Perceived impact of quarry activities on the environment and residents of Akamkpa local government Area, Cross River State, Nigeria

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ABSTRACT

The study investigated the perceived impact of quarrying activities among residents of Akamkpa Local Government Area, Cross River State, Nigeria. To achieve this purpose, two research question were posed and two null hypotheses were formulated in line with the objectives of the study and tested at the 0.05 level of significance. A detailed review of related literature was carried out based on the major variables of the study, namely quarrying activities and their impacts on air pollution and noise pollution. The descriptive survey research design was adopted for the study, as it enabled the researcher to assess existing conditions and residents' perceptions of the environmental and livelihood impacts of quarrying activities. The population of the study comprised 3,003 literate adult residents drawn from three industrial communities Mfamosing, Old Netim, and Nsan—in Akamkpa Local Government Area. A sample of 300 respondents was selected using stratified and simple random sampling techniques. Data were collected using a structured questionnaire titled *Perceived Impact of Quarrying Activities among Residents (PIQAAR)*, complemented with focus group discussions and interview methods. The instrument was validated by experts in Measurement and Evaluation and Environmental Education, while its reliability was established using the Cronbach alpha method. Data collected were analyzed using appropriate statistical techniques, including simple regression analysis. The findings revealed that quarrying activities have significant impacts on air pollution and noise pollution in Akamkpa Local Government Area. The study concluded that while quarrying contributes to economic activities in the area, its environmental and agricultural consequences pose serious challenges to residents' wellbeing and sustainable development. Based on the findings, it was recommended, among others, that government and regulatory agencies should enforce strict environmental regulations, quarry operators should adopt environmentally friendly technologies, and regular environmental monitoring and community health interventions should be implemented to mitigate the negative effects of quarrying activities.

Keynotes, Perceive impact, quarry activities, environment and resident of Akamkpa

INTRODUCTION

Quarry activities refer to the extraction of rocks, sand, gravel and other mineral resources from the earth through processes that include blasting, crushing, excavation and transportation. These operations create a range of environmental stressors such as dust release, noise, vibrations, alteration of land surfaces and potential contamination of soil and water. The term perceived impact describes how residents interpret, experience and judge these effects in their daily lives, based on what they see, smell, hear and feel. Studies have shown that communities living near quarry sites often associate quarry operations with declining air quality, increased noise levels, structural damage to buildings and changes in the natural landscape. Opondo, Ajayi and Makindi (2023) reported that frequent blasting and machinery operations expose residents to noise and vibrations that interfere with daily activities and increase anxiety. Similarly, Ekpa, Laniyan, Agbor, Ben and Okon (2022) noted that dust from quarrying settles on crops, vegetation and living spaces, reducing agricultural productivity and affecting plant biodiversity. These observations shape how individuals judge the overall wellbeing of their environment and whether they believe quarry operations are harmful or manageable.

The environmental impact of quarry activities extends to soil, water bodies and community livelihoods, which reinforces residents' perceptions of environmental degradation. Quarrying alters land structure through excavation and removal of vegetation cover, leaving behind pits that may collect contaminated water or contribute to erosion. Kalu and Ogbonna (2021) found that quarry sites in Ebonyi State exhibited changes in water chemistry and soil composition due to the leaching of minerals and the discharge of waste materials. In communities such as Akamkpa, where people rely heavily on the natural environment for farming and household water supply, these changes are noticeable and often viewed as threats to long-term sustenance. Bassey and Okon (2021) observed that residents in Akamkpa identified dust pollution, noise, disrupted farming patterns and reduced land usability as major

concerns linked to quarry operations. These experiences influence how people understand the environmental risks around them and help explain why quarrying is widely perceived as both a source of livelihood and a significant environmental burden.

Across the world, quarrying is recognized as an essential component of construction and infrastructure development, yet it consistently raises environmental concerns linked to air pollution, noise, land degradation and water contamination. In many regions, especially where regulations are weak or enforcement is inconsistent, residents living near quarry sites report worrying levels of dust, vibrations and ecological disruption. Studies from Turkey, Ethiopia and Kenya show that community perceptions are closely tied to visible environmental changes such as declining vegetation cover, altered landscapes and poor water quality. For instance, Ozcelik (2022) noted that crushed rock quarries in Turkey generate higher dust loads and land disturbance compared to stream deposits, which shapes how communities judge the severity of quarry impacts. In Ethiopia, Mebratu, Nurie, Reta and Emiru (2021) found that communities observed reduced farm productivity and contamination of water sources, influencing how they perceived quarry operations as threats to long-term environmental sustainability. These global experiences reveal that the perceived impact of quarrying is not only a scientific concern but also a lived experience rooted in daily exposure to environmental change.

