

Effects of Artisanal Mining on the Built Environment in Selected Communities in Plateau State, Nigeria

Manbyen Nanven Rintip¹, Wuyep Solomon Zitta² Mark Yohanna Davou³

¹Building Department, Plateau State University, Bokokos

²Department of Geography, Plateau State University, Bokokos

³Architecture Department, Plateau State University, Bokokos

Corresponding author: e-mail: wuyepsolomon@plasu.edu.ng

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Abstract: *Artisanal and small-scale mining (ASM) has emerged as a major driver of environmental degradation in many resource-rich regions, yet its impact on the built environment remains insufficiently examined. This study investigates how illegal ASM affects the built environment through the lens of stakeholder perceptions and governance conditions in Plateau State, Nigeria. A mixed-methods approach was adopted, integrating quantitative data from 396 survey respondents with qualitative insights from interviews and focus group discussions conducted in Jos South and Barkin Ladi Local Government Areas. The findings reveal that illegal ASM contributes to significant built environment impacts, including land subsidence, structural damage to buildings, infrastructure deterioration, and increased safety and health risks. Inferential analysis indicates that impact severity and lived experience are significantly higher in Barkin Ladi, reflecting greater exposure in rural contexts, while governance inadequacies are perceived as systemic across both locations. Qualitative evidence further highlights a livelihood risk paradox, where economic dependence on mining coexists with its destructive consequences. The study advances governance, perception, and built environment nexus and demonstrates that stakeholder perceptions play a critical mediating role in shaping environmental and infrastructural outcomes. The findings underscore the need for integrated governance, alternative livelihood strategies, and participatory policy frameworks to mitigate the impacts of ASM and promote sustainable built-environment development.*

Keywords: artisanal and small-scale mining (ASM), built environment impacts, environmental degradation, stakeholder perception, governance and regulation, mixed methods, spatial analysis, Nigeria

INTRODUCTION

In parts of the Global South that are rich in minerals, especially in the Sub-Saharan Africa, artisanal and small-scale mining (ASM) has been widely documented as a recurring environmental and resource governance issue. Land degradation, deforestation, soil erosion, and water contamination have all been

repeatedly associated with (ASM), which is characterized by informality, lax regulation, and dispersed operations (Mardonova and Han, 2023; Dube et al., 2023; Tetteh et al., 2026). Amuah et al., (2025), stated that these effects are particularly severe in areas where mining operations coexist with human settlements, which creates a heightened environmental and socioeconomic risks that threaten public health, ecosystem services, and long-term sustainability.

One of the most important environmental ways that (ASM) impacts communities is through heavy metal contamination. High levels of mercury, lead, and arsenic have been found in soils and water systems, and these levels frequently surpass safe limits and present both carcinogenic and non-carcinogenic risks (Ogbole, et al., 2024; Amuah et al., 2025; Abdel Maksoud et al., 2025). These effects go beyond ecological deterioration to the built environment, impacting water supply systems, housing, infrastructure, and agricultural land. Artisanal small mining is widely considered as a vital livelihood strategy in spite of these environmental concerns. According to academics, the drivers that fuel participation in illicit mining includes; poverty, unemployment, dwindling agricultural productivity, and a lack of economic opportunities (Lesnikov et al., 2023; Adobor, 2025; Zondo, 2026). This leads to a complicated paradox where; while offering short-term economic benefits, mining also generates long-term environmental and social risks (Syahnur and Diantimala, 2021).

Because of this situation, the opinions of stakeholders are very important in determining the results of environmental governance. According to previous research (Duff & Downs, 2019; Erkan et al., 2025), perceptions affect how communities react to mining operations, including whether they are willing to follow rules, take part in cleanup projects, or oppose interventions. However, there is still a shortage of empirical research that connects stakeholder perceptions to the effects of the built environment.

In Nigeria, Artisanal mining is pervasive, and its effects are linked complicatedly to a more general governance issue. In Plateau State, while illegal tin mining has reappeared as a major problem, gold mining has received a lot of attention worldwide. In Jos South and Barkin Ladi LGAs, renewed mining operations have altered landscapes, deteriorated infrastructure, and produced dangerous living conditions. In order to provide a more comprehensive understanding of environmental change, governance, and resource management, this study investigates stakeholder perceptions and governance of the effects of illegal tin mining on Plateau State's built environment.

LITERATURE REVIEW

Some literature has established the effects of ASM on the environment. As established by Mestanza-Ramón et al., (2022), Chakuya et al., (2023) and Musah (2025) widespread land degradation, deforestation, water pollution, and landscape transformation have been reported in studies conducted throughout Africa and beyond. Remote sensing analyses also revealed rapid changes in land use, such as the growth of built-up areas into degraded mining landscapes (Lameck et al., 2025).

Significantly, the built environment is directly impacted by these environmental changes. In addition to increased risks of flooding, erosion, and land collapsing, researchers have seen damage to housing, infrastructure, and agricultural land (Bansah et al., 2024; Adams et al., 2025). Even though these effects are becoming more widely acknowledged, the literature still gives little consideration to the impacts on how stakeholders view them. The persistence of illicit mining is largely due to governance issues. According to studies by (Baddianaah et al., 2023; Olujobi and Irumekhai, 2024; Madonsela et al., 2025) weak institutions, lax enforcement, corruption, and disjointed regulatory systems allow ASM to flourish. Punitive or militarised methods of controlling illicit mining have frequently failed. Such tactics may worsen social tensions and fail to address underlying economic drivers, according to evidence (Eduful et al., 2020; Faanu and Asamoah-Gyadu, 2026). Furthermore, land-use planning, environmental management, and mining regulation are often poorly integrated in governance systems (Nunan et al., 2020).

For many communities, illegal ASM is acknowledged as a means of subsistence. According to studies, mining is an appealing option despite its risks because it frequently yields higher returns than agriculture or other local activities (Syahnur and Diantimala, 2021; Donkor et al., 2024). According to Adams et al., (2025), this leads to a "livelihood–risk paradox" in which communities rely on mining for survival while also suffering from its detrimental effects. This dependence is further reinforced by elements like unemployment, poverty, and climate variability (Tougma et al., 2025).

