

## ACHIEVING SUSTAINABLE DEVELOPMENT GOAL ONE THROUGH ARTISANAL SMALL-SCALE MINING IN JOS, PLATEAU STATE, NIGERIA

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### ABSTRACT

*Artisanal Small-Scale mining (ASM) contributions to achieving sustainable development goal (SDG) are under-acknowledged and are often criticized for its environmental and health impacts, this study aimed at revealing its contributions to achieving SDG one (poverty reduction) through assessing its socio-economic impact and level of awareness on environment impacts of ASM in Jos Plateau Nigeria. The study utilized data from questionnaires administered to 119 randomly selected respondents in the study area. Frequencies and percentages were used to summarize the data. The result reveals a complex interplay between livelihood, expenditure patterns, and environmental impacts of ASM where most respondents engaged in ASM for 11-15 years as their primary source of livelihood. Miners' earnings are subject to the quantity of minerals extracted and earned between N1,000-N5,000 daily. Income is allocated to essential needs (food, health, and education). The low saving rate illustrates miners' engagement is for basic living needs. A high awareness of the environmental impact of ASM was recorded for soil and vegetation and varied for air pollution, and water resources, while awareness of health impacts was less pronounced. The study reveals a complex interplay between livelihood, expenditure patterns, environmental impacts, and the potential of ASM to achieve SDG one. ASM should be conducted sustainably, guided by international best practices. This approach should include continuous community awareness and training, and promoting environmental sustainability. Additionally, the conservation of ponds and dams for domestic and irrigation water supply, and reclamation of dry ponds were recommended.*

**Keywords:** *Artisanal Mining, Continuation, Poverty Reduction, Sustainable Development Goal One.*

### 1. INTRODUCTION

The discovery of tin has historically attracted many people to Jos Plateau and the mining of these mineral resources is of prime importance to the people, it presents economic value, is a good source of income to the artisanal miners, and is one important livelihood activity that can help to reduce poverty and achieve economic renewal through the development of non-mining income generating opportunities (Melodi & Mary, 2020). However, the mining of mineral resources is conducted by artisanal small-scale miners who typically use rudimentary techniques and operate under hazardous and unregulated conditions, thus it is informal (Michael *et al.*, 2019; Melodi &

Mary, 2020). Generally, artisanal small-scale mining (ASM) employs manual techniques to access the ore, it is labor-intensive, highly disorganized, and illegal; low productivity and is limited to surface or alluvial mining, it lacks safety measures, or environmental protections, exposure to health hazards, and degradation of the environment and usually practiced seasonally (to supplement farm incomes) or temporarily in response to high commodity prices; and lack of long-term mine planning, (Azubike, 2011; Ako *et al.*, 2014; Ahmed and Oruonye, 2016; Otoijamun, *et al.*, 2021).

ASM in Jos Plateau and Nigeria by extension, is an age-long activity. It has put food on the table of millions of households and has served as the main source of livelihood and household income to many individuals. Canavesio (2014) linked ASM to economic benefits including employment opportunities, tourism, technology advancements, and accessibility to both native and migrant populations. Hilson, (2016) stressed that, in sub-Saharan Africa, ASM has employed millions of people directly and created tens of millions more job opportunities in the downstream industries it spawns. Significantly, many of these individuals move into this sector out of desperation, specifically, in a bid to alleviate their hardship, however, the economic importance of ASM is continuously overlooked in development planning and policy-making processes. Idris-Nda, Waziri, Bida, and Abdullah (2018) supported the above assertion and expressed that “ASM has contributed to development by providing employment, increasing local purchasing power, stimulating local economic growth, and slowing urban migration”.

Recently, there has been a tremendous increase in poverty and unemployment that SDGs 1 frowned upon. This explains why there is a growing number of people who engage in ASM. Oramah, *et al.* (2015) revealed that there is an upsurge in the number of rural inhabitants diversifying their sources of income from farm-based livelihoods to non-farm activities such as ASM. This is due to the seasonality of agriculture right from time immemorial, this has diversified the focus of the livelihood dependent on agriculture to non-farm activities especially in the dry season on the Jos plateau. ASM has been an alternative source of livelihood, a poverty and unemployment reduction mechanism, and a means of acquiring other basic necessities of life. The majority of the artisanal small-scale miners may be drawn to ASM due to the incentive to raise money for other alternative livelihoods and family needs. Specifically, it provides comparatively higher remuneration to other livelihood activities such as farming, carpentry, trading, and bricklaying (Oramah, *et al.*, 2015). Darma (2016) stressed that ASM has the potential to improve the standard of living of people in the community who engage directly or indirectly in ASM by boosting their income level, and the impact may even stretch several years beyond the lifespan of the mining operation.

ASM has commanded improvement in individual, state, and national economic development at large; this should be acknowledged, as it has reduced poverty, improved the standard of living of the miners, and generated revenue for the government. This has attracted many individuals to mining. Idris-Nda, *et al.* (2018) categorized factors of attraction as push and pull factors. The push factors are: a decline in the viability of agriculture, or as a way to supplement agricultural income, poverty, conflict, natural disasters, or economic crisis, while the pull factors include the potential for high profits, idleness due to available time with nothing to do after harvests. Despite all these above-mentioned pushes and pull factors and the importance of improving livelihoods, the extraction of these minerals is done without environmental consciousness, thus negating the attainment of the sustainable development goal that the world is striving to achieve through its various outlined goals and commitments. Mallo (2012) expressed that mineral extraction is

always unguided and not regulated due to a lack of proper policies in place to control their operations. The unguided actions of these informal miners have resulted in both social and environmental issues such as increased dust release; air pollution; increase in mine pit collapse; threat to farmland and crops; damages to buildings; noise from blasting; deforestation, land degradation, and water contamination (Otoijamun, *et al.*, 2021). Melodi *et al.* (2021) affirmed that it caused deforestation, increased vulnerability to flooding, poor access road, destruction of soil, land degradation, and high concentrations of compounds in water above the World Health Organization's (WHO) standards 2017 for domestic water sources (Cortruvo, 2017).

