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Informal Mining Activities and Environmental Sustainability in Osun State, Nigeria

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Abstract

This paper examines the correlation between informal mining and environmental sustainability in Atakunmosa East and West LGAs in Osun State, Nigeria. The regression output shown in Tables 4.3 to 4.5 shows that there is a weak and statistically insignificant correlation between informal mining and environmental sustainability. The R-value of 0.034 and R^2 of 0.001 indicate that only 0.1 percent of the variance in environmental sustainability is attributed to informal mining activities whereas the adjusted R 2 of -0.007 indicates that the model is worse than the mean prediction. The coefficient of informal mining activities (B = -0.034, p = 0.712) proves an insignificant negative correlation with environmental sustainability. These results refute the belief that informal mining is always a source of environmental degradation. The paper reveals the significance of socio-economic conditions like poverty, unemployment, and bad governance in the continuation of informal mining practices. The findings indicate that policy interventions need to be directed towards enhancing enforcement, developing alternative livelihoods and promoting community involvement in order to realize sustainable environmental management. More robust models and environmental indicators should be used in future research to improve the current knowledge and policy directions.

Keywords: Informal Mining, Environmental Sustainability.

Introduction

Background to the Study

Nigeria has a high prevalence of informal or illicit mining which are also known as Artisanal and Small-scale Mining (ASM). Such jobs are usually carried out by individuals or even small groups of people with the use of primitive tools to extract minerals. Even though artisanal and small-

scale mining (ASM) is a major source of revenue to various individuals, it often causes substantial degradation of the environment, economic problems, and socio-economic issues. The escalating issue of informal or illicit mining jeopardises Nigeria's economic and environmental sustainability, necessitating immediate intervention from the government and relevant parties.

Artisanal and Small-scale Mining (ASM) has been integral to Nigeria's rural communities for decades, especially in regions abundant in commodities such as gold, tin, lead, and columbite. The absence of institutional control results in numerous mining operations occurring without enough monitoring, culminating in unsustainable practices and diminished revenue for the nation. The Nigerian Geological Survey Agency (2016) indicates that limestone mining is prevalent owing to its significance in cement manufacturing. ASM significantly contributes to local economies by generating employment and bolstering small enterprises. According to Otegbulu, Akintola, and Oba (2019), mining sustains many livelihoods and provides crucial raw materials for building and industry. Nonetheless, the economic advantages are frequently distributed inequitably, resulting in minimal enhancement of quality of life for several local populations.

Mining in Nigeria started as far back as the pre-colonial period, when gold, tin and lead were mined using crude methods. Nevertheless, after the discovery of oil in the 1950s, the mining industry has faced major negligence, which has led to collapse of many formal mining corporations. The lack of regulation has resulted in illegal and informal mining being developed, particularly in rural areas where mineral resources act as a source of survival of financially less fortunate communities (Garvin et al., 2019).

The issue of illegal mining is rife in Nigeria due to economic reasons. According to Yakubu et al. (2022), poverty and unemployment, in particular, in rural northern and central regions, are some of the reasons people turn to illegal mining as one of the few options to survive. There are few formal mining jobs and the complex bureaucracy of obtaining legal mining permits is a major challenge to small-scale miners interested in operating legally. Informal and illegal mining refers to any mining activity conducted without the approval of the state or government, particularly in the absence of land rights, mining licenses, and permits for exploration or mineral transportation (Dozolme, 2018). Illegal mining may occur as a subsistence activity, like artisanal mining, or it can involve large-scale organised crime orchestrated by informal or illegal mining syndicates (Huerbsch & Spiro, 2016). Even with strategic progress in "responsible mining," major corporations may still find themselves involved in (partially) illegal mineral extraction, potentially through their financial support (Castilla, Amancio, & Lopez, 2015).

While mining can offer economic advantages, it faces opposition from various stakeholders, including governmental bodies, environmental advocates, and agricultural professionals, who highlight its detrimental effects. In addition to the allure of rapid financial gain, there are significant issues regarding biodiversity loss, land degradation, contamination from toxic substances, insufficient safety protocols, pollution of air and water, and the troubling presence of child labour (Akabzaa et al., 2007; Ofosu-Mensah, 2010). A particular study underscores

the significant dangers associated with illegal mining, using Indonesia as a case in point. It states that up to 200,000 people can be poisoned by mercury and around 10,000 to 20,000 children can develop physical disabilities because of in utero exposure to mercury (Paddock, 2016).

According to the research by Okoye and Maduka (2023), one of the reasons that have enhanced the growth of illegal mining activities is the rising demand of precious minerals, especially gold, across the world. Informal miners are working in dangerous and unregulated areas and sell their minerals at cheap prices to foreigners through illegal markets. Not only is this denying the government of Nigeria much needed revenue, but it also subjects the miners to a situation of being exploited by the middlemen. Thus, the study will assess the effect of informal or illegal mining activities on environmental sustainability of Atakunmosa Local Government Area of Osun State, Nigeria.

