

BUDGETING FOR CLIMATE CHANGE IN THE MINING SECTOR



CENTRE FOR SOCIAL JUSTICE (CSJ)

(Mainstreaming Social Justice In Public Life)

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By

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ACRONYMS

AMD	Acid Mine Drainage
CH ₄	Methane
CIT	Companies Income Tax
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
EIA	Environmental Impact Assessment
FGN	Federal Government of Nigeria
FMMSD	Federal Ministry of Mines and Steel Development
FMoE	Federal Ministry of Environment
GDP	Gross Domestic Product
GHG	Green House Gas
H ₂ S	Hydrogen Sulfide
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
MDAs	Ministries, Departments and Agencies of Government
MIREMCO	Mineral Resources and Environmental Management Committee
MMSD	Ministry of Mines and Steel Development
NASPA-CCN	National Adaptation Strategy and Plan of Action on Climate Change
NO _x	Nitrogen Oxides
R&D	Research and Development
SDGs	Sustainable Development Goals
SMDFO	Solid Minerals Development Fund Office
SO ₂	Sulfur Dioxide
VAT	Value Added Tax

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EXECUTIVE SUMMARY

The Study is set in the context of the policy, plan and budget continuum. It seeks to review Nigeria's policies, plans and commitments in mining, the environment and climate change. It further seeks to determine how policies and plans reflect in the budget; examining extant challenges whilst making recommendations for budgeting in a way and manner that strengthens mitigation and adaptation to climate change as well as building resilience.

Mining is the act of extracting valuable minerals or other geological materials from the earth to satisfy a range of human needs. In Nigeria, there are about fifty different solid minerals discovered in more than five hundred locations including gold, barite, bentonite, limestone, coal, bitumen, iron ore, tantalite/columbite, lead/zinc, gemstones, granite, marble, gypsum, talc, lithium, silver, etc. Even though not all the minerals are available in commercially viable quantities, mining is carried out across the Federation. The minerals have been classified into high value metallic minerals, industrial minerals and energy minerals. Before the oil boom in the early 1970s, solid minerals such as columbite, coal and tin were major foreign exchange earners and contributed immensely to the economy and development of Nigeria. At some point, Nigeria was the largest producer of columbite in the world.

Mining of solid mineral provides a variety of socio-economic benefits. However, its environmental and social costs, if not well handled, can be massive in terms of land conversion and degradation, deforestation, defacement of the landscape, habitat alteration, water and air pollution which interferes with human health, the quality of life and the natural functioning of the ecosystem. Some of the socio-economic impacts include the loss of top soil that is good for farming, destruction of farm land, felling of economic trees, onset of gully erosion, loss of livelihoods and increased incidences of health impacts such as loss of hearing, respiratory and lung diseases. In Nigeria, the mining sector is often thought to be the second largest source of pollution after crude oil production. In addition to being resource intensive, the sector generates high concentrations of waste and effluents. Also, the noise and vibration caused by blasting of rocks with explosives have adverse effect on buildings and people living within the neighbouring communities. Some specific environmental and climate change related examples of challenges thrown up by mining gold, coal, iron ore and limestone are examined in the Study.

The Study reviews the governance and policy framework of the mining sector in Nigeria. Relevant sectoral standards include the Nigerian Minerals and Mining Act 2007; the Nigerian Mineral and Metals Policy 2008; and 'On the Road to Shared Mining

Prosperity: Roadmap for the Growth and Development of the Nigerian Mining Industry (2016)'. The trend of the Nigerian government policy thrusts in the mining sector is anchored on the need to develop a private sector led mining industry and restricting FGN's role to that of a regulator. The Roadmap identified some key areas in need of greater governmental attention. The full activation and application of the provisions of these policies and making budgetary provisions to transform the policies and plans into activities of implementation will mitigate the impact of mining on the environment and climate change and help communities to adapt better. The fiscal incentives for private sector operatives are quite generous which ensures that investors will reap big profits and there will be no need for short cuts that may endanger the environment for investors to break even. Surprisingly, there was no mention of climate change in all the relevant legal and policy frameworks regulating mining in Nigeria.

A review of the budgeting trend 2013-2016 shows inadequate funding of the sector and a few positives including reclamation of abandoned sites, monitoring and evaluation of steel and aluminum production processes, hydro-geochemical studies, site visits, extension services for small and artisanal miners, etc. The concerns identified in the budget trend include the following: that MIREMCOs provided in the Act to ensure the effective oversight and management of environmental responsibilities at the state level have remained unfunded throughout the period under consideration. Also, the Environmental Protection and Rehabilitation Fund has not been energised by enforcing contributions to the Fund to ensure adequate provision for addressing environmental remediation. The need for the Mining Police and Mines Inspectorate to develop a deeper and more forceful field presence to enforce standards received no allocation during the study period. Again the Mines Environmental Compliance Department received no mention in the allocations over the years. This is not good enough if environment and climate issues are to be mainstreamed in mining policy implementation.

Essentially, there seems to be no clear appropriations for climate change adaptation and mitigation in the budget of the Ministry in the four years under consideration. This is neither good for mine operators nor their host communities. The experience of coal mining in Okobo Community in Kogi State with its heavy pollution of water resources and the entire ecosystem shows the need for improved performance by the Ministry and compliance to laws and policies by mining companies.

In the light of the foregoing, the Study made the following recommendations which are imperative for mainstreaming climate change issues in the budgeting and policy processes. The first eleven are taken from the Roadmap for the Growth and Development of the Nigerian Mining Industry.

- There is need for improved funding for the Mining Police and Mines Inspectorate to develop a deeper and more forceful field presence to combat poor safety practices and to enforce standards.
- Ensure the full implementation of all private sector environmental obligations under the Mining Act considering the provisions of section 30 of the Act which provides for the tax deductibility of a reserve for environmental protection, mine rehabilitation, reclamation and mine closure costs.
- The need to strengthen environmental sustainability of mining especially as it relates to artisanal miners through extension services and new knowledge dissemination to avoid severe destruction of farmlands, creation of physical hazards, high levels of toxic chemical usage and death from poisoning, etc.
- Support the formalization of artisanal miners into cooperatives and support the growth and transformation of small scale miners into cooperatives.
- Ensure the implementation of the approved framework to establish the Environmental Protection and Rehabilitation Fund; enforce contributions to the Fund and ensure adequate provisions for addressing environmental remediation.
- Also provide sufficient funds in budgets to address legacy issues arising from previous environmental damage from illegal mining activities and reclaim abandoned mine land while intensifying efforts to prevent future occurrence.
- Fund MIREMCO to ensure effective oversight and management of environmental responsibilities at the state level.
- Ensure effective demarcation of environmentally sensitive parts of the country e.g. wetlands that are off limits to mining should be captured on maps.
- Establish reference laboratories to conduct standards based testing e.g. detect environmentally contaminant levels e.g. of mercury and lead.
- Educate mining companies about their obligations to communities under Community Development Agreements.
- Provide market based incentives for community participation in commercial exploitation of minerals through support of special purpose vehicles for mining investment e.g. 7.5% to 10% equity shares in return for consent.

