Indian Journal of Environment Engineering (IJEE)
ISSN: 2582-9289 (Online), Volume-2 Issue-1, May 2022

Solid Minerals Blueprint for Sustainable Local Prospects and Development

Amosu C. O., Adeosun T.A.

Abstract: ***Moving from a much more sustainable social, environmental and economic system confronts the government, the community, the people and the industry. There is far-reaching conceptualization of the necessity for minerals. The present status and blend for the production of minerals may well not be absolutely demanded by a more sustainable economy. But beneath any reasonable definition of necessity, there will be a significant need for some mineral products deep in the nearest future. In the recent world beamed with the rays of extremely competitiveness in which economic attainments rely widely on the ability to be innovative; Nigeria is only clamouring to attain a better innovation outcome. Irrespective of being one of the under-developed nations, globally, Nigeria still stands a strong dynamic Black- Africa by position of its headcount census and the economy. This study assessed the inherent innovation and endowment in Nigeria.***

Keywords: ***Solid, Minerals, Development, Sustainable, Innovation, National, Endowment.***

I. INTRODUCTION

Figure 1: Mineral exploitation from a surface mine site

1.1 Innovation:

Innovation is the process of converting a particularconcept or design into a product which after allpeaks into formation of worth. It is displayed by the newly formed goods or services, improved development and outcome of science, based on existing knowledge. The mining industries are among the few establishments that had purposeful work concerning the adoption of innovative cultures, which points towards sustainable development of grassroots communities (Galabo and Trifonova, 2018).

Manuscript received on 8 April 2022 | Revised Manuscript received on 28 April 2022 | Manuscript Accepted on 15 May 2022 | Manuscript published on 30 May 2022.

*Correspondence Author

Amosu C. O.*, Department of Mineral and Petroleum Engineering, Yaba College of Technology, Lagos, Nigeria. E-mail: cyril.amosu@yabatech.edu.ng

Dr. Adeosun T.A. Department of Mineral and Petroleum Engineering, Yaba College of Technology, Lagos, Nigeria. E-mail: tunde.adeosun@yabatech.edu.ng

1.2 Sutainable Development

World commission on Economic Development (WCED) in 1987 defined Sustainable Development as "the state of meeting the necessities of the present day, without affecting the capacity of tomorrow's generations from meeting their own necessities". Sustainable Development has 3 pillars which are social, economic and environmental (Ben, 2018).Sustainable development that is being applied to the minerals industry is actually concerned with utilization of technology to search out newer reserves, recycling materials after usage, acceptance of cleaner energies, waste reduction, profitable resources management and mineral-laden grounds(reclamation of abandoned mine lands), ensuring tenable environmental ethics and mitigating negative impacts on host communities. Furthermore, it engages the application mine management to stake mineral royalties into sectors of education, amenities, health, science, government and other part of the economy to crystallize sustained economic privileges. Research and Development is a certain path of moving sustainable development to the next level of utilizing the potentials of the of Nigeria's solid mineral resources.

1.3 Mineral Resources in Nigeria Maps

Figure 2: Map showing distribution of solid minerals in Nigeria (2009).

Table 1: The Department of Geological Survey grouped these solid minerals according to their uses (Ada, 2018).

Type of Minerals	Examples of Minerals
Metallic Minerals	Copper, Lead, Tin, Manganese, Iron, Zinc, Aluminium, Nickel etc.
Gemstones	Diamond, Emerald, Topaz, Ruby, Zircon, Tourmaline, Sapphire Aquamarine, Garnet, Amethyst etc.
Industrial Minerals	Sodium, Sulphur, Phosphate, Carbonate, Potash, Nitrates and Sulphate etc.
Manufacturing Minerals	Monazite, Mica and Asbestos
Mineral Fuels	Coal, Bitumen, Lignite, Uranium and Thorium.
Structural Building Minerals	Stone, Sand, Gravel, Marble, Limestone, Gypsum and Asbestos.

Metallurgical and Refractory Minerals	Refractory Clays, Graphite, Metallic ores, Fluorspar and Dolomite.
Minerals of Security interest	Uranium, Thorium, Radon etc.
Minerals of Strategic industrial interest	iron ore, Barites etc.

