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Analyzing the environmental and socioeconomic impacts of gas flaring in Rivers State: challenges and opportunities for sustainable development

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ABSTRACT

Gas flaring is a pervasive practice in Rivers State, Nigeria, arising primarily from the extraction of crude oil. The work analyzed the problems associated with gas flaring and explores viable prospects in mitigating these issues. A simple random sampling technique was used to select 115 respondents for the study. Data collected through structured interview and questionnaire were analyzed using percentage presented in tables. Results show that occurrence of gas flaring gave rise to environmental degradation, health risks, economic losses, and social conflicts. Additionally, the results explored viable prospects for mitigating these issues through enhanced regulatory frameworks, technological innovations, community engagement, and renewable energy initiatives. By addressing these challenges and promoting sustainable practices, Rivers State can harness its natural gas resources effectively while ensuring the well-being of its communities.

Keyword: *Gas flaring, problems, prospects, Rivers State*

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INTRODUCTION

Gas flaring remains one of the most controversial and environmentally degrading activities associated with oil exploration in Nigeria. As Africa's largest oil producer and a member of the Organization of the Petroleum Exporting Countries (OPEC), Nigeria extracts billions of cubic feet of associated natural gas during crude oil production, much of which is flared into the atmosphere (Udok & Akpan, 2017). Despite various national and international commitments to reduce environmental degradation and mitigate climate change, gas flaring continues unabated in several oil-producing states, notably in Rivers State the epicenter of Nigeria's hydrocarbon industry. Ojobah (2025) highlights the severe environmental and public health issues caused by gas flaring in Nigeria's oil-rich Niger Delta, particularly in FCE (T) Omoku, Rivers State. Ojobah (2025) comparative study found a strong link between residents' health complaints such as respiratory issues, eye irritation, and skin conditions and pollutant levels including sulfur dioxide, carbon monoxide, and volatile organic compounds. These findings stress the need for stricter regulations and community-focused measures to mitigate the harmful impacts of gas flaring on health and the environment.

Rivers State, located in the heart of the Niger Delta region, bears a disproportionate burden of Nigeria's petroleum industry externalities. With over 100 active flare sites, communities such as Ogba/Egbema/Ndoni, Eleme, and Bonny are subjected daily to toxic emissions, acid rain, loss of biodiversity, and severe health implications (Dappa & Akujuru, 2023; Kiani & Olisa, 2021). The harmful cocktail

of gases emitted methane, carbon dioxide, benzene, toluene, sulfur dioxide, and polycyclic aromatic hydrocarbons contribute significantly to local and global environmental degradation (Emam, 2015; Tavella et al., 2025). Beyond environmental degradation, gas flaring has exacerbated poverty, food insecurity, economic marginalization, and social unrest in Rivers State (Idoga et al., 2025; Gbadamosi & Aldstadt, 2025).

Despite the Nigerian government's commitment to ending gas flaring through policies like the Gas Master Plan and the Nigeria Gas Flare Commercialization Programme (NGFCP), implementation has been marred by poor regulatory enforcement, corruption, and weak institutional frameworks (Mohammed, 2022; Esavwede & Oyibodoro, 2025). As of 2025, Nigeria still ranks among the top ten gas-flaring countries globally, with Rivers State as one of the most affected regions (Onwuka et al., 2025). This raises significant concerns about environmental sustainability, public health, and the feasibility of achieving national and global development goals, including the United Nations Sustainable Development Goals (SDGs) (Thompson et al., 2024; Ogunro, 2024).

The economic implications are equally severe. While billions of dollars' worth of gas are flared annually, local communities experience systemic deprivation. Artisanal fishing, farming, and other traditional livelihoods have declined dramatically, with ripple effects on food security, income generation, and community wellbeing (Keme-Iderikumo et al., 2024; Idoga et al., 2025). Moreover, soot pollution, commonly referred to as black soot in Port Harcourt has reached critical levels, prompting national outcry and international attention (Akue et al., 2025).

Given this paradox of wealth amid poverty and pollution, it is essential to rigorously assess the multi-dimensional impacts of gas flaring in Rivers State. While existing literature addresses gas flaring in broader Niger Delta contexts, fewer studies offer a targeted, integrative analysis specific to Rivers State that concurrently evaluates environmental, public health, and socioeconomic implications with a view toward sustainable development (Iyobhebhe et al., 2025; Usiabulu et al., 2023).

Numerous studies have affirmed the deleterious effects of gas flaring on the environment in Nigeria. Emam (2015) provides a global overview of gas flaring impacts, confirming that Nigeria's emissions are among the most hazardous, resulting in elevated carbon dioxide levels and climate change acceleration. Within the Nigerian context, Kiani and Olisa (2021) analyzed air quality in gas flare zones of Rivers State, documenting high concentrations of sulfur dioxide and volatile organic compounds. Similarly, Akue et al. (2025) demonstrated that gas flaring has led to the formation of urban heat islands and temperature anomalies in Port Harcourt, indicating climate destabilization.