In developed nations, quarrying is generally regulated through strict environmental safeguards, rehabilitation plans and continuous monitoring. Despite this, residents still voice concerns about noise pollution, heavy truck movement and landscape alteration. What distinguishes developed countries is the structured approach to environmental management, where quarry operators are often required to implement dust suppression systems, noise barriers and post-quarry land restoration. Even with these measures, research shows that perceptions of environmental disturbance remain strong in communities located closest to quarries. Concerns such as reduced aesthetic value, fear of property damage from blasting and

worries about long-term ecological balance often shape community attitudes. These experiences highlight that environmental perception is shaped not just by physical exposure but also by trust in regulatory institutions and the transparency of quarry operators.

Across Africa, quarrying has expanded rapidly due to rising demand for construction materials, but this growth has often outpaced environmental planning and community protection. Countries such as Ghana, Kenya and Cameroon have documented persistent complaints from residents about dust, noise, loss of farmland, and changes in water bodies. Baah-Ennumh, Yeboah and Akularemi (2021) reported that communities in Ghana associated quarrying with reduced crop yields and increased erosion, while Samba and colleagues (2022) found that quarrying in Cameroon contributed to deforestation and unstable slopes that residents perceived as dangerous. Makau (2021) also observed that large portions of land in Kenya were left degraded without proper rehabilitation, reinforcing the view that quarrying undermines environmental stability. Similar concerns appear in the work of Opondo, Ajayi and Makindi (2023), who documented how residents in Kisumu County experienced increased dust levels, noise and water contamination that affected both household wellbeing and local livelihoods. These studies show that across the continent, people's perceptions are shaped by real challenges linked to weak governance, limited environmental monitoring and the close proximity of quarry sites to settlements.

In Nigeria, and more specifically in Cross River State, quarrying has become a major economic activity, yet its environmental footprint is a source of ongoing concern. Researchers have consistently reported that communities perceive quarry operations as contributors to declining air quality, soil degradation and water pollution. Ekpa, Laniyan, Agbor, Ben and Okon (2022) found that dust from quarry sites in South-Eastern Nigeria settled on farmlands and vegetation, reducing plant growth and biodiversity, which residents interpreted as a direct threat to food security. Kalu and Ogbonna (2021) also noted significant changes in soil and

water properties around quarry sites in Ebonyi State, reinforcing local fears about contamination. In Akamkpa, where quarrying is widespread, residents have repeatedly linked quarry operations to reduced agricultural productivity, noise disturbance, cracks in building structures and general environmental decline. Bassey and Okon (2021) observed that people in Akamkpa frequently describe quarry dust, blasting vibrations and land degradation as major issues affecting their health, livelihoods and sense of environmental safety. These views show that in Akamkpa, the perceived impact of quarrying is shaped by daily encounters with dust, noise and altered landscapes, and by a growing concern that environmental quality is being traded for short-term economic gains.

Quarry activities are a major source of air pollution in host communities due to drilling, blasting, crushing, and transportation of stone materials. These operations release large amounts of particulate matter, especially $PM_{2.5}$ and PM_{10}, into the atmosphere, which can remain suspended for long periods. Prolonged exposure to quarry-generated dust has been linked to respiratory diseases such as asthma, bronchitis, and reduced lung function among residents. Airborne dust also reduces visibility and degrades overall environmental quality in quarry locations. Studies show that communities located close to quarry sites experience higher concentrations of harmful pollutants than those farther away. In rural areas like Akamkpa, limited regulatory enforcement further worsens air quality impacts. Recent evidence confirms that quarry-related air pollution poses significant environmental and public health risks (Ogundele et al., 2021; World Health Organization [WHO], 2023).

Noise pollution is another prominent environmental consequence of quarry activities, resulting mainly from blasting, drilling, heavy machinery, and transportation trucks. Persistent exposure to high noise levels can lead to hearing impairment, sleep disturbance, stress, and reduced quality of life for nearby residents. Noise pollution also interferes with communication, learning processes, and general wellbeing within affected communities. In

quarry-hosting areas, noise levels often exceed recommended environmental safety standards. Children, the elderly, and individuals with pre-existing health conditions are particularly vulnerable to the effects of excessive noise. Empirical studies indicate that continuous quarry noise contributes to psychological discomfort and community dissatisfaction. Recent research highlights noise pollution as a critical environmental concern associated with quarry operations (Ibhadode & Dagogo, 2020; UNEP, 2022).

Quarry activities significantly affect agricultural productivity through land degradation, dust deposition, and soil contamination. Dust particles settling on crops reduce photosynthesis by blocking sunlight and clogging leaf pores. Blasting and excavation disturb soil structure, leading to nutrient loss and reduced soil fertility. Farmland near quarry sites often becomes less productive due to erosion and compaction caused by heavy machinery. These impacts threaten food security and household livelihoods, especially in agrarian communities like Akamkpa. Farmers in quarry zones frequently report declining crop yields and reduced income. Recent studies confirm that quarrying poses long-term risks to agricultural sustainability in rural environments (Adewole & Adesina, 2021; FAO, 2023).