1.4 Challenges of the Mining industries

i. Mining produces significant stress since it takes place in distant sites.
ii. It is confronted by limitation to access investmentcredits to procure or process tools to mine or beneficiate minerals into profitable state (Rainford and Richards, 2008).
iii. It is stressfully managed by small and medium local artisanal miners who currently meet the needs of the people.
iv. It is not large.
v. It is not widely commercial.
vi. It has dropping price and thin margin.
vii. It is not attractive to qualified young career experts.
viii. It lackspeople who are knowledgeable with exploration and mining issues.
ix. It interferes with socio-economic state, introduction of sexually transmitted diseases (STD's), price hikeofmarket products, truncation of rural living and environmental pollution (Gustavo et al, 2001).
x. Absence of professional mining engineering practices into mineral exploitation has degrading environmental influence, like production of huge amount of metallic concentration wastes (New African Magazine, 2016).
xi. Mined minerals in the nation are still widely exported with little or no profitable value added.
xii. license administration system are opaque and not efficient
xiii. It is afflicted with illegal mining
xiv. It lackstrusted and sumptuous geoscience data.
xv. It is bedevilled by management enterprise who are low financially
xvi. Excessive reliance on petroleum resources
xvii. Policy instability
xviii. Fear of the porous local security breeding banditry, kidnapping etc.
xix. It lacks transparent reporting of mining data (Solid Mineral Deposits of Nigeria, 2009).

1.5 Solutions to the Challenges in the Mining Industry

i. Government should play a middle role forproper channellingof rent, royalties, taxes and revenues for the economic advancementof its people.
ii. Government should build capacity for credit facilities, grants and moral supports.
iii. The RMRDC (Raw Materials Research and Development Council) should help to promotes sourcing and development of minerals by adding values into prospected raw materials (Ada, 2018).
iv. Investing stakeholders should be encouraged with discounted licensing and permits.

Table 2: Solid mineral resources in each state in Nigeria-Source: (Tajudeen, 2018).

S/No.	States	Mineral Deposits
1	Abuja, FCT	Iron-Ore, Dolomite, Gold, Marble, Feldspar, Granite, Lead-Zinc, Clay, Sand.
2	Abia State	Salt, Phosphate, Gypsum, Glass -Sand, Kaolin,Clay, Limestone, Shale, Ball Clay, Galena, Granite, Marble, Laterite, Bentonite, Pyrite, Feldspar, Lignite, Sphalerite.
3	Adamawa State	Limestone, Laterite, Granite, Clay, Gypsum, Uranium, Kaolin, Coal, Barite, Salt, Marble, Magnesite.
4	AkwaIbom State	Silica-Sand, Clay, Granite, Lignite, Glass-Sand, Salt, Coal, Kaolin, Limestone.
5	Anambra State	Clay, Iron Stone, Lignite, Sand, Stone, Kaolin, Pyrite,
6	Bayelsa State	Salt, Silica-Sand,
7	Bauchi State	Graphite, Talc, Ilmenite, Zircon Kaolin, Quartz, Tin, Glass,Sand, Salt, Monazite, Feldspar Cassiterite, Gypsum, Mica, Tantalum, Rutile, Tungsten, Copper, Tantalite, Galena, Iron Ore, Gemstone, Silica Sand, Sphalerites, Barites, Columbite, Lead-Zinc, Muscovite, Wolfram, Coal, Stone Aggregate.
8	Benue State	Limestone, Magnetite, Ilmenite, Glass Sand, Gemstone, Barites, Feldspar, Quartz, Lead-Zinc, Clay, Coal, Gypsum, Kaolin, Anhydrite, Calcium, Sulphate, Brick-Clay, Marble, Mica, Silica Sand, Galena, Crushed And Dimension-Stone, Bentonite, Crude Salt, Fluorspar, Wolframite, Bauxite, Shale.
9	Borno State	Refractory-Clay, Gold, Tin, Potash, Sapphire, Mica, Quartz, Gypsum, Natural Salt, Silica-Sand, Topaz, Uranium, Iron-Ore, Magnesite, Feldspar, Granite, Aquamarine, Nepheline, Limestone, Kaolin, Bentonite, Laterite,
10	Cross River State	Muscovite, Uranium, Barites, Rutile Ilmenite, Gold, Quartz, Glass-Sand, Tourmaline, Sharp-Sand, Clay, Talc, Granite, Galena, Lead-Zinc, Goethite, Limestone, Salt, Coal, Manganese, Mica, Kaolin, Tin Ore.
11	Delta State	Sharp-Sand, Clay, Gravel, Silica Sand, Ball Clay, Laterite, Kaolin Bauxite, Granite,
12	Ebonyi State	Salt, Limestone, Ball-Clay, Granite, Silver,Lead-Zinc, Refractory Clay, Gypsum,
13	Edo State	Ceramic-Clay, Marble, Charnockite, Copper, Gold, Granite, Gypsum, Diorite, Lignite, Limestone.
14	Ekiti State	Limestone, Columbite, Tantalite, Feldspar, Kaolin, Granite, Gemstone, Lignite, Clay, Charnockite, Quartz, Bauxite, Cassiterite.
15	Enugu State	Limestone, Barites, Silica,Sand, Salt, Laterite, Clay Kaolin, Coal, Lead-ZincIron-Ore.
16	Gombe State	Gypsum, Clay, Coal, Limestone,Lignite.
17	Imo State	Sand, Marble, Shale, Limestone, Kaolin, Laterite Salt.
18	Jigawa State	Glass-Sand, Granite, Iron Ore, Quartz, Limestone, Laterite, Potash, Talc, Kaolin, Silica.
19	Kaduna State	Muscovite, Cassiterite, Talc, Feldspar, Rutile,Manganese, Clay, Graphite, Sand, Zircon, Kyanite, Tin, Columbite, Ilmenite, Gemstone, Gold, Granite, Bismuth, Lithium, Wolframite.