Despite these environmental challenges of ASM, its contributions to human livelihood have been under-rated, and its contribution to achieving sustainable development goal one is under-acknowledged. This is because ASM is often criticized for its environmental and health impacts, and its significant role in providing livelihoods for millions of people globally is frequently overlooked. Many individuals depend on ASM as their primary source of income, which supports not only their families but also local economies. This study therefore is anchored on this premise and aimed at revealing the contribution of ASM to achieving sustainable development goal 1 (poverty reduction) through assessing the socio-economic impact of ASM on livelihood and awareness of mining impact on environmental degradation of the tin mining region of Jos plateau Nigeria.

Jos Plateau and Nigeria are blessed with lots of mineral resources under their soil. The Nigerian Extractive Industries and Transparency Initiative (NEITI) (2012) stated that the Ministry of Mines and Steel Development (MMSD) has identified about 34 different kinds of solid minerals and precious metals buried in Nigerian soil waiting to be exploited that have the potential of contributing significantly to livelihoods of Nigerian and also the economic development of the nation. This explains why the World Bank referred to ASM as a poverty-driven activity that provides an important source of livelihood for miners who engage in the extraction of minerals, and that it has served as a source of livelihood for an estimated 20 million people around the world working in more than 80 countries (World Bank, 2012). These minerals' blessings should have translated into enormous wealth and riches to individuals and the nation at large, and why the commercial value of Nigeria's solid minerals is estimated to be in hundreds of trillions of dollars (Eludoyin *et al.*, 2017). Yet, the majority of Nigerians are wallowing in abject poverty. Economically, the activities of artisanal miners are not yielding the desired economic benefits to the state and nation at large because, from the literature search, no records of payments of taxes and royalties to the state government were discovered, this could not be unconnected to the absence and improper implementation of legal framework to register and monitor the activities of artisanal miners where it exists. It is on that, that it was asserted that Nigeria is losing lots of monetary value from the untapped mineral deposits and smuggling of the little mineral mined out of the country and further believing the health implications in monetary terms outweigh the benefits gained in mining operations (Melodi, 2017).

Mallo (2012) stressed that illegal miners extract minerals in the rawest form and also smuggle them out of the country to willing buyers, this downplays the capacity of minerals mined to bring economic returns to the country. This is despite the importance of mining to economic development in Africa cannot be overemphasized and this sector has played a key role in many African countries through export earnings and Gross Domestic Product (GDP) (Isung *et al.*, 2021). Isung *et al.* (2021), further posited that despite poverty being endemic in developing countries, the emergence of mining has declined incidences of poverty relatively over the years.

Aubynn (2012) cited in Isung *et al.* (2021) postulated that mining employs over 20,000 people in the large-scale mining sector and over 500,000 people in the small-scale mining sector. However, its impact on the mining communities and the environment has always been contentious. Darimani (2010) revealed that most mining activities are rural-based and affect to a large extent the traditional livelihoods of people. It destroys land that should have been put to productive agricultural use. Anane (2008) expressed that most of these rural communities where mining takes place are often left with no or limited livelihood choices due to the effects of the activities on the natural environment. Isung *et al.* (2021) further revealed that agriculture is the single most affected economic activity by mining because mining and agriculture compete for the same scarce resources, especially land, and labour. Hence, it generates inevitable conflict by displacing farmers and rendering them jobless without commensurate compensation.

Mallo (2012) expressed that the unregulated nature of ASM due to poor policy implementation to control their operations in Nigeria, mining has adversely affected mining communities negatively and had not provided them with any benefit during or after mining except the adverse effects on the environment. Ako *et al.* (2014) alleged that most artisanal small-scale miners handling different mineral types work in difficult and often hazardous conditions without the required safety mining regulations to safeguard their mining activities. Melodi *et al.* (2021) stated that due to the absence of a well-developed large-scale mining company with a sustainable and structured operational policy in Nigeria, one would not be wrong to say mining in the country is carried out without due regulation which has created a series of social and environmental challenges ranging from scarring of the environment, loss of farmland, loss of flora and fauna, surface and groundwater contamination, plant and soil contamination, (Idris-Nda, 2013). These have created a series of health and environmental risks associated with their activities and the impact may even stretch several years beyond the lifespan of the mining operation. Amosu & Adeosun (2021) report that the materials and methods that are environmentally unfriendly but used in mining put the health of people in danger. These illegal and unsafe miners hire labour to dig for minerals, but due to their crude methods, they sometimes experience the collapse of mines resulting in several deaths, creating craters that are wide and deep. These formed craters or trenches become mining ponds when it rains, and dangerous acidic and poisonous metallic residue from the mining operations is deposited in the ponds or washed into streams and rivers serving as sources of water. Idris-Nda (2013) further reveals that ASM can pollute waterways through mercury use, dam contamination, a build-up of silt, poor sanitation, and effluent dumped in rivers. In 2014, Ako *et al.* reinforced Idris-Nda's (2013) assertion on the environmental impact of ASM when they said that Nigeria is vulnerable to environmental hazards such as land degradation, de-vegetation, loss of aquatic plants and animals, and water and air pollution.

A review of the enumerated environmental impact of ASM by Amosu & Adeosun (2021) reveals that ASM generally alters and influences the originality of the landscape of the mining location, few materials are left for refilling, like in the quarries of stones, altered the channels of water on the surface and consequential loss of groundwater quality due to the percolation of poisoning wastewater, leaching of stockpiles, and dumps, rain storm washed mined minerals found their ways into the near-by streams that eventually caused high river turbidity and alkalinity, drilling, and blasting of mineral plain-bedded rocks compels animals to migrate from their original ecosystem which has negative effect on the biophysical cycle. The aspects of aerosol (small dust and smoke) propagated from explosions of rocks that settle on the vegetation; affect the

procedural path of plants manufacturing their food, productive portions of land that are wrecked and made unfit for farming for length of years, deny the farmers privileges to such rare land, and after mine-abandonment, there is still a great alteration of the chemical and physical properties and fertility of soil during re-cultivation for farming.