The importance of stakeholder perceptions in environmental governance is becoming more widely acknowledged, as studies by (Okumah and Yeboah, 2020; Hong et al., 2025) noted that perceptions influence participation, compliance, and conflict dynamics. Conflicts in mining environments are frequently caused by weak institutional trust, unequal benefit distribution, and environmental degradation (Hanaček et al., 2022; Scheidel et al., 2023). There is still little research, though, that directly connects stakeholder perceptions to the effects of the built environment.

The connection between illicit mining, environmental deterioration, and governance issues is well-supported by Nigerian literature. Research has shown that mining areas like Osun, Benue, and Plateau States have contaminated water, soil, and ecosystems (Awomeso et al., 2017; Paul et al., 2024). Additionally, studies have indicated that institutional shortcomings and lax regulations play a major role in the continued existence of illicit mining (Otoijamun et al., 2021; Olujobi & Irumekhai, 2024). Communities in Plateau State are still impacted by the long-term land degradation and abandoned mining sites caused by tin mining. Despite this evidence, little is known about how Nigerian stakeholders view the effects of illicit mining on the built environment, especially in Plateau State. According to the literature, stakeholder perceptions, environmental change, and governance conditions interact to produce the effects of illegal mining. The framework used in this study connects these components (Figure 1).

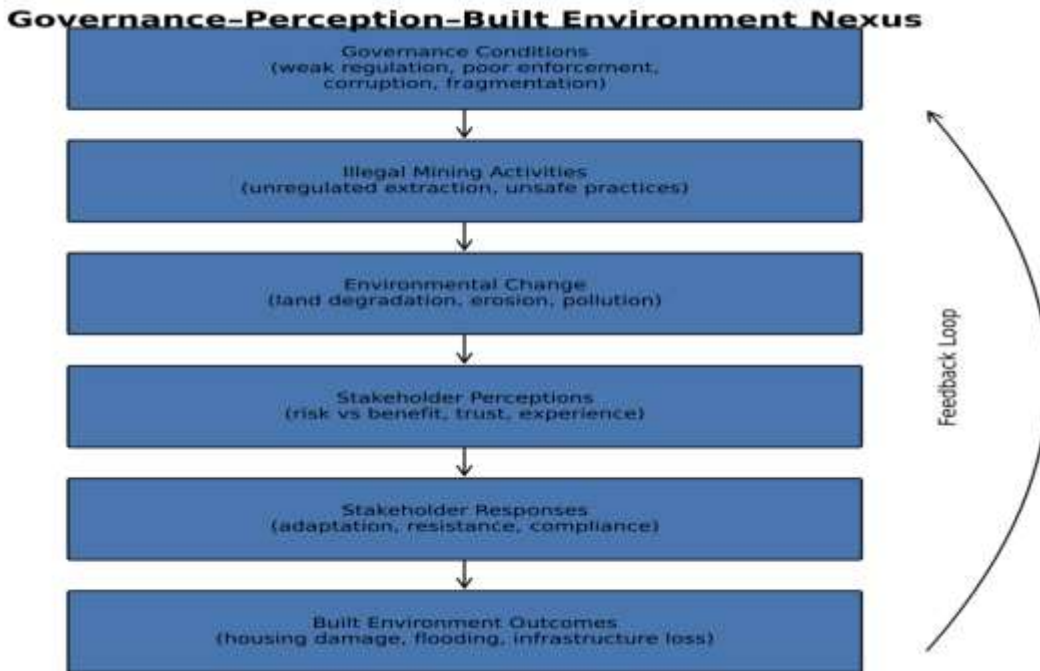


Figure 1. Conceptual framework

The framework highlights how governance structures and stakeholder interpretations influence built-environment impacts in addition to their physical effects. Additionally, it takes into account feedback loops, in which environmental harm affects perceptions and governance reactions in the future. When the various pieces of evidence from the literature are combined, a recurring pattern appears in all instances of illegal ASM. Previous research has adequately demonstrated the widespread environmental deterioration linked to ASM, especially with regard to ecosystem decline, water pollution, and land disturbance (Bansah et al., 2024; Musah, 2025). However, studies have generally acknowledged that these environmental effects also affect the built environment, impacting settlement safety, infrastructure integrity, and housing stability (Chakuya et al., 2023; Adams et al., 2025).

These effects, however, are not isolated. Research has demonstrated that the persistence of illicit mining and the extent of its effects are significantly influenced by governance conditions, particularly weak institutions, fragmented regulation, and ineffective enforcement (Baddianaah et al., 2023; Madonsela et al., 2025; Olujobi and Irumekhai, 2024). Because communities rely on mining for survival, socioeconomic pressures exacerbate these governance issues (Syahnur and Diantimala, 2021; Donkor et al., 2024). Stakeholder perceptions show up as an important but little-studied factor in this context. Research has shown that perceptions affect behaviour, including participation in environmental governance, resistance, and compliance (Okumah and Yeboah, 2020; Hong et al., 2025). However, they are hardly ever included in analyses of the effects on the built environment.

Thus, three major gaps are apparent. Firstly, compared to ecological effects, the built-environment effects of illicit mining are still poorly understood. Secondly, environmental and governance analyses do not adequately incorporate stakeholder perceptions. Thirdly, there is a shortage of empirical research that looks at how stakeholder perceptions, governance conditions, and built-environment outcomes interact within a single framework. These disparities are even more noticeable in Nigeria. Few studies have looked at stakeholder perceptions of built-environment impacts, especially in Plateau State, despite reports of environmental degradation and governance failures (Oramah et al., 2015; Awomeso et al., 2017; Paul et al., 2024). By using a combined approach that connects governance, perception, and built-environment outcomes, this study fills these gaps and offers fresh empirical insights for practice and policy.

METHODOLOGY

This study used mixed-methods research design, in order to provide a thorough analysis of stakeholder perceptions of the effects of illegal tin mining on the built environment. The understanding that illicit artisanal and small-scale mining (ASM) is a complicated socio-environmental problem influenced by the interplay of governance frameworks, environmental procedures, and stakeholder experiences guided the selection of this strategy. According to earlier research, combining quantitative and qualitative methods improves environmental governance research's explanatory depth and robustness (Duff and Downs, 2019; Okumah and Yeboah, 2020).