20	Kano State	Granite, Hyalite, Beryl, Amethyst, Gemstone, Silica, Silver Gold, Tin, Clay, Laterite, Cassiterite, Columbite, Thorium, Wolframite, Monazite, Galena, Ilmenite, Phyrochlorite, Kaolin.
21	Katsina State	Asbestos, Tourmaline, Chrysotile Asbestos (Serpentine), Gold, Manganese, Laterite, Feldspar, Granite, Sand, Uranium, Chromites, Ilmenite, Diamond, Graphite, Iron-Ore, Potash, Silica, Tourmaline (Black), Amethyst, Quartz, Kaolin, Mica, Gypsum, Sillimanite, Clay.
22	Kebbi State	Gold, Salt, Iron-Ore, Limestone, Quartz, Bauxite, Clay, Feldspar, Manganese, Kaolin, Mica.
23	Kogi State	Clay, Sand, Marble, Cassiterite, Granite, Limestone, Feldspar, Gemstone, Kaolin Dolomite, Phosphate, Mica, Ornamental-Stone, Coal, Iron-Ore.
24	Kwara State	Dolomite, Granite, Limestone, Quartz, Kaolin, Silica, Clay, Marble, Feldspar, Gold, Tantalite, Cassiterite.
25	Lagos State	Gravel, Laterite, Sand, Sharp-Sand, Bitumen, Silica.
26	Nasarawa State	Barites, Galena, Monazite, Topaz, Chrysolite, Salt, Kaolin, Amethyst, Beryl, Zircon, Glass-Sand, Coal, Cassiterite, Gemstone, Emerald, Garnet, Sapphire.
27	Niger State	Limestone, Granite, Glass-Sand, Cyanite, Silica-Sand, Gold, Iron-Ore, Red Clay, Marble, Talc, Gemstone, Feldspar, Graphite, Kaolin, Ball-Clay, Quartz, Asbestos.
28	Ogun State	Clay, Phosphate, Quartz, Tar-Sand, Gypsum, Limestone, Kaolin, Feldspar, Silica-Sand, Mica, Granite.
29	Ondo State	Marble, Lignite, Clay, Diorite, Bitumen, Gold.
30	Osun State	Clay, Dolomite, Ilmenite, Limestone, Mica, Talc, Granite, Feldspar, Quartz.
31	Oyo State	Dolomite, Marble, Gold, Talc, Clay, Kaolin, Quartz, Feldspar, Granite, Ilmenite, Iron-Ore, Aquamarine, Amethyst, Tourmaline.
32	Plateau State	Cassiterite, Gemstone, Tin, Columbite, Dimension-Stone, Feldspar, Ilmenite, Barites, Talc Monazite, Clay, Kaolin, Dolomite, Rutile Copper, Topaz, Tantalite, Mica, Zircon, Marble, Bismuth-Ore, Gamet, Tourmaline, Granite, Gravel, Bauxite, Silica, Sharp-Sand, Galena, Quartz.
33	River State	Clay, Marble glass-Sand, Silica.
34	Sokoto State	Potash, Granite, Laterite, Silica, Phosphate-Salt, Clay, Limestone, Gypsum, Kaolin.
35	Taraba State	Barites, Uranium, Clay, Fluorspar/Zinc, Salt, Sand, Granite bauxite.
36	Yobe State	Bentonite, Clay, Sand, Gypsum.
37	Zamfara State	Clay, Sand, Barites, Iron-ore, Wolframite, Manganese,Gold, Lithium, Lead-Zinc.

