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Comparative Study on the Adverse Environmental and Social Impacts of Mining Activities in India and Nigeria

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Abstract

Mining has been an important primary industry for all developing economies. Despite its numerous advantages, mining activities have many harmful social and environmental implications. These effects are experienced more in developing economies due to a lack of coordinated political, educational, and legal machinery. This forms the basis for this research as the problems of mining operations in India and Nigeria were studied and compared. For Nigeria, it was found that the social and environmental considerations as regards sustainable mining operations are far from being realized. This can be attributed to poor exploration, processing, and management of mining wastes by the illegal and small-scale artisanal miners that dominate the country's mining industry. In India, issues of sustainability were not as pronounced as those in Nigeria. While the local communities of mineral-rich areas in Nigeria are engaged in illegal mining activities, some of the locals in India are aware of the dangers of irresponsible mining reflected in their protests. The government of India is also more committed to sustainable mining compared to that of Nigeria. Generally, this research exposed the dangers of unsustainable mining activities in India and Nigeria, however, India looked better at the two from economic, environmental, and societal points of view. This paper reviews the state of mining implications by comparing the industries in both countries including ways to make the industries sustainable.

Keywords: *Mining, Sustainability, Environmental Impact, Social Impact, Illegal, India, Nigeria*

1.0 Introduction

India and Nigeria are post-colonial economies. The heavy excesses of colonial legacy in both countries spearheaded domestic reforms to develop the national income. However, this was all at a cost owing to the consequent environmental and social impacts. This becomes more emphasized in unsustainable industrial practices such as mining. Both India and Nigeria boast vast deposits of mineral resources. However, since independence, the activities that are employed in the exploitation of these minerals are yet to be properly managed and regulated.

These industrial activities, therefore, become a precursor for worsened environmental degradation (inefficient waste management and spilling of harmful chemicals in water bodies which leads to damage to marine life, sulfide related acid mine drainage, excavation of land which leads to soil erosion and increased chances of natural disasters). The nature of these activities poses long-term threats to the environment and socio-economic development. For instance, open-pit mining and the consequent displacement of the local communities. The latter is rendered politically, economically, and socially marginalized as a result.

On the one hand, mining which is the process of extracting useful minerals from the earth and even oceans is responsible for most technological advancements and innovation witnessed in the world today. This single activity helps to provide the raw materials that drive most innovations of modern civilization. Transportation, Communication, Military, Aerospace, etc. are some of the areas that enjoy the exceptional properties of materials obtained from mining activities. In developed countries like Sweden, mining activities are monitored closely to ensure that their adverse effects are reduced to the barest minimum. However, developing countries like India and Nigeria are still lagging in this regard.

Sustainability in mining operations can be conceived in terms of a framework comprising the following elements: (i) scientific mining, (ii) environmental protection, especially minimizing the impacts of mining practices on biodiversity, (iii) local stakeholder engagement, (iv) enabling local socio-economic development (in the areas of mining operations) and (v) accountability and transparency. However, two main preconditions for achieving sustainability through these mechanisms are the existence of good governance and self-regulating mining enterprises which are economically viable, financially profitable, and technically efficient (Down To Earth, 2017). Keeping in mind that only nine years is remaining for India and Nigeria to realize the standards set by the UN for sustainable development in the raw material sector, mining in both countries through the lenses of the politico-legal, environmental, and social framework has been reviewed. The authors also compared and analyzed the effectiveness of policies in mitigating the effects. Finally, sustainable practices were also recommended for both countries.

2.0 Thesis

Review of the mining industry based on comparative analysis between India and Nigeria from 2000-2021, with recommendations for sustainability.

3.0 Literature Review

Compared against the global standard practices in developed countries, the mining sectors of India and Nigeria are still underdeveloped. Both countries are still trying to find a solid footing as regards sustainable practices in the value chain of mineral resources. Nevertheless, the approach and level of progress in the pursuit of sustainable mining differ considerably in these two countries.

