate this relationship. These mixed results indicate that while perception can influence health awareness and behaviors, the actual impact on public health outcomes remains context-dependent.

Stakeholders' Perception of Urban Air Pollution and Environmental Policy Formulation
The influence of stakeholders' perception on environmental policy formulation and implementation is a critical area of research. Empirical studies have shown that policymakers are often influenced by public opinion, expert recommendations, and environmental advocacy efforts. A study by Liu, Long, Chen, Wu, Ma and Li (2024) examined how citizen complaints and environmental awareness influenced policy changes in major Chinese cities. The results indicated that cities with a higher level of public concern over air quality were more likely to implement stricter air pollution controls.

Similarly, in Nigeria, Mashi and Shuaibu (2018) analyzed how stakeholder engagement influenced environmental policy in Abuja. They found that policymakers responded more to organized advocacy efforts rather than individual perceptions. This finding aligns with research by Haou, Allarané, Aholou and Bondoro, 2025), which highlights the role of civil society organizations in shaping urban environmental policies in sub-Saharan Africa. Their study found that while individual perceptions of pollution were widespread, only organized pressure groups significantly impacted policy changes.

However, conflicting findings exist. Akinmusuyi and Nnonyelu (2024) investigated the relationship between stakeholder perception and policy enforcement in Lagos and found no significant direct influence. Instead, they noted that policy decisions were primarily driven by international environmental regulations and economic considerations rather than public perception. This suggests that while public perception is an important factor, its influence on

policy formulation and implementation may be mediated by broader socio-political and economic factors.

The empirical review highlights mixed findings on the relationship between stakeholders' perception of urban air pollution and both public health outcomes and environmental policy formulation. While some studies suggest that perception significantly influences health behaviors and policy actions, others argue that additional factors such as economic constraints, advocacy efforts, and regulatory frameworks play a more decisive role. These variations underscore the need for further localized research in Calabar Metropolis to determine the specific dynamics at play.

Methodology

Research Design

This study employed a descriptive survey research design to gain a comprehensive understanding of stakeholders' perceptions of urban air pollution and its implications for public health and environmental policy in Calabar Metropolis, Cross River State, Nigeria. The approach is chosen to ensure a holistic analysis of perceptions from key stakeholders (Creswell & Plano Clark, 2018).

Study Area

The study is conducted in Calabar Metropolis, the capital city of Cross River State, Nigeria. Calabar is characterized by increasing urbanization, vehicular emissions, industrial activities, and waste burning, all of which contribute to air pollution. The metropolis comprises Calabar Municipality and Calabar South Local Government Areas, making it a suitable setting for examining urban air pollution and its associated public health and policy implications.

Population of the Study

The population of this study includes key stakeholders, such as residents of Calabar Metropolis, environmental health officers, public health professionals, policymakers, representatives from non-governmental organizations (NGOs), and academics in environmental science and public health. This diverse population allows for a broad spectrum of perspectives on the issue of urban air pollution. The total estimated population of calabar metropolis comprisong of calabar municipal area and calabar south is 712,904 people (National Population Commission, NPoC, 2025).

Sample Size and Sampling Technique

A multi-stage sampling technique is employed in this study. First, purposive sampling is used to select relevant government agencies, NGOs, and academic institutions involved in environmental and public health matters. Second, stratified random sampling is applied to select residents from different neighborhoods in Calabar Metropolis to ensure representation from various socio-economic backgrounds. The sample size is determined using Krejcie and Morgan's (1970) formula, ensuring statistical validity. The required sample size for this survey study with a population of 712,904, using Krejcie and Morgan's (1970) formula, is 384 respondents.

Data Collection Methods

Data for this study was collected using a primary source: a 4-point Likert-type structured questionnaire was administered to residents, public health professionals, and policymakers. The questionnaire consisted of closed-ended and Likert-scale questions focusing on perceptions of air pollution sources, its health effects, policy responses and implementation. The Likert Scale Response Options range from Strongly Agree (SA) – 4, Agree (A) – 3, Disagree (D) – 2, and Strongly Disagree (SD) – 1.