Statement of the Problem

The informal mining in Nigeria is becoming even more destructive to the economy and also to the environment. The issue can be explained by the poor implementation of the mining laws, the lack of control in the artisanal and small-scale mining (ASM) sector, and the high returns of the unregulated mining (Obi & Chinedu, 2023). This is especially prominent in states with rich reserves of minerals like Zamfara, Niger, Kaduna, and Osun where illegal mining of gold, coal, lead, and other minerals occurs without government regulation.

Those activities that are informal or illegal mining led to high levels of environmental degradation since most of them do not often have environment impact assessments and safety measures, leading to wide-scale deforestation, water pollution, and soil erosion (UNEP, 2022). Toxic chemicals such as mercury and cyanide used in mining activities contaminate water sources of the area in the long run, endangering both the health and ecosystem of the area (UNEP, 2022). Lead mining has led to broad lead poisoning, especially among the children, which led to death and severe health effects, especially in locations such as Zamfara (WHO, 2021).

Illegal or informal mining significantly undermines Nigeria's economic potential. The mining industry in the country has the potential to significantly enhance GDP; however, illegal operations circumvent taxes, royalties, and export duties, resulting in annual revenue losses amounting to billions of naira (NEITI, 2022). This loss deprives the country of resources that could enhance infrastructure, education, and healthcare. The emergence of an underground black-market economy negatively impacts the formal sector and deters legitimate investments in mining.

Research Questions

The following research questions were addressed in the study

i. What are the factors influencing the prevalence of informal mining activities in selected Local Government Areas in Osun State?

ii. What is the effect of informal mining activities on environmental sustainability of the study area?

Objectives of the Study

The general objective of the study assessed the effect of informal or illegal mining activities on environmental sustainability in Atakunmosa East and West Local Government Areas of Osun State. While the specific objectives of study are to:

i. investigate the factors influencing the prevalence of informal mining activities in selected Local Government Areas in Osun State; and
ii. assess the effect of informal mining activities on environmental sustainability in the study area.

Hypotheses of the Study

The following hypotheses were tested in the study:

i. **$H0_1$**: Informal mining activities do not have significant effect on environmental sustainability of the study area.

Scope of the Study

Contextually this study focused on the informal mining activities and Environmental sustainability in Atakunmosa Area of Osun State, Nigeria. The factors that cause informal or illegal mining activities, environmental degradation in the form of soil erosion, water pollution, environmental pollution, and health hazard and government mining regulatory framework were the scope of the study.

LITERATURE REVIEW

Conceptual Review of Literatures

Concept of Informal or Illegal Mining Activities in Nigeria

Mining in Nigeria started as far back as the pre-colonial period, when gold, tin and lead were mined using crude methods. Nevertheless, after the discovery of oil in the 1950s, the mining industry has faced major negligence, which has led to collapse of many formal mining corporations. The lack of regulation has resulted in illegal and informal mining being developed, particularly in rural areas where mineral resources act as a source of survival of financially less fortunate communities (Garvin et al., 2019).

There is a significant number of environmental and social impacts surrounding the unregulated or illegal mining in Nigeria and this is primarily attributed due to lack of emphasis on safety and the low levels of enforcing the regulations. Among the most visible environmental effects, it is possible to cite the elimination of the large pieces of land using the assistance of the uncontrolled open-pit mining and forestation. Investigations like the one presented by Garvin et al. (2019) have attested that AI in such places as Zamfara and Niger led to the destruction of forests and cultivated lands due to illegal gold mining. Also, there is contamination of rivers, lakes and drinking water with toxic chemicals that are used to extract the gold and that are

harmful to biodiversity and health e.g., mercury, cyanide (Obi & Chinedu, 2023). Mercury presents considerable dangers, as noted by Bawa and Ibrahim (2023), leading to serious neurological harm to nearby populations, particularly children, who come into contact with water tainted by mercury.

Small-scale gold mineral mining contributes to poverty alleviation by generating employment opportunities and income streams, while simultaneously bolstering local businesses that utilise raw materials sourced from the community and its vicinity. The funds acquired by the victors are primarily allocated towards food, transportation, education, and health care. The benefits of victory often come at a cost, as the exploitation of this natural resource threatens the ability of future generations to access the environment (Adu-Baffour et al., 2021). In addition, land deterioration, loss of plants and animals, unprecedented pollution of water bodies and destruction of agriculture are some of the most notable negative consequences and impacts of small-scale mining. The most widely used mode of mineral extraction is strip mining, which has a lot of effects on the environment and which may impose risk and loss to the workers as well as people living around the region. It has been reported that small-scale gold miners have lost their lives after incidences such as collapsing mines underground (Beylot et al., 2021).

Sustainable mining development is an international project that focuses on the significance of economic, social and environmental sustainability (Wireko-Gyebi et al., 2020). However, Stemn (2020) claims that small-scale mining has become an essential sector in every developing country. Over the past years, there has been a growing rate of interest and apprehension of different small-scale mining processes, particularly in the areas that are renowned to harbor gold mining. Artisanal or small-scale mining supports millions of people; nevertheless, it has major environmental consequences, including health hazards, socioeconomic costs, poverty, and political conflicts (Adu-Baffour et al., 2021).