With up to 2.3 per cent contributions to the Gross Domestic Product (GDP), the mining sector of India is better off compared to Nigeria's less than 1 per cent. For instance, in 2011, the mining sector of India contributed up to 10.67 billion US dollars to its GDP; reaching an all-time high of 15.07 billion US dollars in the first quarter of 2020. These figures show that there is ongoing improvement in the Indian raw materials sector. In contrast, the mining sector of Nigeria reached an all-time high of 6209.22 US dollars in the first quarter of 2011 and a record low of 2959.62 US dollars in the fourth quarter of 2020 (Trading Economics, 2020). From this information, it is very clear that India and Nigeria are miles apart in terms of the development of their raw material sectors.

According to Mining Review Africa 2020, Nigeria is well endowed with metallic minerals, but it has not exploited its potential for industrial development due to poor infrastructure for extracting, processing, and transporting exploited minerals. These are the major factors limiting the development of Nigeria's mining industry. With Nigeria still importing most of her raw materials from abroad, table 1 below shows the position of India in global raw material production and exportation.

Table I: India's Position in the World in Terms of Production

Product	Position in World Production
Mica blocks and splitting	1 st
Coal & Lignite; Barytes; Chromite	3 rd

Iron Ore	4 th
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Bauxite; Manganese ore	6 th
Aluminium	10 th
Crude Steel	11 th

Source: Government of India, Ministry of Commerce & Industry.

3.1 Indian Mining Sector: History and Current Trends

The Indian mining sector struggles to maintain sustainability in its practices. Before 1993, the mineral sector of India was guided by the Mines Act of 1953 and Industrial Policy Resolution of 1953. Some resources that were mined at this time were iron ore, coal, manganese ore, gold, copper, lead, zinc, tin, etc. (Department for Promotion of Industry and Internal Trade, 1956).

However, shortly after Independence, and the nationalization of coking coal mines, Indian Iron and Steel Co. (IISCO) had approached the World Bank for funds to develop the new mine at Chasnala. Unprecedentedly, this led to the first major mine-related disaster India had encountered, with 375 officially reported deaths (Ministry of Housing and Urban Affairs, 2019).

To mitigate the unsustainable consequences of mining for the environment and society, many reforms including India's Sustainable Development Framework of 2011 were legislated. With this, regulations for making mining more sustainable were underway. However, this became null and void with the amendment of Mines and Minerals (Development and Regulation Amendment Act, 2015). Currently, with the National Mineral policy of 2019 private exploration agencies are attracted resulting in a host of illegal mining operations (Drishti IAS, 2019). This leaves a long haul until sustainability at informal small mining operation sites is achieved.

3.2 Nigerian Mining Sector: History and Current Trends

The concept of sustainable mining is still in its infancy in Nigeria. The country began its industrialization in 1960. However, the majority of her exploration and production activities were done in the hunt for crude oil. For this reason, the solid mineral mining

industry in Nigeria is dominated by artisanal small-scale miners (ASMs) whose operations are largely informal and often not known to the government (Oruonye et al. 2016).

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The neglect of the solid mineral sector by the government has led to many environmental and societal problems. In 2008, radioactive materials abandoned since 1960 in mining fields in central Nigeria's Plateau State were reported to pose serious health hazards to about 2 million people (The New Humanitarian, 2008).

According to studies by Merem et al. (2017), illegal mining activities in Pandogari, Niger State increased from 17.5 Km² to 130 Km² between 1992 to 1998. By the year 2000, unsustainable mining practices stretched further to 200Km² and continued in 2004 to 2006 with more incursions onto 254 to 312 Km². These issues were further compounded by the death of 400 people recorded in Zamfara State in 2010. These deaths were a result of lead poisoning caused by illegal quarrying (Merem, et al. 2017).