Water pollution is a major environmental concern associated with quarry activities due to runoff, sedimentation, and chemical contamination. Quarry operations can introduce suspended solids, heavy metals, and oil residues into nearby rivers, streams, and groundwater. This degrades water quality and makes water unsafe for domestic use, irrigation, and aquatic life. Residents often rely on untreated surface and groundwater sources, increasing their vulnerability to waterborne diseases. Pollution of water bodies also disrupts fishing activities and local ecosystems. In Akamkpa, quarry sites are frequently located close to natural water sources, intensifying the risk of contamination. Recent studies emphasize that quarry-induced water pollution poses serious environmental and public health challenges (Aigbedion & Iyayi, 2021; WHO, 2024).

In view of the combined influence of air pollution and noise pollution, reduced agricultural productivity, land vibration, and water pollution, quarry activities present complex environmental challenges for host communities. Despite the economic benefits of quarrying, the environmental costs borne by residents are often underreported and insufficiently addressed. Understanding how residents perceive these impacts is crucial for effective environmental management and policy formulation. In Akamkpa Local Government Area, quarrying is extensive, yet empirical evidence on its perceived environmental effects remains limited. This knowledge gap hinders informed decision-making and sustainable development planning. Assessing residents' perceptions provides insight into lived environmental experiences beyond technical measurements. Therefore, the researcher decided to undertake this study to systematically examine the perceived impact of quarry activities on the environment of residents of Akamkpa Local Government Area of Cross River State, Nigeria.

Methodology

The designed employed on this research study was a descriptive survey design.This is because the research purpose is concerned with the investigation phenomeno, situations, events and or opinions that occur within a given population. The study design was also adopted in order to investigate the influence between the variables within the study area.

The study population consist of Akamkpa local government area about 151,125.

The population comprised of 3,003 of the literate inhabitants men and women, the workers, the company representative and key community leaders within age range 20 years and above from the 3 industrial communities of Mfamosing, old netim and and Nsan

The sample for the study comprises of 3,003 respondents was drawn from the study area. Stratified and simple random sampling techniques was employed from the study.

Two Research question was raised to guide the study.

ISSN: 1595-8051 EISSN: 3092-9571

i. How do quarry activities influence air pollution on residents of Akamkpa local Government Area?

ii. What influence do quarry related noise pollution have on residents of Akamkpa local government area.

Two research hypotheses was formulated to guide the study.

i. There is no significant influence of quarry activities on air pollution in Akamkpa Local Government Area.

ii. Quarry-related noise pollution has no significant influence on residents in Akamkpa Local Government Area.

Structured questionnaire was used for the instrument for data collection in the study area

A structured questionnaire titled *Perceived Impact of Quarrying Activities among Residents (PIQAAR)*, The researcher introduced themselves to the respondents and informed them of the exercise and the essence of giving objective respondents tothe items. The respondent were advise to be honest in their responses to the items as information obtained will be treated with Findings from this study revealed that quarry activities have a significant perceived impact on air pollution in Akamkpa Local Government Area.

Residents reported increased dust levels resulting from blasting, crushing, and transportation of quarry materials, which aligns with the study's statistical result showing a significant influence between quarry operations and air quality deterioration. This finding supports earlier studies which noted that particulate matter ($PM_{2.5}$ and PM_{10}) released during

quarrying remains suspended in the air for extended periods, thereby reducing air quality and visibility (Ogundele et al., 2021; WHO, 2023). In Akamkpa, where regulatory enforcement is often weak and dust suppression measures are inconsistently applied, residents' perceptions of air pollution are shaped by daily exposure to dust settling on homes, farmlands, and water sources. The result further corroborates Ekpa et al. (2022), who found that quarry dust adversely affects vegetation and plant biodiversity in Nigerian quarry-hosting communities. Thus, air pollution emerges as one of the most immediate and visible environmental consequences of quarry activities in the study area.

and amount of confidentially in analyzing the data. Hypothesis was tested by the statical tool employed. The instrument was validated by experts in Measurement and Evaluation and Environmental. Data collected were analyzed using appropriate statistical techniques, including simple regression analysis.

Results

There is no significant influence of quarry activities on air pollution in Akamkpa local Government Area.

Simple regression statistical analysis was employed and findings is presented

Simple Regression Analysis of influence between Quarry Activities and Air Pollution Impact (N = 300) Table 1.