Figure 2.1: Environmental Degradation Due to Mining Activities

Mining activities in Southwest Nigeria are of concern as far as the environmental impacts are concerned. Some of the most important challenges that are linked to the legal and illegal mining processes are deforestation, land degradation and water pollution. Adebayo et al. (2020) concluded that the non-regulated mining is mostly not in agreement with the environmental laws and therefore causes dire environmental harm. Negative effects of such operations on the habitats leading to soil erosion and pollution of water sources with adverse effect on local agriculture and health of the people of concern was touched on in the paper.

In as much as mining can create jobs, the same process increases the socio-economic problems. Immigration to the mining regions is usually associated with a clash of land use and resource allocations. Okwu et al. (2021) noted that illegal mining usually causes land conflicts, which create tension between miners and the local farmers. Furthermore, a lack of good regulation systems exposes most communities to risks of being taken advantage of by larger companies and black-market players.

Alternatively, the Nigerian government has come to recognize that it must have an approach to mining organization that is more formal. In building the Nigerian Minerals and mining act 2007, it has been established such that it would promote sustainable mining operations and also attract foreign investors. However, the methods of the enforcement are generally inefficient, particularly in the isolated parts where the illegal mining is prevalent (Federal Ministry of Solid Mineral Development, 2020). Effectiveness in policies and community involvement are very essential in solving the challenges that accrue as a result of mining activities.

There is a diversified approach to mining in the community. Some perceive it as a means of attracting economic prosperity, others are concerned with how it destroys the environment and possible health impacts that may occur. In one study conducted by Osunade et al. (2022), it turned out that the majority of the participants were aware of the economic value of mining, besides sharing significant concerns about the environmental impact. The community is increasingly finding it necessary to have its say in the activities of decision making processes that are centered on the mining activities to guard the interest of these communities.

Illlegal mining is widely practiced in Nigeria particularly artisanal and small scale mining is generally practiced in an environmentally unsafe manner bringing severe consequences on the land, the air and the water resources. Adeola (2022) and Ojo et al. (2023) pay attention to the environmental implications of the illegal mining procedure and the outcomes of the process in the regions with gold deposits. Open pit mining and poisonous chemicals such as mercury and cyanide are some of the technologies that have contributed to soil erosion, destruction of forests as well as water pollution. The cutting of trees that goes hand in hand with illegal mining is of particular concern since this destroys habitats besides causing impoverishment of biodiversity and enhanced climate change.

Theoretical Review

Resource Curse Theory

Resource Curse Theory proposed by Richard Auty in 1993 attempts to address the paradox in which countries with large natural resources, the non-renewable ones in particular, e.g., oil

and minerals, tend to grow more slowly, have lower democratic systems, and yield poorer development outcomes than their less resource-endowed counterparts. The phenomenon can be attributed to the fact that in most cases where a country is blessed with a lot of natural resources, it becomes economically unstable, full of corruption, and prone to conflict and war, rather than economic development.

The Resource Curse Theory, commonly known as the "Paradox of Plenty," posits that countries rich in natural resources, like minerals, often face reduced economic growth, higher corruption rates, and greater environmental degradation relative to nations with fewer resources. This theory is especially applicable to the mining industry since the countries that are rich in resources tend to overexploit natural resources, consequently endangering not only the long-term economic sustainability, but also the environmental health, as well.

Environmental Implications: - This over-reliance on mining activities normally leads to disastrous effects such as forestation, soil erosion and pollution.

Empirical Findings

Factors Responsible for Illegal Mining Activities

According to Bawa and Ibrahim (2023), a significant percentage of the young men involved in illicit mining activities consider mining a viable source of income since it is the only option available to them in the face of limited economic opportunities in rural areas. However, the informality of these activities regularly contributes to unsafe working conditions, miners not always having proper precautions, and an impressive number of accidents and fatalities. The absence of formalisation denies the miners and the communities they live in the economic wealth generated by mining activities since their profits are often diverted by intermediaries and smuggling groups.

In the Southwest Nigeria, mining is a very critical economic activity. Olatunji et al. (2023) conducted a quantitative study based on the data provided by 200 mining companies that are based in Ekiti, Ogun and Oyo States. The econometric model revealed that the mining sector accounted for roughly 8.2% of the region's GDP in 2021. Analysis showed that mining jobs had a direct impact on about 12,000 jobs, and indirectly about 35,000 workers in other activities such as transport and local services were influenced.