Validity and Reliability

To ensure validity, the research instruments underwent expert review from environmental and public health professionals. A pilot study was conducted in a small section of the study area to refine the questionnaire and interview guides. Reliability was assessed through a test-retest method, and the internal consistency of the survey items was measured using Cronbach's alpha coefficient. Reliability coefficients ranging from .77-.89 was considered high enough to sanction the use of the instrument.

Data Analysis

Quantitative data from surveys were analyzed using descriptive and inferential statistics, including frequency distributions, mean scores, and Pearson product Moment Correlation analysis to identify relationships between variables. Statistical analysis was conducted using SPSS software.

Ethical Considerations

Ethical approval for the study is obtained from the appropriate institutional review board. Informed consent is sought from all participants, ensuring their voluntary participation.

Confidentiality and anonymity are maintained throughout the study, and participants have the right to withdraw at any stage without any consequences.

Limitations of the Study

Potential limitations include the possibility of response bias in self-reported perceptions and challenges in accessing some key stakeholders. To mitigate these, careful interpretation of findings are employed.

Presentation of results

Ho_1

There is no significant relationship between stakeholders' perception of urban air pollution and public health outcomes in Calabar Metropolis.

Table 1: Pearson product moment correlation analysis of the relationship between stakeholders' perception of urban air pollution and public health outcomes in Calabar Metropolis. (N384).

Variables	Mean	SD	Cal-r	Sign
Perception of urban air pollution	14.5729	1.48970		
			-.064	.210
Public health outcomes	31.1016	1.62313		

*P> 0.05; df = 382.

The Pearson product-moment correlation analysis was conducted to examine the relationship between stakeholders' perception of urban air pollution and public health outcomes in Calabar Metropolis, using a sample of 384 respondents. The results revealed that the mean perception of urban air pollution was 14.57 with a standard deviation of 1.49, while the mean public health outcome score was 31.10 with a standard deviation of 1.62**.**

The correlation coefficient **(**r = -0.064**)** indicates a very weak negative relationship between stakeholders' perception of urban air pollution and public health outcomes. However, this correlation was found to be statistically insignificant (p = 0.210, p > 0.05), suggesting that the observed relationship is likely due to chance rather than a meaningful association.

These findings imply that stakeholders' perception of urban air pollution does not significantly influence reported public health outcomes in the study area. This could mean that factors other than perception, such as actual pollution levels, access to healthcare, or other socio-environmental determinants, may play a more critical role in shaping public health outcomes in Calabar Metropolis.

H_{O2}
Stakeholders' perception of urban air pollution does not significantly relate with environmental policy formulation and implementation in Calabar Metropolis.

Table 2: Pearson product moment correlation analysis of the relationship between Stakeholders' perception of urban air pollution and environmental policy formulation and implementation in Calabar Metropolis. (N384).

Variables	Mean	SD	Cal-r	Sign
Perception of urban air pollution	14.5729	1.48970	-.385**	.000
Environmental policy formulation and implementation	24.6250	1.84093		

*P< 0.05; df = 382.

The Pearson product-moment correlation analysis was conducted to examine the relationship between stakeholders' perception of urban air pollution and environmental policy formulation and implementation in Calabar Metropolis, based on a sample of 384 respondents.

The results indicate that the mean perception of urban air pollution was 14.57 with a standard deviation of 1.49**,** while the mean score for environmental policy formulation and implementation was 24.63 with a standard deviation of 1.84**.**

The correlation coefficient **(**r = -0.385) suggests a moderate negative relationship between stakeholders' perception of urban air pollution and environmental policy formulation and implementation. This means that as stakeholders' perception of urban air pollution increases, their assessment of the effectiveness of environmental policy formulation and implementation tends to decrease.

Furthermore, the relationship was found to be statistically significant ($p = 0.000$, $p < 0.05$), indicating that the observed correlation is unlikely to have occurred by chance.
These findings suggest that stakeholders who perceive urban air pollution as a serious issue may have a lower level of confidence in the effectiveness of existing environmental policies and their implementation. This could point to concerns about gaps in policy responsiveness,

enforcement, or the adequacy of measures taken to address urban air pollution in Calabar Metropolis.