Apart from petroleum resources, Nigeria is also richly blessed with solid minerals (Adekoya, Kehinde-Phillips, and Odukoya 2011). These minerals include Gemstone, Coal, Gold, Iron-Ore, Rock-Salt, kaolin, (NHC 2020), Columbite, Limestone, Tin-Ore, and Sulphates of Zinc and Lead (Alison- Madueke 2009) and so on. More than 70 percent of solid minerals are of high value in the mineral industry sector. Barite reserveswhich is about 7.5 million tonnes is embedded in Taraba and Bauchi States. (Jack, Nkwocha and Odubo 2016); Ayodele, Akongwale, and Nnadozie, (2013) emphasized the relevance of solid minerals in sustainable development in the face of the necessity to diversify from oil and gas resources. The impact of solid minerals to the growth of the country has been relevantly established by Olalekan, Afees, and Ayodele (2016). Despite the challenges in solid mineral extraction which has led to some negative environmental effects (Budnuka, Clinton, and Agi-Ottoh 2015; Ezeaku 2012; Gutti, Aji, and Magaji 2012), putting adequate methods and procedures of mineral extraction will prevent matters like this to come up. Adenugba and Dipo (2013) observed that the exports of solid minerals are not doing well, hence the negligence to what it offers. It is of necessary to tap into the solid minerals for sustainable national development. In addition, the innovations of converting raw materials into relevant product will be of high benefit to all involved (Adenugba and Dipo, 2013).

1.6 Prospects of the Mining Industry

i. Wealth derived from mineral is a national heritage
ii. Revenues, levies, rents, and royaltiesgotten from its extraction can be channelled for promoting developmental projects, economically (Mineral Rights to Human Rights, 2017).
iii. Provision of jobs which cuts across all disciplines likeengineering, manufacturing, geological, medicals, educational, environmental, etc.
iv. Boostingthe strength of foreign exchange earnings and national proceeds.
v. Provision of raw materials utilized in industrial construction and building, locally and nationally.
vi. Encourages self- reliance which invariably supports political independence (NEITI, 2013).

1.7 Resources for sustainable development in Nigeria

The presence of mineral resources in any nation is a plus to the financial base of that nation, which propels development, socio- economically (Jack, Nkwocha and Odubo, 2016). Blessed with vast mineral resources, Nigeria has all it takes to be an affluent nation, which is the reason that 50 million of its citizens amongst the over 3 billion people in the world lives below the level of poverty - i.e. less than US$1 a day, with a Human Poverty Index (HPI) of 46.1 (Uchegbu 2015).

1.8 Industrial Minerals

Industrial minerals are minerals or rocks that are non-fossilised, non-metallic and utilized in the earthly and treated states in different sector of the mining industry. These mineral ores include Silica-Sand, Bauxite, Chromite and Rutile, Dolomite, Clay, Gypsum, Sand, Gravel, Shale, Marble. Volcanic-based rocks and Limestone make the two widest classes of minerals which are industrial and has approximate billions tonnes of the resources (Ministry of Land and Environment, 2005; Rainford and Richards, 2008).

II. LITERATURE REVIEW

Thijs (2018) pointed out that innovation occur with the availability of efficient procedures, goods, services, technologies or transactions provided to the community, markets, and government. Consequently, an innovation is authentic and more result-oriented, locally (Peru, 2009).

Innovation is widely viewed as an important part of development and economic advancement (Bosworth and Collins 2003; Ekperiware and Adepoju 2013). Innovations can be derived by doing research and development, systematically for knowledge empowerment, especially for the advancement of industrial procedures (Bako 2005). Research has proved the strong link between sustainability and innovation; these also bring developmental achievement, socially, environmentally, and economically (Kuzma et al,2020; Adams et al, 2016 and Freire et al, 2019). Technological innovations are considered as an important element for sustainable development (Kuzma et al, 2020). Participation as a form and marker that all things are based on local aspirations, needs and abilities (Sidik, 2015).

2.1 Material And Methods

This study targets the solid minerals development for sustainable local potentials and innovations in Nigeria.

2.2 Data Mining And Methodology

Data Collection, Review and Analysis

The review method was applied in this paper. The data captured in table 3 and 4 where reviewed for the result and discussion part of this project, i.e. minimum Viable capacity of local project, estimated national demand, number of industries required and manpower requirement in Nigeria.

Table 3: Collections of minerals and locations in Nigeria (Moses, 2019)