METHODOLOGY

This study was carried out in Atakunmosa East and West Local Government Areas of Osun state in Nigeria. Osun state is located in the South Western part of Nigeria. The state is blessed with natural resources which support mining activities in several Local Government Areas. Population is the total number of subjects of interest to the researcher. In line with the study, the population consists of various key stakeholders who have experience on mining activities in Osun State. The respondents were selected from (Community Stakeholders in Atakunmose LGA, Employee of the Regulatory Agencies in Osun State, and Miners (Legal and Illegal), and Ministry of Environment. Total estimated population of community leaders and mining professionals are two hundred and ninety (290). Purposive Sampling: For selecting key

informants such as, regulatory officials, key informants on informal mining activities and environmental experts who can provide in-depth insights into informal mining activities. A sample size of One Hundred and Sixty (165) respondents is adequate for a population of (290) using Krejcie and Morgan calculation table. This number is considered adequate and representative enough to give informed answers to the research questions. To ensure that all the various groups in the sampling frame were surveyed, the stratified sampling technique or approach was used in the first stage of the selection exercise.

A questionnaire was designed in a closed ended question. It was given to the identified respondents. Primary data was collected using a questionnaire distributed to the respondents. The section A of the questionnaire include demographic information such as (age, gender, education, occupation). While section B include: Awareness of illegal mining activities, Perceived impacts on the environment, health, and the local economy. The questionnaire was administered among selected respondents in the communities and mining professionals. Focus group discussions with community leaders, members and mining professionals was carried out to explore collective experiences and perceptions about informal mining activities. This method facilitates interaction and reveals insights into mining activities in the study area. Method of data analysis includes both descriptive and inferential statistics. Frequency, mean and standard deviation were used to analyze the descriptive data. Pearson Correlation Coefficient was used to analyse the relationships between digital marketing determinants and students' shopping behaviour. Multiple regression analysis was used to analyse stated hypotheses It highlights the most important factors that influence customers' decisions to buy.

RESULTS AND DISCUSSION

Response Rate

This chapter presents and discusses the results obtained from the field survey conducted in Atakunmosa East and West Local Government Areas of Osun State. The analysis is based on responses to the structured questionnaire designed to address the study objectives. Out of the 168 copies of questionnaire administered to respondents, 125 were retrieved and found valid for analysis, representing a response rate of 74.4%. This high response rate enhances the reliability of the findings and ensures that the perspectives captured are representative of the study area.

Table 4.1: Questionnaire Response Rate

Questionnaire Distributed	Questionnaire Retrieved and Valid	Response Rate
168	125	74.4%

Source; Field Survey, 2025

Factors Influencing the Prevalence of Informal Mining Activities

Informal or illegal mining also called artisanal mining has spread to many regions in Nigeria as a result of economic hardship, weak enforcement of regulations and high demand of mineral

resources (Hilson, 2002). However, in the Osun State (especially in the Atakunmosa East and West Local Government Areas), there has been an alarming trend of informal mining which has brought about the question of its environmental and socio-economic impact. Identifying the factors that have contributed to this prevalence is important in order to make effective policies and intervening in the community. Poverty, unemployment rates, ineffective institutional frameworks, and the high profitability of mineral exploitation conducted without any regulatory conditions usually play a significant role in the prevalence of informal mining activities (Bansah, Yalley & Dumakor-Dupey, 2016). This goal aims at exploring these root causes in order to formulate specific measures which can curb the adverse impacts of these activities on the sustainability of the environment.

The findings provided on Table 4.2 represent the views of the respondents regarding different aspects that have led to the prevalence of informal mining in Atakunmosa East and West Local Government Areas of Osun State. The Likert scale was applied to measuring each item and the Relative Importance Index (RII) was used to determine the ranking of the level of influence. The missing opportunities in the area turn out to be the factor of the highest rank, with a mean score of 4.67 and the RII of 0.93. This implies that unemployment contributes greatly to people turning to other means of livelihood like informal mining which is more accessible and seems to be lucrative. Right behind is poverty and economic hardship also possessing an RII of 0.93 and mean of 4.65. This means that the socio-economic conditions of the area force citizens to undertake informal mining as survival mechanism.

The strongly agreed response was that informal mining yielded higher immediate returns in terms of finances than other sources of finance available (mean = 4.63, RII = 0.93). This economic factor renders informal mining very attractive even though it is illegal and it is associated with environmental consequences. The need of the precious metals like gold leads to the development of informal mining (mean = 4.62, RII = 0.92). The economic worth of these minerals acts as a great incentive to the locals to get involved into such activities.

The unawareness of the environmental impact of the informal mining had a mean of 4.54 and RII of 0.91. This shows that the level of environmental education is low and most of those involved may not be aware of the damages their practices bring. Also of significance is the insufficient implementation of mining rules (mean = 4.50, RII = 0.90). Informal mining flourishes where there is no or little enforcement with no deterrence in place.

Many of the respondents agreed that informal mining is not only considered as a livelihood, but also a survival mechanism due to a lack of alternatives with a mean score of 4.48 and RII of 0.90. The ratings of the influence of local elites or powerful individuals, which might provide some protection or ease of mining operation to serve personal interests, was 4.46 (mean) and RII 0.89. This is indicative of the fact that informal mining is entrenched in the local power structures. The presence and accessibility of the mining sites is also a factor that leads to the prevalence of the activity (mean = 4.42, RII = 0.88). Accessibility makes it less difficult to enter and promotes the involvement of the local people.

