

Opportunity and Side Effects of Artisanal and Small-Scale Mining in Nigeria

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Abstract

Artisanal and Small-Scale Mining in Nigeria has been considered as an unorganized sector in mining industry because of its environmental implication and violations associated with the industry. However, this article tends to present the benefits of ASM alongside with the side effect and drawn a conclusion if ASM is an integral part in mining industry in case the government of Nigeria will provide them with the administrative and support necessary to facilitate their activities. The authors with the wide knowledge and experience with ASM present a case study of Agwan Kade ASM located in Nassarawa state. In this study, field excursions were done in different mining area particularly at Agwan Kade. According to the data collected from semi-mechanized mining at Agwan Kade show that the artisanal and Small-scale mining which are mining done by a single miner or small businesses; mostly done by hand, unsupported financially, and typically not formally recognized; are facing by a large aspect of challenges. These challenges are caused by the lacks of geology knowledge, financial support, government hand, etc. To solve these, and make artisanal and small-scale mining to become an official, organized and profitable activity that uses efficient technologies and is socially and environmentally responsible, there need a formalization of artisanal miners and a development in a context of good governance, transparency, legality, participation and respect for all partners.

Keywords

Nigeria, Artisanal and Small-Scale Mining, Agwan Kade, Nassarawa State

1. Introduction

According to the Nigeria Extractive Industry Transparency Initiative report, 1273 Artisanal and Small-scale Mining (ASM) conducted mining activities across the

country in 2020 (source: Ministry and Mining and Steel Development 2020). This was reported in its annual audit of the mining sector. Artisanal and Small-Scale Mining (ASM) is mining done informally by miners who extract natural resources across the country as their source of livelihood. These subsistence miners use mostly crude implements. Their activities provide a source of livelihood for millions in the rural areas where they are clustered.

With the use of Agwan Kade mining as a case study and side trips into other artisanal and small-scale mining, this paper offers a summary of the Nigerian artisanal and small-scale mining (ASM) industry and discusses its advantages from an economic, social, and environmental standpoint.

The results of this study demonstrated that these ASMs can become catalysts for sustainable development in the affected regions and across the nation if government efforts are made to acknowledge them and legalize their operations.

Scale and Geographical Scope of Nigeria's Mining Sector: Strategic Classification (**Figure 1**):

1) Minerals with very high market value, not requiring much investment for their valorization (concentration), Energy, easy transport: Gold, 3T (Tin, Tungsten, Tantalum), precious stones, gems minerals.

2) Minerals requiring a lot of investment for their valorization Complex infrastructures. High CAPEX and OPEX: Ni-Co, V, etc.

3) Energy minerals: Petroleum.

4) Industrial ores: Building materials.

The principal minerals and metals mined in Nigeria:

- Gold mining
- Coal mining
- Coltan (columbite and tantalite)
- Pegmatite (coltan's deposits that can be a source of precious stones)
- Wolframite
- Bitumen
- Iron (pure deposits exist and require further development)
- Uranium
- Gemstone

2. History of Artisanal and Small-Scale Mining in Nigeria

2.1. Introduction

In 1903, organized mining began in Nigeria through foreign corporations that were privately owned. The first mining laws were passed in 1964, and they weren't reviewed until 1999. Artisanal mining is not covered by any of the two statutes (1946 and 1999). The breakdown of the large mining corporations in the 1970s caused a massive mine worker unemployment rate with little other sources of income. To live, several of them engaged in illegal mining activities, which eventually resulted in the growth of small-scale and artisanal mining in Nigeria.