ASM although it is also associated with poverty-driven practices that can lead to environmental degradation and health risks, is essential in achieving sustainable development as it is a source of income for approximately 20 million people globally, supplies minerals essential for the global clean energy transition, and responds to the growing demand for minerals used in everything from smartphones to solar panels and batteries and from roads and buildings. (World Bank, 2012; World Bank, 2024; James & Uyanga, 2024). This explains why the World Bank emphasizes the need for a renewed framework to unlock ASM's potential for economic growth and poverty reduction, advocating for better regulation and support systems to enhance safety and sustainability within the sector (World Bank, 2024). UNDP (2023) corroborated that ASM as a largely informal poverty-driven activity, can be environmentally damaging, often posing serious health and safety consequences for workers and surrounding communities, with little economic benefit. Yet, if properly harnessed, it offers huge potential for increased household income, MSME growth, government revenues, and progress toward achieving several sustainable development goals (SDGs). In recognition above assertion, the World Bank's new approach, articulated in a new report, 'Achieving Sustainable and Inclusive Artisanal and Small-Scale Mining (ASM): A Renewed Framework for World Bank Engagement', is championing the professionalization and social well-being of artisanal and small-scale miners, urging governments to play a leading role in regulating and supporting sustainable ASM practices to achieve national growth targets.

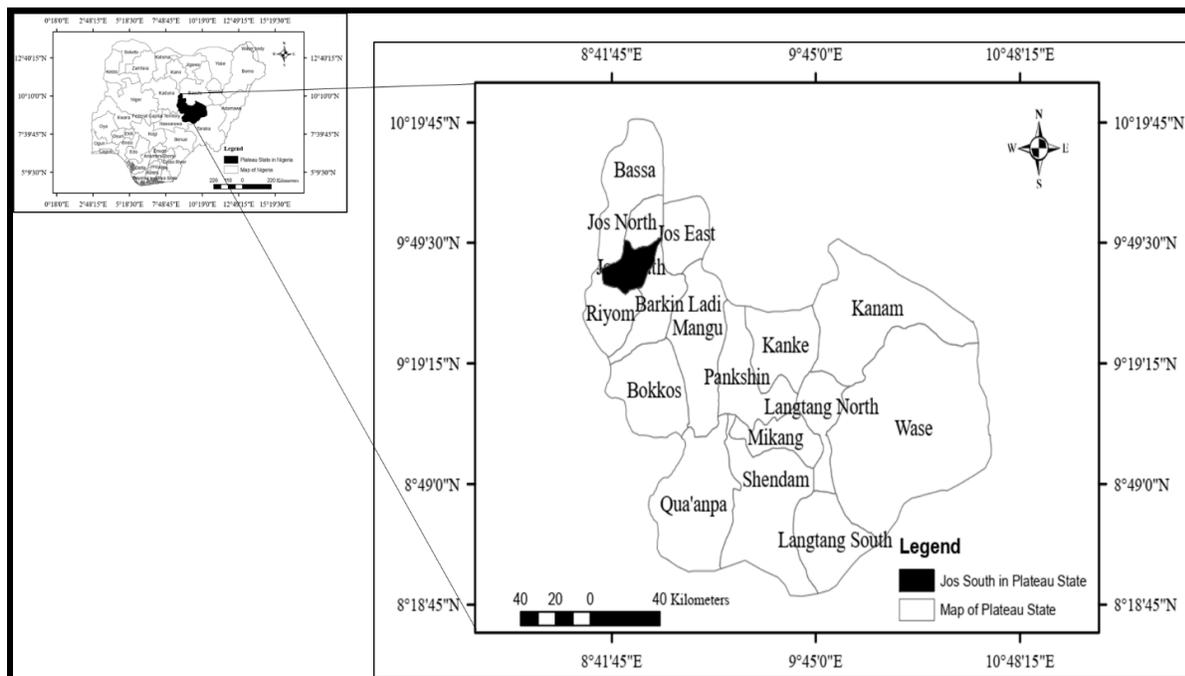
In a recent study conducted by de Haan, Dales, and Mcquilken (2020), which mapped ASM's impacts against the SDGs by analyzing the relationships between ASM and each of the 17 SDGs and their associated targets provides concrete guidance to policymakers, donors, and private partners for harnessing ASM-SDG interlinkages and unlocking the sector's full sustainable development potential. The study revealed both positive and negative relationships. de Haan *et al.* (2020) expressed that even in its informal state, ASM makes positive contributions to almost all SDGs, particularly those concerned with social (SDGs 4, 5, and 10) and economic development (1 and 8), nutrition (2), clean energy, infrastructure, and sustainable cities (7, 9 and 11), adaptation to climate change (13), peace, justice, and governance (16), and partnerships (17). Also, ASM has negative impacts on the majority of the SDGs, particularly those concerned with human health (SDGs 3 and 6), environment (13, 14, and 15), nutrition (2) social development (4, 5, and to some degree, 10), decent work (8), cleaner production (12), and peace, justice, and governance (16). This shows the potential of ASM to contribute to achieving sustainable development.

## **2. MATERIALS AND METHODS**

### **2.1 The Study Area**

Melodi and Mary (2020) reveal that the Jos South is located between latitude 9° 48' 00" - 9° 80' 00" N and longitude 8° 52' 00" - 8° 86' 66" E, see Fig. 1, and occupying a total land area of about 1,037 km<sup>2</sup> (Adegboye, 2012). The geological relief feature is similar to lithological formations and is characterized by eroded gneiss formations, granite intrusions forming massifs with numerous extinct volcanic cones surrounded by basaltic flows composed of the basement complex, biotite granite, and new basalts (Melodi & Mary, 2020). The study area is vegetated

with shrubs and tony plants; there are occasionally tall trees, even though the original woodland vegetation has long been cleared for mining and agricultural activities, turning the region into open savannah grassland with widely spread eucalyptus and acacia trees, and cactus hedges which are used for land/boundary delineation and there are Community Forest seen at locations (Adegboye, 2012; Mallo, 2012).