Minerals	Illustration	Deposits Locations	Additional Information
Gold		Northern Nigeria Osun State (Iperindo). Other areas near Maru, Tsohon Birnin Gwari-Kwaga,Gurmana, Anka, Malele, Bin-Yauri and Okolom- Dogondaji. States with trace of deposits are found in Bauch, Oyo, Zamfara, Osun, Abuja, Edo, Cross River, Niger, Kaduna, Sokoto, Kebbi, Abia, Kogi.	Ten sites have been confirmed via preliminary exploration to having reserves deposit of above 600,000 weights of high-valued Gold.
Iron Ore		The Federal Capital Territory, and States of Enugu, Benue, Kwara, Anambra, Kogi, Delta, Niger States.	Nigeria has 3 billion tonnes of probable reserves and above 500 million tonnes of proven reserves.
Coal		States of Nasarawa, Enugu, Ondo, Zamfara, Benue, and Plateau.	Nigeria hasabout 3 billion tonnes of possible reserves and 600 million tonnes of proven reserves in about 17 known coal fields.Coal are utilized for generation of power and the in rail transports.
Tin		States of Bauchi, Plateau.	Tin is applied in making of containers, cans, electrical tools, and inorganic tin-based chemicals.
Talc		States of Niger,Osun, Oyo Kogi, etc.	Nigeria has about 40 million tonnes of Talc deposits.
Rock Salt		States of Cross River, Akwa-Ibom, Ebonyi, Abia.	Nigeria has about 1.5 million tonnes Rock Salt deposit of. It is applied for making table salt, hydrogen peroxide, caustic soda, chlorine etc.
Gemstones		States of Kaduna, Bauchi and Plateau.	Gemstone is applied for adornments/jewellery, i.e. Topaz, Beryl, Quartz, Aquamarine, Tourmaline Corundum and Garnet.

Gypsum		States of Borno, Kogi, Delta, Imo,Bayelsa, Ondo, Bauchi, Sokoto, Adamawa, Gombe, Anambra, Benue and Edo.	Nigeria has about 1 billion tonnes of Gypsum which is applied for making white chalk, plaster of Paris and cement.
Bentonite and Barite	 	States of Bauchi and Taraba.	Nigeria has proven reserves of about 110,000 tonnes and probable reserves of about15 million tons respectively (Moses, 2019). They are applied in mud additive for drilling of oil wells. Nigeria utilizes above 70,000 tonnes of barite yearly, in which nearly half is imported (Moses, 2019).
Bismuth		Kaduna state	It is applied in alloys of Bismuth, Paints, Ceramics Pharmaceuticals, Chemicals, Catalysts, etc.
Lead and Zinc		States of Bauchi, Ebonyi, Abia,Gombe, Nasarawa, Akwa-Ibom and Abuja	Nigeria hasreserves of about100, 000 tonnes of zinc and 10 million tonnesof lead ore.
Silver		States of Northern Nigeria, i.e. Kano,Ebonyiand Taraba.	Nigeria has sparse deposit of silver.
Kaolin		States of Ondo, Ekiti, Delta, Ogun, Adamawa, Sokoto, Borno, Kogi, Katsina, Kaduna and Plateau.	Nigeria has about three billion tonnes of Kaolin deposits.
Limestone		States of Ogun, Cross River, Benue, Borno and Sokoto.	Nigeria has estimated reserves of about 31 million tonnes in the Southern part, as that of thecountry's reserves cumulative surpasses 600 million tonnes. It is applied in asbestos, building, monuments sculptures, ceramics, paints, tooth paste, adhesives-paper, pharmaceuticals, cosmetics, soaps, detergents, etc.
Columbite		States of Kogi, Kaduna, Nassarawa, Kano, Plateau and Bauchi.	Columbite is applied in the electronics and telecommunications industries for transmitting radio; in valves and as alloy of high speed steel.
Fluorspar		Abuja and States of Kebbi, Kogi, Ogun, Kaduna, Zamfara and Kano.	Fluorspar is appliedin manufactured products for plastics, fillers, glasses ceramics, putty, cosmetics, papers, etc.
Copper Ore		States of Bauchi, Gombe, Kano Nassarawa, Zamfara, Plateau and Abia.	Nigeria has abundance of these metallic deposits.

Glass-Sand		States of Ogun, Ondo, Delta, Plateau, Katsina, Lagos.	It is applied in glass products for windows, bottles, mirrors glasses, optical instruments, crucible, electrical insulation, condensers, pipe, aircraft and automobile bodies, etc.

2.3 Mining of Ore Minerals (Industrial Minerals)

These are minerals used as raw materials for production purposes. The table below displays some projects in Nigeria with capacity for industrial mineral usage.

Table 4: Minimum viable capacity of small-scale projects, estimated national demands and number of industries/manpower required (Ada., 2018).

