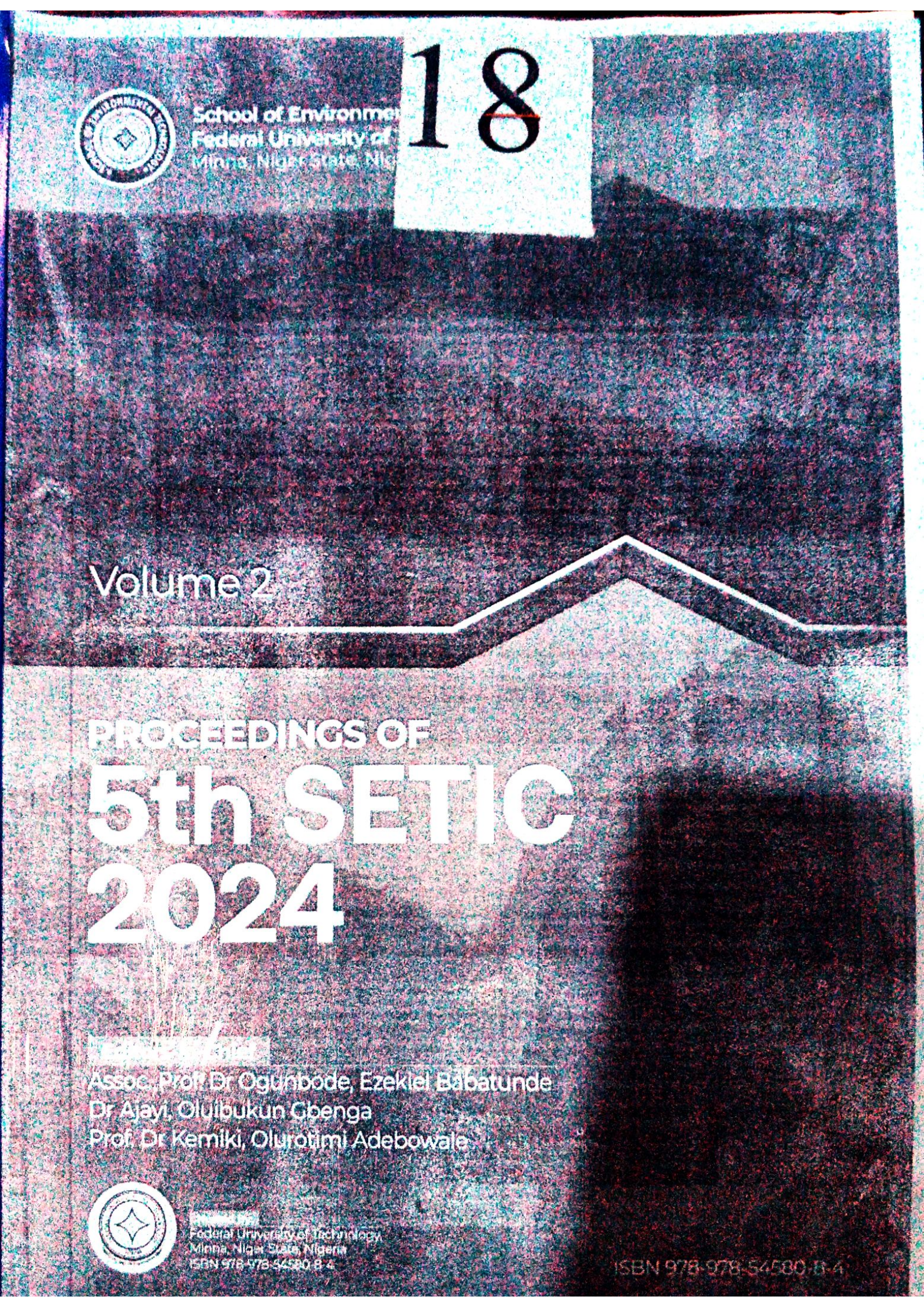

18
School of Environme
Federal University of
Minna, Niger State, Nig
Volume 2
PROCEEDINGS OF
5th SETIC
2024
Assoc. Prof. Dr Ogunbode, Ezekiel Babatunde
Dr Ajayi, Oluibukun Gbenga
Prof. Dr Kemiki, Olurotimi Adebowale
Federal University of Technology
Minna, Niger State, Nigeria
ISBN 978-978-54580-8-4
ISBN 978-978-54580-8-4

Proceedings of SCHOOL OF ENVIRONMENTAL TECHNOLOGY INTERNATIONAL CONFERENCE 2024 (SETIC 2024)