**Fig. 1: Jos South in Plateau State**

Source: Department of Geography Nigeria Defence Academy Kaduna

## 2.2 Sampling Techniques and Data Collection

The study is limited to Jos South and defined its target population as all miners in Jos South LGA of Plateau state. Since the population of miners in the study area is unknown, the estimated population of miners was used as a criterion to determine the number of sampled respondents for questionnaire administration. Therefore, the World Bank (2012) estimated 20 million miners worldwide working in more than 80 countries was used as a basis for determining the sample size of the study. That is 20 million divided by 80 gives the estimated population of miners in Nigeria, the result was further divided by 36 states and FCT, and the result was further divided by 17 local government areas in Plateau state, from which 30% of the result was sampled, thus given the estimated population of the study.

$$\text{Therefore: } 20\,000\,000 \div 80 = 250\,000$$

$$= 250\,000 \div 37 = 6757$$

$$6757 \div 17 = 397$$

$$30/397 \times 100 = 119.$$

$$= 119 \text{ questionnaires.}$$

Data for this study is presented in tables and figures and was analyzed using descriptive statistics. Plates used in this study were to further provide a clear picture of existing situations.

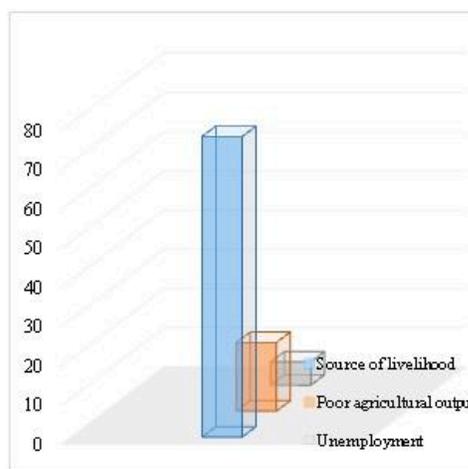
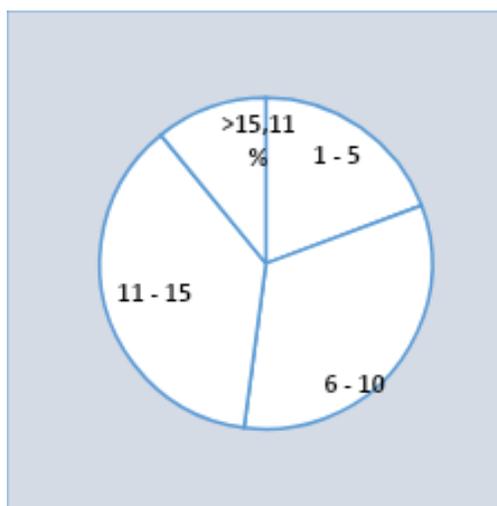
### 3. RESULTS AND DISCUSSION

#### 3.1 Socio-economic Impacts of ASM

This section sought to find out the socio-economic impact of artisanal mining on the people of the study area. This results from the discovery of tin and columbite and the decline in agriculture due to the declining fertility of the soil which made residents search for alternative means of survival among which is ASM. This socio-economic activity has been used as a means for survival (a source of livelihood), a means of defining the socio-economic status of people, and also a means to reduce the unemployment and poverty profile of the people in the study area and Nigeria. The reason this study sought to find out the contribution of ASM as a source of livelihood for the respondents.

##### 3.1.1 Years Engage in Artisanal Mining

The study sought to find out the number of years respondents engaged in ASM. The result presented in Fig. 2 reveals that the majority of the respondents (37%) had engaged in artisanal mining for 11-15 years, about 33% of the respondents had engaged in for 6 -10 years, 19.3% had engaged in mining for 1 - 5 years, while about 11% of the respondent had engaged in artisanal mining for more than 15 years. The engagement of respondents in ASM had positively reduced unemployment rate and poverty profile of the people which confirms Isung *et al.* (2021) findings that despite poverty being endemic, the emergence of mining in communities, the incidence of poverty has relatively declined over the years, where it was postulated that mining employs over 20,000 people for the large-scale mining sector and over 500,000 people in the small-scale mining sector (Aubynn, 2012 cited in Isung *et al.*, 2021).



**Fig. 2: Number of Years Engaged In Mining.**

Source: Fieldwork, 2024.

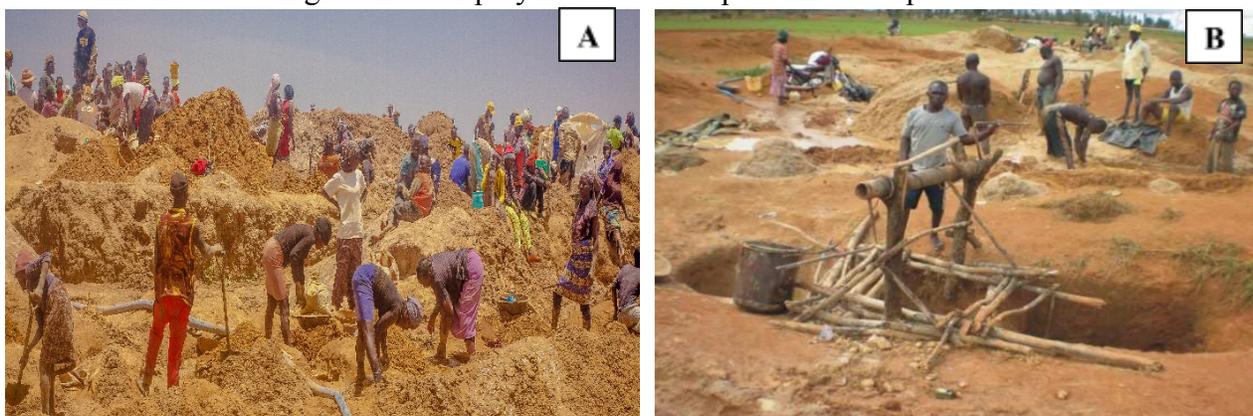
**Fig. 3: Reason for Engaging in Mining**

Source: Fieldwork, 2024.