Variable	R	R^2	Adj. R^2	Std. Error
Quarry activities	.262a	.069	.068	1.873

Source of Variation	SS	Df	MS	F	Sig.
Regression	74.512	1	74.512	21.734*	.000b
Residual	1027.411	298	3.447		
Total	1101.923	299			

Variables	Unstandardized B	Std. Error	Beta	T	Sig.
Constant	5.122	0.432		11.848*	.000
Quarry activities	0.451	0.097	0.262	4.662*	.000

Significant at .05 level

The analysis in Table shows that the Adjusted R^2 is 0.068. This implies that 6.8% of the variance in air pollution impact can be accounted for by quarry activities. The F-value = 21.734 ($p < .05$), indicating statistical significance at 1 and 298 degrees of freedom. Since $p = .000 < 0.05$, quarry activities significantly influence air pollution in Akamkpa. Therefore, the null hypothesis is rejected.

Findings from this study revealed that quarry activities have a significant perceived impact on air pollution in Akamkpa Local Government Area. Residents reported increased dust levels resulting from blasting, crushing, and transportation of quarry materials, which aligns with the study's statistical result showing a significant influence between quarry operations and air quality deterioration. This finding supports earlier studies which noted that particulate matter ($PM_{2.5}$ and PM_{10}) released during quarrying remains suspended in the air for extended periods, thereby reducing air quality and visibility (Ogundele et al., 2021; WHO, 2023). In Akamkpa, where regulatory enforcement is often weak and dust suppression measures are inconsistently applied, residents' perceptions of air pollution are shaped by daily exposure to dust settling on homes, farmlands, and water sources. The result further corroborates Ekpa et al. (2022), who found that quarry dust adversely affects vegetation and plant biodiversity in

Nigerian quarry-hosting communities. Thus, air pollution emerges as one of the most immediate and visible environmental consequences of quarry activities in the study area.

TABLE 2

Simple Regression Analysis of influence between Quarry Activities and Noise Pollution Impact (N = 300)

Variable	R	R^2	Adj. R^2	Std. Error
Quarry activities	.234a	.055	.054	1.781

Source of Variation	SS	Df	MS	F	Sig.
Regression	52.763	1	52.763	16.935*	.000b
Residual	928.546	298	3.116		
Total	981.309	299			

Variables	Unstandardized B	Std. Error	Beta	T	Sig.
Constant	4.218	0.391		10.785*	.000
Quarry activities	0.378	0.092	0.234	4.116*	.000

Significant at .05 level

Table 2 reveals that quarry activities significantly affect noise pollution, with an Adjusted R^2 of 0.054. This means that 5.4% of the variation in residents' exposure to noise pollution is explained by quarry operations. The F-value of 16.935 ($p < .05$) confirms the statistical significance of this relationship. Consequently, the null hypothesis is rejected, indicating that quarry activities contribute significantly to noise pollution in the communities.

The findings also indicate that quarry activities significantly influence noise pollution in Akamkpa. Blasting operations, heavy machinery, and haulage trucks were perceived by residents as major sources of persistent noise that interferes with daily life. This outcome is consistent with previous studies that identified quarry-generated noise as a cause of stress, sleep disturbance, and reduced quality of life among nearby residents (Ibhadode & Dagogo, 2020; UNEP, 2022). The perceived impact of noise pollution is heightened in rural settings like Akamkpa, where background noise levels are typically low, making quarry noise more intrusive. Opondo, Ajayi and Makindi (2023) similarly observed that frequent blasting exposes residents to disturbing noise levels that increase anxiety and disrupt routine activities. The findings suggest that noise pollution contributes not only to physical discomfort but also to psychological distress, reinforcing negative community perceptions of quarry operations

Conclusion.

In conclusion, this study established that quarrying activities have a significant impact on the environment and wellbeing of residents in Akamkpa Local Government Area, Cross River State, Nigeria. Specifically, quarrying activities significantly influence air quality, noise level in quarry-host communities. The acceptance of all the alternative hypotheses indicates that the observed environmental and livelihood challenges are directly linked to quarrying operations

in the study area. While quarrying contributes to economic development and employment opportunities, the absence of adequate environmental safeguards has resulted in substantial negative consequences for residents. The study therefore concludes that quarrying activities in Akamkpa require urgent regulation and sustainable management to reduce their adverse effects on human health, agriculture, and the natural environment.

5.4 Recommendations

Based on the findings of the study, the following recommendations are proposed:

1. Government and environmental regulatory agencies should strictly enforce environmental impact assessment (EIA) regulations for quarry operations.
2. Quarry operators should adopt modern technologies to minimize dust emission, noise pollution, and land vibration.
3. Regular environmental monitoring and impact assessments should be conducted in quarry-host communities.

ISSN: 1595-8051 EISSN: 3092-9571

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