- FGN should consider increasing the capital budget allocation for the Ministry. Combating impact of climate change on the mining sector value chain will require continuous infrastructural development.
- The Ministry can initiate cross-industry (inter-ministerial) collaboration on the different mining regions adaptation strategies. This can be done by exploring opportunities to collaborate within geographic regions to share information and costs for climate modeling, other supporting scientific and technical activities, best practices and implementation of large scale adaptation strategies. Private companies under the supervision of the Ministry can meet quarterly to share climate information and learn from each other's efforts to develop mitigation and adaptation strategies.
- Using existing climate data from Nigeria Meteorological Agency, the Ministry should conduct a far-reaching research on how recorded and projected changing climatic conditions will affect the major mining locations in the country.
- There is need to consider mandating the mining sites to go off the national energy grid owing to their high energy consumption.
- There is no need to pursue the revitalization of coal mining. Developed countries of the world like Germany etc. are shutting down their coal plants because of the health and environmental hazards associated with coal mining. Emphasis should rather be on solar, wind and other renewable sources of energy.
- Nigeria should stop the attempt to build a nuclear power plant. We neither have the capacity nor discipline to manage such a high risk energy generation enterprise. Further, the storage of radioactive materials will pose a huge challenge which we are not yet ready to confront.

1.1 INTRODUCTION

Scientific evidence shows that the climate is changing and it is beyond doubt linked to anthropogenic greenhouse gas (GHG) emissions. The amount of anthropogenic greenhouse gas emissions in the atmosphere is influenced by lifestyle, population size, economic activity, energy use, technology, land-use change and climate policy¹. Based on this fact, research is shifting from focusing on the causes and nature of climate change to its implication for humans. Changing climatic conditions have major consequences for economic viability, social and cultural well-being. Thus identifying and characterising impacts for the different sectors, regional and national economies is imperative. It is increasingly understood that by identifying and anticipating potential vulnerabilities, stakeholders, practitioners and regulators can take proactive measures to limit future impacts and uncertainties.

Mining is the act of extracting valuable minerals or other geological materials from the earth to satisfy a range of human needs. In Nigeria, there are about fifty different solid minerals discovered in more than five hundred locations including gold, barite, bentonite, limestone, coal, bitumen, iron ore, tantalite/columbite, lead/zinc, gemstones, granite, marble, gypsum, talc, lithium, silver etc.² Even though not all the minerals are available in commercially viable quantities, mining is carried out across the Federation³. The minerals have been classified into high value metallic minerals, industrial minerals and energy minerals⁴. Before the oil boom in the early 1970s, solid minerals such as columbite, coal and tin were major foreign exchange earners and contributed immensely to the economy and development of Nigeria. At some point, Nigeria was the largest producer of columbite in the world.

The discovery of oil led to the abandonment of solid minerals development and presently, Nigeria's solid minerals mining sector is largely underdeveloped and needs a lot of reforms and investment to pick up again. With the collapse of oil prices, Nigeria is once more on the search for alternatives to diversify her economy, hence the renewed interest in solid minerals. Solid minerals contributed 0.33% of the Nigerian GDP in

¹ Intergovernmental Panel on Climate Change (2014), Climate Change 2014: Synthesis Report, Contribution of Working Group I, II and III, to the Fifth Assessment Report of the IPCC [Core Writing Team: R.K. Pachauri and L.A. Meyers (eds)]. IPCC, Geneva, Switzerland, 151pp

² Alison-Madueke, D. (2009), Opportunities in Nigeria's Minerals Sector, Ministry of Mines and Steel Development, Abuja, Nigeria, 22nd April 2009.

³ KPMG (2012), Nigerian Mining Sector, available online:

<https://www.kpmg.com/NG/en/IssuesAndInsights/ArticlesPublications/Documents/Nigerian%20Mining%20Brief.pdf> [Accessed: August 25, 2016]

⁴ High value metallic minerals such as gold, coltan, lead-zinc, iron core, cassiterite, etc; industrial minerals such as limestone, barite, clay, etc. and energy minerals such as coal, lignite, bitumen, etc. See Roadmap for the Growth and Development of the Nigerian Mining Industry, 2016 at page 1

2015⁵ which in real terms, translates to about ₦400 billion in value to the economy. Efforts to improve production and economic viability of the sector led to the establishment of special Ministry of Mines and Steel Development and there are targets for the sector to contribute a minimum of 5% of GDP in the next couple of years. The earlier neglect of the sector led to Nigeria becoming a net importer of minerals that could be produced locally and that are required for manufacturing such as iron ore and salt. It is estimated that Nigeria losses about \$3.3 billion to the importation of materials made from steel and Iron ore annually⁶.

The potential vulnerability of mining activities and its contribution to climate change is considerably significant; it also has large implications for job creation, economic growth, the health of the population, etc. The vulnerability of the mining sector stems from the finite nature of mineral resources and the fact that commercial viability of mines is primarily determined by global mineral prices. Worsening global climate is projected to be a major factor driving mines operational costs which are already significantly influenced by distance and landscape. Most mines are remotely located with poor access. Thus, climate change will present a complex set of impacts on solid minerals sector in a country that is already facing economic decline. Beyond the impact of climate change on the mining sector, mining operations and the use of some solid minerals have devastating consequence on the environment and people. Despite this knowledge, there have been only a few researches showing the devastating impact of unregulated solid mineral exploitation on the environment and the host communities in Nigeria. This is in sharp contrast to the well documented devastating consequences of unregulated petroleum resource exploitation in the Niger Delta⁷. Developments in the mining sector therefore need to take cognizance of climate change and emerging environmental challenges.