##### 3.1.2 Reason for Engaging in ASM

The study sought to find out reasons for engaging in ASM, the results presented on Fig. 3 reveal that the majority (about 77%) engaged in ASM as a source of livelihood. This is due to inherent

demand placed on man by reality of life in which the proceed from mining is used in paying bills, also poor agricultural output was a reason given by about 18% of the respondents as to why they engage in ASM as their harvest cannot carter for their needs as they wait for the next raining season, while less than 6% of the respondents said unemployment was behind their engagement in ASM to fend for themselves and family, this confirmed the findings of Darimani, (2010) where it was reported that most mining activities are rural-based and effects to a large extent the traditional livelihoods of people living in these communities as such no government or private establishments that can guarantee employment of the respondents. See plate 1A & B.

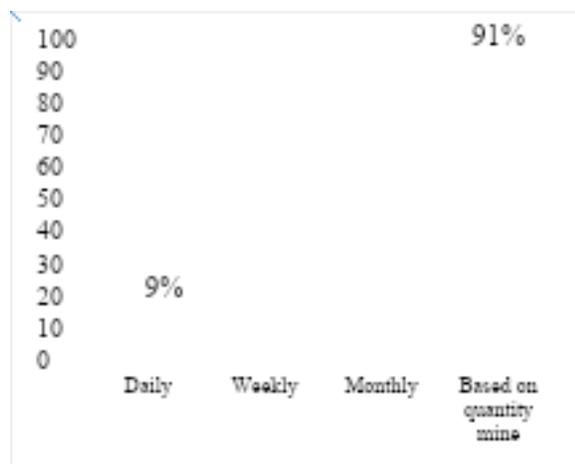


**Plate 1A & B: People Engage in Mining Activities**

Source: fieldwork, 2024.

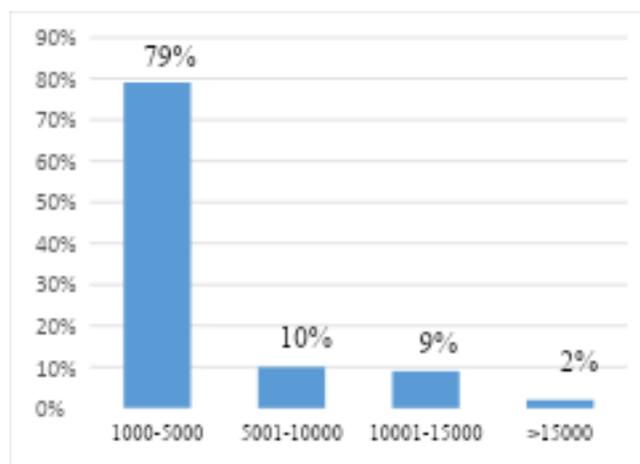
### 3.1.3 Mode of Payment

In a formal engagement of workers, payment is made at month end. Since ASM is not a formal engagement, the study sought to find out how artisanal miners are paid. The finding of the study presented on Fig. 4 reveals that artisanal miners are paid based on the quantity of minerals mined as attested by the majority (about 91%) of the respondents. This is unlike a formal paid job in government and private establishments where payment is usually on a monthly basis or weekly for some companies or casual staff. Artisanal miner payment is based on the quantity they can take to the market for sale daily, weekly or monthly as the case may be. In some instances miners monitor the market value of the minerals before taking their product to the market for sale. Those that attest to being paid on daily bases are less than 10% of the respondents and are basically miners who works for others at the mines, especially women who engage in planning and washing of the extracted earth to separate minerals from mud or soil, while none of the respondents attest to being paid weekly or monthly.



**Fig. 4: Mode of Payment.**

Source: Fieldwork, 2024.



**Fig. 5: Income Earned from ASM.**

Source: Fieldwork, 2024.

### 3.1.4 Income Earned from ASM

As a source of livelihood, artisanal miners are required to earn a certain amount of money at the end of their engagement which will be used for feeding, medical, and other personal and household needs and guarantee their continuous engagement in mining activities, reason this study sought to find out the amount earned by artisanal miners. The findings of the study presented in Fig. 5 reveal that, the majority of the respondents i.e. 79% earned between 1,000 – 5,000, less than 11% said they earned between 5,001 – 10,000, also less than 10% of the respondents earned between 10,001 – 15,000, while less than 2% of the respondents earned above 15,000. Based on the current official exchange rate of the 1730 Naira to 1 dollar), as of Wednesday 6<sup>th</sup> November, 2024 ([www.nairatoday.com/black-market-usd-ngn/](http://www.nairatoday.com/black-market-usd-ngn/)). This indicates that the majority of artisanal miners live below the poverty level of \$2 per person per day which explains why Nigeria is currently regarded as the world’s poorest country with 87 million people living in abject poverty and this number is expected to rise, (World Poverty Clock Projection compiled by Brookings Institution, 2018).

### 3.1.5 How Earning is Spent

Engagement in artisanal mining as a livelihood source comes with earnings, these earned resources are spent based on household needs in certain percentages, the reason this study sought to inquire how earned resources are spent. The findings of the study presented in Table 1 reveal that the majority of the respondents (about 81%) spent 41-60% of their earnings on food, less than 11% spent 20-40% while less than 10% spent 61-80% of their earnings on feeding or food. None of the respondents spent less than 20% or more than 80% of their earnings on food. A good majority of the respondents i.e. 58% spent 21-40% of their earnings on health with about 38% spending 20-40%, while less than 5% of the respondents spent 41-60% of their earnings on health. None of the respondents spent 61-80% or 81-100% of their earnings on health. Also, the majority of the respondents i.e. about 60% spent 21-40% of their earnings on school fees, about 22% of the respondents spent 0-20%, while about 19% of the respondents spent 41-60% of their earnings on school fees. None spent 61-100% of their earnings on school fees. The majority of the respondents i.e. about 85% also spent 0-20% of their earnings on household items, 15.1% spent 21-40% of their earnings on household items while none of the respondents spent 41 – 100% of their earnings on household items. The majority of the respondents i.e. 94.1% save 0 - 20% of their earnings, with about 6% of the respondents saving between 21-40% of their

earnings while none of the respondents save 41-100% of their earnings. The matrix of income spending as expressed by miners with food taking the highest amount of income earned in a confirmation of food as the number one need of man as attested by Watkins, (2019) but a key requirement not just for survival but for long term physical and mental wellbeing.