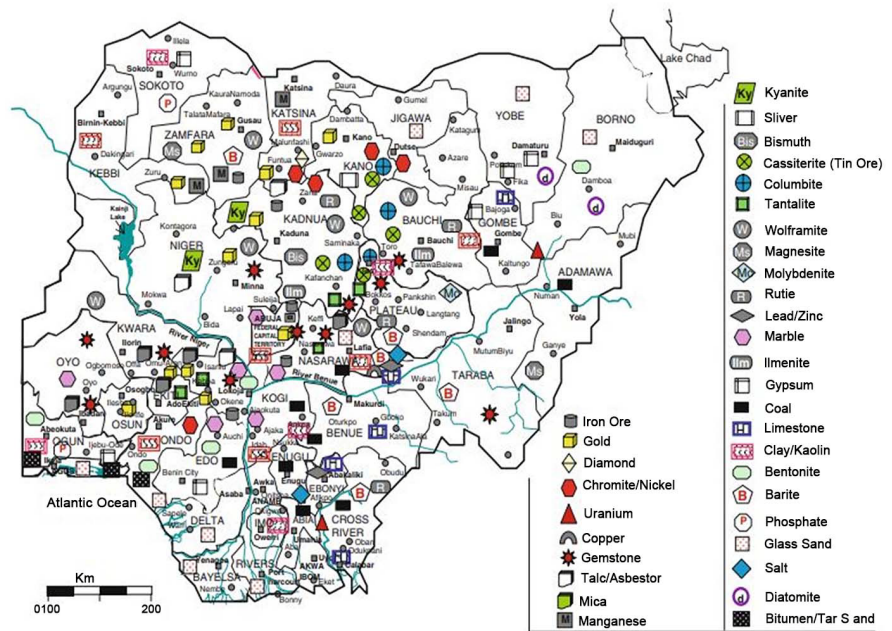


Figure 1. An overview of the solid mineral resources distribution map of Nigeria (unlike petroleum, every state in the federation has a fair representation of solid mineral deposits) (Obaje, 2009).

Over 90% of the country's mineral production is currently produced by artisanal and small-scale miners (ASMs), despite the lack of recognition for these industries in Nigeria. Over 500,000 miners in the nation are thought to be employed in the ASM subsector, despite the industry not being fully established. Up to 13 - 20 million Nigerians may be employed if it is successfully incorporated into the country's economy, primarily in the mining of commodities including tantalite, gold, barite, gypsum, copper, limestone, and kaolin.

Nearly all unlawful mining activities take place in the ASM, which is mostly made up of family-run, artisanal businesses without the necessary safety precautions, equipment, or regulations in place to protect its employees. They are frequently distinguished by the minimal or nonexistent use of mechanization. This industry covers the extraction of industrial minerals, raw materials for building, and valuable minerals including gold, silver, and gemstones. Even while small-scale miners are not very productive, their relative output can nevertheless have a big impact on local communities, families, and even some national economies.

2.2. Nigerian Minerals and Mining for ASM Practice

According to the Nigerian Minerals and Mining Act of 2007, the area of land covered by a Small-Scale Mining Lease must be at least 5 acres but at most 3 square kilometers. Additionally, all leaseholders are required to properly rehabilitate the areas that have been mined out to the satisfaction of the Mines Environmental Compliance Department. They must also pay a prescribed rehabilitation fee proportional to their profits to cover the cost of further rehabilitation

and reclamation.

To ensure responsible mining practices, the Small-Scale and Artisanal Mining Department is responsible for ensuring that all mining activities are restricted to established zones of mineralization. It helps to prevent indiscriminate mining, which can lead to environmental damage and the depletion of resources. By adhering to these regulations, small-scale mining operations can contribute to sustainable economic development in Nigeria while protecting the environment and ensuring the well-being of local communities.

2.3. Nigerian Presidential Artisanal Gold Mining Initiative (PAGMI)

According to reports of Presidential Artisanal Gold Mining Initiative 2020, up to 95% of gold in Nigeria is mined illegally, and revenues are not remitted to the country. The Presidential Artisanal Gold Mining Initiative (PAGMI) was created to address the issue of illegal gold mining by ensuring that revenues generated by the sector were adequately remitted to the government by improving the sustainability of artisanal gold mining operations and promoting fair trade practices. PAGMI purchases gold directly from artisanal miners, processes it to export standards, and sells it at international market rates to capture value for the Nigerian economy.

A study by the Nigerian Ministry of Mines and Steel Development found that over 85% of ASM sites in the country are located in protected areas, and many are located near or within water sources, leading to severe environmental degradation. The Nigerian government established the Artisanal and Small-Scale Mining Department to support and train miners and introduce measures to improve safety and reduce environmental impacts.

One of the main challenges facing ASM in Nigeria is the informal and unregulated nature of the sector. According to estimates, over 1000 children work in artisanal and small-scale gold mines in Nigeria, and many workers lack adequate protective equipment or training. For this piece, ASM will be classified into two categories: nomadic miners and agrarian miners.

Nomadic miners move from place to place in search of mineral deposits, while agrarian miners reside in the communities where they engage in mining activities. Nomadic miners are typically uneducated and operate in an unregulated manner, using rudimentary tools and techniques to extract minerals, often resulting in hazardous working conditions and environmental damage.

Despite the challenges, ASM provides a source of livelihood for many people in Nigeria, particularly in rural areas where other economic opportunities are limited (Oramah et al., 2015). However, child labour, health and safety issues, environmental damage, and confrontations with large-scale mining firms plague ASM in Nigeria.

Addressing these challenges will require a collaborative effort from stakeholders at all levels to develop policies and practices that promote responsible ASM practices and provide a workable pathway to formalization. By doing so, ASM in

Nigeria can contribute to sustainable economic development while protecting the environment and the well-being of local communities.