While the qualitative component offers contextual and interpretive insights through focus group discussions (FGDs) and interviews, the quantitative component records quantifiable patterns of perception across a large respondent base. The triangulation of findings made possible by this design guarantees convergence, complementarity, and a deeper comprehension of the Governance-Perception-Built Environment nexus that forms the basis of this investigation. The study was carried out in the Jos South and Barkin Ladi Local Government Areas (LGAs) of Plateau State, Nigeria, (Figure 2), both of these LGAs have historically been linked to tin mining operations and still have significant built-environment and environmental effects. According to Nigerian mining studies, these sites were specifically chosen because of their active participation in illicit mining and the obvious effects on infrastructure and settlements (Oramah et al., 2015; Olujobi and Irumekhai, 2024).

To guarantee representation across the two LGAs and important stakeholder categories for the quantitative component, a stratified sampling strategy was used. A total of 396 valid responses, (181 from Barkin Ladi and 215 from Jos South), were collected and analysed. The sample size variation is statistically sufficient for inferential analysis and reflects response availability rather than sampling bias. Respondents came from a variety of stakeholder groups that have been identified in the literature as being crucial to mining governance and environmental decision-making, such as community members, professionals in the built environment, government and regulatory officials, representatives of NGOs and civil society, and traditional and community leaders. According to studies that have emphasised the significance of multi-stakeholder analysis in comprehending environmental conflicts and governance outcomes, this stratification guarantees diversity in viewpoints (Hanaček et al., 2022; Scheidel et al., 2023)

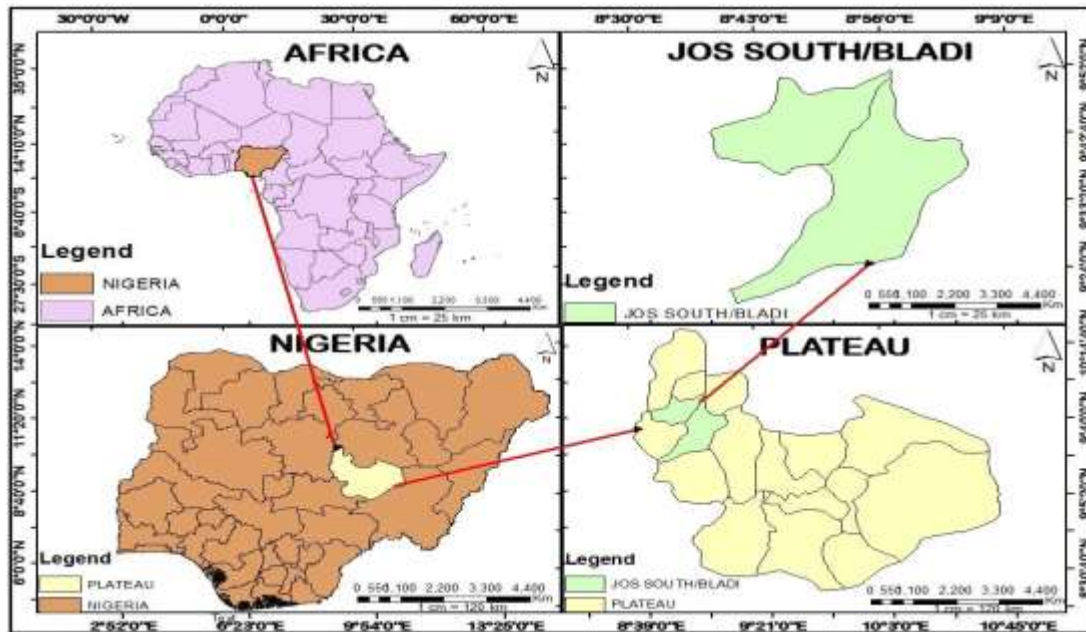


Figure 2. Map Showing the Study Area

A structured questionnaire intended to gather stakeholder perceptions of governance conditions, mitigation readiness, and the effects of illegal mining was used to gather quantitative data. Composite indices were made possible by the questionnaire's closed-ended items, which were scored on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Based on constructs found in the literature, four important indices were created. The Governance Adequacy Index (GAI) measures perceptions of institutional effectiveness; the Impact Severity Index (ISI) measures perceived environmental and built-environment impacts; the Lived Experience and Exposure Index (LEEI) measures direct exposure to mining-related effects; and the Mitigation and Policy Readiness Index (MPRI) measures stakeholder support for intervention. In order to ensure conceptual validity and relevance to the study objectives, the instrument was based on earlier research on environmental degradation, governance, and stakeholder perception (Okumah and Yeboah, 2020; Baddianaah et al., 2023; Bansah et al., 2024).

Twenty eight key informants were purposefully chosen for semi-structured interviews with 14 participants from Barkin Ladi and 14 from Jos South in order to supplement the quantitative data. Based on their experience, leadership positions, and participation in mining-related or community governance initiatives, participants were chosen. Rich, context-specific insights into stakeholder experiences, interpretations, and institutional dynamics could be gathered thanks to this method. Additionally, there were two focus group discussions (FGDs) with a total of twelve participants. The FGDs were created to encourage interactive dialogue, enabling participants to express common experiences, compromise viewpoints, and jointly identify the main obstacles associated with illicit mining. According to Locatelli et al., (2022), participatory approaches in environmental governance research have been demonstrated to improve comprehension of community-level dynamics and collective perceptions. This approach is consistent with those approaches.

Descriptive and inferential statistical methods were used to code and analyse survey data. Key variables were summarised using descriptive statistics, and differences between LGAs were examined using inferential analysis, specifically independent samples t-tests. Comparing mean index scores among LGAs, finding statistically significant differences ($p < 0.05$), and analysing trends concerning governance and environmental effects were the main goals of the analysis. This strategy is consistent with earlier research that examined stakeholder perceptions in mining and environmental contexts using statistical techniques (Donkor et al., 2024). Thematic analysis was used to examine qualitative data from FGDs and interviews. Data cleaning and preparations, preliminary coding, code classification, and theme development were all part of the process. With regard to governance failure, environmental degradation, and built-environment impacts in particular, this iterative approach made it possible to identify recurring patterns, opposing viewpoints, and contextual explanations.