It was only in recent years that Nigeria began taking the concept of sustainable development more seriously. In 2015, the Federal Government of Nigeria (FGN) and the Federal Ministry of Mines and Steel Development (MMSD) developed a Roadmap to foster sustainable growth and development in her raw materials sector. The Roadmap was designed to help promote sustainable mining in the country between 2015 and 2025. To this end, both the public and private sectors now have an equal opportunity to exploit Nigeria's mineral deposits; albeit under the terms and regulations of the FGN and MMSD. With a lack of efficient exploration and extraction of the mineral resources in the country 6 years later, Nigeria still has to do more to achieve the anticipated sustainable practices in her mining sector.

3.3 Case Studies of Unsustainable Mining Activities in India and Nigeria

In Nigeria, uneducated artisanal miners dominate most of their ore beneficiation activities. As such, poor exploration and excavation activities, substandard tailings management, and land reclamation practices are some of the pressing issues hindering sustainable mining. From studies conducted at an illegal mining site in Pandogari, Niger State in 2013, the figure below shows an abandoned mining pit that contributes to environmental and ecological degradation in the country.



Fig. 1: An Abandoned mining pit filled with water that forms a new ecosystem.

Source: Dukiya, J. (2013b). An Abandoned mining pit filled with water forms a new ecosystem. In *Environmental Implication of Illegal Mining Activities in Nigeria: A Case Study of Pandogari and Barking Ladi/Buruku Surface Mines in Niger/Plateau*.

The issue with such careless and inhumane practice is that every aspect of the biological and ecological activity is affected. Animals die from drinking from such tailings ponds contaminated with heavy chemicals, land for agricultural purposes is disturbed, the safety of the inhabitants in the state is also endangered coupled to the instability in the environment capable of triggering natural disasters like earthquakes, volcanic eruptions, etc. According to Dukiya J. (2018), open-pit mining of Cassiterite and Columbite in Burki-Ladi and Buruku Plateau State has denuded their landscape. Numerically, it is estimated that around 372 Km² of the total 8600 Km² of the state has been destroyed by all sorts of mining activities. Of these, about 40 per cent are due to illegal mining (Dukiya J., 2018).

Like Nigeria, India is also plagued with sustainability issues as regards mine to metal production. According to Saini et al. (2015), intensive mining activities in the Jharia coalfield for over 100 years have brought significant environmental changes in the area; that is reflected in terms of degradation of air, water, and soil, damage to the ecological system, loss of agricultural land, and change in the vegetation pattern. A study carried out to assess the vegetation index of the area showed that sparse vegetation has increased compared to dense vegetation from 2004 to 2011. This can be reflected in table 1 below and is mainly influenced by coal mining.

Table II: Change in area of different Normalized Difference Vegetation Index classes from 2004 to 2011

Year/NDVI Classes	Area (Hectares)				
	Water	Barren	Sparse Vegetation	Moderate Vegetation	Dense Vegetation
2004	838.2	3133	19428	282572	1442
2011	834	6096	39108.5	7059.3	0.4

Source: Saini, V., Arora, M. K., & Gupta, R. P. (2015b). Change in area of different Normalized Difference Vegetation Index Classes from 2004 to 2011 [Illustration].

Also, in Goa, India, iron ore mining presents a picture different from that of the mining states like Jharkhand. The local communities in the mining areas have a higher degree of awareness about environmental consequences than that of the communities in the relatively backward state of Jharkhand and therefore, they are unwilling to accept damage to environmental and social integrity in their habitats. This has compelled the mining companies to behave more responsibly and undertake active measures for engagement with the communities and bring about socio-economic development in the villages near the mines. There appears to be relatively more transparency and accountability in the behaviour of mining companies due to vigilant pressure from civil society. (Planning Commission, India, 2012)

4.0 Unsustainable mining: The consequences for the environment and society

As part of the sustainable development goals (SDGs), SDG 12 which focuses on safe production practices is highly crucial. This is due to the dangers of unsafe industrial production operations both on the environment and in the entire humanity at large.