3. Mining Field Excursions and a Case Study of the Agwan Kadi Mining Site in Kokona, The State of Nasarawa

3.1. Data Acquisition

Field visits to several mining sites in Nassarawa State and a review of previous research have been used to get information for this study.

This study visited five artisanal and small-scale mining sites in Nassarawa state: Garaku, Kundami, Sabogida, Jenta and Agwan Kade, which mines lithium ore. The goal of these visits was to create an overview of artisanal and small-scale mining in the nation.

3.2. Case Study of Mining site in Agwan Kade, Kokona, Nassarawa State

Kokona is a local government area in Nasarawa State, Nigeria. Its headquarters is in the town of Garaku. It has an area of 1844 km² and a population of 187,600 (NIPOST, 2022). The study area is located in Agwan Kade Kokona LGA of Nasarawa state at 9°0'43"N, 8°05'33"E, which is about 20 km drive from Keffi LGA along Makurdi road, Benue state. The population of the people in Agwan Kade is about 1120, with the majority of them both young and old are involved in Artisanal and Small-Scale mining as they occupation, including they children both males and females. Sometimes supported with farming.

Agwan Kade has no school situated there, therefore the children there have no any form of education, and they are born and grow into ASM sector as they main means of livelihood. The few that seem to be civilized enrolled their children in the primary school located at Kokona about 4 km walk away, of which the child will likely dropped out of school to join his peer in “hustling” in ASM sector within the community. This is what they are birthed into (Figure 2).

a) Mode of operation

Agwan Kade artisanal mining operates as semi-mechanized small scale mining operation. The major mining equipment used includes excavator, air compressor and jackhammer, drilling rods and bits, pumping machine, chisels, hammers, shovels and explosives.

The excavator model is 330DL Cat, which is used for removal of the overburden, leveling of ground surface, and shifting of the boulders after blasting of rocks. The air compressor and jackhammer are used to create or drilled holes in the rock, the holes will be loaded with explosive and blast the rock to get a fragment of the rock. Pumping machine is used to pump water log from the pit to outside. Shovels are used for clearly, loading and sand filling of the drilled holes whereas the chisels and hammers are utilized in removing and breaking the ore into sizeable portion (Figure 3).