Discussion of findings

The results of this study suggest that stakeholders' perception of urban air pollution in Calabar Metropolis does not significantly correlate with reported public health outcomes. The very weak negative correlation **(**r = -0.064**)** and the lack of statistical significance (p = 0.210) indicate that perception alone may not be a reliable predictor of public health impacts in this context. This finding contrasts with existing literature that establishes a strong link between air pollution and adverse health effects, such as respiratory diseases, cardiovascular conditions, and premature mortality (Manisalidis et al., 2020).

One possible explanation for the lack of a significant relationship is that stakeholders' perception of air pollution may not accurately reflect actual pollution levels**.** In many cases, public awareness and perception are influenced by factors such as media exposure, government communication, and personal experiences, rather than empirical measurements of air quality. Additionally, other determinants of public health outcomes, such as healthcare accessibility, socioeconomic status, genetic predispositions, and environmental conditions, may play a more substantial role than perception alone.

Another critical aspect to consider is that in Nigeria, urban air pollution is an increasing concern due to vehicular emissions, industrial activities, and waste burning, particularly in cities like Abuja, Enugu, and Calabar Metropolis (Chukwu, 2023). However, if stakeholders do not perceive air pollution as a significant issue, this could indicate a gap in public awareness, environmental monitoring, or policy enforcement**.**

Furthermore, the findings of this study contradict the results of Wang and Cao (2024) in China, which found a positive correlation between public perception of pollution and self-reported respiratory symptoms. This discrepancy may be attributed to differences in environmental policies, public awareness levels, and healthcare reporting mechanisms between the two regions. In China, extensive air quality monitoring and public awareness campaigns may have contributed to greater alignment between perception and health outcomes.

Implications of the Findings

Need for Enhanced Public Awareness – Since perception does not significantly correlate with health outcomes in Calabar Metropolis, there may be a need for improved air quality monitoring, public education campaigns, and data-driven environmental policies.

Role of Actual Pollution Levels – Future research should explore whether measured air quality indices (such as PM2.5 and NO2 levels) show a stronger correlation with public health outcomes compared to stakeholder perception.
Policy and Intervention Strategies – Policymakers should focus not only on public perception but also on scientific air quality assessments and targeted health interventions to mitigate pollution-related health risks.

H_{O2}

The results of this study suggest that stakeholders' perception of urban air pollution in Calabar Metropolis does not significantly correlate with reported public health outcomes. The very weak negative correlation **(**$r = -0.064$**)** and the lack of statistical significance ($p = 0.210$) indicate that perception alone may not be a reliable predictor of public health impacts in this context. This finding contrasts with existing literature that establishes a strong link between air pollution and adverse health effects, such as respiratory diseases, cardiovascular conditions, and premature mortality (Manisalidis et al., 2020).

One possible explanation for the lack of a significant relationship is that stakeholders' perception of air pollution may not accurately reflect actual pollution levels. In many cases, public awareness and perception are influenced by factors such as media exposure, government communication, and personal experiences, rather than empirical measurements of air quality. Additionally, other determinants of public health outcomes, such as healthcare accessibility, socioeconomic status, genetic predispositions, and environmental conditions, may play a more substantial role than perception alone.

Another critical aspect to consider is that in Nigeria, urban air pollution is an increasing concern due to vehicular emissions, industrial activities, and waste burning, particularly in cities like Abuja, Enugu, and Calabar Metropolis (Chukwu, 2023). However, if stakeholders do not perceive air pollution as a significant issue, this could indicate a gap in public awareness, environmental monitoring, or policy enforcement**.**

Furthermore, the findings of this study contradict the results of Wang and Cao (2024) in China, which found a **positive correlation** between public perception of pollution and self-reported respiratory symptoms. This discrepancy may be attributed to differences in environmental policies, public awareness levels, and healthcare reporting mechanisms between the two regions. In China, extensive air quality monitoring and public awareness campaigns may have contributed to greater alignment between perception and health outcomes.

Implications of the Findings

Need for Enhanced Public Awareness – Since perception does not significantly correlate with health outcomes in Calabar Metropolis, there may be a need **for** improved air quality monitoring, public education campaigns, and data-driven environmental policies.