**Table 1: How Earning is Spent**

Range	0-20%	21-40%	41-60%	61-80%
<b>81-100%</b>				
Items	%	%	%	%
Food	0	10.1	80.7	9.2
Health	37.8	58	4.2	0
School fees	21.8	59.7	18.5	0
Households	84.9	15.1	0	0
Saving	94.1	5.9	0	0

Source: Fieldwork, 2024.

### 3.2 LEVEL OF AWARENESS ON THE ENVIRONMENTAL IMPACT OF ARTISANAL MINING

Though mining is a lucrative venture, there are a lot of health and environmental challenges associated with ASM, these include: epidemics, gullies, unsafe pits, siltation, land degradation, deforestation, and veld fires, yet mining cannot be held because of the socio-economic impact mining has on human and economic of the nation. It is based on this fact that this study sought to find out the level of awareness of artisanal miners on the environmental and health impact of ASM on soil, air, water, vegetation, and health.

The findings of the study as presented in Table 2 reveal that cumulatively, 100% of the respondents are aware of the impact of ASM on the soil because mining degrades the soil by rendering it unproductive, while none of the respondents claimed to be not aware at all, somewhat aware or indifferent to the impact of mining on the soil. See plate 2A, B, C, & D.

On air, cumulatively, 51% of the respondents are aware of the impact of mining on the air, about 29% of the respondents are indifferent, and 20% of the respondents are not aware at all of the impact of mining on the air. Their level of awareness concerning air is in reflection of the invisible particles and gasses released into the atmosphere. In the process of mining chunk of dust is released into the atmosphere causing air pollution; on the impact of ASM on water, cumulatively, about 92% attest to being aware of the impact of mining in water, and about 7% are indifferent on the impact of mining on water, while only less than 2% are not aware of the impact of mining on water.

**Table 2: Level of Awareness on Environmental Impact of Artisanal Mining**

Level of awareness	1	2	3	4	5	Total
<b>Soil</b>						
Responses (%)	0	0	0	9.2	8	10
<b>Air</b>						
Responses (%)	20.	21	28.6	16.8	13.	10
<b>Water</b>						
Responses (%)	1.7	15.1	6.7	39.5	37	10
<b>Vegetation</b>						
Responses (%)	0	3.6	2.4	18.4	75.	10
<b>Health</b>						
Responses (%)	6	26	22.7	25.2	13.	100

(1. Not aware at all; 2. Somewhat aware; 3. Indifferent; 4. Aware; 5. Highly aware)

Source: Fieldwork, 2024.



**Plate 2 A, B, C, & D: Levels of soil Degradation due to Mining Activities**

Source: Fieldwork, 2024.

The level of awareness of the impact of ASM on the water is in recognition of the turbidity of water resulting from the panning of extracted minerals and also the release of harmful sustenance in the water. On vegetation, cumulatively, about 98% of the respondents are aware of the impact of mining, while less than 3% of the respondents are indifferent to the impact of mining on vegetation. Their responses were in recognition of the amount of vegetation that is constantly destroyed due to mining activities in the environment. See plate 3.



**Plate 3: Cleared Vegetation due to Mining Activities.**

Source: Fieldwork, 2024.

On Health, cumulatively, the Majority i.e. about 39% of the respondents are aware of the impact of mining on health, 26% are somewhat aware, about 23% are indifferent to the impact of mining on health, while about 13% are not aware at all of the impact of mining on health despite widely reported impact of mining on health.

Responses expressed show a high level of awareness of the impact of mining on the environment yet unguided and continuous engagement in mining destroyed the environment attributed to the unregulated nature of ASM and poor implementation of policies in place to control mining operations as put forward by (Mallo, 2012), and has confirmed Idris-Nda (2018) findings of mining adversely affecting mining communities and had not provided communities with any benefit during or after mining except the adverse effects on the environment such environmental degradation which range from scared of the environment, loss of farmland, loss of flora and fauna, surface and groundwater contamination, plant and soil contamination, collaborating this Ncube-Phiri *et al.* (2015), when said miners were aware of the negative impact of gold panning as respondents identified specific challenges associated with ASM, to include: epidemics, gullies, unsafe pits, siltation, land degradation, deforestation, and veld fires. Melodi *et al.* (2021) also expressed that mining without due regulation has created a series of health and environmental risks associated with their activities and that the impact may even stretch several years beyond the life span of the mining operation with Amosu & Adeosun (2021) also expressing that, the materials and methods which are environmentally unfriendly but used in mining put the health of people in the community in big danger.

ASM in this study has been acknowledged to be associated with source, it has been used to provide for individual and family essential needs such as food, education, health, among others which sustainable development goals aimed to achieve. This also exposed de Haan *et al.* (2020) positive contributions to SDGs, particularly those enumerated that concerned social (SDGs 4, 5, and 10) and economic development (1 and 8), nutrition (2), clean energy, infrastructure, and sustainable cities (7, 9 and 11), adaptation to climate change (13), peace, justice, and governance (16), and partnerships (17). Based on these expositions, ASM holds significant potential for contributing to sustainable development if managed effectively through recognizing its economic importance while addressing the associated environmental and health challenges.