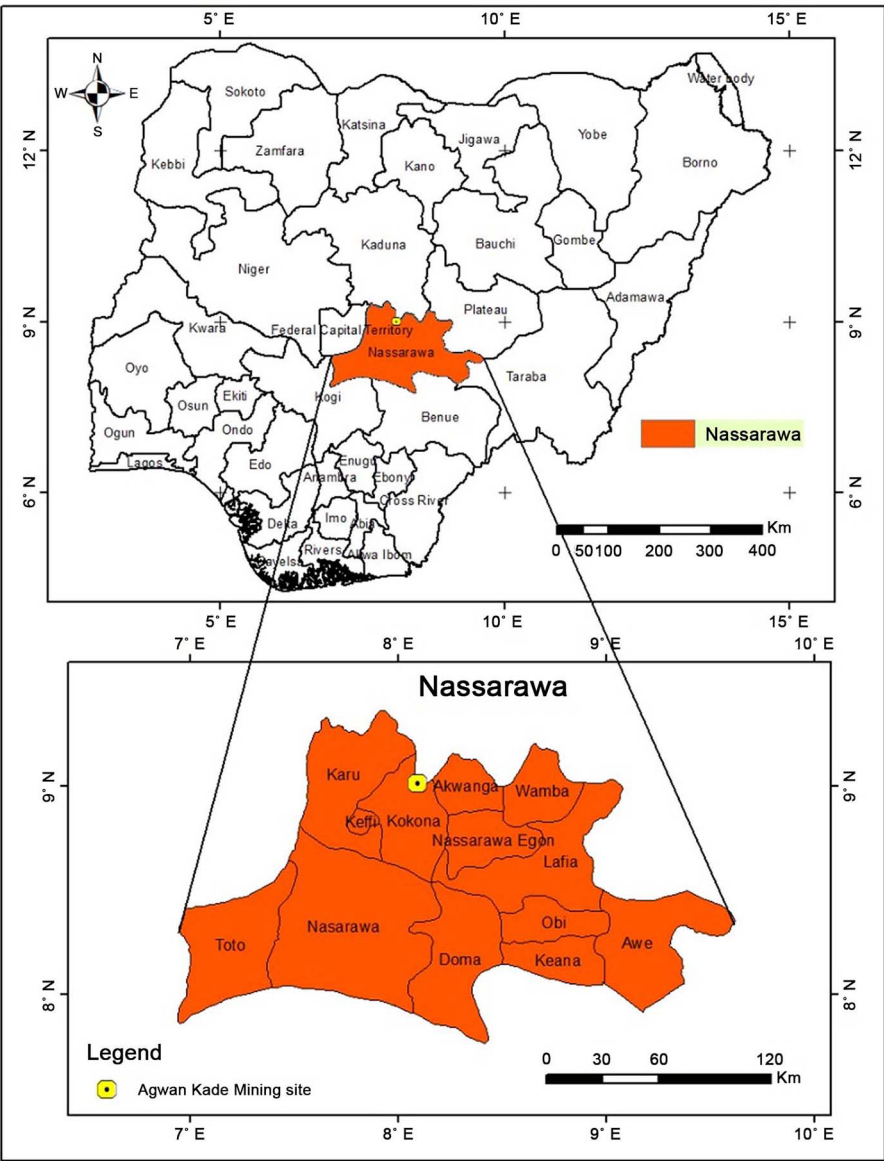


Figure 2. Geographic location of Agwan Kade Mining Site at Nassarawa State in Nigeria. Map credit: authors.



Figure 3. (a) Air Compressor, (b) Jackhammer. Photo credit: Authors.

b) Labour force

Artisanal and Small-scale mining in Nigeria is known to create a means of employment for the people within the locality. The mining site of the case study employed about 48 labourers. 42 out of 48 are males while the remaining 6 are females, excluding the 2 junior geologists which make it a total of 50 employees in the site. The age range of the male folk labourers range from 16 - 34 years while the 6 females folks age range from 13 - 19 years.

The drilling and blasting team are to discharge the duties of drilling of holes in the rock and loading the drilled holes with explosives to carried out blasting where the other team uses chisels and hammers as the tools for removal the ore.

However, at the end of each day, both teams have to carry the materials sorted on their heads from the pit to the loading point.

The females are to wash the sand and pulling out the desired materials from it. This required them to load they bowls from the pit to a point where there is water to washed the sands in other to select the materials.

c) Side effects

The mining operations in this village have numerous negative repercussions, including inadequate attention to the worker's safety and well-being.

▪ Safety

Out of the 42 male labourers, only 23 of them were provided few PPE such as safety boot, this was done by "first come, first serve" scenario. Also, the drilling team was not given a nose mask that could prevent inhaling of the drilling dust into their body system, while the chisels and hammers team were not given hand gloves to protect them from cutting of hands with the sharp edges of rocks.

Due to the absent of safety officer in the mines, there is lack of training on safety. Sometimes, the labourers tend to jump inside the pit, which might cause his or her life. Furthermore, total absent of first aid box in the site. The safety of the labourers is not guarantee by their employer.

Smoking is an evitable competition among the male folks. This is done to stimulate their body system to work harder.

The female folks are charged with a target, in order for them to meet up with the target, most times they have to use chisels and hammer for breaking of rocks to recover ore. Outside this, they are required to carry and heavy load of sands from the pit to where there is water for washing the sands and do the selection.

Uncontrolled blasting of rocks. Blasting is carried out without proper alarm or notification to other neighbouring site or even to their fellow co-worker. On the case of uncontrolled blasting, a boy of 7 years was wounded with a flying rock as a result of blasting.

Lack of proper mining pit design, the labourers are only concerned with the vein of the deposit, which resulted into narrow access into the pit and sometimes causes the collapsing of bloc to them.

▪ Socio-cultural

Agwan Kade is a community without school, the children there are birthed

and grown into either Artisanal mining job or as a farmer. However, since Artisanal and small-scale mining provide them with a quite money, 95% of them venture into it. Most of the children are dropped out from school and focus on Artisanal mining. This has resulted into child labour.

▪ **Land and environment destruction**

Destruction of vegetable, farm land, and water bodies. The activities of mining in this locality, has caused the destruction of their farmland, most people crops were destroyed without proper compensation. The vegetation is destroyed to create access road to the site, and where to dump the overburden.

a) Opportunities

Despite the facts that we stated above side effects, the populace derived happiness in working in Artisanal and small-scale mining because it provides to them, their source of income, and livelihood. The youths are employed, which enable some of them to marry and take care of their immediate family.

Medium of transaction between retails and the labourers within the site. Those that sell foods, shoes, clothes, in general the hawkers do have

It generates a revenue for the community and also payment of royalties to the government, which contribute to the GDP of the country.

Migration of people from other villages to Agwan Kade in search for job, the ASM create an avenue for socio-cultural interaction of people from different background.