1.2 ENVIRONMENTAL IMPACTS OF MINING AND CLIMATE CHANGE

Mining of solid mineral provides a variety of socio-economic benefits. However, its environmental and social costs, if not well handled, can be massive in terms of land conversion and degradation, deforestation, defacement of the landscape, habitat alteration, water and air pollution which interferes with human health, the quality of life and the natural functioning of the ecosystem⁸. Some of the socio-economic impacts include the loss of top soil that is good for farming, destruction of farm land, felling of

⁵ See Roadmap for the Growth and Development of the Nigerian Mining Industry, 2016 at page 1. This is low when compared to its earlier contribution of 4-5% of the GDP in the 1960s- early 70s.

⁶ Former Minister of Industry, Trade and Investment, Olusegun Aganga in a speech dated August 13, 2013 ,opening a conference on Revamping the Solid Minerals Economy.

⁷ UNEP (2011), Environmental Assessment of Ogoniland

⁸ Nnabo P.N. and Taiwo, A.O (2001), "A historical survey of solid mineral exploitation and associated problems with examples from parts of Nigeria," Journal of Environmental Sciences, vol. 4, p. 42-54

economic trees, onset of gully erosion, loss of livelihoods and increased incidences of health impacts such as loss of hearing, respiratory and lung diseases. In Nigeria, the mining sector is often thought to be the second largest source of pollution after crude oil production⁹. In addition to being resource intensive, the sector generates high concentrations of waste and effluents. In addition, the noise and vibration caused by blasting of rocks with explosives have adverse effect on buildings and people living within the neighbouring communities.

Mining activities extract natural resources that produce income for the present generation and when extracted cannot be replaced. Thus, the issue of inter-generational equity arises in terms of the rights and interests of incoming generations. This is the challenge of one generation taking the benefits whilst leaving their successors with the environmental challenges.

There are seven minerals which are found in commercial quantities and are of strategic importance to Nigeria's economic mining prospects¹⁰. They are stated in Table 1.

Table 1: The Seven Strategic Minerals, their Locations and Estimated Quantities

Minerals	Dominant Location	Reasonably Estimated Quantities
Coal	Enugu, Anambra, Kogi and Benue States	2,750 metric tonnes ¹¹
Bitumen	Ondo State	27,000 million barrels
Limestone	South-West and Middle Belt regions	2,300,000 million tonnes
Iron Ore	Various location in the North-Central, North-East and South-East	10,000 million tonnes
Barites	Benue and Nasarawa States	15 million tonnes. With more inferred locations ¹² .
Lead/Zinc	North-East and North-Central regions	Lead – 10.0 million tonnes
Gold	North-West, North- Central and South-West	200 million ounces

Source: Ministry of Mines and Steel Development and KPMG (2012); Updated with Information from the Roadmap for the Growth and Development of the Nigeria Mining Industry

Some specific environmental and climate change related examples of challenges thrown up by mining are as follows.

⁹ Adekoya, J.A. (2003), Environmental effect of solid minerals mining, Journal of Physical Science Kenya, pp. 625–640

¹⁰ Mining in Nigeria –The Nigerian Minerals and Mining Act, 2007; the minerals were identified by the Minister in charge of the Ministry of Mines and Steel Development during a September 2008 ministerial press briefing.

¹¹ Coal Exploration and Power Generating Opportunities in Nigeria - Publication of the Ministry of Mines and Steel Development

¹² Inferred resource estimate for barites in Benue, Cross River, Nassarawa and Taraba States is 21.1 million metric tonnes

Box 1: Gold Mining and the Environment

Gold mining ravages landscapes, contaminates water supplies, and contributes to the destruction of vital ecosystems. Cyanide, mercury, and other toxic substances are regularly released into the environment due to dirty gold mining. Modern industrial gold mining destroys landscapes and creates huge amounts of toxic waste. Due to the use of dirty practices such as open pit mining and cyanide heap leaching, mining companies generate about 20 tons of toxic waste for every 0.333-ounce gold ring. The waste, usually a gray liquid sludge, is laden with deadly cyanide and toxic heavy metals. Many gold mines dump their toxic waste directly into natural water bodies. To limit the environmental damage, mines often construct dams and place the toxic waste inside. But these dams do not necessarily prevent contamination of the surrounding environment. Toxic waste can easily seep into soil and groundwater, or be released in catastrophic spills.

Acid Mine Drainage: Dirty gold mining often leads to a persistent problem known as acid mine drainage. The problem results when underground rock disturbed by mining is newly exposed to air and water. Iron sulfides (often called “fool’s gold”) in the rock can react with oxygen to form sulfuric acid. Acidic water draining from mine sites can be 20 to 300 times more concentrated than acid rain, and it is toxic to living organisms. The dangers increase when this acidic water runs over rocks and strips out other embedded heavy metals. Rivers and streams can become contaminated with metals such as cadmium, arsenic, lead, and iron. Cadmium has been linked to liver disease, while arsenic can cause skin cancer and tumors. Lead poisoning can cause learning disabilities and impaired development in children. Iron is less dangerous, although it gives rivers and streams a slimy orange coating and the smell of rotten eggs. Once acid mine drainage starts, it is difficult to stop. Acidic waters flowing from abandoned mines can raise acidity levels and destroy aquatic life for generations.

Mercury Pollution: The use of mercury in gold mining is causing a global health and environmental crisis. Mercury, a liquid metal, is used in artisanal and small-scale gold mining to extract gold from rock and sediment. Unfortunately, mercury is a toxic substance that wreaks havoc on miners’ health, not to mention the health of the planet.

For every gram of gold produced, artisanal gold miners release about two grams of mercury into the environment. Together, the world’s 10 to 15 million artisanal gold miners release about 1000 tons of mercury into the environment each year, or 35 percent of man-made mercury pollution. Artisanal gold mining is actually among the leading causes of global mercury pollution, ahead of coal-fired power plants. When mercury enters the atmosphere or reaches rivers, lakes, and oceans, it can travel across great distances. Once it reaches a resting place, mercury is not easily removed. Mercury is extremely harmful to human health. The amount of vapor released by mining activities has been proven to damage the kidneys, liver, brain, heart, lungs, colon, and immune system. Chronic exposure to mercury may result in fatigue, weight loss, tremors, and shifts in behavior. In children and developing fetuses, mercury can impair neurological development.

Source: <https://www.brilliantearth.com/gold-mining-environment/>

Box 2: Limestone Extraction and the Environment

Limestone quarries can be above ground or underground, and can cover large areas. Environmental hazards from mining operations depend in part on the location, characteristics and extent of the mining operations.