Table 4.2: Factors Influencing the Prevalence of Informal Mining Activities

Factors influencing the prevalence of informal mining activities	SD (%)	D (%)	MA (%)	A (%)	SA (%)	Mean	RII	Remark
The lack of employment opportunities in Atakunmosa East and West is a major factor influencing informal mining activities.	0.00	0.80	0.0	30.40	68.80	4.67	0.93	Very High
Poverty and economic hardship contribute to the prevalence of informal mining activities in the study area.	0.80	0.0	0.80	30.40	68.00	4.65	0.93	Very High
Informal mining provides better immediate financial returns compared to other sources of livelihood, making it an attractive option.	0.00	0.00	0.00	36.80	63.20	4.63	0.93	Very High
The demand for minerals such as gold and other precious stones is driving informal mining activities in the area.	0.00	0.00	0.00	37.60	62.40	4.62	0.92	Very High
Lack of awareness about the negative environmental impact of informal mining activities contributes to their prevalence.	0.00	4.00	0.00	34.40	61.60	4.54	0.91	Very High
The inadequate enforcement of mining laws and regulations encourages informal mining activities in the Local Government Areas.	0.00	1.60	0.80	44.00	53.60	4.50	0.90	Very High
Informal mining is driven by the need for survival, as many individuals view it as a necessary livelihood.	0.00	0.00	0.80	50.40	48.80	4.48	0.90	Very High
The involvement of local elites or influential individuals in informal mining activities has a significant impact on their prevalence.	0.00	0.00	0.80	52.00	47.20	4.46	0.89	Very High
The availability of easy-to-access mining sites in Atakunmosa East and West fosters the prevalence of informal mining.	0.00	0.80	0.00	55.20	44.00	4.42	0.88	Very High
The absence of formal education and skills training among the local population leads to higher participation in informal mining.	1.60	1.60	0.00	61.60	35.20	4.27	0.85	Very High
Average Relative Importance Index (RII)							0.905	Very High

SD - Strongly Disagree; D – Disagree; MA – Moderately Agree; A – Agree; SA - Strongly Agree Very Low = 1.00 - 1.80; Low = 1.81 - 2.60; Moderately High = 2.61 - 3.40; High = 3.41 - 4.20; Very High = 4.21 - 5.00

The empirical findings from Table 4.2 underscore the complex and interwoven factors that drive the prevalence of informal mining in Atakunmosa East and West Local Government Areas of Osun State. At the forefront, the lack of employment opportunities, poverty, and economic hardship emerged as the most influential drivers. These results align with the broader body of literature that situates informal mining within the context of economic survival and livelihood diversification in resource-rich but impoverished regions of Nigeria (Hilson, 2002). Specifically, studies by (ILO, 2023) and Ezeaku (2011) highlight that in rural Nigerian communities, especially in states like Zamfara and Niger, unemployment and poverty consistently push individuals especially youth toward artisanal mining as a means of sustenance.

The fact that the informal mining has the immediate economic advantage lends credence to the economic rationality model of informal labour participation that has people focus on immediate rewards over long-term sustainable ones (Tschakert, 2009). Such economic drive is also echoed in the work of Adeyemi et al. (2020) on Kogi State, which found that in many cases miners were cognisant of the legal and environmental impacts of their actions but decided to mine due to the relative economic benefits as compared to subsistence farming and petty trade. Similarly, the RII scores that indicate high prices of mineral demand also support the findings of Ifatimehin et al., (2021) who focused on the contribution of the market demand of gold and other precious minerals to the sustainability of informal mining in Osun and Oyo states.

Environmental awareness and poor enforcement of mining laws also show to be empirically important (RII = 0.91 and RII = 0.90 respectively). These results are indicative of institutional failings-a common theme in Nigerian environmental governance literature. As an example, Aigbedion and Iyayi (2007) concluded that the lack of a strong environmental education and governmental control allows the spread of destructive mining exploits in Edo State. On the same note, research conducted by (Machokoto & Banwa, 2025) points out that the lack of regular law enforcement and community-based monitoring of the environment means that without consequence, informal miners have a tendency to act with impunity that contributes to the degradation of land and water pollution.

Also, the identification of survivalist motives (RII = 0.90) and local elites' involvement (RII = 0.89) implies the political economy dynamic of informal mining as being something more than a purely economic practice but rather a practice influenced by social stratification and local governance arrangements. This confirms the statement of Omotehinse and Ako (2019) that traditional authorities and other influential people tend to benefit off informal mining and therefore are a two-sided coin that either supports or weakens regulatory efforts. This would mean that it might be worthless to run anti-mining campaigns without the participation of these local power brokers.

Also, geographical accessibility (RII = 0.88) supports the study of Bansah et al. (2021) that the proximity to mineral deposits decreases the entry costs to unskilled people, stimulating informal mining. The low-levels but still high impact of the lack of formal education and skills training (RII = 0.85) indicates a gap in capacity that has been reported in the literature, as in Quarm et al., (2022) where the authors placed a focus on vocational education to reallocate labour due to the environmental degradation of mining industries to alternative livelihoods.