The environmental impact caused by mining takes three main forms (Richards, 2002):

1. The land disturbance that covers change of land use and landforms, the visual impact of an open pit or waste dump, and subsistence of the ground surface due to mining; 1942
2. Destruction of habitat including flora, fauna, natural watersheds and drainage pattern and of aquifer causing lowering of the water table;
3. Adverse chemical impacts of improperly treated wastes which cover air pollution due to dust and noxious fumes, water pollution due to surface runoff from different areas of mines, waste dumps, seepage from tailings dam, etc., effluents including acid mine drainage, associated with many past and present coal and metalliferous mines as also noise and ground vibration due to blasting. (Planning Commission, India, 2012)

The environmental implications of irresponsible mining activities with instances from both countries are enumerated below;

4.1 Biodiversity

Mining poses serious and specific threats to biodiversity. Biodiversity is a biological concept which explains the importance of each biological entity in maintaining ecological balance. For instance, trees help in purifying the climate by absorbing carbon dioxide particles which is a greenhouse gas. Also, aquatic lives are a very good source of food and protein. As such, activities like mining which disturb biodiversity are harmful to both biological balance and for the present and future generations of man. The noise pollution resulting from extraction activities disturb the neighbouring human settlements, and force birds and other animals out of their natural habitats. Similarly, the incidence of micro-dust (aerosol) generated from rock explosions settles on plant leaves thereby reducing the process of photosynthesis (Dukiya J., 2013). In general, mining affects biodiversity at multiple spatial scales (sites, landscapes, regional and global) through direct (i.e mineral exploration) and indirect processes (via industries supporting mining operations and external stakeholders who gain access to biodiversity-rich areas as a result of mining (Sonte et al., 2018).

4.1.1 Aquatic and Marine Habitats

Toxic metals such as He, Pb, Cd, and As which find their way into water bodies as wet tailings from mining industries pose serious issues to marine organisms. Toxic metals have been reported to be responsible for the generation of the Reactive Oxygen Species

(ROS) which destroys the protein, lipid, and DNA content of exposed aquatic animals (Okerefor et al., 2020). Also, the toxic chemical form of mercury, methyl mercury is a public health concern as it contaminates fish which form part of the food chain

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(Soliman, 2006). From studies conducted at a coal mine in Enugu Nigeria by Omotehinse and Ako in 2019, the major dangers of unsustainable mining to marine habitats are given below;

4.1.1.1 Surface water contamination by mine water

Acid mine drainage (AMD) occurs when minerals and coal deposits containing sulfide minerals, e.g. pyrite (FeS_2) are exposed to air, thus releasing sulfuric acid causing the pH of the water to become very low (as low as 2). AMD in an abandoned coal mine in Enugu had negative effects on the quality of both groundwater and surface water. Mine water is a huge danger to aquatic life and adversely affects the health of communities that rely on this water source for drinking water and agriculture.

4.1.1.2 Surface water contamination by mineral dressing

Chemical agents (e.g. cyanide or sulfuric acid) used in processing ores can spill, leak, or leach from the mine site into water bodies thereby contaminating or polluting the water. These chemicals are highly toxic to both humans and wildlife.

4.1.1.3 Surface water contamination by infiltrates from a mine waste dump

Mine construction results in soil disturbance where soils and sediments (mine wastes) are transported into streams and rivers, resulting in the loss or alteration of habitats for aquatic organisms, as well as changes in water quality.

4.1.1.4 Groundwater contamination and flow regime

The breakdown of pyrite and other sulphides by water or air releases acid, sulphate, and metals into the environment.