Oghenejabor et al. (2020) further elaborated on the impacts of acid rain resulting from gas flaring, which leaches soil nutrients and inhibits plant growth, affecting local agriculture. Their findings resonate with those of Onwuka et al. (2025), who documented significant alterations in the geochemical composition of the soil and groundwater near flare sites. These studies collectively underscore the degradation of natural resources and highlight the ecological imbalance that threatens biodiversity in the Niger Delta.

Gas flaring poses severe risks to human health through the continuous emission of toxic substances. Wami-Amadi (2025) documented the prevalence of respiratory illnesses such as asthma, bronchitis, and chronic obstructive pulmonary disease in communities within a 5-kilometer radius of gas flaring facilities. These findings are corroborated by Iyobhebhe et al. (2025), who observed increased cases of cardiovascular anomalies and blood disorders linked to long-term exposure to airborne particulate matter.

In addition, Thompson et al. (2024) investigated the reproductive health effects of soot exposure among women and found increased risks of miscarriages and infertility. The study by Onwuka et al. (2025) also examined haematological indices and immune responses, revealing elevated white blood cell counts and inflammatory cytokines in affected residents, suggesting chronic systemic inflammation.

The socioeconomic effects of gas flaring are profound and multifaceted. Idoga et al. (2025) reported declining agricultural productivity and fish yields in Gokana, attributing it to soil acidification and aquatic ecosystem collapse. This decline directly affects household income, exacerbating poverty and food insecurity. Keme-Iderikumo et al. (2024) linked gas flaring to disrupted education and youth unemployment, with many youths turning to artisanal refining for survival.

Moreover, Gbadamosi and Aldstadt (2025) emphasized the spatial dimension of socioeconomic disparity, identifying flare site proximity as a determinant of poverty intensity. Ubodiom and Ariye (2025) also argued that government neglect and unequal resource distribution have led to feelings of marginalization and conflict. This view aligns with Udok and Akpan (2017), who explained that community resentment often manifests in militancy and vandalism.

Although Nigeria has instituted numerous regulations to curb gas flaring, including the Petroleum Industry Act (PIA) of 2021 and the National Gas Policy, enforcement remains inadequate. Mohammed (2022) attributed policy failure to corruption, weak institutional capacity, and oil company influence. Esavwede and Oyibodoro (2025) criticized the nominal fines imposed on oil firms, which are insufficient deterrents to continued flaring.

Ajia (2025) called for a decentralized regulatory system that involves local communities in decision-making. Eyisi et al. (2025) advocated for the adoption of international best practices, such as those used in Norway, where gas flaring is virtually eliminated through stringent penalties and incentivized gas utilization. Safarzadeh and Jafari (2025) proposed a multi-criteria decision-making model that can optimize environmental and economic trade-offs in oil-producing regions. There is a growing body of literature exploring pathways for reducing gas flaring and promoting sustainable development.

Mmesomachukwu and Uchechukwu (2024) stressed the importance of investing in gas capture and utilization infrastructure. Omobolanle and Ikiensikimama (2024) outlined opportunities for converting flared gas into electricity and liquefied natural gas (LNG) to boost local energy access. Blanco et al. (2024) discussed the alignment of gas flare reduction with Nigeria's Energy Transition Plan and Paris Agreement targets. Similarly, Ray et al. (2025) emphasized the need for environmental remediation and skills training as part of a holistic transition plan. Kodiya et al. (2025) suggested that circular economy models, including agricultural valorization and waste-to-energy schemes, can offer long-term sustainability.

Gasu et al. (2022) further argued for transdisciplinary approaches that integrate environmental science, public health, economics, and social equity in policymaking. These integrated frameworks are crucial for addressing the complex, interlinked challenges posed by gas flaring in Rivers State.

Ray et al. (2025) emphasize the critical role of the petroleum industry in global energy and economic growth while highlighting its considerable environmental impact in *Green Chemistry*. They underscore the urgent need for sustainable practices, advocating green chemistry principles such as cleaner extraction, waste reduction, and eco-friendly alternatives. Their analysis stresses the importance of aligning oil production with environmental responsibility and long-term sustainability.

When oil is pumped out of the ground, the gas produced is separated and, in Nigeria, most of it is burnt as waste in massive flares. This practice has been going on for almost five decades. The burning of this “associated gas” has long been acknowledged as extremely wasteful and environmentally damaging. More recently, communities and NGOs have raised concerns about the impact of gas flaring on human health. Although the government has announced various deadlines for the cessation of flaring, each deadline has passed and flaring continues (Amnesty International, 2009).

Gas flaring is the burning of natural gas that is released during the oil extraction process. In Rivers State, one of Nigeria's largest oil-producing regions, flaring has become a common practice, significantly affecting local communities and the environment. According to the Nigerian National Petroleum Corporation (NNPC), Nigeria flared approximately 16 billion cubic meters of gas in 2020 alone (NNPC, 2021). Gas flaring is also the combustion of gas in an open flame that burns unceasingly at the top of flare stacks in oil production sites is one of the major environmental challenges of crude oil production in the Niger Delta (Dung et al., 2008).