Ground Water: Limestone mining can affect ground water conditions. Limestone deposits often occur in association with karst, a topography where limestone slowly dissolves away underground. The deposits result in sinkholes, caves and areas of rock fractures that form underground drainage areas. When mining occurs in karst, disruption to natural aquifers, or flows of underground water, can result. Often, mining operations remove ground water to expose the quarrying site, which can lower the water table and change how water flows through the rock formations.

Surface Water: Streams and rivers can be altered when mines pump excess water from a limestone quarry into downstream natural channels. This increases the danger of flooding, and any pollutants or changes in water quality affect the surface water. Upstream surface water features, such as marshes, ponds and wetlands, can lose volume as their waters drain into the mine and are pumped out.

Sinkholes: As water and rock are removed from mines, the support they give to underground features is gone. Sinkholes can develop, where the roofs of underground caverns are weakened or collapse. Collapse can be gradual or sudden. Although natural sinkholes develop over time, man-made ones predominate in mine areas. Sinkhole formation can cease after mine dewatering is stopped and the water table is allowed to return to normal levels.

Blasting and Construction: Limestone mines use two types of blasting. Small explosive charges set along drilled lines free blocks of stone to be removed for construction. Large charges reduce whole areas of limestone to rubble, which is removed for use as crushed stone. The noise, dust, and impact from explosions can result in noise pollution and dust. Underground forces from the blasts can cause sinkholes or change the drainage and water quality of underground aquifers. Construction equipment, such as large trucks, crushing machines and earth-moving equipment, also contribute to noise and dust.

Source: <http://education.seattlepi.com/environmental-hazards-limestone-mining-5608.html>

Box 3: Mining Iron Ore and the Environment

Impacts on Land: Altered landscape, land caves in; erosion; changes in land use pattern; land becomes barren, no crops, plants and trees.

Impacts on Water: Removal of water bodies; creation of new water bodies; pollution of water bodies

Impacts on Atmosphere: Increase in temperature in the area due to mining activity and

decreased vegetation; pollution due to explosive fumes; increase in noise level due to vehicle movement and operating mining equipment.

Impacts on Ecology: Removal of vegetation impacts the animal life in the area; pollution of water bodies affects the aquatic animal life; fumes and gases impacts on the growth and quality of plant life.

Source: https://prezi.com/jdms_29p0ir8/the-environmental-impacts-of-mining-iron-ore/

Box 4: Coal Mining, the Environment and Climate Change

Coal is a very dirty solid mineral. Coal releases harmful pollutants into air, water and land along its value chains from the process of mining, cleaning the coal, transporting the coal, generating electricity and disposal. All these processes destabilizes ecosystems and put human health in danger. The health concerns ranges from cancer, to damage of nervous, immune and reproductive systems. The environmental concerns ranges from poisoning of local rivers by acid mine to the global problem of climate change due to emission of carbon dioxide. The so-called 'clean coal' technologies are still very expensive and unable to totally remove dangerous emissions from coal power plants. Mining of coal causes extensive destruction of natural ecosystems like forests and can also destroy landscape beyond repair. Coal mining causes destruction to plants, animals and humans due to destruction of habitat and environmental contamination.

Mine Wastes: Mine wastes are generated in huge quantities and must be disposed of. The wastes are flammable and prone to spontaneous combustion. They also contain heavy metals capable of leaching out into local rivers, streams and groundwater. Coal washing generates similar waste problems

Acid Mine Drainage (AMD): Sulphuric acid is created when exposed coal gets wet and dissolves toxic metals. The resulting run-off is directly toxic to aquatic life and renders the water unfit for use. Furthermore, some of the metals bioaccumulate (i.e. build up in living things) along the aquatic food chain. AMD can contaminate drinking water sources and plague nearby communities for centuries, or even longer.

Health and Safety in the Mines: Mining is dangerous and has high injury and mortality rates. Potential health and safety hazards include respiratory illnesses such as emphysema, black lung disease and chronic bronchitis; exposure to toxic fumes and gases; noise-induced hearing loss; heatstroke and exhaustion.

Transportation: Trucks, rail and barges used to transport coal all affect air and water quality. As well as the environmental and health impacts from blowing coal dust, there is also the air pollution from the vehicles themselves.

Coal-fired Power Generation: Coal-fired power plants emit more than 60 different hazardous air pollutants. Yet, despite billions of dollars of investment, scientists are unable to completely

remove harmful emissions from plants. Pollution from coal-fired power stations is released in four main ways; (i) as fly ash from the smoke stack, (ii) bottom ash which stays at the bottom after the coal is burned, (iii) waste gases from the scrubber units (which are chemical processes used to remove some pollutants) and (iv) gas released into the air.

SO₂ (Sulphur Dioxide) and NO_x (Nitrogen Oxides): Coal-fired power plants produce large quantities of SO₂ and NO_x, the key pollutants in the formation of acid rain. Acid rain acidifies water bodies, and harms forest and coastal ecosystems. SO₂ and NO_x contribute to the formation of particulates. NO_x helps form ozone (smog) and nitrates. Ozone impairs lung function and reduces the yields of many economically important agricultural crops. Nitrate deposition over-enriches water bodies, causing algal blooms that kill fish and reduce biodiversity

Particulates (fine particles): Coal-fired power plants are a major source of particulate pollution. Many scientific studies have shown that raised levels of particulates result in increased illness and premature death from heart and lung disorders, such as asthma and bronchitis. The largest share of particulate emissions comes not from direct emissions, but from the conversion of SO₂ and NO_x into fine particle sulphate and nitrate in the atmosphere

Trace Elements: Coal contains numerous persistent, bioaccumulative trace elements that are released during combustion and end up in the atmosphere and water bodies. These include mercury, dioxins, arsenic, radionucleotides, cadmium and lead.

Source: GREENPEACE Briefing, New Zealand <http://www.greenpeace.org/new-zealand/Global/new-zealand/report/2007/1/enviro-impacts-of-coal.pdf>

The issues arising from Box 1 to Box 4 can lead to extreme temperatures, increased or decreased precipitation, increased frequency and magnitude of storms and rising sea levels¹³. This poses a number of risks to the mining sector and could impact mining operations negatively. One impact of climate change may in turn trigger other impacts of climate change on mining. For example, decreased water availability leads to reduced precipitation which has a major impact on hydro-electricity generation that is a major source of energy for mining companies. Runoff which is the flow of excess water over saturated land in dry or water stressed areas will affect mining. Some mining operations require relatively large amounts of high quality water. A direct implication of increased water stress is that such mining operations will not have access to sufficient supply of high quality water.