4.1.1.5 Changes in surface water flow

Siltation of rivers can occur, which changes the water flow. Siltation occurs when there is a build-up of fine solid particles on the bed of a river. Large quantities of mine dumps are produced during mining activities, and because these dumps are unstable, they can easily

be blown away by the wind when dry and eroded by heavy rain when wet. Thus, rain and wind transport fine particles into nearby water or rivers, forming a buildup of suspended solids and finally siltation.

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4.2 Forests

Deforestation, loss of wildlife, and forest resources are some of the major challenges of mining operations. Open cast-mining involves the removal of many forest resources including topsoil. Most of the time, these mining sites are not properly treated after mining operations leaving them in pitiable states. The concerns on the sustainability of forestry and agricultural systems have increased recently because the world population is ever-increasing and so is the demand for food (Unanaonwi & Amonum, 2017). According to the Intergovernmental Panel on Climate Change (2007), forest degradation and deforestation in developing countries account for about 18% of the global carbon(iv)oxide emissions.

4.3 Air pollution

According to Okereafor et al. (2020), many pollutants (mining waste, chemical, and organic fertilizers, pesticides, industrial wastes, and other materials) are held in soils and often contribute to water and air pollution. Air pollution is an unavoidable negative effect of mining. Even during responsible mining practices, the explosions which are done to reduce the ores to the desired sizes expose many dust particles to the atmosphere. These particles end up polluting the air and exposing the mine workers to health problems. Irrespective of the mining technique used, mining has a devastating effect on the environment. These effects include deforestation, loss of topsoil, accelerated soil erosion, contamination of soil, qualitative and quantitative depletion of surface and groundwater surfaces, migration of wildlife and avian fauna, and addition of air pollutants and dust in the atmosphere (Velpaala K., 2013).

4.4 Agriculture

The implications of mining to agriculture are numerous. It takes up large hectares of landmass, makes them unfit for agricultural purposes, and exposes the soil to harmful chemicals which disturb the growth and development of agricultural products. The presence of mine tailings in the soil leads to acidification. This is due to toxic metal ions that are normally contained in untreated tailings (Okereafor et al., 2020). These toxic metals disturb

the fertility rate of the soil thereby discouraging bountiful agricultural produce. For instance, a higher concentration of Zn in soil suppresses plant metabolic activities, thus resulting in stunted growth and senescence (Okerefor et al., 2020).

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According to India's National Environmental Board (2004) and Environmental Protection Agency (2012), the acceptable limit of cyanide in the agricultural soil is 40 mgCN- equivalent/Kg soil. However, from studies conducted in 2015 by Harish and David in Gold mine ore tailings in Hatti and Kolar in Karnataka, India, the total cyanide level of the soil samples ranged from 220 to 260 mg/Kg and 50 to 60 mg/Kg. These results are well above the permissible limit and will cause severe damage to agricultural products. This calls for serious attention from the government to ensure that mining industries perform necessary tailings management operations before they are disposed of to the environment.

4.5 Human Settlements and Natural Disasters

Perhaps, one of the major implications of mining activities is their impact on the life of people and in the natural environment. Land-use conflicts; induced settlement, destruction of recreation areas are some of the harmful consequences for the human settlements (Dukiya, 2013, p. 18). The excavation and exploration activities are done during mining operations severely affect the stability of the environment in India and Nigeria. This acts as catalysts to environmental issues like earthquakes and tsunamis. When this occurs, problems like fire outbreaks, breakage of dams, landslides, etc. encroach into human settlements taking many lives and rendering the survivors homeless. Also, improper management of mining wastes can cause severe health issues to people as they end up consuming some of these harmful wastes through water and wildlife resources.