On the whole, these findings are extremely important. They first demand combined interventions, which take into consideration economic and institutional conditions. Second, they emphasize the importance of inclusive stakeholder approaches that bring on board local leaders, traditional institutions and civil society organizations. Third, the evidence substantiates the thesis that unless formal education, law enforcement, and alternative livelihoods are reinforced, the attempts to contain informal mining can fail to be effective. These results echo national and sub-national studies in Nigeria, suggesting that the issues

experienced in Osun State are symbolic of a more general trend in artisanal and small-scale mining in the country.

Effect of informal mining activities on environmental sustainability

Informal mining activities have been widely associated with significant environmental degradation, including deforestation, water pollution, soil erosion, and habitat destruction (Dehkordi et al., 2024). In Nigeria, the proliferation of unregulated artisanal mining has raised growing concerns about its long-term implications for environmental sustainability, especially in mineral-rich rural communities. In Osun State, particularly in Atakunmosa East and West, the visible effects of informal mining on land and water resources call for empirical evaluation. This objective seeks to assess the direct impact of informal mining activities on environmental sustainability in the study area, providing evidence-based insight into the scale and nature of ecological consequences tied to such practices.

The regression analysis summarized in Tables 4.3 through 4.5 was conducted to assess the effect of informal mining activities on environmental sustainability in Atakunmosa East and West Local Government Areas of Osun State. The model summary (Table 4.3) indicates a very weak relationship between informal mining activities and environmental sustainability, as evidenced by a Pearson correlation coefficient (R) of 0.034. The R Square value of 0.001 shows that only 0.1% of the variance in environmental sustainability is explained by informal mining activities. The Adjusted R Square is negative (–0.007), which suggests that the inclusion of the independent variable (informal mining activities) does not improve prediction accuracy over the mean model. The standard error of the estimate is 0.28716, indicating moderate variability of the residuals around the predicted values.

The ANOVA (Table 4.4) output further indicates that the regression model is not statistically significant. The regression sum of squares is 0.011, while the residual sum of squares is 9.813, resulting in a total sum of squares of 9.824. The F-value of 0.137 is very low, and the associated significance value (Sig.) is 0.712, far above the conventional alpha levels of 0.05 or even 0.10. This confirms that the predictor variable does not significantly explain the variation in environmental sustainability, and the overall model is not statistically significant.

As shown on Table 4.5, the unstandardized coefficient (B) for informal mining activities is –0.034, indicating a negative but negligible relationship with environmental sustainability. This suggests that increases in informal mining activity are associated with a very slight decrease in environmental sustainability, though the effect is trivial. The standard error of the coefficient is 0.092, and the t-value is –0.370. Most importantly, the p-value (Sig.) is 0.712, which is well above the threshold of 0.05, indicating that the coefficient is not statistically significant. The standardized beta coefficient is also –0.034, confirming that the magnitude of effect is both small and non-significant.

Hypothesis Testing

The null hypothesis (H_{02}) states that informal mining activities do not have a significant effect on environmental sustainability in the study area. Given the regression findings, $R^2 = 0.001$

(effect size is negligible); ANOVA Sig. = 0.712 (not significant); Coefficient Sig. = 0.712 (not significant). There is no statistical evidence to reject the null hypothesis. Therefore, we fail to reject H02, concluding that informal mining activities, as measured in this study, do not have a significant effect on environmental sustainability in the Atakunmosa region.

While informal mining is widely believed to negatively impact the environment, the regression results from this study suggest that, in this specific context, informal mining activities are not statistically associated with measurable changes in environmental sustainability. This result may point to limitations in the measurement of informal mining intensity, a disconnect between perception and empirical outcomes, or the influence of unmeasured confounding variables such as enforcement, education, or ecological resilience. Further investigation using expanded models and alternative indicators is recommended to fully understand the dynamics at play.

Table 4.3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.034[a]	0.001	-0.007	0.28716

a. Predictors: (Constant), Informal Mining Activities

Table 4.4: ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	0.011	1	0.011	0.137	.712[b]
	Residual	9.813	119	0.082		
	Total	9.824	120			

a. Dependent Variable: Environmental Sustainability

b. Predictors: (Constant), Informal Mining Activities

Table 4.5: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	**Std. Error**	**Beta**		
1	(Constant)	4.508	0.100		44.978	0.000
	Informal Mining Activities	-0.034	0.092	-0.034	-0.370	0.712

a. Dependent Variable: Environmental Sustainability

Source: Field Survey, 2025.

The regression results in Tables 4.3 to 4.5 offer key empirical insights regarding the relationship between informal mining activities and environmental sustainability in Atakunmosa East and West LGAs of Osun State. Statistically, the results indicate a very weak and non-significant relationship between informal mining and environmental sustainability.

The model's R value of 0.034 and R^2 of 0.001 suggest that only 0.1% of the variance in environmental sustainability is explained by informal mining activities, while the adjusted R^2 (–0.007) further implies that the model performs worse than the mean prediction. The coefficient for informal mining activities (B = –0.034; p = 0.712) confirms a negligible and statistically insignificant negative relationship.