22nd – 24th October, 2024

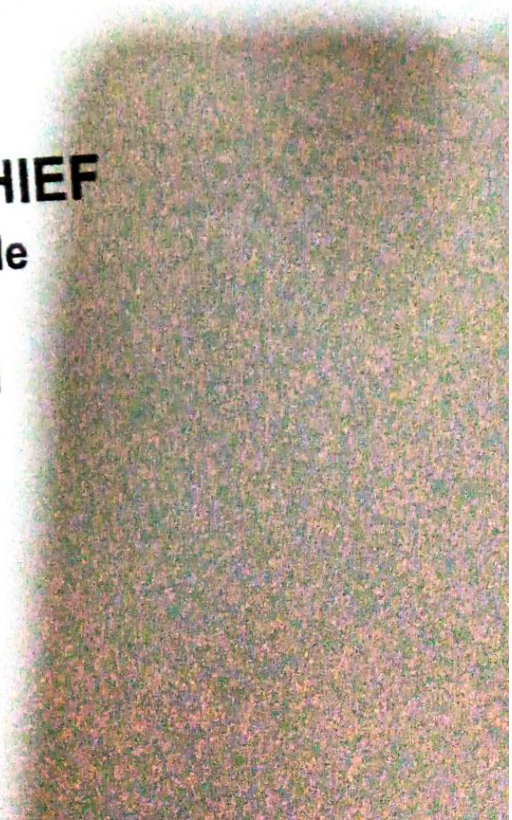
Federal University of Technology, Minna, Niger State, Nigeria

EDITORS IN CHIEF

E. B. Ogunbode

O. G. Ajayi

O. A. Kemiki



School of Environmental Technology
International Conference Proceedings

Received: 29 May 2024; Accepted: 14 October 2024; Available online: 29 November 2024

ISBN: 978-978-54580-8-4
Volume 2 proceedings

Assessing the Environmental Effect of Informal Sand Mining on Artisanal Miners' Livelihood in Amac (Abuja Municipal Area Council), F.C.T, Abuja, Nigeria.

David O. Damola, Valda I. Martins, Daniel.T. Salami*

Department of Urban and Regional Planning, Federal University of Technology, Minna Niger State.
damoladehinde@gmail.com

Abstract

Sand mining is a global practice driven by the increasing need for building materials to support rapid urbanization and infrastructure development. This demand has led to both formal and informal mining operations worldwide. Informal sand mining, often referred to as artisanal or small-scale mining, is prevalent in many developing countries, providing employment and income opportunities for local communities. This study aimed at assessing the environmental effects of mining activities on the livelihoods of artisanal miners in AMAC, Abuja through identifying the types of informal sand mining activities in AMAC, Abuja and assessing the environmental impact of informal sand mining on the artisanal miners' livelihood activities. A quantitative approach was employed with stratified random sampling, using structured questionnaires. The sample size was determined using the Krejcie & Morgan (1970) formula, yielding a sample size of 384 to ensure a representative sample of artisanal sand miners. Data analysis involved were descriptive statistics and Chi-Square analysis representative sample of artisanal sand miners selected. None of the distributed questionnaires were returned, resulting in a 0% return rate. The questionnaire covered components such as demographic information, types of mining activities, locations of sand mining sites, methods and techniques used environmental impacts, perception of environmental impact on livelihood, environmental impacts reported by miners on livelihood and awareness of impact. Data analysis involved were descriptive statistics and correlation analysis using SPSS software which reveals significant environmental impacts such as land degradation, water pollution, and habitat destruction. The most common mining activities were surface mining, with manual extraction being the predominant technique. Miners reported high severity of environmental impacts on their livelihoods, with awareness levels closely linked to educational attainment. The recommendations are the need for enhanced awareness, education, and stricter enforcement of environmental regulations to promote sustainable mining practices collaborative approach involving all stakeholders to develop sustainable mining practices and implementing an integrated environmental assessment, management, and monitoring program for sand extraction operations. An integrated approach involving all stakeholders is essential to balance the economic benefits of sand mining with environmental sustainability, thereby promoting sustainability in AMAC.

Keywords: Artisanal, Effect, Environmental, Impact, Informal, Miners, Mining, Sand

1. Introduction

Sand mining is a global practice driven by the increasing need for building materials to support rapid urbanization and infrastructure development. This demand has led to both formal and informal mining operations worldwide (Peduzzi, 2014; Torres *et al.*, 2017). Informal sand mining, often referred to as artisanal or small-scale mining, is prevalent in many developing countries, providing employment and income opportunities for local communities (Koehnken and Rintoul, 2018).