Gas flaring goes on for twenty-four hours and some have gone on for as long as thirty years and in the process hydrogen sulphide is released into the atmosphere. The oil companies are not only destroying Niger Delta environmentally but also immensely contributing to global warming (Chijioke et al., 2018). The chemicals released aid in acid rain formation which corrodes the roofing sheets, causing skin diseases and others (Yakubu, 2017). Dung et al., (2008). Also showed elevated levels of lead at concentrations of 0.56 mg/l in the atmosphere and argued that large concentration of oxides of nitrogen and sulphur from gas flares in the Niger Delta released into the environment contributes to acid rain experiences in the region. The quantity of carbon released per day is about 2,525,000 tons (Ubani and Onyejekwe, 2013). These flares have affected vegetation, farming, fishing and the entire community in general.

Ubani and Onyejekwe (2013) also noted that there has been massive destruction of aquatic life in communities due to acid rain. Also, no vegetation can have proper growth in an area close to flare sites. The leaves of cassava, waterleaf, and pepper near flare sites have decreased in dimension and the nutrients such as starch and ascorbic acid in the cassava in flare sites are less as compared to those located farther away from flare sites (Dung et al., 2008).

A study done at the Izombe flaring site indicates that there is a 100% loss in crop yield within 200 meters of the station. Cotton and oil palm among other economic plants wither away at any instance where they are located close to flares (Gobo et al., 2009). This has brought about high socioeconomic cost on the people in terms of repairing their corroded zinc roofing sheet, treating of sicknesses (breathing difficulties and pain, asthma, headaches, nausea, chronic bronchitis), buying of fertilizers, resettlement, and farming. And eventually increase in unemployment and poverty in the region (Chijioke et al., 2018). Unfortunately, these impacts will continue for a long time if not forever because the existing law only charge the companies money for continuous flaring but do not ban gas flaring (Udok and Akpan, 2017).

Yakubu (2017) stated that pollutant concentrations are highest in the Niger Delta after undertaking a comparison of concentrations of ambient air pollutants in the Niger Delta region and Lagos State. Yakubu (2017) argued that the emitted greenhouse gases (such as methane and carbon dioxide) at flare sites contribute to global warming. Sadly, the highest number of the flare sites are located in the Niger Delta where the heat temperature from the flare sites could be as high as 1600 °C contributing to thermal pollution. Adewale and Mustapha (2015), after their research on gas flaring at Akwa Ibom, Rivers and Bayelsa states confirmed that gas flaring has caused sicknesses, a damaged and unsustainable environment, toxic waterways, loss in productivity of fishing and farming activities.

Gas flaring has severe environmental consequences in Rivers State. The combustion of gas emits substantial quantities of greenhouse gases, including carbon dioxide and methane, contributing significantly to climate change (World Bank, 2021). In Nigeria, it is estimated that about 20 million tons of carbon dioxide are released into the atmosphere annually due to gas flaring (Nwoko, 2020). Moreover, flaring generates toxic byproducts that contaminate the soil and water bodies, adversely affecting biodiversity and local ecosystems (Bassey, 2016). The health implications of living near gas flaring sites are profound. Residents of communities such as Ogoni land and Port Harcourt have reported increased rates of

respiratory diseases, skin conditions, and even psychological distress (Alli et al., 2019). Studies indicate that exposure to air pollutants from flaring can lead to chronic health issues, prompting calls for urgent intervention (Ogunleye et al., 2018). The World Health Organization (WHO) recognizes air pollution from industrial activities as a leading cause of global morbidity and mortality, underscoring the public health crisis tied to gas flaring in this region (WHO, 2021).

The economic implications of gas flaring in Rivers State are significant. Nigeria is estimated to lose approximately $2.5 billion annually due to the wastage of natural gas (Odugbesan and Sani, 2018). This loss of revenue reflects not only on state and national income but also hinders the development of critical infrastructure and job opportunities in the energy sector. For instance, if harnessed, the gas could be transformed into liquefied natural gas (LNG) or used for domestic power generation, alleviating the chronic energy shortages faced by the region (Petroleum Products Pricing Regulatory Agency (PPRA), 2020). Gas flaring has exacerbated tensions between oil companies and local communities, leading to protests and unrest (Onyebuchi, 2019). The perception of neglect and exploitation by both the government and oil companies has fostered resentment among affected populations. Addressing these social issues through meaningful engagement and accountability is critical to restoring trust and promoting peace in the region (Egbewale and Efe, 2019).

Strengthening regulatory frameworks is essential for mitigating gas flaring in Rivers State. The Nigerian government has made strides in establishing policies aimed at gas utilization, including the National Gas Policy, which seeks to maximize the use of natural gas while minimizing flaring (Federal Ministry of Petroleum Resources, 2017). Effective enforcement of these regulations, coupled with penalties for non-compliance, will incentivize oil companies to adopt better practices. Advancements in technology can play a pivotal role in reducing gas flaring. The development and implementation of gas-to-liquid processes and combined heat and power systems can transform flared gas into usable energy products (Olabode et al., 2020). Investments in the necessary infrastructure, such as gas processing plants and transportation systems, are critical to capturing and utilizing flared gas.