Also, climate change has business and financial consequences on mining companies. At construction and operation stages, there are financial risks from increased capital and operating expenses to secure new sources of water for expansion of existing operations in water-stressed areas. The level of investment in desalination plants,

¹³ These issues include deforestation, deep erosion, loss and or pollution of water sources, etc.

pumping and transportation infrastructure can have negative effects on the financial capacity of the mining company. Sourcing water from longer distances increases operating costs. There are also secondary financial risks from the possibility of reduced reliability in electricity supplied. Mining companies may incur higher costs from having to rely on back-up generators. Hydroelectric power production facilities are susceptible to water supply fluctuation challenges. The shortfall in resources of the mining company may affect its relationship with the host community in terms of its ability to effectively carry out corporate social responsibility.

Climate change also negatively affects the transportation supply chains of mining companies especially if the transportation supply chain infrastructure is located in coastal areas and regions susceptible to inland flooding. In the case of coastal areas, the operation of port and storage facilities may be affected by gradual sea level rise, as well as higher storm surge during extreme weather events such as floods. Roads and railways are also susceptible to impacts in these areas, as well as impacts from inland flooding from increased precipitation. Run offs can damage road and rail segments

For some of these minerals such as coal, there are alternatives which support their being phased out whilst others may not have immediate alternatives. However, the big challenge is how to reduce the ecological footprints of key mining operations and to reduce global warming and negative climate change.

Due to the wide geographic distribution of mining operations, climate variation in the form of extreme weather changes and change in precipitation patterns will have complex impacts on the sector if enough measures are not taken. The need for the mining industry to approach climate adaptation and mitigation proactively stem from the following reasons:

- GHG emissions from the mining sector are massive considering the unsustainable mining practices being adopted. There is potential to reduce tonnes of CO₂ emissions from the sector by adopting good practices that might require huge investments and capacity development.
- Mining action plans, strategies etc. must be climate sensitive to ensure that mining infrastructure are climate-proof and resilient.
- Employee health and safety will be put at risk by increased exposure to heat-related illnesses and the likelihood of rising temperatures accidents.

- Obtaining and maintaining an operating license will become more difficult in communities in which climate change exacerbate existing vulnerabilities.
- Increasing pressure from investors, lenders, and insurers to minimize carbon liabilities and develop adaptation plans.

Corporate adaptation strategies in the mining sector may differ significantly, considering the diversity of geographies and commodities produced. But no matter where they are located or what mineral they explore, mining companies can become catalysts for adaptation, not only within their own operations but in their host communities and among regional businesses¹⁴.

1.3 MINING POLICY AND GOVERNANCE IN NIGERIA

The Federal Ministry of Mines and Steel Development (FMMSD) is the federal agency responsible for governance, policy and oversight in the mining sector. However, other MDAs also play a role in the sector. The FMMSD defines its mandate as contributing to the diversification of the country's revenue base and to create jobs and broaden the scope of economic opportunities available to Nigerians for economic advancement. The listing of the governance architecture is detailed in Box 5 below.

Box 5: Government Agencies with Responsibility related to Mining

- The Federal Ministry of Mines and Steel Development is primarily responsible for administering and managing all solid minerals in Nigeria by ensuring compliance with mining laws and regulations.
- The Federal Ministry of Environment is responsible for ensuring that all environmental laws including environmental and social impact assessments are complied with.
- National Environmental Standards and Regulations Enforcement Agency is responsible for enforcing compliance with laws, guidelines, policies and standards on environmental matters and creating public awareness on sustainable environmental management.
- The Federal Ministry of Water Resources is responsible for regulating the use of water resources. Mining companies need authorization from this Ministry before they can use any water bodies for mining purposes.
- State Mineral Resources and Environmental Management Committee (MIREMCO) is responsible for advising the Federal Minister of Mines and Steel on issues relating to solid minerals (grant of mining titles; issues relating to compensation; pollution and environmental degradation; conflicts; protective measures, etc) in the state

Source: Analysis by the Authors

¹⁴ BSR Adapting to Climate Change: A Guide for the Mining Industry

Relevant sectoral standards include the Nigerian Minerals and Mining Act 2007; the Nigerian Mineral and Metals Policy 2008; and 'On the Road to Shared Mining Prosperity: Roadmap for the Growth and Development of the Nigerian Mining Industry (2016)'. The trend of the Nigerian government policy thrust on the mining sector is anchored on the need to develop a private sector led mining industry and restricting FGN's role to that of a regulator.

Under section 4 of the Mining Act, part of the duties of the Minister of Mines and Steel Development includes ensuring the orderly and sustainable development of Nigeria's mineral resources; develop a well-planned and coherent programme of exploitation of mineral resources taking into account the economic development, ecological and environmental factors; monitor compliance with Community Development Agreements by industry operators; accelerate the development of technical and professional manpower required in the mineral sector; establish environmental procedures and requirements applicable to mining operations; and collaborate with other Ministries and agencies of the Federal Government whose functions relate to the objectives of this Act.

By section 17 of the Mining Act 2007, provision is made for functions of Mines Inspectorate Department whilst section 18 provides the function of Mines Environmental Compliance Department which is charged inter alia with reviewing all plans, studies and reports required to be prepared by holders of mineral title in respect of their environmental obligations under this Act and monitor and enforce compliance by holders of mineral title with all environmental requirements and obligations established pursuant to this Act, its regulations and by any other law in force. The Department is also charged with periodically auditing the environmental requirements and obligations established pursuant to this Act, its regulations and by any other law in force and make recommendations thereon to the Minister; and liaise with relevant agencies of Government with respect to the social and environment issues involved in mining operations, mines closure and reclamation of land. In terms of fiscal provisions, Section 30 provides for the tax deductibility of environmental costs and this ensures that mining companies comply fully with their environmental obligations. Section 34 establishes the Solid Minerals Development Fund to develop human and physical capacity in the sector.

By section 111 of the Act, holder of mineral title shall, in exercise of his rights under the title, have regard to the effect of the mining operations on the environment and take such steps as may be necessary to prevent pollution of the environment resulting from the mining operation. Section 114 is on restoration of mines land; reclamation of land after mining operations (section 115); community development agreements (sections

116 and 117); environmental obligations of miners (section 118); and environmental impact assessment (sections 119 and 120).