4.6 Health Hazards

In India, the informal nature of the mining in Jharkhand, home to the production of mica, etc. exploits the labour of children. (Illegal mica mining not only causes serious health hazards among the women and child workers) (Singh, 2019). In Chhattisgarh, the latest government study has found that mining activities in the coal-rich Tamnar area of Chhattisgarh have put the local population, mainly tribal people, at an increased risk of acute respiratory diseases and tuberculosis. The study reveals that in the case of tuberculosis, the

disease burden rate in Tamnar is nearly double the national rate and almost triple the rate in the state, highlighting the adverse impact of mining. (Agarwal & Ghosh, 2020)

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4.7 Poor Quality of Life and Economic Insecurity

While Nigeria still awaits the economic development of its population in the mining sector which consists of a largely poverty-stricken workforce, the state of Jharkhand in India is a perfect example of a 'resource curse.' Thirty-nine per cent of the population lives below the poverty line, even though the state has about 32 per cent of the nation's coal reserve, 25.07 per cent of iron ore, 18.48 per cent copper ore, and is the only producer of coking coal. (Statesman News Service, 2020)

4.8 Human Rights Violations

Mining also puts the lives of miners at risk due to the rudimentary ways adopted and the absence of adequate safety gear and protocols. For instance, mine-related accidents at rathole sites - Ksan coal mine in Meghalaya- Jaintia Hills (2018). Massive local protests have taken place against mining in Niyamgiri Hills of Odisha, POSCO India branch of a Korean multinational company formerly called Pohang Iron and Steel Co., Ltd in Odisha, Sterlite protest in Tamil Nadu. (Drishti IAS, 2019) Nigerian districts Okobo (Kogi State), Shikira (Niger State), Anka, and Bungudu (Zamfara State) have tasted similar human rights violations (Ononaiwu, 2018).

4.9 Displacement and rehabilitation issues

Large-scale displacement of local people leads to grievances and improper rehabilitation measures, thereby, leading to people's alienation and developing distrust over the government machinery. It's not just a loss of land for the local population rather the loss of a tribal way of life and their rich cultural heritage. For India, it has given space to left-wing extremism in resource-rich areas like Chhattisgarh, Jharkhand, Odisha, etc.

5.0 Impacts And Effectiveness Of Policy In Mitigating Unsustainable Mining Practices

In most case scenarios, the inability of policymakers (government and legal officials) to monitor and ensure that responsible practices are adhered to by the private and public

mining sectors is the reason for unsustainable mining. Mining laws point out procedures, rules and guidelines that manage the sector so that mineral exploration may have the least adverse effect on the environment.

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Additionally, it provides regulations regarding the transformation of the mineral resource, resulting in benefits from the economic and social point of view, guaranteeing the rights of the miner, the country, and the society, in favour of economic, environmental, and socially sustainable development (Ataide P., 2017; Monteiro et al., 2021).

5.1 Nigeria and Impact of Policy

In Nigeria, the policymakers are mostly after their pockets. They receive huge sums of monetary benefits from mining industries and as a consequence, do not take the necessary action needed to foster safe mineral exploration, mineral processing, and waste disposal operations. Some of these incompetencies reflect in the form of unskilled personnel working in high-risk sectors of mining companies, inadequate social responsibility and lack of social acceptance, and poor closure of mine sites after operations. In Nigeria, the passing of the Minerals and Metal Act 2007, the Minerals and Metal Policy, and the establishment of the National Environmental Standards Regulation and Enforcement Agency, The Explosives Act, and the Nuclear Safety and Radiation Protection Act are all attempts by the Federal Government to control illegal and unsustainable mining practices in the country. The mining act allows for the deposit of tailings in any natural watercourse, subject to the requirements of the mining regulations. Under this regulation, an application to deposit tailings shall be in the prescribed form and any permit issued to deposit the tailings shall specify the maximum amount of tailings to be deposited. This is something that mining operators and titleholders are expected to provide for an effective management system throughout the operation and to ensure the protection of the general public in their storage operations. No dumping operations would be undertaken without issuing a notice of at least 30 days and obtaining the approval of the Mines Inspectorate Department (MID). Mineral title holders are expected to prepare mine waste disposal plans, establish water retention and treatment techniques suitable for relevant mine sites and ensure safe management of contaminated runoff and groundwater contamination. Similarly, the holder of a mining lease intending to abandon or permanently cease production on a site is expected to notify the MID three months before abandonment.