4. Artisanal and Small-Scale Mining in Nigeria: Benefits

Nigeria is richly endowed with abundance of mineral resources (Ogbonnaya, 2020). The country boasts of more than 40 valuable mineral deposits including clay and kaolin, gold, gypsum, iron ore, lead and zinc, phosphate, and tin across the 36 States (Figure 4). Baryte, bitumen, coal, gold, iron ore, and limestone, lead-zinc and coal have been identified by the Federal Government through the Ministry of Mines and Steel Development as Nigeria's strategic mineral deposits on grounds of their economic value. Quarrying dominates the output of the Mining and Quarrying sector by over 90 percent and recorded a growth of 21.16% in full year 2020 from -5.63% in 2019 and 10.33% in 2018, in contrast with Metal Ores which contracted by -5.85% in full year 2020 from -14.38% in 2019 and 26.34% in 2018, and Coal Mining which contracted by -20.5% in full year 2020 from 13.15% in 2019 and -5.81% in 2018. Products such as granite, gravel, marble, sand, and other construction materials are in high demand locally because of a combination of a growing housing deficit and infrastructure development projects. However, notwithstanding the growth in preceding years, Nigeria has barely scratched the surface of its enormous geological potential, taking into consideration the contribution of less than 1% by the mining sector to her GDP. Although the productivity level of the sector is insufficient to meet local demands particularly for industrial minerals, Nigeria has been unable to attract significant investment in exploration of her mineral resources. This constraint can be traced to the lack of attractive environment for private-sector



Figure 4. Artisanal mining activities in *Lafia*, Nassarawa state.
Credit photo: Abel Leonard.

mining, paucity of accurate and up-to-date geological information and the systems to manage the information, poor performance of institutions and limited enforcement of regulations, insecurity in the host communities, and insufficient human skills and capacity to effectively manage the sector. It is critical that Nigeria positions its mining sector to attract foreign investment and partnerships as is the case in Angola, Morocco, South-Africa and other African nations who have made veritable progress in creating a better business environment for investors in the mining sector.

The mining sector is widely recognized as a key driver for industrial development; thus, emphasis is placed on the need to follow through the execution of the industry plan in order to obtain benefits that would accrue from the mining sector. Minerals constitute a large portion of the inputs used in manufacturing and production of numerous economic goods and is an important contributor to the construction and drilling industry, making of automobiles, ICT gadgets, solar panels, furniture, papers and rubbers, medical equipment and energy generation. There is no doubt that if the opportunities in the artisanal and Small Scale Mining sector are fully maximized, it would create job opportunities and improve living standard, reduce cost of production for local manufacturers, reduce dependence on foreign exchange for imports of materials, reduce infrastructure deficit, and also enhance competitiveness of our local industries amongst others.

With more than half of the country's revenue derived from oil exports, Nigeria's economic progress is practically tied to the boom of the oil market. However, the uncertainty of oil prices, lack of transparency in revenue obtained, lack of proper use and accountability in proceeds generated, alongside the drive towards energy transition necessitates the need for economic diversification. Neighbouring African countries like Ghana and South Africa have found the mineral mining sector to be a good contributor to their GDP. In Ghana, for example, mining is said to account for 5% of the country's GDP and 37% of its exports while South Africa's solid minerals accounts for 18% of its GDP, half of its foreign exchange earnings and approximately 1 million jobs (Hentschel et al., 2003). Diversification is an important element of economic growth. According to an estimate by the committee put together to develop a roadmap for the sustainable

development of the mining and metals sector in Nigeria, the minerals and mining sector could generate more than US\$25 billion by 2025 which makes up 3 percent of our GDP.

The main issues with informal mining particularly for Artisanal and Small Scale Mining in Nigeria are: mineral waste; mining operations conducted informally, disregarding established laws and regulations; operators move around from site to site; their activities are disorganized; low productivity, resulting in low returns and revenue; unprocessed mineral sales at extremely low prices; lack of access to financial assistance; lack of technical knowledge regarding geology and mining; inability to meet health and safety standards; high level of environmental degradation; inability to invest in appropriate tools and equipment; social issues, such as child labor and substandard living and working conditions at mine sites; high level of smuggling; and loss of revenue as a result of government.

Artisanal and small-scale mining sector is a main source of income for the populace in the rural community, also it has contributed to the GDP of the country. Many rural community ventures into this sector, to be able to take care of the family and their immediate needs. However, this sector needs to be more structured and organized for it to become a safe enterprise.

5. Artisanal and Small-Scale Mining in Nigeria: Side Effects

Artisanal and small-scale mining in Nigeria causes negative impacts to the environment and socio-economic. Those impacts are like:

- 1) Archaic mining and processing methods—huge losses/amalgamation.
- 2) Safety, health and hygiene issues.
- 3) Impacts on the physical environment.
- 4) Socio-cultural problems.
- 5) Women's work in ASM.
- 6) Child labour in ASM.