Other relevant provisions are the establishment of the environmental protection and rehabilitation fund (section 121)¹⁵; this requires every holder of a mineral title to commence contributions to the Environmental Protection and Rehabilitation Fund in accordance with the amounts specified in the approved Environmental Protection and Rehabilitation Programme not later than one year from such approval. Contributions to the Fund are assessed based on the mining operation and the need for rehabilitation and remediation. Section 123 is on prohibition of pollution of water course; purification of water (section 124)¹⁶; compensation for damages and pollution (section 125); deposit of tailings (section 126); alterations in water supply prohibited (section 127); restoration of river bank (section 128); and amendment of water license (section 129).

The full activation and application of these provisions and making budgetary provisions to transform the policy and plan into activities of implementation will mitigate the impact of mining on the environment and climate change and help communities to adapt better. The fiscal incentives are quite generous which ensures that investors will reap big profits and there will be no need for short cuts that may endanger the environment for investors to break even¹⁷. Surprisingly, there was no mention of climate change in all the relevant legal and policy frameworks regulating mining in Nigeria. However, key issues related to the environment and climate change raised in the Roadmap for the Growth and Development of the Nigerian Mining Industry include the following in Box 6.

¹⁵ This is based on the polluter pays principle.

¹⁶ It is debatable whether the mining of certain minerals like coal can be done without pollution of water sources and how the licensing scheme and implementation of the Act can stop this harm anticipated in the Act.

¹⁷ According to the Federal Inland Revenue Service and ACAS-LAW, *the Nigerian Solid Minerals Sector - An Investment Destination, March, 2015*; Companies engaged in mining activities in Nigeria are liable to companies income tax (CIT) at the rate of 30% of chargeable profits, and education tax at the rate of 2% on assessable profits and value added tax (VAT) of 5% imposed on the gross value of vatiable goods and services. Also payable are royalty, annual fees and rentals. There are incentives given for licensed mining activities. These include: a three to five years tax holiday for new mining companies and a system of deferred royalty payment determined by the investment level and nature of the project; a 95% capital allowance on qualifying capital expenditure incurred on exploration, development and processing. Others are an annual indexation of unclaimed balance of capital expenditure by 5% (only applicable to mines that commence production within five years of enactment of the Act); the carrying forward of losses for a period of 4 years; and exemption from customs and import duties on approved plants and machinery, equipment and accessories – imported specifically and exclusively for mining operations. Also, a tax deductible reserve for environmental protection, mine rehabilitation, reclamation and mine closure costs; and interest income tax relief on foreign loans.

Box 6: Key Environment issues in the Roadmap

Mining is a very environmentally intensive and intrusive activity with its biggest impact felt by the immediate communities in which it is carried out. Yet in many cases, communities fail to benefit sufficiently from the ongoing activity and instead bear the brunt of the damaging effect of the industry in a number of ways e.g. From pollution, destruction of vegetation and farmland, poor infrastructure among others. In order to avoid the repetition of the challenges seen in the oil industry, it is critical that a mechanism for more engagement with communities throughout the lifecycle of mining activity be established and strengthened. Federal mining inspectors should ensure operator compliance with key provisions of the Act with respect to pollution and remediation.

The need for the Mining Police and Mines Inspectorate to develop a deeper and more forceful field presence to combat poor safety practices and to enforce standards.

The need to strengthen environmental sustainability of mining especially as it relates to artisanal miners to avoid severe destruction of farmlands, creation of physical hazards, high levels of toxic chemical usage and death from poisoning, etc.

Ensure the implementation of the approved framework to establish the Environmental Protection and Rehabilitation Fund; enforce contributions to the Fund and ensure adequate provisions for addressing environmental remediation. Also provide sufficient funds to address legacy issues arising from previous environmental damage from illegal mining activities while intensifying efforts to prevent future occurrence.

Fund MIREMCO to ensure effective oversight and management of environmental responsibilities at the state level.

Ensure demarcation of environmentally sensitive parts of the country e.g. wetlands that are off limits to mining should be captured on maps.

Establish reference laboratories to conduct standards based testing e.g. detect environmentally contaminant levels e.g. of mercury and lead.

Support the formalization of artisanal miners into cooperatives and support the growth and transformation of small scale miners into cooperatives.

Educate mining companies about their obligations to communities under Community Development Agreements.

Provide market based incentives for community participation in commercial exploitation of minerals. Through support of special purpose vehicles for mining investment e.g. 7.5% to 10% equity shares in return for consent.

Source: Roadmap for the Growth and Development of the Nigerian Mining Industry

The National Policy on Environment in relation to mining activities seeks the prescription of adequate regulation for the control of noise, dust, discharge and treatment of wastes, additives, mine tailings, effluents, water pollution. It also seeks the monitoring of water quality, non disturbance of sensitive zones such as wetlands, estuaries, critical wildlife habitats; monitor air emissions and gaseous wastes (CO, CO₂, NO_x, H₂S, CH₄, SO₂,

etc.) etc. The Policy calls for maintaining regular environmental audit to stimulate the adoption of environmentally sound practices and technologies in all mineral exploitation operations. Sound collaboration between the public and private sectors is envisaged for effective implementation of policy objectives.

2.1 TREND OF BUDGET ALLOCATION TO THE FEDERAL MINISTRY OF MINES AND STEEL DEVELOPMENT

Table 2 shows the trend of budget allocation to the sector between 2013 and 2016.

Table 2: Trend of Budget Allocation to the Federal Ministry of Mines & Steel Development between 2013 and 2016

YEAR	TOTAL ALLOCATION	RECURRENT BUDGET ALLOCATION	PERCENTAGE OF RECURRENT EXPENDITURE	CAPITAL BUDGET ALLOCATION	PERCENTAGE OF CAPITAL EXPENDITURE
2016	16,734,729,961	9,402,106,704	56.18	7,332,623,257	43.82
2015	11,031,109,540	10,031,109,540	90.9	1,000,000,000	9.1
2014	12,756,825,405	10,579,956,791	82.9	2,176,868,615	17.1
2013	13,639,361,392	10,339,361,392	75.8	3,380,000,000	24.2

Source: Annual Budgets, Budget Office of the Federation.