Project	Minimum Viable Capacity of Project (Tones/Annum)	Estimated National Demand (Tones/Annum)	Number of Industries Required	Manpower Requirement
Kaolin Processing	10,000	300,000	30	1,200
Granulated Limestone	20,000	400,000	20	1,600
Talc processing	5,000	100,000	20	800
Phosphate Beneficiation	10,000	200,000	20	500
Hydrated Lime production	10,000	300,000	30	750
Gypsum processing	5,000	200,000	40	800
Feldspar Processing	6,000	150,000	25	750
Barite Processing	10,000	200,000	20	1,000
Bentonite Processing	10,000	200,000	20	800
Soda-ash Production	5,000	50,000	10	500
Iron-ore Concentrate	10,000,000	200,000,000	2	5,000
Lead Smelting	60,000	75,000	2	500
Zinc Smelting	75,000	100,000	2	500
Formed Coke Production	25,000	500,000	20	1000
Smokeless Coke Processing	15,000	600,000	40	1,200
Crude salt refining	10,000	500,000	50	2,000

III. RESULTS AND DISCUSSION

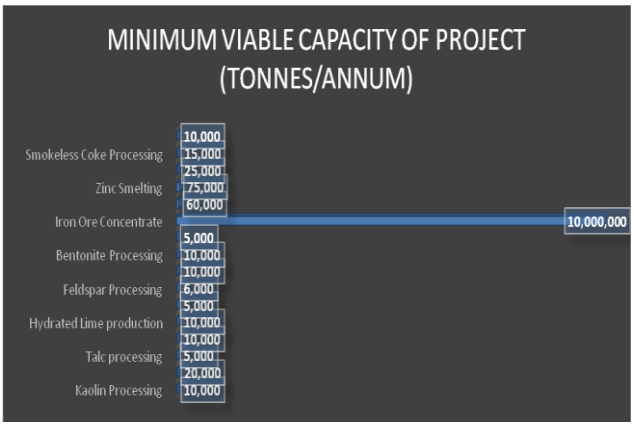

Figure 3: Plot showing the minimum tonnage rate (per year) for different mining project.

Figure 5: Plot showing the averagely required labour (per persons) for different solid minerals processing section in Nigeria.

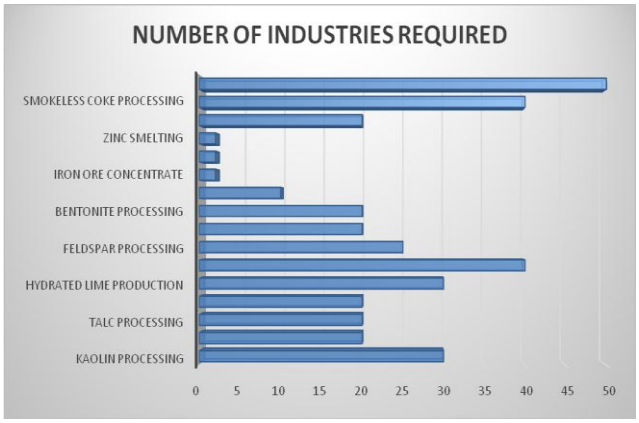

Figure 4: Plot showing the total available number of development/processing industries for different solid minerals in Nigeria.

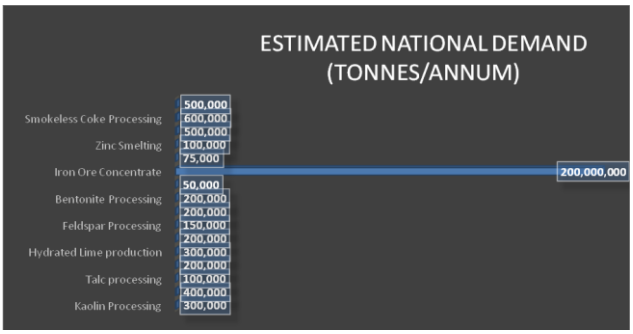

Figure 6: Plot showing the approximate demand rate (per year) for different mining project.

In Figure 3, the display of the production rate for different processed mineral is shown. The highest production rate of solid minerals was the Iron-ore Concentrate with 10,000 tonnes per year. This was followed by Zinc Smelting with 75,000 tonnes per year, and Lead Smelting coming third with 60, 000 tonnes per year. The least industry was the Soda-Ash production, Gypsum Processing and Talc Processing with 5,000 000 tonnes per year each. In Figure 4, the plot of available number of processing industries for the various solid minerals in Nigeria was rendered. Crude salt Refining topped the graph with 50,000 plants distributed across the nation. This was followed by the Smokeless Coke Processing and Gypsum Processing industries with 40 plants each. The least number of industries was Iron-ore Concentrates, Lead Smelting and Zinc Smelting with 2 plants each. In Figure 5, the graph for the averagely required labour per persons was presented. The industry that required more men for work is Iron-ore Concentrate with 5,000 men, followed by the Crude Salt Refining with 2,000 men. The third position is Granulated Limestone with 1,600 men. The industry with the least requirement of labour is Lead Smelting, Zinc Smelting, Soda-Ash Production and Phosphate Beneficiation with 500 persons each. In Figure 6, the plot to determine absolute demand for solid minerals is nationally presented. The highest was for Iron-ore Concentrate with 200,000,000 tonnes per year, followed by Formed Coke Production and Crude Salt Production with 500,000 tonnes per year. The least demand of solid minerals came from Soda-Ash Production with 50,000 tonnes per year. Since the demand for Iron-ore Concentrate is nationally the highest in terms of production rate, then more industrial plants should be provisionally built for processing it. Crude Salts has high propensity and growth prospect. Its production capacity should be boosted. The same goes for other outlined minerals. If production rate and plants are increased locally, it will definitely sustain Nigeria's economy from grass to grace.