These findings challenge the widely held assumption that informal mining universally contributes to environmental degradation. While numerous studies have emphasized the destructive ecological consequences of informal or artisanal mining in Nigeria, particularly in relation to land degradation, deforestation, and water pollution (Aigbedion & Iyayi, 2007; Hilson, 2002; Omotehinse & Ako, 2019), this study's result suggests a more complex and possibly context-dependent relationship.

A potential implication is that the informal mining activities measured in the study has not sufficiently represented its magnitude and ecological intensity. Research like Yakubu (2020) and Babalola et al. (2021) have highlighted that the impact on the environment can be very different based on the amount of extraction, distance to water bodies, the methods of mining, and the effectiveness of enforcement. The weak statistical effect could be a reflection of relatively small scale or dispersed informal mining in Atakunmosa East and West or a reflection of natural regenerative processes helping to compromise the physically visible degradation.

Additionally, the difference in distance between the perceived and actual impact (as indicated in the previous descriptive analysis with high score on RII of degradation and pollution) may be a perception-reality gap. This aligns with results obtained by Oladeji and Ajayi (2019) who stated that localized perceptions of environmental depreciation frequently surpass quantifiable physical harm, more so in scenarios in which there has been regulatory discourse in framing the masses.

Also, the moderating effects of influences not included in the regression model that could be the government regulation, traditional land-use practices, or adaptive community behavior are possible. Even in the absence of regulatory oversight, Ibrahim et al. (2021) demonstrated that environmental resilience and local community engagement strategies would alleviate the environmental impacts of mining. The insignificance in regression of this study may thus be indicative of a local level intervention that cushions environmental degradation, or an incomplete specification of pertinent variables in the statistical model.

Policywise, these results highlight the importance of stronger monitoring systems of the environment and enhancing data on the intensity of informal mining and practices. It also begs the question of whether or not it is sufficient to employ perception-based or single-item proxies to model complex environmental outcomes. Empirical detection of mining effects could be enhanced in future research using geospatial approaches or environmental quality indicators (soil fertility, water contamination) to enhance the identification of mining effects.

Although the theoretical and observational studies in various parts of Nigeria continue to corroborate that informal mining is destroying the environmental conditions (Omotehinse & Ako, 2019; Ayanlade & Owolabi, 2020), the empirical study in the present case study, did not

confirm the statistically significant relationship between the two variables. The finding warrants caution when generalizing the effects of informal mining on the environment across different regions and the importance of pursuing more in-depth, multidimensional research on local processes, the quality of measurements, and mediating forces that may be environmental or governance.

Conclusion

The findings in the present study are significant contributions to the understanding of the relationship between the informal mining activities and environmental sustainability in the Atakunmosa East and West LGAs. Although environmental degradation is commonly associated with informal mining in general literature, the empirical result in this case, did not provide a statistically significant direct relationship. Rather, the results provide evidence that the factors associated with the abundance of informal mining and its impacts on the environment can be deemed as the underlying socio-economic factors.

Compared to past studies carried out in Nigeria such as the one carried out in Zamfara, Niger and Plateau States, the study indicates that the research has a certain divergence in statistical findings but convergence in the thematic issues, especially the roles of poverty, livelihood dependency, and bad governance in perpetuating informal mining activities. Similar analyses have been made in Ghana and Tanzania which have also reported the overwhelming influence of socio-economic and institutional issues over technical environmental-related issues in the evaluation of the effects of artisanal mining. These findings are in line with other studies elsewhere in Nigeria and Africa, which stress the importance of a more context-specific approach and the socio-economic factors that drive them. The paper finds that the issue of environmental sustainability in the region needs to be tackled in a multidimensional way, including policy reform, improved enforcement, community involvement, and development of alternative sustainable livelihoods.

Recommendations

i. Policy Reform: Adopt policies that address the root causes of informal mining such as poverty alleviation, and employment generation to minimize reliance on mining as a socio-economic activity.
ii. Enhanced Enforcement: Enhance the enforcement of environmental regulations and mining laws to curb the negative impact of informal mining activities on the environment.
iii. Community Engagement: Engage the local communities and traditional authorities in the formulation and enforcement of mining regulations to make the practice sustainable and reduce illegal activities.

REFERENCES

Adebayo, A., Olayanju, O., & Ogunjobi, O. (2020). Environmental impacts of illegal mining in Southwest Nigeria. *Environmental Management and Sustainability, 18*(3), 121-134.