In Nigeria, the construction sector's growth, fueled by urbanization, population increase, and infrastructure development, has led to a significant rise in demand for sand, a crucial component in concrete and other construction materials. This surge has resulted in the proliferation of informal sand mining activities across the country, including the Federal Capital Territory (FCT), Abuja (Nwakwoala and Ike, 2020).

Informal sand mining is a widespread practice across many developing countries, driven by the increasing demand for construction materials and the lack of alternative livelihood opportunities (UNEP, 2019). Informal sand mining in Abuja Municipal Area Council (AMAC) is driven by rapid urbanization and construction boom, leading to the extraction of sand from rivers, beaches, or other natural sources without proper regulation or oversight (Koehnken and Rintoul, 2018). These activities can have significant adverse environmental effects, including land degradation, water pollution, and habitat destruction (UNEP, 2019).

Understanding the environmental impacts of informal sand mining on the livelihood of artisanal miners in AMAC is crucial. These insights can inform policies and interventions aimed at improving their livelihoods while promoting sustainable mining practices (Koehnken and Rintoul, 2018). Evaluating the environmental impacts of informal sand mining can help identify areas where mitigation measures are needed to prevent further degradation and protect the natural resources upon which the livelihoods of artisanal miners depend (UNEP, 2019).

Evaluating the environmental impacts of informal sand mining can help identify areas where mitigation measures are needed to prevent further degradation and protect the natural resources upon which the livelihoods of artisanal miners depend (UNEP, 2019).

Informal sand mining activities often involve the use of heavy machinery and equipment, which can contribute to air and noise pollution, further exacerbating the environmental impact (UNEP, 2019). The unregulated nature of these activities also raises concerns about the potential for occupational hazards and the exploitation of artisanal miners (Koehnken and Rintoul, 2018).

2. Literature Review

Informal sand mining refers to the extraction of sand outside the legal and regulatory framework. It is often small-scale, using simple tools and techniques, and typically lacks environmental protection measures (Hilson and Maconachie 2020). This practice is common in developing countries where the demand for sand is high due to rapid urbanization, yet governance is weak, and economic opportunities are limited (Mngeni 2014). Poverty, unemployment, and a lack of alternative economic options drive people into informal mining, even though the environmental and health risks are considerable (Hilson and Garforth 2012).

Though it provides crucial income for many, it leads to severe environmental degradation, including land erosion, habitat destruction, and water resource depletion. Sand extraction alters river morphology, increases turbidity, and lowers groundwater levels, while also contributing to biodiversity loss and pollution (Adedeji *et al.* 2018).

The environmental impacts of informal sand mining are extensive. Land degradation is a major consequence, as sand extraction drastically alters the local landscape and soil composition, leaving areas prone to erosion and vulnerable to natural disasters like landslides and flooding (Adedeji *et al.* 2018). The removal of vegetation further exacerbates soil erosion, disrupts habitats, reduces biodiversity, and accelerates shoreline erosion in coastal areas, endangering infrastructure and ecosystems (Musah and Barkarson 2019). Informal sand mining also negatively affects water resources, particularly in riverbeds and floodplains. Sand extraction alters river morphology, increases riverbank erosion, and changes sediment transport patterns (Padmalal and Maya 2014). The increased turbidity from mining activities harms aquatic ecosystems and degrades water quality for human consumption and agriculture (Ololade and Annegarn 2021). Additionally, over-extraction lowers groundwater levels, reducing water availability and, in coastal regions, risking saltwater intrusion into freshwater aquifers (Jonah *et al.* 2015).

Economically, informal sand mining accounts for a significant portion of household incomes in regions like Nigeria and Ghana (Akande and Idris 2021). However, miners face health risks, economic insecurity, and environmental degradation, which jeopardizes the long-term sustainability of mining as a livelihood (Hilson and Maconachie 2020).

Sustainability in informal sand mining involves balancing the immediate economic needs of communities with long-term environmental protection and resource conservation.

Environmental sustainability requires resource conservation to prevent over-exploitation and ecosystem protection to minimize the impact on aquatic habitats and riparian zones (Padmalal and Maya 2014). Post-mining land rehabilitation, such as re-vegetation and slope stabilization, can help restore ecosystems (Mngeni 2020). Economic sustainability involves stabilizing incomes, promoting value-added activities, and encouraging alternative livelihoods (Hilson and Maconachie 2020). Social sustainability focuses on community engagement, gender equity, and improving occupational health and safety (Lahiri-Dutt 2020).