1) Archaic Mining and Processing Methods

a) Huge losses: Skimming of deposits

Losses reach about 75% of the metal stock for an alluvial deposit and about 90% for a vein deposit. In the vast majority of cases, the deposit is irreparably doomed by a first phase of non-technical work; the deposit is well and truly lost (Figure 5).

b) Huge Losses: Poor Recovery

The losses induced by grinding, hydro-gravitational concentration, and bread-ing operations are enormous, exceedingly over a ratio of 50% of the metal stock, depending on the nature of the ore (Figure 6).

c) Amalgamation: Mercury, Cyanide

2) Safety, Health and Hygiene Issues

Fatal or disabling accidents that are frequent and rarely reported (land subsidence, landslides, asphyxiation, sudden influx of water, careless exposure to rock dust, noise, vibrations, etc.).

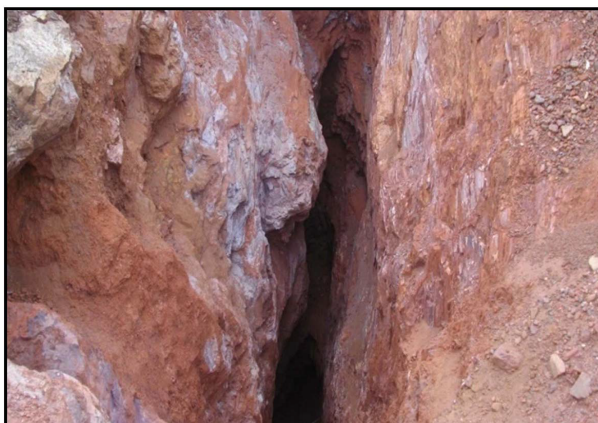


Figure 5. Artisanal pits follow a small part of metals/minerals underground which cause a huge of Losses. Photo credit: Authors.



Figure 6. Washing materials, poor recovery. Metals/minerals scavenged by water. Photo credit: Authors.

Inhumane working conditions, unhealthy spontaneous villages far from any education and health infrastructure: unsanitary conditions, malnutrition, lack of drinking water on site, lack of sanitation facilities, development of all kinds of endemic diseases (malaria, yellow fever, cholera, typhoid, tuberculosis, etc.); excessive use of alcohol, drugs, narcotics to “give courage”, etc.

3) Socio-cultural problems

Spontaneous migratory dynamics on exploitation sites—overcrowding on these sites, extreme promiscuity. Numerical importance of retired and former demobilized soldiers/rebels still in possession of weapons.

Frequent conflicts between artisans, communities and sometimes with the authorities. Delinquency, swindling, banditry and even criminality.

Prostitution is very present and the spread of STDs, including AIDS, etc.

4) Negative impacts on the physical environment

Gullies and intensification of intensive erosion processes, disfigurement of the landscape, deforestation and destruction of vegetation cover and soil, pollution of water resources, degradation of soil and loss of land intended for agricultural

activities, over-alluvial of valleys and their asphyxiation to a greater or lesser extent, pollution of the environment by waste and organic matter, pollution of groundwater and rivers, destruction of banks, massive sediment inputs, contamination of water by sludge leading to impoverishment of aquatic fauna, etc. (Figure 7).

5) Women's work at mining sites

Turnout is difficult to assess. The main reason for their presence is the low income from the agricultural sector. Intervention stations in the production circuit: especially at the level of mineral processing: drawing water for the washing of the ores, sometimes a few kilometres away and on uneven terrain. Often very poorly paid for this work (Figure 8).

6) Problems of child labour at mining sites

Different nations or cultures have different ideas about what constitutes a child. In Nigeria, anyone under the age of eighteen is considered as a child. Therefore, in modern society, child labor is defined as paid and unpaid work that takes place in any sector, including domestic, informal, and agricultural sectors, and is detrimental to children's mental, physical, social, or moral development; child labor also includes any work that prevents children from attending school, forces them to leave school permanently, or requires them to try to balance school attendance with excessively long and heavy work (FOS/ILO/SI-MPOC, 2000/2001).

Main causes of child labour in small-scale mining are poverty, difficulties in accessing schooling, deficiencies in the school system or lack of motivation, lack of prospects for regular employment, lack of a coordinated policy to abolish child labour, lack of implementation of legislation, inability to make the social investments required to end child labour.

Nature of work reserved for children: (boys and girls)

Pounding and washing the ore for several hours, transporting the ore, fetching water and watching over the babies on site, preparing and selling meals and food, cleaning, looking after siblings, selling water for washing the ore, itinerant or stationary sales of drinks, cigarettes, food (Figure 9).