The results from the quantitative and qualitative components were combined using a triangulation framework to improve the study's validity and robustness. This method enabled expansion to reveal new insights beyond statistical results, complementarity to use qualitative insights to explain quantitative patterns, and convergence to confirm findings across data sources. In mixed-methods research, triangulation is frequently advised as a way to improve reliability and offer a more thorough understanding of intricate socio-environmental systems (Duff and Downs, 2019; Erkan et al., 2025). Through the integration of various data sources, the study offers a more comprehensive and empirically supported understanding of how stakeholder perceptions, governance conditions, and environmental changes interact to influence built-environment outcomes in illegal mining contexts.

RESULTS AND DISCUSSION

The respondents' demographic profile shows a sample that is both spatially and stakeholder-wise well-distributed and analytically sound. In order to ensure sufficient representation for comparative analysis, respondents were selected from the two study areas, Jos South and Barkin Ladi, with a slightly higher proportion from Jos South, as shown in Figure 3. Additionally, Figure 4 demonstrates that the majority of respondents in the sample are community members, followed by professionals in the built environment. Government officials, traditional and community leaders, and NGO actors make up smaller percentages. This distribution is especially significant because it encompasses both institutional and technical viewpoints as well as firsthand accounts of the effects of mining. By guaranteeing that the results represent a wide range of stakeholder experiences, institutional roles, and spatial contexts, the demographic composition enhances the study's validity and supports the dependability of later statistical and qualitative analyses.

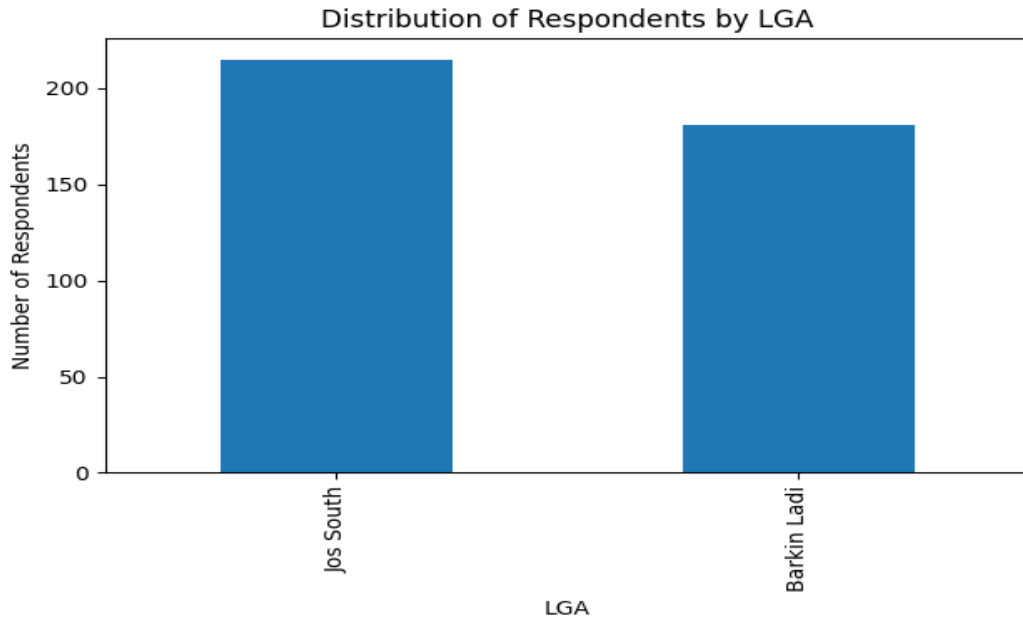


Figure 3. Distribution of respondents by LGA

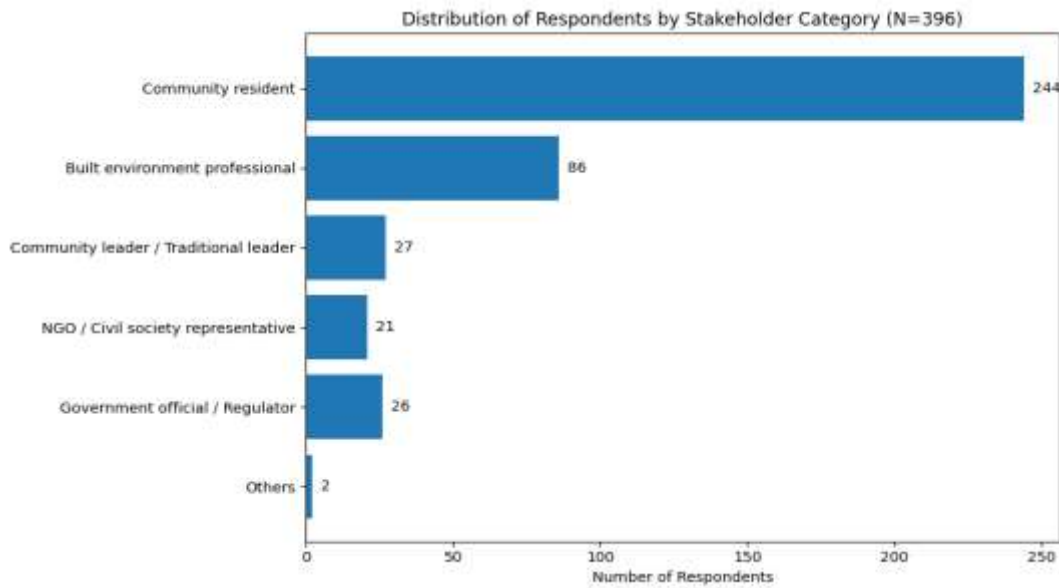


Figure 4. Distribution of respondents by stakeholder category

The descriptive statistics for the four composite indices for the Barkin Ladi and Jos South LGAs are shown in Table 1 compares the two LGAs. The findings show that lived experience (LEEI) and Impact Severity (ISI) are consistently high throughout the study areas, demonstrating the direct and severe effects of illegal mining (Table 1). On the other hand, systemic discontent with institutional performance is indicated by

governance adequacy (GAI), which is below the neutral threshold. Strong stakeholder agreement on the necessity of intervention is reflected in the highest scores for mitigation and policy readiness (MPRI).