An applicant for closure of a mining area shall ensure that it has adhered to all the conditions as regards relevant environmental impact assessment statement, the environmental protection and rehabilitation plan of the mining act, and the mining regulations (Global Legal Group, 2021).

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However, despite these arrangements, only little has been achieved due to neglect, incompetence, and corruption. Also, despite the policies on the ground, illegal mining activities are still on the increase across the mineral-rich areas in the entire federation. In Nigeria's Minerals and Mining Regulation, 2011, there is not one mention of the critical matter of human rights. Given this, organizations, excluding thoughtful leaders, may argue that they are not mandated to conduct their activities in a socially responsible way (Ononaiwu, 2018). This includes part 4 of the Nigeria mining regulations which govern health and safety in mining. If these shortcomings are properly checked, Nigeria will be at the same level as developed countries as far as the growth and development of the mining/raw materials sector are concerned.

5.2 India and Impact of Policy

Indian policy-makers have created mining legislation that is yet to be fully implemented within a sustainable framework. Herein, because of the adverse environmental and social impacts of mining, the Supreme Court of India has pointed out the importance of Environmental Impact Assessments (Goa Foundation Case, April 2014). It noted that there are adverse consequences when "the macro effect of such wide-scale land and environmental degradation caused by the absence of remedial measures (including a rehabilitation plan)" is not taken into account (Karnataka mining case, Supreme Court of India, April 2013). To regulate the environmental consequences of this sector, the Apex Court has also stated that mining operations must be conducted within the parameters of the requirements of Article 21 of the Constitution, i.e. the right to a clean environment and pollution-free air, the precautionary principle, and the principles of sustainable development and intergenerational equity (Statesman News Service, 2020). Even though there are laws in place for the protection of workers' wages like The Payment of Wages (Mines) Regulation Act, 2019, and for the regulation of labour and safety in mines like Articles 246, 24, 39 and 42 but they don't get implemented to the end that they seek. Since the workers are illiterate they cannot read and write resulting in them being unaware of their rights. The owners and the contractors take

this benefit and the workers continue to be the victim of humiliation and harassment, barring a few exceptions, like the state of Goa (Sharma, 2015).

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Where major mining companies use advanced, adopt comprehensive environment protection measures, sensitise their personnel on sustainability issues and progressively try to improve their environmental performance, there are other large, medium and even small enterprises whose environment obligation consists in strictly conforming to the prescribed legal provisions. In the case of illegal mining, these niceties are not observed. It is reported that illegal sand mining is largely responsible for environmental degradation especially the river beds of the Ganga and Yamuna rivers. Lack of checks and political interference has turned the situation grim. This is further aggravated by a poor law and order situation and ineffective police administration in the mining areas, lack of vigilance and action by the forest department officials, poor infrastructure and inspection facilities such as non-functioning government weighbridges and inadequate supervision of private weighbridges, as well as absence of adequate authority of the inspecting staff in the field agencies of the State mining department. The absence of coordinated action among the multifarious state and central agencies responsible for the regulation of various aspects of mining like arbitrary allocation of coal mines and delays in environmental clearance is also a major factor responsible for this unfortunate situation. Finally, there is an overpowering presence of corruption to which the mining sector is particularly susceptible given the huge sums of money involved in the extraction and trading of minerals (Down To Earth, 2017).