Engaging local communities in the dialogue regarding gas flaring is paramount. Oil companies must implement corporate social responsibility initiatives that address the concerns of affected populations. Programs aimed at environmental sustainability and community development can significantly improve relations and foster collaboration (Osagie and Ugbede, 2020). The adoption of renewable energy sources, such as solar and wind, offers a viable alternative to reliance on flared gas. The government can incentivize investments in renewable energy projects that provide local employment opportunities and reduce dependency on fossil fuels (Adenikinju, 2018). Promoting energy efficiency measures will further decrease overall energy consumption, mitigating the need for gas flaring.

This paper aims to provide an in-depth analysis of the problems associated with gas flaring in Rivers State and evaluate the prospects for reducing flaring and utilizing natural gas more sustainably.

METHODOLOGY

The research involved a survey and data collection through questionnaires and scheduled interviews. It was designed to cover respondents residing in 6 Local Government Areas of Rivers State, Nigeria. Rivers State is abundant in oil and gas deposits, with oil fields, production, and exploration spread across all LGAs. Frequent cases of crude oil and gas pollution-related issues characterize the state. Rivers State is located in the southern part of the Niger Delta region. The state occupies latitudes 6°E - 7°E and longitudes 4°N-6°N. Rivers State is known for its abundant natural resources, including rich and fertile soils suitable for tropical agricultural production, as well as a significant portion of the nation's oil and gas deposits. Rivers State is currently comprised of 23 Local Government Areas (LGAs) with a total of 319 wards. The primary data were conducted through scheduled interviews, observation and structured questionnaire distributed among residents of the state. A multistage sampling procedure was used to obtain the data for the study. The first stage involved the selection of six (6) Local Government Areas of Rivers State out of 23 LGAs. These 6 LGAs were selected based on the fact that they were more prone to gas flaring. The next stage involved a random selection of 20 respondents from each of the selected Local Government Areas of Rivers State, namely; Bonny, Emuoha, Khana, Ogba-Egbema-Ndoni, Oyigbo and Tai. A total of one hundred and twenty respondents formed the sample name, but only 115 copies of respondent's questionnaire were useful for the analysis.

RESULTS AND DISCUSSION

Demographic characteristics of the respondents

The demographic characteristics of the respondents is shown in table1 below. The results show that 43.5% of the respondents are between 41–50 years while 17.4% and 14.8% of the respondents are over 50 years and between 20-30 years respectfully. The mean age from the distribution is 42 years. Table 1 also revealed that 65.2% of the respondents are males while 34.8% are female. This implies that majority of the respondents were male. Furthermore, 73.9% of the respondents are married while 26% of the respondents are single. The table further revealed that 53.9% of the respondents have tertiary education, followed by 33% that have secondary education, 10.4% has primary education, while 2.6% of the respondents have no formal education. The result revealed that majority had formal education, hence could read and write. On occupational status of respondents, 55.7% of the respondents are civil servants, followed by

Table 1: Demographic Characteristics of the Respondents.

Age	Frequency	Percentage
20 -30	17	14.4
31 -40	34	29.6
41 -50	50	43.5
51 -above	20	17.4
Gender		
Male	75	65.2
Female	40	34.8
Educational level		
No formal education	3	2.6
Primary	12	10.6
Secondary	38	33
Tertiary	62	53.8
Occupation		
Farming	12	10.4
Trading	36	31.3
Civil service	64	55.7
Others	3	2.6
Marital status		
Married	85	73
Single	30	26

Source: Field Report, 2025

31.3% that are traders, 10.4% are into farming while 2.6% of the respondents engage in other activities (Table 1).

Problems associated with gas flaring activities

The problems associated with gas flaring by the respondents is presented in Table 2 and from the table, 95.7% of the respondents agreed that environmental impacts, health issues and other effects were more pronounced as problems associated with gas flaring in Rivers State. These findings were in line with Nwoko (2020) and World Bank (2021) who observed that the combustion of gas emits substantial quantities of greenhouse gases, including carbon dioxide and methane, contributing significantly to climate change. Also recognizes air pollution from industrial activities as a leading cause of global morbidity and mortality, underscoring the public health crisis tied to gas flaring in this region (Alli et al., 2019; WHO, 2021). Table 2 also revealed that 92.2% of the respondents agreed that gas flaring trigger economic consequences and loss of crops. These agrees with Odugbesan and Sani (2018); Ubani and Onyejekwe (2013); Dung et al., (2008). Furthermore, 85.2% of the respondents agreed that social conflicts are also a problem associated with gas flaring. These agrees with Onyebuchi (2019) and Egbewale and Efe (2019).