Table 1. Descriptive Statistics of Composite Indices

| Index | LGA | N | Mean | Std. Deviation |
|-------|-------------|-----|-------|----------------|
| ISI | Barkin Ladi | 181 | 4.266 | 0.674 |
| | Jos South | 215 | 4.106 | 0.848 |
| LEEI | Barkin Ladi | 181 | 4.046 | 0.825 |
| | Jos South | 215 | 3.815 | 0.866 |
| GAI | Barkin Ladi | 181 | 2.822 | 1.052 |
| | Jos South | 215 | 3.003 | 1.127 |
| MPRI | Barkin Ladi | 181 | 4.451 | 0.501 |
| | Jos South | 215 | 4.382 | 0.696 |

As shown in Table 2, independent samples t-tests were performed to determine whether these differences are statistically significant. In comparison to Jos South, stakeholders in Barkin Ladi suffer more severe and direct effects from illegal mining, according to the analysis, which shows statistically significant differences for ISI and LEEI. However, there were no distinct differences between the two LGAs in terms of governance adequacy (GAI) or policy readiness (MPRI), indicating that governance issues and expectations for intervention are generally similar.

Table 2. Independent Samples t-test Results

| Variable | t | df | Sig. (2-tailed) | Mean Difference |
|----------|--------|-----|-----------------|-----------------|
| ISI | 2.092 | 394 | 0.037 | 0.160 |
| LEEI | 2.715 | 394 | 0.007 | 0.231 |
| GAI | -1.656 | 394 | 0.099 | -0.182 |
| MPRI | 1.135 | 394 | 0.257 | 0.068 |

Deeper understanding of the mechanisms underlying the quantitative patterns is provided by the qualitative component. Table 3 illustrates the various themes that emerged from the thematic analysis of the interviews and focus group discussions. Four main themes emerged from the further reduction of the themes.

Table 3. Qualitative Evidence Matrix of Illegal Mining Impacts

| Theme | Key Evidence (Illustrative Quotes) | Analytical Insight |
|--------------------------------|---|--|
| Physical Infrastructure Damage | “Our houses have cracks... farms are being washed away.”; “Ground subsidence... leads to foundation failure.”; “Roads are impassable due to gullies.” | Mining-induced subsidence and erosion directly undermine structural integrity, transport networks, and settlement stability. |
| Environmental Degradation | “Our farmlands are gone... soil has lost fertility.”; “Our wells are polluted.”; “Land is littered with abandoned pits.” | Environmental degradation acts as the primary pathway through which mining affects livelihoods, health, and land usability. |
| Safety and Health Concerns | “I have lost friends to pit collapses.”; “Mosquitoes have increased due to stagnant water.”; “We feel helpless.” | Illegal mining creates immediate physical risks and long-term public health and psychological vulnerabilities. |
| Socio-Economic Impacts | “Poverty drives people to mining.”; “Young men see mining as quick income.” | Confirms the livelihood–risk paradox, where economic necessity sustains environmentally destructive practices. |
| Governance Failures | “Laws are ineffective due to corruption.”; “Security officials are compromised.”; “Jurisdictional overlap complicates enforcement.” | Reveals systemic governance breakdown characterized by weak enforcement, corruption, and institutional fragmentation. |
| Community Responses | “Communities pool resources to fix roads.”; “Residents avoid certain areas.”; “Community monitoring is emerging.” | Indicates adaptive but insufficient grassroots coping mechanisms and informal governance responses. |
| Proposed Solutions | “Government must enforce laws.”; “There should be alternative jobs.”; “Land reclamation is essential.” | Reflects strong stakeholder consensus on integrated solutions combining regulation, livelihood support, and environmental restoration. |

Participants frequently connected mining operations to infrastructure degradation, land instability, and structural damage to buildings. There were frequent reports of damaged roads, sinking foundations, and cracked walls, especially in Barkin Ladi. These explanations support the high ISI scores and demonstrate that the effects of the built environment are tangible, observable realities rather than abstract concepts. The main cause of built-environment deterioration, according to many respondents, is environmental degradation, particularly erosion, water contamination, and abandoned mining pits. This validates the causal pathway found in the conceptual framework: Illegal mining → Environmental degradation → Built-environment impact

This result is consistent with research showing that hydrological disruption and land degradation are important mechanisms connecting mining operations to infrastructure failure (Mardonova and Han, 2023). Participants in both LGAs reported inadequate coordination between regulatory agencies, corruption, and lax enforcement. Despite being aware of the negative effects of illegal mining, many respondents expressed frustration. This directly explains the low GAI scores and validates research that suggests governance deficiencies are a key factor in ASM persistence (Olujobi and Irumekhai, 2024). The conflict between economic reliance on mining and its detrimental effects was a recurrent theme. Participants agreed that while mining generates revenue, it also harms infrastructure, housing, and land. This validates the livelihood-risk paradox that has been extensively reported in ASM literature (Syahnur & Diantimala, 2021).

Strong triangulation across data sources is revealed by the integration of quantitative and qualitative findings, strengthening the study's robustness. Convergence of evidence demonstrates that low GAI scores are consistent with stakeholder narratives of governance failure, high MPRI scores are supported by qualitative expressions of urgency for intervention, and high ISI and LEEI scores are supported by qualitative accounts of visible damage and lived experience. The findings' validity is strengthened by this convergence, which also verifies that stakeholder perceptions are based on real environmental and built environment conditions. The complementarity of findings shows that qualitative data offers explanations, whereas quantitative data finds patterns and differences. Barkin Ladi has greater impact levels, according to quantitative data, while rural exposure, land dependence, and environmental vulnerability are explained by qualitative data. By illuminating the mechanisms of impact as demonstrated by erosion, subsidence, and water contamination; the social dynamics as demonstrated by trust, frustration, and adaptation strategies; and the governance realities that go beyond statistical measurement, the qualitative findings supplement the quantitative results. Visual and spatial evidence highlight the scope and distribution of illegal mining across Barkin Ladi and Jos South. Figure 5, shows scattered pits and degraded land, indicating strain on urban infrastructure i.e bridges and agricultural land. Figure 6, reveals severe environmental damage in Jos south. Figure 7, illustrates mining site distribution, with Jos South showing dispersed patterns and Barkin Ladi displaying concentrated clusters. These findings confirm that illegal mining is widespread and significantly impacts both environments, supporting stakeholder reports and statistical analyses.