#### 4. CONCLUSION

This study has explored the socio-economic realities and environmental awareness of individuals engaged in artisanal mining, revealing a complex interplay between livelihood, expenditure patterns, and environmental impacts of ASM. Miners receive payment for their labour where their earnings are subject to the quantity of minerals extracted. The income is predominantly allocated to essential needs, particularly food. Health and education are other significant areas of expenditure. These findings highlight the precarious nature of livelihoods in ASM, where financial resources are stretched thin by basic living expenses. The low saving rate further illustrates that miners' engagement is for basic living needs. The limited savings restrict their ability to invest in future opportunities or respond to emergencies, perpetuating cycles of poverty and instability. In addition to economic factors, this study also assessed the environmental awareness among respondents regarding the impacts of ASM where high awareness of the impact of mining on soil quality was recorded, while awareness levels vary for other environmental aspects: such as air pollution, and water resources. However, there was a strong recognition of the detrimental effects on vegetation. Notably, awareness regarding health impacts was less pronounced. This suggests a critical gap in knowledge that could have significant implications for community health outcomes.

#### 5. RECOMMENDATIONS

Since poverty alleviation is one of the Sustainable Development Goals (SDGs), the continuation of artisanal mining is strongly encouraged, provided it is conducted sustainably to align with these objectives. It is essential to establish effective regulatory frameworks that ensure environmentally and socially responsible practices in artisanal and small-scale mining (ASM). Training programmes should be implemented for miners to promote sustainable practices, and efforts should be made to formalize the ASM sector to enhance its economic potential.

Reclamation of mined-out areas is crucial; this process involves backfilling excavated sites and planting specific tree species that can quickly restore lost nutrients. There is an urgent need for robust regulation and effective monitoring by relevant federal, state, and local government agencies to uphold best practices in the industry. The government should actively promote environmentally sound practices that not only enhance miners' earnings but also ensure safer working conditions.

#### REFERENCES

Ahmed, Y. M. & Oruonye, E. D. (2016). Socioeconomic Impact of Artisanal and Small-Scale Mining on the Mambilla Plateau of Taraba State, Nigeria. *World Journal of Social Science Research*, 3(1), 1-12. [www.scholink.org/ojs/index.php/wjssr](http://www.scholink.org/ojs/index.php/wjssr)

- Ako, T. A., Onoduku, U. S., Oke, S. A., Adamu, I. A., Ali, S. E., Mamodu, A., & Ibrahim, A. T. (2014). Environmental impact of artisanal gold mining in Luku, Minna, Niger State, North Central Nigeria. *Journal of Geosciences and Geomatics*, 2(1), 28–37. <https://doi.org/10.12691/jgg-2-1-5>
- Amosu C. O. & Adeosun T. A. (2021). Curtailing Illegal Mining Operation in Nigeria. *International Journal of Physical and Human Geography*, 9(1), 13-24.
- Anane, M. (2008, March 31) Farmers Resist Newmont Operations in Ajenua Bepo Forest. <https://allafrica.com/stories/200803311331.html>
- Azubike, A. L. (2011). The Technology of Peaty Soils in Mozambique and Angola, Transactions of the 5th International Congress of Soil Science, Leopoldville 3, 398-401.
- Canavesio, R. (2014). Formal mining investments and artisanal mining in southern Madagascar: Effects of spontaneous reactions and adjustment policies on poverty alleviation. *Land Use Policy*. 36145-154. <https://doi.org/10.1016/j.landusepol.2013.08.001>
- Cotruvo, J. A. (2017). 2017 WHO Guidelines for Drinking Water Quality: First Addendum to The Fourth Edition. *Journal-American Water Works Association*, 109(7), 44-51. <https://doi.org/10.5942/jawwa.2017.109.0087>
- Darimani, A. (2010). Mining Boom and Enclave Economy: Development Impact and Challenges in Mining Areas in Africa. In: Hilson, G., Ed., *Enclaves of Wealth and Hinterlands of Discontent: Foreign Mining Companies in Africa's Development, Third World Network-Africa, Accra*.
- Darma, M. R., Kankara I. A., & Abdullahi S. (2016). Effect of Artisanal Gold Mining at Maiwayo Environ Northern Nigeria: Implication for Environmental Risk. *International Journal of Advanced Studies in Ecology, Development, and Sustainability*, 4(1), 100-112.
- de Haan, J., Dales, K., & McQuilken, J. (2020). *Mapping Artisanal and Small-Scale Mining to the Sustainable Development Goals*. Newark DE: University of Delaware (Minerals, Materials and Society program in partnership with Pact). <http://www.pactworld.org> and <https://sites.udel.edu/ceoe-mms/>
- Dollar (USD) to Naira Black Market Rate Today November 27, 2024 Aboki. [www.nairatoday.com/black-market-usd-ngn/](http://www.nairatoday.com/black-market-usd-ngn/)
- Eludoyin, A. O., Ojo, A. T., Ojo, T. O., and Awotoye, O. O. (2017). Effects of artisanal gold mining activities on soil properties in a part of southwestern Nigeria. *Sustainable Environment*, 3(1), 1305650. <https://doi.org/10.1080/23311843.2017.1305650>
- Environmental Law Institute [ELI] (2014). Artisanal and Small-Scale Gold Mining in Nigeria Recommendations to Address Mercury and Lead Exposure. <https://www.eli.org/sites/default/files/eli-pubs/nigeria-asgm-assessment-final-report.pdf>
- Hilson, G. (2016). *Artisanal and small-scale mining and agriculture: Exploring their links in rural sub-Saharan Africa* (pp. 24-24). International Institute for Environment and Development.