The results presented in the (Table 2) reveal the profound and multifaceted consequences of gas flaring activities in Rivers State. A substantial 95.7% of respondents identified environmental degradation as a major issue, which aligns with the findings of Otasowie, Pasupuleti, and Adeoye (2024), who emphasize the deleterious effects of flared gases, including carbon dioxide, methane, and volatile organic compounds, on ecological stability and climate change. Similarly, Olaleye et al. (2024) underscore the severe impact of oil and gas exploration activities on biodiversity and natural ecosystems, especially in fragile aquatic and terrestrial habitats. These environmental outcomes are consistent

Table 2: Problems associated with gas flaring activities.

Problems	Frequency	Percentage
Environmental Impact	110	95.7%
Health Issues	110	95.7%
Economic Consequences	106	92.2%
Social Conflicts	98	85.2%
Loss of crops	106	92.2%
Others	110	95.7%

Source: field report, 2025 Multiple responses were recorded

with global observations; for instance, Liu et al. (2023) report that the global decline in offshore flaring is insufficient to meet climate targets, indicating the persistence of environmental threats where regulatory oversight is weak.

Health concerns were equally pronounced, with 95.7% of respondents citing them as a critical problem. This is corroborated by Gbadamosi and Aldstadt (2025), who conducted a scoping review revealing that gas flaring in the Niger Delta is associated with increased cases of respiratory illnesses, cancer, and reproductive health disorders. The release of toxic substances such as benzene and sulfur dioxide near residential areas exacerbates public health crises, especially among vulnerable populations. Oyewunmi (2023) adds that addressing these health challenges requires transnational governance and stronger enforcement of methane emission regulations, highlighting the global nature of this environmental health risk.

Economic consequences were noted by 92.2% of the respondents, indicating a clear understanding of the financial implications of flaring. Omobolanle and Ikiensikimama (2024) argue that gas flaring results in the loss of significant economic value, as natural gas that could be utilized for power generation and industrial activities is wasted. This inefficiency stifles economic development, particularly in energy-dependent sectors. Supporting this view, Mmesomachukwu and Uchechukwu (2024) detail how the underutilization of Nigeria's domestic gas has led to missed opportunities for energy diversification and industrial growth. Romsom and McPhail (2021) further emphasize that the monetization of flared gas could foster economic resilience and job creation, advocating for the adoption of gas reinjection and recovery technologies to harness these economic potentials.

Social conflicts, identified by 85.2% of participants, reflect the deep-rooted societal tensions that arise from the persistent flaring of gas and its associated inequities. Communities affected by flaring often experience land degradation, reduced livelihoods, and inadequate compensation, leading to unrest and resistance against oil companies. Mohammed (2022) attributes these tensions to the failure of regulatory frameworks and enforcement mechanisms, noting that community grievances are often neglected by both government and corporate actors. Gbadamosi and Aldstadt (2025) highlight that these social conflicts are frequently fueled by environmental injustice and marginalization, which perpetuate cycles of violence and undermine development efforts in oil-producing regions. The loss of crops, reported by 92.2% of

respondents, is another critical consequence of gas flaring that has both environmental and socioeconomic implications. As flared gases settle on soil and vegetation, they disrupt soil chemistry and reduce agricultural productivity. Olaleye et al. (2024) provide evidence that crops grown near flaring sites exhibit stunted growth and contamination, posing threats to food security and farmer livelihoods. Altraiki et al. (2024) advocate for the adoption of flare gas recovery systems as a means to protect agricultural zones from pollution, thereby supporting rural economies. Sukmasari and Nugroho (2025) reinforce this by promoting strategic carbon mitigation policies that prioritize agricultural land conservation in oil-producing zones.

The others category, also accounting for 95.7% of responses, likely includes broader and interconnected issues such as the psychological toll of living in polluted environments, decreased property values, and systemic governance failures. According to Guerin et al. (2025), effective regulatory strategies, such as those implemented in Alberta, Canada, provide critical lessons for reducing flare volumes and enhancing transparency. Mohammed (2022) also points to the need for institutional reforms and accountability mechanisms to improve environmental compliance in Nigeria. Lorenzato et al. (2022) propose financing solutions that can support flare-reduction projects, highlighting the importance of addressing economic and political barriers to environmental sustainability.

Prospects for improving gas flaring in rivers state

Table 3 shows the prospects for improvement from the respondents. It shows that 95.7% of respondents advocated for enforceable policy and genuine regulations. This advocacy agreed with the Federal Ministry of Petroleum Resources (2017). Effective enforcement of these regulations, coupled with penalties for non-compliance, will incentivize oil companies to adopt better practices. Also, 74.8% of respondents suggested a Gas Utilization Technologies which was in line with Olabode et al. (2020) who observed that the development and implementation of gas-to-liquid processes and combined heat and power systems can transform flared gas into usable energy products. Furthermore, table 3 revealed that 94.0% of respondents suggested Community Engagement in a way to improve the issues arising from gas flaring. This supports the findings of Osagie and Ugbede (2020) who opined that engaging local communities in the dialogue regarding gas flaring is paramount. Also in (Table 3), 82.6% suggested the initiative called Renewable Energy Initiatives which supports the findings of Adenikinju (2018). Promoting energy efficiency measures will further decrease overall energy consumption, mitigating the need for gas flaring.