Figure 5. showing degraded land at Barkin Ladi LGA



Figure 6. severe environmental damage in Jos south

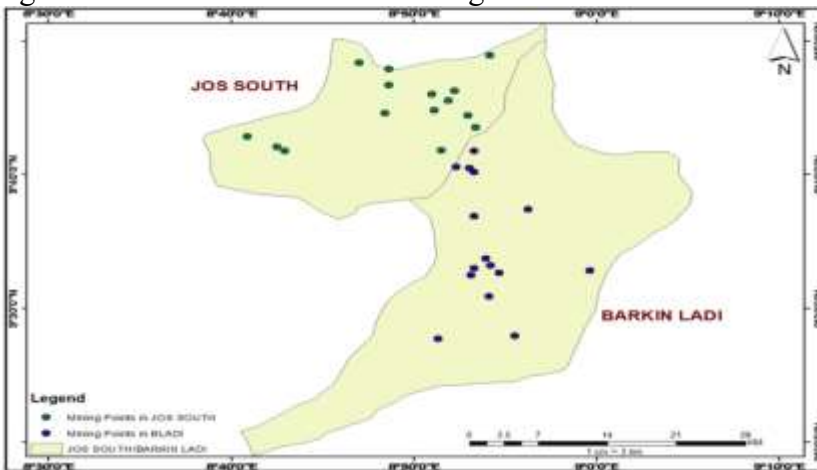


Figure 7. Map showing selected mining pits

The results give the Governance–Perception–Built Environment Nexus substantial empirical support. The lack of notable variations in Governance Adequacy Index (GAI) scores implies that governance failure is a systemic issue, contributing significantly to the effects of illicit mining (Table 1). This suggests that weaknesses in institutional effectiveness, such as inadequate regulation, corruption, and lack of enforcement, perpetuate environmental degradation and social impacts associated with artisanal mining. Studies support that effective governance is critical in mitigating mining's negative impacts (Hilson, 2002; Tsuma, 2019). In Nigeria, governance challenges exacerbate environmental and social issues in mining areas (Akpabio, 2013). Stakeholder perception is shaped by exposure and lived experience, which influences behavioral responses, as demonstrated by significant differences in ISI and LEEI (Table 1). Studies have shown that stakeholder perception is shaped by exposure and lived experience, influencing behavioral responses to artisanal mining impacts. Research by Moffat and Zhang (2014) highlights the importance of understanding community acceptance and social licence in mining. Similarly, Hilson and Murck (2000) note that perceived environmental impacts are critical in shaping stakeholder responses. The significant differences in Impact Severity Index (ISI) and Lived Experience and Exposure Index (LEEI) measures underscore the role of direct exposure in shaping perceptions (Bebbington & Williams, 2008; Mensah & Adu-Boahene, 2018). These findings are consistent with literature emphasizing the importance of contextual understanding in environmental management (Tsuma, 2019).

The built environment is the most obvious and immediate result of mining impacts, according to both quantitative and qualitative findings. The study shows that stakeholder perception, environmental change, and governance failure interact dynamically to produce the effects of illegal mining, with the built environment acting as the crucial interface where these forces come together.

Effective intervention, according to the triangulated findings, must prioritize built-environment protection and land restoration, take into account stakeholder perceptions in policy design, address structural governance failures rather than isolated enforcement gaps, and take advantage of community readiness for participatory governance. These results are consistent with research that indicates integrated governance strategies are critical for long-term ASM management (Erkan et al., 2025).

CONCLUSION

This study used an integrated Governance-Perception-Built Environment lens to investigate stakeholder perceptions of the effects of illicit tin mining on the built environment in Jos South and Barkin Ladi Local Government Areas of Plateau State, Nigeria. The results, which are based on a mixed-methods approach, offer solid empirical proof that illicit mining is a significant built-environment and governance challenge in addition to an environmental problem. The findings show that mining impacts are severe and, crucially, spatially differentiated, with rural communities, particularly Barkin Ladi, experiencing much higher exposure and structural repercussions. The built environment is the most direct and obvious interface of mining-related risks, as evidenced by the concrete manifestations of these effects, which include housing damage, land instability, and infrastructure deterioration.

However, the study also shows that deficiencies in governance are not location-specific but rather systemic. The lack of statistically significant variations in the two LGAs' perceptions of governance indicates that the study context is rife with inadequate institutional capacity, disjointed regulation, and ineffective enforcement. This result supports the claim that governance failure is a major factor in the continued existence of illicit mining rather than a side issue. Importantly, the study also emphasises how stakeholder perception functions as a mediator. The statistically significant variations in lived experience and impact severity demonstrate how exposure and socioeconomic context shape perception, which in turn shapes behavioural responses. The consistently high levels of policy readiness and mitigation across both LGAs further demonstrate a robust and common demand for intervention, indicating that communities are willing to support organised and cooperative solutions in addition to being aware of the risks.

By combining quantitative data with qualitative insights, the study presents a more comprehensive understanding of illicit mining as a socio-environmental governance issue. By empirically confirming a Governance Perception Built Environment nexus, it contributes to the body of literature by showing the close connections between stakeholder interpretation, institutional dynamics, and environmental degradation. From a policy standpoint, the results highlight the necessity of moving away from enforcement-driven and reactive strategies and toward more integrated, participatory, and context-sensitive governance approaches. For an effective intervention, the study supports that prioritising land reclamation and infrastructure protection, enhancing institutional coordination, addressing underlying livelihood drivers, and implementing community-based monitoring systems are all necessary. The findings have significant implications for policy and practice in artisanal and small-scale mining (ASM). Policies should consider the specific concerns and priorities of affected communities, rather than adopting a one-size-fits-all approach. Effective engagement with stakeholders is critical to understand their perceptions, build trust, and address grievances. Policies should prioritize mitigation measures that address the most severe impacts, as perceived by affected communities. Building the capacity of regulatory institutions can improve enforcement and address governance gaps.