IV. CONCLUSION

The mining sector over has been identified as an inherent stimulant for the cumulative growth especially for those countries still in the developing stage like ours who generates foreign exchange earnings and revenue from mining. Nigeria is blessed with huge potentials of minerals, even though this has turned into a curse to hunt and hinder development in disguise in many ways such as in the form of artisanal illegal mining/ banditry, the lack of infrastructure, poor mineral processing capacity, smuggling and lob-sided tax policies. Nigeria being a major role in the world must imbibe this trend by ensuring that all mining communities combines sustainable development techniques, into the technical and business concepts that are encompassing in the mineral industry from exploitation to decommissioning of the mine. Due to the widespread of solid mineral across all states in the federation, pursuing the development of the solid minerals will not be a misplaced priority. However, complementary policy and infrastructure must be put in place to ensure the sustainability of the development of materials-to-product and thus the industry and the government should explore and dig into the potential resources to achieve holistic sustainable development. The best practices and stakeholders contributions in the industry should also be encouraged and adopted.

REFERENCE

1. Ada A.(2018): Contributions of Solid Mineral Sectors to Nigeria's Economic Development, Eastern Mediterranean University.
2. Adams R. et al (2016): Sustainability-Oriented Innovation - A Systematic Review; *Int. J. Manag. Rev*.18, 180–205. [CrossRef]
3. Adekoya J., Kehinde-Phillips O. and Odukoya A. M. (2011): Geological Distribution of Mineral Resources in Southwestern in Nigeria*; Journal of Mining and Geology* 47: 1–13.
4. Adenugba A. A. and Dipo S. O. (2013): Non-oil Exports in the Economic Growth of Nigeria - A Study of Agricultural and Mineral Resources*; Journal of Educational and Social Research* 3: 403. [CrossRef]
5. Alison-Madueke D. (2009): Opportunities in Nigeria's Minerals Sector Ministry of Mines and Steel Development, Nigeria: Abuja.
6. Bako S. (2005): Universities, Research and Development in Nigeria - Time for a Paradigmatic Shift 11th General Assembly of CODESRIA, In Rethinking African Development, Beyond Impasse - Towards Alternatives Maputo, 1–31. Mozambique.
7. Ben P., Young M. And Darren R.(2019):Three Pillars of Sustainability; in search of Conceptual origins; 14, 681-695 [CrossRef]
8. Bosworth B. and Collins S. M. (2003): The Empirics of Growth - An Update Brookings Panel, Economic Activity 10: 113–206. [CrossRef]
9. Budnuka A. C., Clinton A. and Agi-Ottoh C. (2015): The Effect of Unplanned Exploitation of Environmental Resources - The Nigeria's Experience*; Journal of Environment Pollution and Human Health* 3: 39–45.
10. Ezeaku I. P. (2012): Evaluating the Influence of Open Cast Mining of Solid Minerals On Soil, Landuse and Livelihood Systems in Selected Areas of Nasarawa State*; North-Central Nigeria Journal of Ecology and the Natural Environment* 4: 62–70. [CrossRef]
11. Freire R., Costa E., Alves J. and Brito C. (2019): A dialectic on innovation and Sustainability; *InternationalJ.Innov. Sustain. Dev.*, 13, 246–258. [CrossRef]
12. Galabo B. and Trifonova B.(2018): Sustainable development and innovation potential Of the mining companies; University of Mining and Geology, Researchgate, page 1-21.
13. Gustavo L. et al (2001): The Role of the Minerals Sector in the Transition to Sustainable Development, Catholic University of Chile.
14. Gutti B., Aji M. M. and Magaji G. (2012): Environmental Impact of Natural Resources Exploitation in Nigeria and the Way Forward; *Journal of Applied Technology in Environmental Sanitation* 2: 95–102.
15. Hafizullah A. A. (2009): Solid Mineral Deposits of Nigeria - Potentials, Challenges And Prospects Department of Geology, ModibboAdama University of Technology, Yola, Adamawa State, Nigeria.
16. Jack J. T., Nkwocha I. B. and Odubo T. R. (2016): Natural Resource Exploitation and Socioeconomic Development, Nigeria (1981–2015); Sustainable Human Development Review 8.
17. Kuzmaet al (2020): The Relationship between innovation and sustainability - A meta-analytic study. *J. Clean. Prod*. 259. [CrossRef]
18. Mineral Rights to Human Rights (2017): Mobilising Resources From The Extractive Industries For Water, Sanitation and Hygiene (Case Study: Nigeria) - Oxford Policy Management.
19. Moses O. (2009): Solid Mineral Deposits and Mining in Nigeria - A Sector in Transitional Change.
20. NEITI (2013): Solid Minerals Industry Audit Report 2007 – 2010.
21. New African Magazine: Nigeria Minister's unlikely return, 2016.
22. Olalekan O., Afees O. and Ayodele S. (2016): An Empirical Analysis of the Contribution of Mining Sector to Economic Development in Nigeria; *Khazar Journal of Humanities & Social Sciences* 19 (1): 88–106. [CrossRef]
23. Peru F. (2009): Questioning two myths in innovation literature; *The Journal of High Technology Management Research*, 20: 40-51. [CrossRef]
24. Rainford O.B. and Richards R.A. (2008): Sustainable Development and the Industrial Minerals Sector - Integrating the Principles of Sustainable Development Within Jamaica's Industrial Minerals Sector; Business, Finance & Economics In Emerging Economies Vol. 3, No. 1, Page 90 – 120.