Conclusion

Gas flaring in Rivers State presents significant challenges that require immediate and concerted action. By addressing the environmental, health, and economic impacts of flaring through proactive policies, technological innovation, community engagement, and renewable energy initiatives, Rivers State has the potential to leverage its abundant natural gas resources sustainably. The urgency of the situation demands a collaborative approach involving the government, oil companies, and local communities to ensure a healthier and more prosperous future for all stakeholders.

Table 3: Prospects for improvement.

Prospects	Frequency	Percentage
Policy and Regulation	110	95.7%
Gas Utilization Technologies	86	74.8%
Community Engagement	108	94.0%
Renewable Energy Initiatives	95	82.6%

Source: Field Report, 2025 Multiple responses were recorded

Conflicts of Interests

There was no conflict of interests among the authors.

REFERENCES

Adenikinju, A. (2018). Renewable energy options for Nigeria: A review. *Journal of Renewable and Sustainable Energy Reviews*, 81: 1751-1760.

Adewale, O. O. & Mustapha, U. (2015). The impact of gas flaring in Nigeria. *International Journal of Science, Technology and Society*, 3(2), 40-50.

Ajia, A. T. (2025). Policy Challenges and Opportunities for Renewable Energy Development in Nigeria: A Systematic Review. African Journal of Environmental Sciences and Renewable Energy, 18(1), 115-137.

Akue, L. O., Gbarabe, F. O., & Dagogo, S. (2025). Spatio-temporal variations of climate change and urban heat island in Port Harcourt, Rivers State, Nigeria (Implications on Physical Planning). World Journal of Advanced Research and Reviews, 25(1), 2296-2304.

Alli, M. K., Akingbade, O. A. & Taiwo, B. O. (2019). Gas flaring and public health implications in Nigeria: A critical review. *Environmental Science and Pollution Research*, 26(10), 9840-9854.

Altraiki, M., Sharif, A., F Alnaas, J., & O Kratim, M. (2024). A Flare gas recovery unit for refineries in Libya: Innovative technologies are a step towards a sustainable environment (zero flare in 2030).

Amnesty international (2009). Nigeria: petroleum, pollution and poverty in the Niger Delta. Amnesty International Publications International Secretariat, Peter Benson House, Easton, United Kingdom.

Bassey, N. (2016). To save a river: An environmental advocacy in Ogoni land. Akwa Ibom: Friends of the Earth Nigeria.

Blanco, A., Febre, D., Martin, J., & Magne, G. (2024). Rethinking the Role of Natural Gas to Accelerate Decarbonization in Latin America and the Caribbean.

Chijioke, O. B., Ebong, B. I. & Ufomba, H. (2018). The impact of oil exploration and environmental degredation in the Niger Delta region of Nigeria: A study of oil producing communities in Akwa Ibom State. *Global Journal of Human Social Science, Geo-Sciences, Environmental Disaster Management*, 18(3), 213-228.

Dappa, G. N., & Akujuru, V. A. (2023). Impact of Gas Flare on Human Life and Wellbeing of Ogba/Egbema/Ndoni Local Government Area of Rivers State. European Journal of Environment and Earth Sciences, 4(2), 32-35.

Dung, E. J., Bombom, L. S. & Agusomu, T. D. (2008). The effects of gas flaring on crops in the Niger Delta, Nigeria. *Geojournal*, 73(4), 29-38.

Egbewale, B. O. & Efe, F. M. (2019). Oil exploitation and social conflicts in the Niger Delta region of Nigeria. *African Journal of Political Science and International Relations*, 13(4), 59-66.