- Idris-Nda, A., Ajenifuja, G. O., & Jimada, M. A. (2015). Effects of Artisanal and Small-Scale Gold Mining and Granite Quarrying on Women Miners in Parts of Minna, North Central Nigeria. *Nigerian Mining Journal*, 13(1), 76-84.
- Idris-Nda, A., Olasehinde, P. I., Okunlola, I. A., Alao, D., & Ofoegbu, J. O. (2013). An Assessment of the Environmental Effect of Mining Tourmaline in the Pegmatites of Sarkin Pawa area, Central Nigeria. *Nigerian Mining Journal*, 2(1), 23-37.
- Idris-Nda1, A., Waziri, N. M., Bida, A. D., & Abdullahi, S. (2018). Socio-Economic Impacts of Artisanal and Small-Scale Mining in Parts of Niger State, Central Nigeria. *International Journal of Mining Science (IJMS)*, 4(3), 21-30. <http://dx.doi.org/10.20431/2454-9460.0403003>
- Isung, C. B., Salifu, Y., & Agana, T. A. (2021). The socio-economic implications of artisanal and small-scale mining on mining communities in northern Ghana. *Open Access Library Journal*, 8(3), 1-17. <https://doi.org/10.4236/oalib.1107010>.
- Jaiye, D. J. (2013). The environmental implication of illegal mining activities in Nigeria, a case study of Pandogari and Barkin Ladi/Buruku surface mines in Niger/plateau states. *Journal of Humanities and Social Sciences*, 13(5), 13-19.
- James, W. & Uyanga, G. (2024). Transforming Artisanal Mining Can Be Beneficial for People and the Planet. United Nations Africa Renewal. <https://www.un.org/africarenewal/magazine/april-2024/transforming-artisanal-mining-can-be-beneficial-people-and-planet>
- Jiriko, G. K., Wapwera, S. D., Mallo, D. M., & Rikko, L. S. (2015). An Assessment of Environmental Quality; a Case of the Jos Plateau Tin-Mining Region (JPTMR). *Swift Journal of Geography and Regional Planning* 1(2), 12-24.
- Mallo, S. J. (2012). Mitigating the Activities of Artisanal and Small-Scale Miners in Africa: Challenges for Engineering and Technological Institutions. *International Journal of Modern Engineering Research*, 2 (6), 4714-4725.
- Mallo, S. J. (2012). The Socio-Economic Impact of Artisanal Mining in Kuru (Naraguta Sheet 168) Plateau State, North Central Nigeria. *Continental Journal of Engineering Sciences*, 7 (3): 27 - 32, <http://doi:10.5707/cjengsci.2012.7.3.27.32>.
- Melodi, M. M. (2017). Assessment of Environmental Impacts of Quarry Operation in Ogun State, Nigeria. *FUOYE Journal of Engineering and Technology*, 2(2), 100-103. <https://doi.org/10.46792/fuoyejet.v2i2.141>
- Melodi, M. M., Ojulari, M. K., & Oluwafemi, V. I. (2020). Economic and Environmental Impacts of Artisanal Gold Mining on the Near-By Community of Sauka Kahuta, Nigeria. *Topical Scientific Researches into Resource-Saving Technologies of Mineral Mining and Processing*, 340-353.
- Melodi, M. M. (2020). Productivity of Artisanal Tin Mining in Jos South Local Government Area, Plateau State, Nigeria. *International Journal of Engineering and Advanced Technology Studies*, 8(1), pp.46-54.

- Michael, A., Molly, B., Brian, C., Bilguun-Ochir, E., Samir, J., Ayisha, M. K., Kathy, Y. T., Anton, W., & Jeremy, W. (2019). Creation of a Sustainable Mining Program through Formalization of Artisanal and Small-Scale Miners. <https://www.sipa.columbia.edu/sites/default/files/migrated/downloads/Government%2520of%2520Nigeria%2520Capstone%25202019%2520Report.pdf>
- Ministry of Mines and Steel Development. Nigeria's Mining and Metal Sector. Investment Promotion Brochure. Ministry of Mines and Steel Development: Federal Republic of Nigeria. 2016. Available online: [www.portal.minesandsteel.gov.ng](http://www.portal.minesandsteel.gov.ng)
- Ncube-Phiri, S., Mucherera, B., & Ncube, A. (2015). Artisanal small-scale mining: Potential ecological disaster in Mzingwane District, Zimbabwe. *Jambá: Journal of Disaster Risk Studies*, 7(1), 1-11. <http://dx.doi.org/10.4102/jamba.v7i1.158>.
- Oraham, I. T., Richards, J. P., Summers, R., Garvin, T., & McGee, T. (2015). Artisanal and small-scale mining in Nigeria: Experiences from Niger, Nasarawa and Plateau states. *The Extractive Industries and Society*, 2(4), 694-703. <http://dx.doi.org/10.1016/j.exis.2015.08.009>
- Otoijamun, I., Kigozi, M., Abdulraman, S. O., Adetunji, A. R., & Onwualu, A. P. (2021). Fostering the sustainability of artisanal and small-scale mining (ASM) of Barite in Nasarawa State, Nigeria. *Sustainability*, 13(11), 5917. <https://doi.org/10.3390/su13115917>
- The population of the states and local government areas (LGAs) of Nigeria according to census results and latest population projections. <https://www.citypopulation.de/php/nigeria-admin.php?adm2id=NGA032006>
- UNDP, (2023). *Beaming The Light on a Hidden Sector: Artisanal and Small-scale Mining (ASM) As a Vital Sector for Sustainable Development In Nigeria*. <https://www.undp.org/nigeria/blog/beaming-light-hidden-sector-artisanal-and-small-scale-mining-asm-vital-sector-sustainable-development-nigeria>
- Watkins, A. (2019). *What are People's Basic Needs? Six Things You Really Can't Live Without*. [http://populationeducation.org/what-are-people-basic-needs-six-things-you-really-can't-live-without](http://populationeducation.org/what-are-people-basic-needs-six-things-you-really-can-t-live-without)
- World Bank (2012). *Artisanal Mining in Critical Ecosystems: A Look at Gabon, Liberia, and Madagascar*. Washington DC 20433: The World Bank, African Region.
- World Bank, (2024). *World Bank's New Framework to Boost Sustainable and Inclusive Artisanal and Small-Scale Mining*. <https://www.worldbank.org/en/news/press-release/2024/09/19/world-bank-s-new-framework-to-boost-sustainable-and-inclusive-artisanal-and-small-scale-mining>