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Conflicts of Interest

The authors declare no conflict of interest

Contributions

All authors contributed to the study's conception and design. Conceptualization: M.N.R.; Data curation: W.S.Z.; Formal analysis: M.N.R.; Investigation: M.Y.D.; Methodology: MY.D.; Project administration: M.N.R.; Writing – original draft: M.N.R.; Writing – review & editing: W.S.Z

REFERENCES

- Abdel, M., K. M., Mostafa, M. T., Sabri, S. M. and AlMetwaly, W. M. (2025). Geostatistical and geochemical assessment of illegal artisanal mining impacts in Southern Hamisana, Sudan. *Resources Policy*. <https://doi.org/10.1016/j.resourpol.2025.105479>
- Adams, R. K., Zhang, L., Yeboah, E. and Mensah, K. N. (2025). Unveiling the dual realities of informal artisanal gold mining: Socio-environmental transformations in Tarkwa Nsuaem, Ghana. *Environment, Development and Sustainability*. <https://doi.org/10.1007/s10668-025-06954-2>
- Adobor, H. (2025). Explaining illegal entrepreneurship in the small-scale artisanal mining sector in Ghana: A historical contextualization approach. *Journal of Business Research*. <https://doi.org/10.1016/j.jbusres.2024.115020>
- Akpabio, E. M. (2013). Environmental impacts of oil exploration in the Niger Delta. *Journal of Environmental Management*, 131, 250-258.
- Amuah, E. E., Fei-Baffoe, B., Sackey, L. N., et al. (2025). Tracing potentially toxic elements and nutrient levels from extensive illegal mining using multivariate statistics, pollution indices and ecological assessments. *Environmental Nanotechnology, Monitoring and Management*. <https://doi.org/10.1016/j.enmm.2025.101043>
- Awomeso, J. A., Taiwo, A. M., Gbadebo, A. M., Adenowo, J. A. and Ayantobo, O. O. (2017). Human health and environmental assessments of small-scale mining activities in Ijesha land, Osun State, Nigeria. *Journal of Health and Pollution*, 7(15), 32–45. <https://doi.org/10.1186/s40068-017-0095-4>
- Baddianaah, I., Baatuuwie, B. N. and Adams, A.-M. (2023). Governance challenges in Ghana's artisanal and small-scale mining sector: Is stakeholder interaction the way forward? *African Journal of Science, Technology, Innovation and Development*. <https://doi.org/10.1080/20421338.2022.2115607>
- Baffour-Kyei, V., Mensah, A., Owusu, V. and Horlu, G. S. A. K. (2021). Artisanal small-scale mining and livelihood assets in rural southern Ghana. *Resources Policy*. <https://doi.org/10.1016/j.resourpol.2021.101988>
- Bansah, K. J., Acquah, P. J. and Boafo, A. (2024). Land, water, and forest degradation in artisanal and small-scale mining: Implications for environmental sustainability and community wellbeing. *Resources Policy*. <https://doi.org/10.1016/j.resourpol.2024.104795>
- Bebbington, A. and Williams, M. (2008). Water, risk, and poverty: Artisanal mining and water management in the Andes. *Water Policy*, 10(2), 131-145.
- Chakuya, J., Munkuli, N., Mutema, C. and Gandiwa, E. (2023). An assessment of the impact of illegal artisanal gold mining on the environment in parts of Chewore Safari Area, Northern Zimbabwe. *Environmental Research Communications*. <https://doi.org/10.1088/2515-7620/ace23b>
- Donkor, P., Siabi, E. K., Frimpong, K., Frimpong, P. T., Mensah, S. K., Vuu, C., Siabi, E. S., Nyantakyi, E. K., Agariga, F., Atta-Darkwa, T. and Mensah, J. K. (2024). Impacts of illegal Artisanal and small-scale gold mining on livelihoods in cocoa farming communities: A case of Amansie West District, Ghana. *Resources Policy*, 91, 104879. <https://doi.org/10.1016/j.resourpol.2024.104879>

- Dube, T., Dube, T. and Marambanyika, T. (2023). A review of wetland vulnerability assessment and monitoring in semi-arid environments of sub-Saharan Africa. *Physics and Chemistry of the Earth*. <https://doi.org/10.1016/j.pce.2023.103473>
- Duff, P. M. and Downs, T. J. (2019). Frontline narratives on sustainable development challenges and opportunities in illegal gold mining regions of Madre de Dios, Peru. *The Extractive Industries and Society*. <https://doi.org/10.1016/j.exis.2019.01.005>
- Eduful, M., Alsharif, K., Eduful, A., Acheampong, M., Eduful, J. and Mazumder, L. (2020). The illegal artisanal and small-scale mining menace in Ghana: Is military-style approach the answer? *Resources Policy*, 68, 101732. <https://doi.org/10.1016/j.resourpol.2020.101732>
- Erkan, D., Warsilah, H. & Yudawati Cahyarini, S. Y. (2025). Community responses in a contested mining landscape: Perceptions and power in Belitung, Indonesia. *Resources Policy*. <https://doi.org/10.1016/j.resourpol.2025.105785>
- Faanu, P., & Asamoah-Gyadu, G. (2026). The social costs and injustices of militarized approaches to illegal artisanal mining governance in Ghana. *Canadian Journal of African Studies*. <https://doi.org/10.1080/00083968.2025.2524338>
- Hanaček, K., Kröger, M., Scheidel, A., Rojas, F., & Martinez-Alier, J. (2022). On thin ice – The Arctic commodity extraction frontier and environmental conflicts. *Ecological Economics*, 191, 107247. <https://doi.org/10.1016/j.ecolecon.2021.107247>
- Hilson, G. (2002). An overview of land use conflicts in mining communities. *Land Use Policy*, 19(1), 65-73.
- Hilson, G. and Murck, B. (2000). Sustainable development in the mining industry: An overview. *Natural Resources Forum*, 24(4), 269-280.
- Hong, P., Wei, Y., Bouckaert, F., Johnston, K. and Head, B. (2025). Mapping stakeholder dynamics: Understanding knowledge, values, and engagement in the Murray-Darling Basin. *Journal of Rural Studies*, 120, 103891. <https://doi.org/10.1016/j.jrurstud.2025.103891>
- Lameck, A. S., Rotich, B., Ahmed, A., Kipkulei, H., Mnyawi, S. R. and Czimber, K. (2025). Land use/land cover changes due to gold mining in central Tanzania. *Environmental Monitoring and Assessment*, 197, 464. <https://doi.org/10.1007/s10661-025-13921-x>
- Lesnikov, P., Kunz, N. C. and Harris, L. M. (2023). Gender and sustainability reporting in mining. *Resources Policy*. <https://doi.org/10.1016/j.resourpol.2022.103273>
- Locatelli, B., Laurenceau, M., Calla Chumpisuca, Y. R., Pramova, E., Vallet, A., Quispe Conde, Y., Cervantes Zavala, R., Djoudi, H., Lavorel, S. and Colloff, M. J. (2022). In people's minds and on the ground: Values and power in climate change adaptation. *Environmental Science & Policy*. <https://doi.org/10.1016/j.envsci.2022.08.002>
- Madonsela, B. S., Maphanga, T. and Grangxabe, X. S. (2025). Environmental Degradation from Zama-Zama Illegal Mining in South Africa: Policy Implementation and Governance Challenges. *Sustainability*. <https://doi.org/10.3390/su17083418>
- Mardonova, M. and Han, Y.-S. (2023). Environmental, hydrological, and social impacts of coal and nonmetal minerals mining operations. *Journal of Environmental Management*. <https://doi.org/10.1016/j.jenvman.2023.117387>