Emam, E. A. (2015). Gas flaring in industry: an overview. Petroleum &

coal, 57(5).
Esavwede, J. P., & Oyibodoro, U. G. (2025). Gas flaring in Nigeria's NIGER Delta: legal Challenges and lessons from Norway's regulatory framework. ISSN 2564-016X| 05 (01) April 2025 www. grassrootsjournals. org/jelp, 5, 01.
Eyisi, E. C., Agha, E. O., & Uzor, D. C. (2025). Environmental management and sustainable Development in Nigeria: challenges, policies and prospects. African Journal of Social and Behavioural Sciences, 15(3).
Federal Ministry of Petroleum Resources. (2017). National gas policy. Abuja: Federal government of Nigeria.
Gasu, M., Gasu, G., Olanrewaju, S., & Yakubu, S. (2022). International and national policy responses to combating global warming and climate change in Nigeria. Town and Regional Planning, 81, 113-123.
Gbadamosi, F., & Aldstadt, J. (2025). The interplay of oil exploitation, environmental degradation and health in the Niger Delta: A scoping review. Tropical Medicine & International Health.
Gbadamosi, F., & Aldstadt, J. (2025). The interplay of oil exploitation, environmental degradation and health in the Niger Delta: A scoping review. Tropical Medicine & International Health.
Gobo, A., Richard, G. & Ubong, I. U. (2009). Health impact of gas flares on Igwuruta/ Umuechem communities in Rivers State. *Journal of Applied Sciences and Environmental Management*, 13(3), 27-33.
Guerin, A., Ho, P., Najjar, N., & Schaufele, B. (2025). Lessons for Regulating Flaring and Venting: Results from Alberta, Canada. Canada (April 07, 2025).
Idoga, A., Dadan-Garba, A., Shuaibu, I., & Ganiyu, S. (2025). Assessment of the socioeconomic effects of illegal artisanal petroleum refineries on farmers in Gokana Local Government Area, Rivers State, Nigeria. Plasu Journal of EnvironmentaL Sciences, 1(1), 17-34.
Iyobhebhe, I., Agbesuyi, O. K., Abiodun, O., & Soneye, A. A. (2025). When oil becomes poison: the hidden health crisis in Nigeria's oil-producing regions. Journal of Economics and Allied Research (JEAR), 555.
Keme-Iderikumo, K., Augustus, E. A., & Raimi, M. O. (2024). Unveiling the impact: gas flaring on artisanal fisheries in Taylor creek, Bayelsa state, Nigeria. Int J Hydro, 8(6), 235-248.
Kiani, I., & Olisa, I. (2021). Environmental impact of gas flaring in parts of Rivers State, Nigeria. Faculty of Natural and Applied Sciences Journal of Scientific Innovations, 3(1), 44-49.
Kodiya, M. A., Modu, M. A., Ishaq, K., Yusuf, Z., Wakili, A. Z., Dayyabu, N., ... & Babangida, M. U. (2025). Environmental Pollution in Nigeria: Unlocking Integrated Strategies for Environmental Sustainability. African Journal of Environmental Sciences and Renewable Energy, 18(1), 30-50.
Liu, Y., Pu, Y., Hu, X., Dong, Y., Wu, W., Hu, C., & Wang, S. (2023). Global declines of offshore gas flaring inadequate to meet the 2030 goal. Nature Sustainability, 6(9), 1095-1102.
Lorenzato, G., Tordo, S., Van den Berg, B., & Howells, H. M. (2022). Financing solutions to reduce natural gas flaring and methane emissions. World Bank Publications.
Mmesomachukwu, C. U. P., & Uchechukwu, O. N. (2024). Improving Natural Gas Utilization in Nigeria: An Analysis of the Domestic Gas Industry From 2010-2022. In SPE Nigeria Annual International Conference and Exhibition (p. D021S010R001). SPE.
Mmesomachukwu, C. U. P., & Uchechukwu, O. N. (2024). Improving Natural Gas Utilization in Nigeria: An Analysis of the Domestic Gas Industry From 2010-2022. In SPE Nigeria Annual International Conference and Exhibition (p. D021S010R001). SPE.
Mohammed, J. I. (2022). An investigation into the effectiveness of the design and enforcement of Nigeria's anti-gas flaring law and policy regimes, and the considerations of measures that could improve environmental regulatory compliance (Doctoral dissertation).
Mohammed, J. I. (2022). An investigation into the effectiveness of the design and enforcement of Nigeria's anti-gas flaring law and policy regimes, and the considerations of measures that could improve environmental regulatory compliance (Doctoral dissertation).
NNPC. (2021). Annual Statistical Report 2020. Nigerian National Petroleum Corporation.
Nwoko, J. (2020). Environmental impacts of gas flaring on local communities in Nigeria. *Journal of Environmental Management*, 255: 109961.
Odugbesan, J. A. & Sani, I. (2018). Economic implications of gas flaring in Nigeria: A study of the Niger Delta Region. *Nigerian Journal of Economic and Social Studies*, 5(2), 115-129.
Oghenejabor, O. D., Itiowe, O. O., & Ehumadu, U. G. (2020). Assessment of Gas Flaring and Temperature Variability in the Niger Delta: A Case study of Delta State. International Journal of Innovative Science and Research Technology, 5(1), 1023-1027.
Ogunleye, O. J., Bassey, N. E. & Akinola, A. O. (2018). Health impacts of gas flaring in the Niger Delta Region of Nigeria: A review. *Environmental Monitoring and Assessment*, 190(8), 484.