Role of Actual Pollution Levels – Future research should explore whether measured air quality indices (such as PM2.5 and NO2 levels) show a stronger correlation with public health outcomes compared to stakeholder perception.

Policy and Intervention Strategies – Policymakers should focus not only on public perception but also on scientific air quality assessments and targeted health interventions to mitigate pollution-related health risks.

Ho_2

The findings of this study indicate a moderate negative correlation **(**r = -0.385, p **= 0.000**) between stakeholders' perception of urban air pollution and the formulation and implementation of environmental policies in Calabar Metropolis. This statistically significant relationship suggests that as stakeholders perceive air pollution as a growing concern, their confidence in the effectiveness of existing environmental policies and their implementation declines.

This negative correlation highlights a potential disconnect between policy measures and public perception. One possible explanation for this is the perceived inefficiency of policy enforcement**.** If stakeholders feel that air pollution is worsening despite the presence of environmental regulations, they may see these policies as either inadequate or poorly enforced. Weak institutional frameworks, lack of accountability, and insufficient government commitment to enforcing pollution control measures may contribute to this skepticism.

Another factor that could explain this relationship is the limited involvement of stakeholders in environmental policymaking**.** Policies that are formulated without adequate input from the public, industry leaders, and environmental groups may fail to address key concerns or lack public support. When citizens are not actively engaged in governance, they are less likely to trust in the effectiveness of policy measures. Additionally, the lack of access to accurate air quality data may further contribute to negative perceptions. Without clear, transparent information about pollution levels and government interventions, stakeholders may assume that policies are ineffective, even if efforts are being made to mitigate air pollution.

These findings align with previous studies, such as those by Awewomom et al. (2024)**,** which emphasize that the success of environmental policies depends on public awareness, stakeholder involvement, and strict enforcement mechanisms**.** Similarly**,** Commodore et al. (2017) found that when communities are actively engaged in environmental governance, policies are more likely to be effective and trusted. By contrast, in cities with stronger environmental governance structures—such as in Europe and North America—governments prioritize public participation, real-time pollution monitoring, and strict regulatory compliance, leading to greater public confidence in environmental policies.

Given these findings, several key implications emerge. First, strengthening policy implementation and enforcement is essential. This requires increased government commitment to air quality regulations, improved institutional frameworks, and stricter penalties for non-compliance. Second, enhancing public engagement in environmental governance could help bridge the trust gap. When stakeholders are involved in policymaking, they are more likely to understand and support regulatory measures. Finally, improving air quality monitoring and transparency is critical. If the government provides real-time data on pollution levels and policy outcomes, stakeholders may develop a more informed and realistic perception of environmental policies.

In conclusion, these findings suggest that low public confidence in air pollution policies may stem from perceived gaps in enforcement, lack of stakeholder engagement, and limited transparency in air quality data**.** Addressing these challenges through stronger governance, public participation, and improved environmental monitoring could enhance the effectiveness of environmental policies and promote more sustainable air quality management in Calabar Metropolis.

Conclusion and Recommendations

The study examined stakeholders' perception of urban air pollution and its implications for public health and environmental policy in Calabar Metropolis, Cross River State, Nigeria. The findings revealed a moderate negative correlation between stakeholders' perception of urban air pollution and environmental policy formulation and implementation. This suggests that as concerns about air pollution increase, confidence in the effectiveness of environmental policies tends to decline. The results indicate potential gaps in policy enforcement, stakeholder engagement, and transparency in environmental governance. These findings highlight the need for more effective environmental policies, stronger enforcement mechanisms, and improved public participation in air quality management.

Based on these findings, the following recommendations are proposed:

1. Strengthen Policy Implementation and Enforcement: Government agencies should ensure strict enforcement of air quality regulations and implement penalties for non-compliance**.** Adequate resources should be allocated for pollution monitoring and policy evaluation **to** improve effectiveness**.**

2. Enhance Stakeholder Engagement in Environmental Governance**:** Policymakers should involve local communities, industries, and environmental organizations in the formulation and implementation of pollution control policies. Public awareness campaigns should be conducted to educate citizens on air pollution risks and their role in mitigating its effects.