The Sustainable Livelihoods Approach (SLA) and Political Ecology Theory are needed to understand informal sand mining's environmental and socioeconomic impacts. The SLA views livelihoods as a combination of capabilities, assets, and activities necessary for living. It emphasizes human, social, natural, physical, and financial capital as key components in shaping livelihood outcomes (Scoones 1998). This framework helps explain how artisanal miners utilize these different forms of capital, such as social networks and skills, to sustain their livelihoods through sand mining (Hilson and Maconachie 2011). However, critiques of SLA have called for a stronger focus on power dynamics and long-term environmental sustainability (Scoones 2009).

Political Ecology Theory examines how power, politics, and broader socio-political factors influence human-environment interactions, particularly in natural resource extraction (Robbins 2012). This approach is valuable in understanding how access to resources like sand is shaped by power relations, how environmental narratives are constructed, and how local and global forces interact to shape sand mining practices (Peluso and Ribot 2020).

Combining the SLA and Political Ecology

Nigeria, and Ghana to illustrate the diverse challenges and impacts of informal sand mining. In Nigeria, informal sand mining in Lagos and Enugu States is driven by urbanization and construction demands, leading to severe environmental degradation, including coastal erosion and water pollution (Adedeji and Ademiluyi 2019). Similarly, in Ghana, sand mining along the Volta River has caused substantial riverbank erosion, threatening local communities and agricultural land (Mensah 2018).

Weak enforcement of mining regulations exacerbates the environmental and social impacts of informal sand mining. In Nigeria, the Nigerian Minerals and Mining Act of 2007 provides a legal framework for resource extraction, but enforcement is hindered by corruption, limited resources, and the dispersed nature of small-scale operations (Oladipo et al. 2020). International best practices from countries like Malaysia and India, where technology such as drones is used to monitor illegal mining, offer potential solutions to improve governance in Nigeria (Ying *et al.* 2021). To promote sustainable practices, recommendations include formalizing mining operations, enhancing monitoring and enforcement, promoting alternative livelihoods, and involving communities in resource management. These steps can help balance economic development with environmental conservation (Hilson and Maconachie 2020; Akinyemi *et al.* 2021).

3. Methodology

This study employed a research design to comprehensively assess the environmental effects of informal sand mining on the livelihood of artisanal miners in Abuja Municipal Area Council (AMAC), Abuja. The approach involved in collecting and analysing the quantitative data, provides a holistic understanding of the research objectives.

3.1 Data Collection

Quantitative Data: A structured questionnaire was administered to a representative sample of artisanal sand miners. Stratified random sampling was employed to ensure diverse representation across different mining sites. The survey included closed-ended questions was employed to determine the types of informal sand mining activities in the study area and environmental effects on livelihood activities, the use of Likert scales was used to measure perceptions and awareness regarding the environmental effects of sand mining and its impact on their livelihood activities.

3.2 Data Analysis

Quantitative data were analysed using statistical software (e.g., SPSS), employing descriptive statistics and Chi-Square analysis to summarize the data and inferential statistics to examine relationships between variables.

3.3 Sample Size

To determine the sample size for this study, the following formula was used (Krejcie and Morgan, 1970):

$$S = X^2NP(1 - P) \div d^2(N - 1 + X^2P(1 - P) \quad (1)$$

Where:

- S represents the sample size,
- X^2 represents the critical value from the chi-square distribution for the desired confidence level,
- N represents the population size,
- P represents the estimated proportion of the population,
- d represents the desired margin of error.

The sample size for the study was calculated using the Krejcie and Morgan (1970) formula i.e Eq(1). With a population of 1,967,500 for AMAC, a 95% confidence level (X^2 = 1.96), a 5% margin of error (d = 0.05), and assuming a population proportion (P) of 50%, the required sample size was approximately 384 respondents.

3.4 Sample Frame

The sampling frame will comprise a number of categories, including people of AMAC, a list of locations known to be used for sand mining, and artisanal miners working within AMAC. In order to find and incorporate any previously undiscovered sand mining sites and artisanal miners in the sample frame, field observation exercises were also carried out. To attain representative and trustworthy results, it was essential to make sure the sample frame was large and current. A thorough evaluation of the research objectives required an understanding of the traits and viewpoints of the artisanal sand miners.