Ojobah, C. (2025). Comparative Analysis of Human-Perception and Empiricism of Gas Flaring Activities on Health Hazards of Residents in FCE (T) Omoku, Rivers State.
Olabode, O. O., Udom, I. E. & Akpomuje, A. I. (2020). Advances in gas utilization technologies: Opportunities and challenges. *Energy Reports*, 6: 267-273.
Olaleye, S. A., Isibor, P. O., Agbontaen, D. O., Imoobe, T. O., & Kayode-Edwards, I. I. (2024). Impacts of Oil and Gas Exploration. In Arctic Marine Ecotoxicology (pp. 195-209). Springer, Cham.
Omobolanle, O. C., & Ikiensikimama, S. S. (2024). Gas flaring: Technicalities, challenges, and the economic potentials. Environmental Science and Pollution Research, 31(28), 40838-40850.
Omobolanle, O. C., & Ikiensikimama, S. S. (2024). Gas flaring: Technicalities, challenges, and the economic potentials. Environmental Science and Pollution Research, 31(28), 40838-40850.
Onwuka, N. A., Imananagha-amene, B., Lemii, B. C., Onwuka, K. S., & Nwankpa, N. N. (2025). Evaluation of Haematological and Cytokine Indices of Humans in a Gas Flare-Impacted Community. American Journal of Environment Studies, 8(1), 21-39.
Onyekachi, O. (2019). The role of social movements in environmental justice: A case study of Ogoniland. *African Journal of Environmental Science and Technology*, 13(10), 317-329.
Osagie, E. O. & Ugbede, E. O. (2020). Corporate social responsibility and community development: A study of oil companies in Nigeria. *Journal of Business Ethics*, 162(3), 651-664.
Otasowie, I. I., Pasupuleti, V., & Adeoye, A. A. (2024). Greenhouse gas emissions and the challenges of environmental sustainability: Leveraging AI technologies for lasting solution. African Journal of Environmental Sciences and Renewable Energy, 16(1), 99-116.
Oyewunmi, T. (2023). Transnational Approaches to Controlling Methane Emissions from Oil and Gas Operations (Chapter 13). Reducing Emissions of Short-Lived Climate Pollutants: Perspectives on Law and Governance (Brill, 2023) pp, 364-391.
PPRA. (2020). The Nigerian oil and gas industry: A review of the current state. Petroleum Products Pricing Regulatory Agency.
Ray, S., Shaju, S. T., & Jangid, C. (2025). Petroleum and oil industries. In Green Chemistry (pp. 293-327). Elsevier.
Romsom, E., & McPhail, K. (2021). Capturing economic and social value from hydrocarbon gas flaring and venting: solutions and actions (No. 2021/6). WIDER Working Paper.
Safarzadeh, S., & Jafari, H. (2025). On the application of multi-criteria decision-making methods in environmental pollution management: a comprehensive systematic review. Environment, Development and Sustainability, 1-48.
Sukmasari, L. R., & Nugroho, G. (2025). Analysis and Optimization of Carbon Reduction Measures in the Oil and Gas Sector: Multi-Criteria Decision Making for Carbon Mitigation. In Journal of Physics: Conference Series (Vol. 2973, No. 1, p. 012003). IOP Publishing.
Tavella, R. A., da Silva Júnior, F. M. R., Santos, M. A., Miraglia, S. G. E. K., & Pereira Filho, R. D. (2025). A Review of Air Pollution from Petroleum Refining and Petrochemical Industrial Complexes: Sources, Key Pollutants, Health Impacts, and Challenges. ChemEngineering, 9(1), 13.
Thompson, O., Ajewole, O., Jinadu, B. J., Awange, P. D., & Oladotun, E. O. A. S. O. (2024). 'WHEN we notice these, calamity is coming: soot, maternal healthcare and the challenges of sustainable development goals in Nigeria's Niger-Delta. JASSD-Journal of African Studies and Sustainable Development, 7(5).
Ubani, E. C. & Onyejekwe, I. M. (2013). Environmental impact analysis of gas flaring in the Niger Delta region of Nigeria. *American Journal of Scientific and Industrial Research*, 4(2), 246-252
Ubodiom, E., & Ariye, E. C. (2025). The effect of oil and Gas Exploration on Youth Development in Yenegoa Metropolis.
Udok, U. & Akpan, E. B. (2017). Gas flaring in Nigeria: Problems and prospects. *Global Journal of Politics and Law Research*, 5(1), 16-28.
Udok, U., & Akpan, E. B. (2017). Gas flaring in Nigeria: Problems and prospects. Global Journal of Politics and Law Research, 5(1), 16-28.
Usabulu, D. C. et al. (2023). Flare site profiling in Niger Delta

communities. Nigerian Environmental Survey Reports, 15(4), 110-128.
Usiabulu, G. I., Amadi, A. H., Adebisi, O., Ifedili, U. D., Ajayi, K. E., & Moses, P. R. (2023). Gas flaring, and its environmental impact in Ekpan Community, Delta State, Nigeria. American Journal of Science, Engineering and Technology, 8(1), 42-53.
Wami-Amadi, C. F. (2025). The Impact of Air Borne Toxins from Gas Flaring on Cardiopulmonary and Other Systemic Functions. Sch Int J Anat Physiol, 8(1), 12-28.
WHO. (2021). Air quality and health. World Health Organization. Retrieved from (WHO website) (https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health).
World Bank. (2021). Global gas flaring reduction partnership. Washington, DC: The World Bank Group.
Yakubu, O. (2017). Addressing environmental health problems in Ogoniland through implementation of United Nation environment programme Recommendation. *Environments,* 4(2), 28-39.