6. Artisanal and Small-Scale Mining Sector in Nigeria: Proposals

6.1. Legal and Administrative Issues

Legalization should help ensure that the negative social and environmental effects of the sector are better managed and will enable governments to capture more revenue from the sector. Artisanal and small-scale miners persist in their operations within the informal sector for several reasons. They might not be aware of the legal requirements, and the burdensome bureaucratic processes that are frequently necessary for an activity to become and stay a formal business could exacerbate this. Reluctance to be legalized may also exist among communities that have historically functioned outside of the official sector, especially if there are no clear incentives to do so and if becoming legal requires paying taxes



Figure 7. Disfigurement of the landscape. Photo credit: authors.



Figure 8. Women involvement in barite production in Azara, Nasarawa state (a) women transferring run-of-mine ore to designated washing point; (b), (c) washing of barite by women; (d) stacking of barite at collection (Otoijamun et al., 2021).

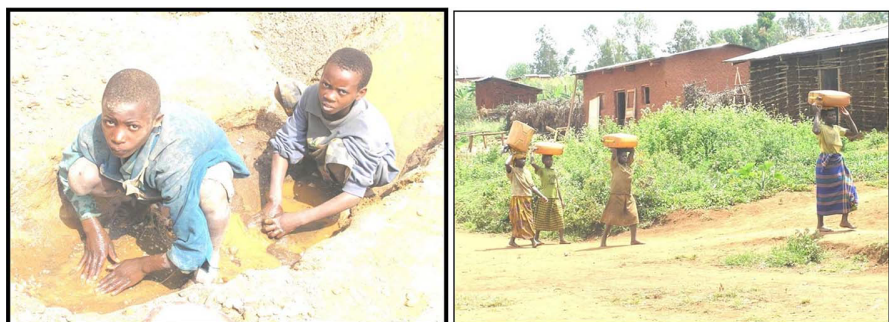


Figure 9. Work of Children: washing, fetching water. Photo credit: Authors.

that they would not otherwise pay. Further discouraging factors for miners are governments' inability to impose penalties or offer the advantages that come with legality.

In certain cases, the lack of political will to create an adequate enabling framework for legalization can be explained by personal interests related to corruption, money-laundering, and similar illegal practices (Okoh & Hilson, 2011). The government may also try to attract international mining companies to invest in the country and a strong ASM sector may be seen as a disincentive.

The main tasks for governments in the ASM sector are to:

- ✓ Manage the exploitation of the national mineral resources in a socially acceptable, environmentally sound and sustainable manner;
- ✓ Promote investment in the sector;
- ✓ License mining titles;
- ✓ Promote legalization and normalization of the ASM operations.

The main tools that governments can use in this regard are mining laws, the concession system, and the supervision of the compliance with the laws, together with national or international technical standards and procedures.

Governments are recommended to provide impartial, uniform, transparent, and nondiscriminatory regulatory frameworks that facilitate easy access to mining rights and legal production with regard to legal and administrative matters. This includes having an administrative process with transparent, unambiguous, and set norms and practicing good governance. The only things the government should be involved in the ASM sector are normative and regulatory matters.

6.2. Organization

On the government side there is a differentiated organizational structure comprising ministries, national mining authorities and regional directions. In the private sector, ASM normally lacks a structured organization. Governments therefore do not have an adequate counterpart to work with. A chamber of commerce and industry or chamber of mines should be encouraged and nurtured to ensure that the ASM sector is adequately represented.

The primary tasks of such a chamber should be to:

- Serve as a source of information and aid on all important issues related to: legal, fiscal, institutional and administrative framework of the sector; access to foreign markets; and activities within the sector (comprising not only extraction but also transforming, marketing and exporting the products);
- Serve as an agent to provide access to training and further qualifications for members (in the long-term training centres could be established);
- Lobby government for the needs of the sector and defend the interests of the members, i.e., propose changes to the legal framework in order to deregulate the markets, facilitate exports, etc.;
- Help informal groups of miners to become formalized and help the formal businesses to compete with the informal and to control more effectively informal activities in the sector;
- Act as a promotional agent for the sector to improve or build a good image.

6.3. Finance and Credit

Most small enterprises would like to upgrade production capacity and/or develop new reserves. This requires investment capital. Generally, the ASM sector needs better access to financing. However, in practice, access to credit and formal banking is difficult for ASM miners, and they face serious problems obtaining it.

Many financing institutions consider the artisanal mining sector to be too risky for them to be a part of. Financial institutions that are willing to deal with small-scale miners tend to charge high interest rates. This challenges the viability of many projects.