Adeyemi, O., et al. (2020). The impact of artisanal mining on the environment in Kogi State, Nigeria. *Environmental Sustainability Journal, 15*(3), 55–63.
Adu-Baffour, S., Owusu-Sekyere, E., & Osei, E. (2021). The environmental and socio-economic impacts of small-scale gold mining in Ghana. *Environmental Economics and Policy Studies, 23*(3), 477-496.
Aigbedion, I., & Iyayi, S. E. (2007). Environmental effect of mineral exploitation in Nigeria. *International Journal of Physical Sciences, 2*(2), 33–38.
Akabzaa, T., Ofosu-Mensah, A., & Hammah, R. (2007). Mining and environmental degradation in Ghana: The case of gold mining in the Ashanti Region. *Journal of Environmental Management, 40*(2), 251-268.
Ayanlade, A., & Owolabi, A. (2020). Informal mining and environmental degradation in Nigeria. *Journal of Environmental Science, 22*(2), 105–118.
Babalola, T., et al. (2021). Environmental impact of informal mining in Nigeria. *International Journal of Environmental Studies, 34*(1), 41–50.
Bansah, K., Yalley, F., & Dumakor-Dupey, N. (2016). The drivers of informal mining in Ghana: A case study of the gold mining areas. *Natural Resources Research, 25*(4), 239–252.
Bawa, A., & Ibrahim, M. (2023). Mercury contamination and the effects of artisanal mining on public health in Nigeria. *International Journal of Environmental Health, 35*(4), 443-455.
Beylot, P., Garvin, T., & Okwu, M. (2021). Occupational safety in small-scale mining: A study of artisanal gold mining in Nigeria. *Mining Safety Journal, 44*(2), 78-85.
Castilla, M., Amancio, J., & Lopez, S. (2015). Corporate involvement in informal mining practices: A case study of the Latin American gold market. *Mining Economics, 30*(2), 101-111.
Dehkordi, M., et al. (2024). Land degradation and pollution due to mining activities in rural communities. *Environmental Management Review, 33*(4), 74–85.
Dozolme, A. (2018). Defining informal and illegal mining in West Africa: A review of the literature. *African Mining Review, 22*(1), 33-47.
Ezeaku, P. (2011). Artisanal mining and economic impact in rural Nigeria. *Journal of African Economic Studies, 5*(2), 101–112.
Federal Ministry of Solid Mineral Development. (2020). *Nigeria Minerals and Mining Act 2007* (Amended 2020). Federal Government Printing.
Garvin, T., Ofosu-Mensah, A., & Yakubu, R. (2019). Informal mining and its effects on local communities: A study of rural Nigeria. *Journal of African Development, 25*(4), 256-269.
Hilson, G. (2002). The environmental impact of small-scale gold mining in Ghana. *The International Journal of Environmental Studies, 59*(5), 515–530.
Huerbsch, S., & Spiro, S. (2016). The economics of illegal mining: The role of syndicates in artisanal mining in West Africa. *International Journal of Resource Economics, 9*(3), 112-125.
Ibrahim, M., et al. (2021). Community strategies for mitigating mining's environmental impact. *Environmental Policy and Governance, 30*(6), 482–493.
Ifatimehin, O., et al. (2021). Market demand and informal mining in Osun and Oyo States, Nigeria. *Resource Economics Journal, 27*(3), 112–121.
Machokoto, M., & Banwa, F. (2025). Mining governance in Nigeria: Law enforcement and community monitoring. *International Mining Policy Review, 8*(2), 120–132.
Ofosu-Mensah, A. (2010). The implications of illegal mining for Ghana's economic and environmental sustainability. *Environmental and Resource Economics, 16*(2), 231-245.
Okoye, C., & Maduka, C. (2023). The impact of gold demand on informal mining activities in Nigeria. *Global Economic Journal, 12*(2), 54-70.
Okwu, M., Bello, A., & Nwachukwu, C. (2021). Land use conflicts in Nigeria's mining communities: Effects on agriculture and local economy. *Agricultural Economics Review, 29*(4), 93-104.
Oladeji, A., & Ajayi, O. (2019). Perception of environmental degradation in informal mining communities. *Environmental Awareness Journal, 21*(4), 118–126.
Omotehinse, O., & Ako, R. (2019). Informal mining and environmental degradation in Nigeria. *Journal of Environmental Science and Technology, 18*(3), 234–246.
Otegbulu, A., Akintola, O., & Oba, O. (2019). The role of mining in the development of rural Nigeria. *Sustainable Development, 23*(3), 115-128.
Paddock, R. (2016). The impact of mercury contamination from illegal mining in Southeast Asia. *Environmental Health Perspectives, 41*(2), 82-90.
Stem, J. (2020). Small-scale mining and its socio-economic impacts. *Journal of Development Studies, 34*(1), 23-41.
Tschakert, P. (2009). Artisanal gold mining: A survivalist economic model.
UNEP. (2022). *Environmental impacts of mining in the Niger Delta and beyond*. United Nations Environment Programme.
WHO. (2021). *Lead poisoning and health effects in artisanal mining communities in Nigeria*. World Health Organization.
Yakubu, M. (2020). Environmental impacts of small-scale mining in Northern Nigeria. *African Journal of Environmental Science, 26*(3), 105–113.
Yakubu, T., Iwuala, S., & Obi, D. (2022). Poverty, unemployment, and the rise of illegal mining in Northern Nigeria. *Journal of Economic Studies, 15*(2), 120-135.