- Mensah, A. K. and Adu-Boahene, K. (2018). Environmental impacts of artisanal and small-scale mining in Ghana. *Journal of Environmental Studies*, 22(1), 1-12.
- Mestanza-Ramón, C., Mora-Silva, D., D'Orio, G., Tapia-Segarra, E., Dominguez Gaibor, I., Esparza Parra, J. F., Chávez Velásquez, C. R. and Straface, S. (2024). Artisanal and small- scale gold mining (ASGM): Management and socioenvironmental impacts in the northern Amazon of Ecuador. *Sustainability*. <https://doi.org/10.3390/su14116854>
- Moffat, K. and Zhang, A. (2014). The paths to social licence to operate: An integrative model explaining community acceptance of mining. *Resources Policy*, 39, 61-70.
- Nunan, F., Omondi, M. A., Nchimbi, A. Y., Mangora, M. M., Kairo, J. G., Shalli, M. S. and Jiddawi, N. S. (2022). The silos of natural resource governance: Implications of sector- led coastal management at the village level in Kenya and Zanzibar-Tanzania. *Conservation and Society*. https://doi.org/10.4103/cs.cs_18_116
- Ogbole, A. S., Wuyep, S.Z., Monday, S. N., Boiltif, Y. E. and Ocheri, M. I. (2024). Assessment of Heavy Metals in Vegetables Grown on Irrigated Land in Butura, Bokkos LGA, Plateau State, Nigeria. *British Journal of Earth Sciences Research*, 12 (3), 32-45.
- Okumah, M. and Yeboah, A. S. (2020). Exploring stakeholders' perceptions of the quality and governance of water resources in the Wenchi municipality. *Journal of Environmental Planning and Management*. <https://doi.org/10.1080/09640568.2019.1663724>
- Olujobi, O. J. and Irumekhai, O. S. (2024). Exploring stakeholders' perceptions of the quality and governance of water resources in the Wenchi municipality. *Resources Policy*. <https://doi.org/10.1016/j.resourpol.2023.104459>
- Oramah, I. T., Richards, J. P., Summers, R. and Garvin, T. (2015). Artisanal and small-scale mining in Nigeria: Experiences from Niger, Nasarawa and Plateau states. *The Extractive Industries and Society*. <https://doi.org/10.1016/j.exis.2015.08.009>
- Otoijamun, I., Kigozi, M., Abdulraman, S. O., Adetunji, A. R. and Onwualu, A. P. (2024). Fostering the sustainability of artisanal and small-scale mining (ASM) of barite in Nasarawa State, Nigeria. *Sustainability*. <https://doi.org/10.3390/su13115917>
- Paul, S. N., Frazzoli, C. and Orisakwe, O. E. (2024). Towards a One Health assessment of artisanal and informal mining in Benue State, Nigeria. *Medical Sciences Forum*, 25(1), 2. <https://doi.org/10.3390/msf2024025002>
- Scheidel, A., Fernández-Llamazares, A., Bara, A. H., Del Bene, D., David-Chavez, D. M., Fanari, E., Garba, I., Hanaček, K., Liu, J. and Whyte, K. P. (2023). Global impacts of extractive and industrial development projects on Indigenous Peoples' lifeways, lands, and rights. *Science Advances*, 9(23), eade9557. <https://doi.org/10.1126/sciadv.ade9557>
- Syahnur, S. and Diantimala, Y. (2021). Surviving and growing up with illegal status: The Analysis of Socio-Economic Household, Potential Conflict, the Environmental Damage, and Vulnerability of Local Community to Disaster. *Journal of Sustainable Mining*. <https://doi.org/10.46873/2300-3960.1061>
- Tetteh, A. T., Yevugah, L. L. and Moomen, A. W. (2026). Stakeholders' perceptions of land degradation and rehabilitation efforts in mining communities: A case study of the Birim North

mining district, Ghana. *Nature-Based Solutions*, 9, 100320.

<https://doi.org/10.1016/j.nbsj.2026.100320>

Tougma, W. J., Koffi, G. B., Kouraogo, P. and Yao, K. A. (2025). Balancing economic gains and environmental sustainability: The role of artisanal gold mining in achieving SDGs 1 and 15 in Gaoua, Burkina Faso. *Mineral Economics*, 38, 473–483. *Mineral* <https://doi.org/10.1007/s13563-025-00502-0>

Tsuma, W. (2019). Governance and artisanal mining in Ghana. *Journal of Sustainable Mining*, 18(2), 61-70.

Zondo, N. M. (2026). Dimensions of everyday resistance in rural artisanal mining communities in South Africa. *Resources Policy*, 112, 105798. <https://doi.org/10.1016/j.resourpol.2025.105798>