Ideally, the financing of ASM projects should be tailor-made for the sector, and develop creative solutions such as:

- ❖ Using the miners' own capital resources;
- ❖ Joint ventures;
- ❖ Equity participation
- ❖ Risk capital (such as in exploration funds or mining development banks); or
- ❖ Leasing of equipment.

For credit financing (occasionally considered an appropriate tool by international donors or governments for technology transfer or dissemination of innovations regarding mining and mineral-processing tools) experience from international ASM-promotion projects should be taken into account, such as:

- Finance means not only credit, but also savings. Self-financing or savings should be included in the finance programme.
- The sustainability of the financial service must be considered from the very beginning. Features of a sustainable financing programme are: the lender is independent in its loan decision and bears the full lending risk; interest rates for final borrowers must at least cover the cost of inflation, operation and loan losses; an appropriate financial system for lending to small enterprises starts with small loans, and later goes to larger loans.
- Significant outreach and/or a large number of clients, is important in achieving development impact; it also makes the programme economically viable through economies of scale.
- Potential financial intermediaries should be screened using existing donor guidelines. Measures for institution building are often required since financial institutions in ASM countries are generally unwilling to lend to any small enterprises, much less the mining sector. Funds for these measures have to be provided.
- Subsidies to ASM should not be given in the form of subsidized loans, but in training or other technical support.
- Regular control and supervision of the financial institution as well as guidance are required.

Credit schemes should not be set up for the one-off delivery of equipment, but rather focus on financing a business over a long period.

6.4. Priority in Strategies to Develop Nigeria's Mining Potential in the Short and Medium Term

Specific policy for a transition to industry

Reasons:

- The current state of knowledge of the Nigerian subsoil;
- Realistic development horizons and forecasts for the discovery of deposits;
- The lack of opportunities for development and job creation in rural areas;
- The poverty of the Nigerian state in view of the almost immediate financial, economic and social benefits that ASM could bring

6.5. Formalization of ASMs in Nigeria

The artisanal mining sector in Nigeria, subject to improved management, can assert itself as a vector of growth for the fight against poverty and sustainable development.

The State, the private sector and artisanal miners can derive significant income from it, artisanal miners can support their households, send their children to school, provide health care for their families, and provide work for other people.

In view of population growth, degradation and insufficiency of arable land, these ASMs should be supported and organized with a view to combating the constantly increasing poverty in Nigeria.

To do this, it is necessary to carry out the formalization of this activity.

Definition Formalization of ASMs

A long process that is based on the organization of the ASMs and which starts with the implementation of appropriate legislation (Midende & Pact Institute, 2016).

This process is carried out through strategies in favor of artisanal miners such as technical support and training, the improvement of market access conditions, the improvement of their living conditions in general, the protection of the environment, and the establishment of collaboration mechanisms with other programs and projects envisaged for local and sustainable development.

Global and participatory approach to the formalization of ASMs: Project to be implemented.

Involve all stakeholders	Dealing with all issues
Institutional Services	Technical
Craftsmen	Social & Cultural
Communities	Financial
Nigeria's partners	Legal
Local authorities	Health, Safety & environment
Mining companies	Para-mining services
Professional Associations	Market/Trade Channels
NGOs etc.	

6.6. Mining and Sustainable Development

As minerals are non-renewable resources, their exploitation must be supported by an integrated approach to stimulate and serve as an anchor for the development of sustainable productive activities. Identification of these activities by region.

7. Conclusion and Recommendations

Artisanal and Small-scale mining which are mining done by a single miner or small businesses; mostly done by hand, unsupported financially, and typically not formally recognized; can and should become an official, organized and profitable activity that uses efficient technologies and is socially and environmentally responsible. This activity can only develop in a context of good governance, transparency, legality, participation and respect for all partners.

It can and must strengthen its contribution to the provision of decent work, local development, the fight against poverty and social peace.

ASMs, often, represent a real environmental crime and are a huge loss for the state and for future generations. Formalized, these ASMs can become drivers of sustainable development in the regions concerned and at the level of the whole country.

The artisanal miners are faced by a large aspect of challenges. There is need for decentralization of various sectors of the economy in order to boost their effectiveness and contribution to the growth of the economy. We are currently seeing this play out in the electricity sector as constitutional amendments are underway to allow States generate, transmit and distribute electricity even in areas covered by the national grid. Finally, we emphasize that more efforts should be put into formalizing artisanal mining, and policing host communities to forestall the activities of illegal miners, and there should be adequate engagement between the government, the title holders and the host communities. This would minimize hostilities and disruptions currently experienced by operators in artisanal and scale mining sector.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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