The trend of budgetary allocation to the Federal Ministry of Mines and Steel as shown in Table 2 above indicates that budgetary allocation declined between 2013 and 2015 and marginally improved in 2016. This was the same trend in capital expenditure which also increased in the 2016 Appropriation. Some agencies in the Ministry received year-on-year zero capital allocation. This is in contrast to the 2016 budget with a capital budget of ₦7.33 billion; all agencies in the Ministry were allocated some amount for capital expenditure. From the budget allocation, it is clear that the mining sector is a grossly under-funded sector. For example, in 2014 and 2015, Ajaokuta Steel Company Limited received zero capital expenditure allocation but received recurrent allocation of ₦3.92 billion and ₦3.87 billion in 2014 and 2015 respectively. Why allocate nearly ₦8 billion for recurrent expenditure and zero allocation for a capital intensive projects? Are people being paid and offices operated without the actual running of the steel plant? Such budgetary trend cannot contribute to growth in the sector by any means.

The central question to be answered in this section takes cognizance of the role of the MMSD as enunciated in the Mining Act and various policy documents reviewed above. That role is one of a facilitator and regulator whilst private companies and artisanal

miners are directly involved in mining activities. The poser is; to what extent has the MMSD fulfilled its role using the budget as the anchor to implement policies and plans?

2.2 POSITIVE IMPACT OF BUDGET ALLOCATIONS ON CLIMATE CHANGE AND PROJECTS THAT SHOULD BE CONTINUED

The budget of Federal Ministry of Mines and Steel Development including her ten (10) agencies over a three year period (2013-2015) shows that there are some projects that have the potential to reduce the impact of climate change. Such programmes are listed in Table 3 below.

Table 3: Budget Items that Will Positively Impact on Climate Change Mitigation

YEAR	LINE ITEM	ALLOCATION (₦ MILLIONS)
2013	Reclamation of 100 High Risk Critical Abandoned Mine Sites in the Country from year 2007 to 2015	100,000,000
	Erosion & Flood Control	28,402,990
	Hydro geochemical Studies for Sustainable Development	12,067,343
	Training Local Miners on Simple and Safe Mining Protocol and Methods	20,000,000
2014	Reclamation of 100 High Risk Critical Abandoned Mine Sites in the Country from year 2007 to 2015 (3)	145,000,000
	Establishment of Extension Services to Performing Artisanal & Small Scale Miners Operations	95,000,000
	Monitoring of Steel and Aluminum Industry	25,465,657
	Monitoring and evaluation of Nigerian Extractive Industries that Employ and Practice Geosciences in six (6) geo-political zone	2,321,262
	Monitoring of Compliance to Mining Policy	1,000,000
	Hydro geochemical Studies for Sustainable Development	9,421,170
	Total Research and Development (6 items)	1,295,477,909
2015	Reclamation from year 2007 to 2015 100 High (3) Risk Critical Abandoned Mine Sites in the Country	135,000,000
	Monitoring of Steel and Aluminum Industry	65,000,000
	Total Research and Development (4 items)	593,000,000
2016	Provision of field and safety equipment for inspectorate activities.	47,700,000
	Procurement of field vehicles monitoring illegal mining activities	150,000,000
	Field Equipment, Site Visits, Environmental Auditing, Production of Environmental Handbook, Project Vehicles, Stationaries and Staff Retreat on Environmental Awareness and Enforcement	224,978,800
	Site Visits, Project Design, Site Reclamation, Commissioning, 1 No. Project Vehicle and Documentary	119,000,000
	Procurement, Processing and Integration of Restricted Areas Maps and Administrative Maps of Nigeria	

Source: Annual Budgets, Budget Office of the Federation.

Reclamation of 100 High Risk Critical Abandoned Mine Sites in the Country from year 2007 to 2015 is a positive development. However, it questions the concept of the polluter pays principle enunciated in the Mining Act and the National Policy on Environment. 2007 was the year the Mining Act came into operation and the expectation is that it should have been enforced since then. However, the funds provided for reclamation are small compared to the land area that needs reclamation. For the government to be providing funds for reclamation dating back to the year shows that the law has been obeyed in the breach. Research and Development (R&D) has been identified as a key factor in solving national climate crises. However, the exact research to be carried out needs to be identified in the budget and followed up to ensure that there is value in the expenditure and the results are mainstreamed into sectoral operations. Research should not be undertaken for its own sake, in a way and manner that solves no problems.

Training of local miners to increase their capacity and provision of extension services will facilitate their compliance with environmental regulations and improve their productivity. Erosion and flood control is a key climate change adaptation strategy but this budget item only received allocation in 2013. Site visits, monitoring of the aluminum and steel industry are important to ensure control and respect for laws and policies. Votes for the integration of restricted areas map so as to avoid mining operations in the areas is good for climate change mitigation. But this vote should be increased to cover the whole federation. 'Hydro geochemical studies for sustainable development' shows that the Ministry understands the need for developing sustainably – promoting social inclusion, environmental viability and economic advancement. Thus, it is advocated that these identified line items have the potential to enhance climate resilience and should be continued.

2.3 NEGATIVE IMPACTS, IGNORED PROGRAMMES AND CLIMATE SMART PROJECTS THAT ARE POORLY IMPLEMENTED

Mining negatively impacts on the climate through reduction in freshwater availability. Freshwater is used up or polluted by mining activities. There is also flooding of mine sites; erosion of already loose soil at the mines and access routes to the mines, etc. Mining operations also increase emission of greenhouse gases through the continued use of fossil fuels as main source of energy for the operations. Also, mining and other extractive activities increase the vulnerability of communities and their habitat to climate change, being the degree to which the environment is susceptible to, or unable to cope with, the adverse effects of climate change. Vulnerability is a function of the character,

magnitude, and rate of climate variation to which a system is exposed, its sensitivity and its adaptive capacity¹⁸.

However, there seem to be no clear appropriations for climate change adaptation and mitigation in the budget of the ministry in the three years under consideration. This is neither good for mine operators nor their host communities. The experience of coal mining in Okobo Community in Kogi State with its heavy pollution of water resources and the entire ecosystem shows the need for improved performance by the Ministry and compliance to laws and policies by mining companies¹⁹.

Since the Ministry and its MDAs are not directly involved in mining, they need to strengthen their oversight mechanisms. One way of mainstreaming climate concerns into the roadmaps and growth plans of this sector is through budgetary allocations that are tied to capital projects and sustainable infrastructural developments. The allocation for capital projects is low – a 16.8% average for the three years under consideration. The effective implementation of climate change mitigation and adaptation strategy in this sector that is vulnerable to the effects of climate change, and that equally has the potential to drive climate impacts, will require explicitly dedicated budget lines to drive climate change adaptation and mitigation in the form of projects and programmes.