25. Sidik F. (2015): Menggali Potensi Lokal Mewujudkan Kemandirian Desa; *Jurnal Kebijakan & Administrasi Publik*, vol. 19, no. 2. [CrossRef]
26. Tajudeen B. (2018): Nigeria Extractive Industry Transparency Initiative (NEITI) –Solid Minerals Industry Audit Report 2016, Page 4 – 90.
27. Thijs L. (2018). The Future of the New: Artistic Innovation in Times of Social Acceleration, Arts in society, Valiz.
28. Uchegbu, S. N. (2015): Sustainable Management of Natural Resources and Biodiversity as a Poverty Reduction Strategy in Nigeria - *Environmental Studies and Research Journal* 3: 5–24.

AUTHOR PROFILE

Amosu C. O., Mining Engineer Amosu Cyril Olumuyiwa Professional background: Lecturer and researcher at Yaba College of Technology, Lagos, Nigeria. \ Associate Environmental Professionals (**AEP**), National registry Of Environmental Professionals (**NREP**). Council for Regulation of Engineering In Nigeria (**COREN**). **Education:** Master of Engineering (M. Eng.) in Mining Engineering from Federal University of Technology Akure, Nigeria (2019 - Date). Masters (M. Sc.) in Petroleum Engineering and Project Development (2004 – 2005). Bachelors of Engineering (B. Eng.) in Mining Engineering from Federal University of Technology Akure, Nigeria (1995 – 2001). Previous publishing experience About ten (13) journals published already with different publishers which can be found on Google Scholar, ResearchGate, Publon and Orcid. These journals captures Mining and Petroleum. Personal details: Married with three (3) children; lives in Lagos state, Nigeria; Personal interest is writing and research. **Contact information:** Personal E-mail: muyixx1zillion@gmail.com
Official E-mail: Cyril.amosu@yabatech.edu.ng

Dr. Tunde A. Adeosun, Professional background: Chief lecturer and researcher at Yaba College of Technology, Lagos, Nigeria. \ Council for Regulation of Engineering in Nigeria (**COREN**). Nigeria Society of Engineers (NSE) **Position** , Head of Department, (2015- 2017) Department of Mineral & Petroleum Engineering, School of Engineering, Yaba College of Technology **Education:,** Ph.D. Applied Mathematics (Petroleum and Geosystems) (2011 – 2019) M.Tech. Applied Geophysics (Geosystems Mathematics (2008 – 2010) PGD. Applied Geophysics (2000 – 2004) M.Sc. Petroleum Engineering (Reservoir Simulation (2007 – 2009) PGD. Petroleum Engineering (1996 - 1999) M.Sc. Applied Mathematics (Fluid Flow in Porous Media (2004 - 2007) B.Sc. (Hons) Mathematics (1990 - 1995) **Previous publishing experience** More than (25) journals published already with different publishers which can be found on Google Scholar, ResearchGate, etc. These journals capture Mathematics, Petroleum, geophysics, Geology, Geosystems, etc. **Personal details:** Married with three (3) children; lives in Lagos state, Nigeria; Personal interest is writing and research. Contact information: Personal
E-mail: adebaba2001@yahoo.com
Official E-mail: tunde.adeosun@yabatech.edu.ng