6.0 Sustainable Policies/Recommendations for the Future

A sustainable mining policy is one in which all the things directly or indirectly related to mining are taken into consideration before, during, and after mining operation. According to Monteiro et al. (2021), sustainability in mining requires a more integrated and interdisciplinary approach that considers the relationships among resources, people, and the environment. The major factors that will serve to foster sustainable mining practices in developing economies like that of Nigeria are;

1. Governmental intervention

2. Revoking the license of mining industries that do not adhere to responsible mining practices
3. Sensitization of the general public on the need for sustainable mining and the roles they need to play

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4. Sustainable industrial practices (appraisal of negative mining effects before, during and after mining operations and taking necessary steps to curb them)
5. Regulating and monitoring the activities of artisanal small scale miners whose activities are usually crude and illegal

For India, both the government and industry need to take a comprehensive view of sustainable development that should cover dimensions other than the environment, such as stakeholder engagement and consultations, local area socio-economic development and transparency in communication and accountability. Preparation of a socio-economic assessment report for a mining project should be made a part of the permitting process for the grant and administration of mineral concession to a mining enterprise. Local socio-economic development works should preferably be executed by mining enterprises rather than government and semi-government agencies to avoid the problems of inadequate capacity, political manipulation and corruption.

To alleviate the limitations of small mines in carrying out sustainable development activities, consortia of small mining enterprises in a region should be promoted. Technical advisory services should be made available to them in the relevant areas. Mineral development in a region should be carried out within its available social and environmental “carrying capacity” and infrastructural facilities at a given point of time (Down To Earth, 2017).

7.0 Impacts of Sustainable Mining

Having discussed in detail the economic, environmental and societal effects of unsustainable mining practices in developing countries, especially, India and Nigeria, this section of this expository work looks at the numerous benefits of sustainable mining activities.

1. **Economic development:** Mining accounts for a great percentage of the GDP of countries rich in mineral and metal resources. It employs a large portion of a country's

workforce, leads to the extraction of precious materials that can be used by local companies for production purposes and also generates revenue through exportation.

2. **Conservation of natural resources:** Sustainable exploitation of minerals helps to preserve the rapidly depleting natural resources for the present and future generations. This is because responsible mining looks beyond the primary raw materials obtained directly from the earth's crust. It extends to the recovery of materials from wastes and end-of-life products and as such, helps to preserve the natural/primary sources of these raw materials.
3. **Protection of the environment:** By neutralizing harmful mining wastes before disposal as well as closing mine sites in such a way that the largely excavated lands are brought as close as possible to their original natural states, sustainable mining operations helps to prevent environmental degradation.

Sustainable mining practices can also benefit other areas such as preventing loss of biodiversity, preservation of water, wildlife and forest resources, poverty alleviation, creation of employment opportunities, promotion of industrialization, etc.

8.0 Recommendations

To foster improved practices in the raw materials sector of developing economies like India and Nigeria, we recommend the following;

1. Regular education and sensitization should be done in local communities where precious mineral deposits are located. This will serve to make them understand the dangers associated with illegal mining activities.
2. Developing countries should employ the expertise and technological advancements of developed countries in their mining sectors.
3. The political and legal framework should discharge their duties effectively as this will tremendously foster sustainable practices at all levels.
4. Distribution of mineral resources revenues between budgets should be transparent and equitable so that the local population is appropriately compensated for environmental degradation, the decline of bio- and geodiversity, and deterioration of population health (Nikitina, 2014, p. 8636).
5. Mining industries should adhere to responsible practices before, during and after their operations.

6. Although mining cannot be eliminated because of its exceptional advantages, it is pertinent to ensure that mining sites are treated and developed with forest vegetation after mining operations. This will not only help to make the environment more sustainable but will also be vital for preventing loss of biodiversity and purifying the entire ecosystem.

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9.0 Conclusion

Having studied and compared the environmental and societal effects of mining in India and Nigeria, we draw the following conclusions; the mining sector of Nigeria is largely underdeveloped in terms of economic, environmental and societal efficiency. Despite having sustainable development issues, India is committed to developing its raw materials sector to join the global best practices. The government of Nigeria is currently making efforts to improve its mining sector. However, corrupt government officials and a large number of illegal miners from mineral-rich areas in the country are making this unachievable.

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