From available evidence as shown in the Roadmap, although there is a Solid Minerals Development Fund Office but there is no proof that the Solid Minerals Development Fund has been established. And if it has been so established, there is no evidence of the projects it has funded. Again, MIREMCOs provided in the Act to ensure the effective oversight and management of environmental responsibilities at the state level have remained unfunded throughout the period under consideration. Also, the Environmental Protection and Rehabilitation Fund has not been energised by enforcing contributions to the Fund to ensure adequate provision for addressing environmental remediation. The need for the Mining Police and Mines Inspectorate to develop a deeper and more forceful field presence to enforce standards received no allocation for the study period. Again the Mines Environmental Compliance Department received no mention in the allocations over the years. This is not good enough if environment and climate issues are to be mainstreamed in mining policy implementation.

Supporting the formalization of artisanal miners into cooperatives hardly received a mention in the period under study. N35m was provided for Strategic Empowerment Programme for Jamaare/Itas-Gadau Federal Constituency, Bauchi State under the vote

¹⁸ See the introductory aspects of NASPA CCN.

¹⁹ See Coal Atlas; Facts and Figures on a fossil fuel, Heinrich Boll Foundation and Friends of the Earth 2013.

of the Nigerian Institute of Mining and Geoscience in the 2015 budget. This vote has nothing to do with the mandate of the agency or the MDA and yet found its way into their allocation.

3. LOW HANGING FRUITS FOR CLIMATE CHANGE ADAPTATION AND MITIGATION IN THE MINING SECTOR

Research has demonstrated that in many instances, planning today for future climate change will be more cost effective than waiting until the effects of climate change manifest themselves²⁰. When mining disasters occur (including those influenced by climatic variability), it affects the bottom line, lenders and investors. Insurers are expected to conduct a thorough check to identify climate risks to provide safeguards for investors against the impacts of climate change. Thus, a comprehensive plan for climate change impact in the mining sector is essential. Below are some low hanging fruits for climate smart adaptation and mitigation which needs to be implemented under the supervision of the MMSD. This will entail strengthening the compliance and monitoring mechanism of the Ministry.

- Maintain healthy vegetation around mines sites to help stabilize the ground as it reduces percolation of water and prevents erosion by water. In addition, active mine sites could be screened, landscaped and beautified to improve their aesthetic values. This vegetation will also be a mitigation strategy for carbon sequestration and air pollution control.
- Mining companies can work with host communities to develop concrete climate adaptation plans by sharing scientific information acquired during site planning for host community preparedness; inform them on emergency evacuation practices, and advocate for climate-resilient economic growth.
- Integrate climate-compatible development into initiatives for sustainable local benefit from project operations. Explore development projects that make little or no use of scarce natural resources; strengthen community peace and security programs; build capacity for sound structural engineering and develop government planning and emergency response capabilities.
- Exploration of investments in ecosystem services can improve local resilience through participatory and integrated resource management thus making host communities partners in resource management, monitoring and enhancement. For example: investment in integrated watershed management programs,

²⁰ IPCC (2007) Fourth Assessment Report

enhancement of local water supplies, and protection of existing sources can help secure the availability of sufficient clean water to meet company and community needs, even with increasing scarcity and competition from climate change.

- Full enforcement of the mandatory EIA for any project that has the potential to change the global carbon budget, including an assessment of any project's carbon impact.
- Mining companies can include climate change mitigation in their operation through:
 - Installation of automatic stop function in their machines and trucks after being idle for some time, say ten minutes.
 - Recycle used oil like it is done by some oil exploring companies by filtering it for reuse at the mine sites.
 - Focus should be on the use of machines that have high fuel efficiency.
 - Purchase of small fuel efficient cars when trucks are not needed.

4.0 BUDGET AND POLICY RECOMMENDATIONS

The following recommendations are imperative; the first eleven are taken from the Roadmap for the Growth and Development of the Nigerian Mining Industry:

- There is need for improved funding for the Mining Police and Mines Inspectorate to develop a deeper and more forceful field presence to combat poor safety practices and to enforce standards.
- Ensure the full implementation of all private sector environmental obligations under the Mining Act considering the provisions of section 30 of the Act which provides for the tax deductibility of a reserve for environmental protection, mine rehabilitation, reclamation and mine closure costs.
- The need to strengthen environmental sustainability of mining especially as it relates to artisanal miners through extension services and new knowledge dissemination to avoid severe destruction of farmlands, creation of physical hazards, high levels of toxic chemical usage and death from poisoning, etc.
- Support the formalization of artisanal miners into cooperatives and support the growth and transformation of small scale miners into cooperatives.

- Ensure the implementation of the approved framework to establish the Environmental Protection and Rehabilitation Fund; enforce contributions to the Fund and ensure adequate provisions for addressing environmental remediation.
- Also provide sufficient funds in budgets to address legacy issues arising from previous environmental damage from illegal mining activities and reclaim abandoned mine land while intensifying efforts to prevent future occurrence.
- Fund MIREMCOs to ensure effective oversight and management of environmental responsibilities at the state level.
- Ensure effective demarcation of environmentally sensitive parts of the country e.g. wetlands that are off limits to mining should be captured on maps.
- Establish reference laboratories to conduct standards based testing e.g. detect environmentally contaminant levels e.g. of mercury and lead.
- Educate mining companies about their obligations to communities under Community Development Agreements.
- Provide market based incentives for community participation in commercial exploitation of minerals. Through support of special purpose vehicles for mining investment e.g. 7.5% to 10% equity shares in return for consent.
- FGN should consider increasing the capital budget allocation for the Ministry. Combating impact of climate change on the mining sector value chain will require continuous infrastructural development.
- The Ministry can initiate cross-industry (inter-ministerial) collaboration on the different mining regions adaptation strategies. This can be done by exploring opportunities to collaborate within geographic regions to share information and costs for climate modeling, other supporting scientific and technical activities, best practices and implementation of large scale adaptation strategies. Private companies under the supervision of the Ministry can meet quarterly to share climate information and learn from each other's efforts to develop mitigation and adaptation strategies.
- Using existing climate data from Nigeria Meteorological Agency, the Ministry should conduct a far-reaching research on how recorded and projected changing climatic conditions will affect the major mining locations in the country.

- There is need to consider mandating the mining sites to go off the national energy grid owing to their high energy consumption.
- There is no need to pursue the revitalization of coal mining. Developed countries of the world like Germany etc. are shutting down their coal plants because of the health and environmental hazards associated with coal mining. Emphases should rather be on solar, wind and other renewable sources of energy.

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