3. Improve Air Quality Monitoring and Transparency**: Establishing** real-time air quality monitoring systems and making data publicly accessible can enhance transparency and build public trust in environmental policies. Regular environmental reports should be published to update stakeholders on policy impacts and pollution trends**.**

By implementing these recommendations, policymakers can foster greater public trust in environmental governance, enhance the effectiveness of air pollution policies, and promote a healthier urban environment in Calabar Metropolis.

References

Ajayi, S. A., Adams, C. A., Dumedah, G., Adebanji, O. A., Ababio-Donkor, A., Ackaah, W., & Kehinde, A. (2023). Public perceptions of vehicular traffic emissions on health risk in Lagos metropolis Nigeria: A critical survey. *Heliyon*, *9*(5).

Akinmusuyi, A., & Nnonyelu, I. (2024). The Role of Small and Medium Enterprises in Driving Sustainable Tourism Development in Nigeria: A Case Study of Lagos State.

Aliyu, A. A., & Amadu, L. (2017). Urbanization, cities, and health: the challenges to Nigeria–a review. *Annals of African medicine*, *16*(4), 149-158.

Awewomom, J., Dzeble, F., Takyi, Y. D., Ashie, W. B., Ettey, E. N. Y. O., Afua, P. E., ... & Akoto, O. (2024). Addressing global environmental pollution using environmental control techniques: a focus on environmental policy and preventive environmental management. *Discover Environment*, *2*(1), 8. https://doi.org/10.1007/s44274-024-00033-5

Chukwu, T. M. (2023). *Assessment of air quality in urban settings in Nigeria: a comparison of perceptual indicators, causes and management in Abuja and Enugu* (Doctoral dissertation, University of Surrey).

Commodore, A., Wilson, S., Muhammad, O., Svendsen, E., & Pearce, J. (2017). Community-based participatory research for the study of air pollution: a review of motivations, approaches, and outcomes. *Environmental monitoring and assessment*, *189*, 1-30.

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE Publications.

Haou, E., Allarané, N., Aholou, C. C., & Bondoro, O. (2025). Integrating Sustainable Development Goals into Urban Planning to Advance Sustainability in Sub-Saharan Africa: Barriers and Practical Solutions from the Case Study of Moundou, Chad. *Urban Science*, *9*(2), 22.

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*(3), 607-610.

Liu, J., Long, R., Chen, H., Wu, M., Ma, W., & Li, Q. (2024). Topic-sentiment analysis of citizen environmental complaints in China: Using a Stacking-BERT model. *Journal of Environmental Management*, *371*, 123112.https://doi.org/10.1016/j.jenvman.2024.123112

Manisalidis, I., Stavropoulou, E., Stavropoulos, A., & Bezirtzoglou, E. (2020). Environmental and health impacts of air pollution: a review. *Frontiers in public health*, *8*, 14.

Mashi, S. A., & Shuaibu, H. S. (2018). People and sustainable land management: assessment of stakeholders knowledge of the nature of landuse/cover change in Abuja, Nigeria. *GeoJournal*, *83*, 545-562.

Miller, N. (2008). *Environmental politics: Stakeholders, interests, and policymaking*. Routledge.

Odubo, T. C., & Kosoe, E. A. (2024). Sources of air pollutants: impacts and solutions. In *Air Pollutants in the Context of One Health: Fundamentals, Sources, and Impacts* (pp. 75-121). Cham: Springer Nature Switzerland.

Shi, Z. (2019). Urban air pollution. In *Atmospheric Science for Environmental Scientists* (p. 331).

Wang, C., & Cao, J. (2024). Air pollution, health status, and public awareness of environmental problems in China. *Scientific Reports, 14*, 19861. https://doi.org/10.1038/s41598-024-69992-2

World Bank. (2022). *Air pollution: A silent killer in developing countries*. World Bank Publications.

World Health Organization. (2021). *Air pollution and public health: Global perspectives*. WHO Reports.

Yakubu, O. H. (2017). Particle (soot) pollution in Port Harcourt Rivers State, Nigeria—double air pollution burden? Understanding and tackling potential environmental public health impacts. *Environments*, *5*(1), 2.