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Minerals and Mineral Markets for Downstream Products in Nigeria

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ASTRACT
The full potential contribution of minerals to national economic development is far from being realized in Nigeria. This is not unconnected to a non-existent policy on value addition and beneficiation of minerals but on the fact that infrastructure development plans are not consciously linked to national development priorities. The security of abundant supply of mineral raw materials has become a high-priority theme in the political agenda of most countries, Nigeria inclusive. Critical Raw Materials (CRMs) have therefore been identified with the aim of helping to anticipate/prevent supply shortages and focusing efforts and policy actions on these materials whose supply interruption would have the most harmful consequences on Nigeria has recently been put in place. This includes the seven strategic minerals of Coal, Iron ore, Bitumen, Gold, Limestone, Lead/Zinc and Barite. Supply chain analysis on Nigeria's minerals and markets are here presented and used to detect and signal the use of CRMs to enhance efficiency in their use, facilitate proper end life management, speed up substitution and provide policy makers with proper information. In view of the many challenges the country is facing in terms of extracting its industrial and metallic minerals, it therefore becomes necessary that a purposeful and detailed geological mapping and exploration of mineral deposits be conducted and the deposits classified and characterized (which will provide information on the actual mode of occurrence of any identified mineral, its peculiar chemical and mineralogical composition), and reserves which will aid in populating the country's database, thereby facilitating ease of investment and planning for national economic development. Though challenges abound, the government is determined to overcome them through on-going reforms in the metals and minerals sector aimed at attracting investors and opening up investor opportunities. This effort has the overall effect of wealth creation and employment generation, leading to the transformation of the country in line with the policy of the present administration.

Keywords: Minerals, Minerals Market, Downstream Products and Economic Development.

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I. INTRODUCTION

Nigeria is blessed with several natural and mineral resources that are widely distributed across the length and breadth of the nation. However the dominance of oil as a major foreign exchange earner has completely eclipsed the over 44 other different minerals in about 500 known mineral deposit sites across the 36 states and Federal Capital Territory. The result has been a vulnerable economy and an underdeveloped non-oil sector, specifically the mineral and mining sector. The minerals in the Nigerian landscape are distributed in all the geopolitical zones of the country and are found to be associated with the three major rock types that together constitute the geology of the country. These rock types include the Migmatites and Gneisses, the Older Granites, the Younger Granites, the Older Sedimentary Rocks and the Volcanics.

All the 36 states of the federation and the federal capital territory have more than one mineral type with the primary minerals including gold, tar-sand (bitumen), coal, iron ore, columbite-tantalite, tin ore, wolframite, lead-zinc, sulphides, industrial minerals, precious stones, etc. (the various mineral resources in Nigeria are available on the websites of Raw Materials Research and Development Council (RMRDC), *www.rmrdc.gov.ng* and the Nigeria Geological Survey Agency, NGSA), *www.ngsa.gov.ng.*

The rationale for sound mineral development policies is hinged on the rise in global demand for mineral commodities. This is partly attributable to the emerging economies of Asia and Latin America as well as the bourgeoning global population. Also, in the intervening time, Nigeria's mineral potential is not fully exploited owing to over reliance on oil proceeds which is vulnerable to external shocks in the global oil price.

Thus, the primary objective of the current government policy on mineral development is to take maximum advantage of the increased international commodity prices and the global resurgence of exploration activities, coupled with the potential benefits to the Nigerian economy as a whole, that has for too long depended mostly on oil revenues. Hence the need for diversifying the economy from over reliance on oil, which is intended to achieve the followings;

i. Achieve sustainable increase in GDP contribution by the minerals sector
ii. Generate quality Geoscience data for investment decision and national economic planning
iii. Establish transparent licensing regime
iv. Formalize Artisanal and Small Scale Mining operators
v. Poverty eradication through ASM operations
vi. Employment generations
vii. Wealth creation through value addition
viii. Increased capacity of mineral based industries.

Nigeria's economic growth primarily comes from the country's oil sector. Although it is true that oil and gas provides more than 40% of our GDP and 85% of our foreign exchange generated revenue, the country possesses a range of solid minerals that are of value, some of them have the potential to be considered world class. According to government, the subsector is a vital part of the national economy with the potential of raising, at its full realization as much resources for the public sector and in contributing to the gross domestic product (GDP) to about as much as is currently being contributed by the petroleum subsector. The concerns have been mainly due to poor policy implementation, low private sector participation and the declining role of the subsector which despite its huge and perceived potentials for development, has failed to enormously contribute to the economy.

The full potential contribution of minerals to national economic development is far from being realized. This is not unconnected to a non-existent policy on value addition and beneficiation of minerals but the fact that infrastructure development plans are not consciously linked to national development priorities. The inability of the mineral rich countries to add value to their wealth by way of beneficiation and processing is often denied by lack of capacity, tariff and other trade barriers. In some cases, subsidies make the positions worse. Mismanagement of mineral wealth through inefficiency and corrupt practices has further aggravated the situation.

The prospects in this sector can be described as enormous looking at aspects like mineral royalty, wealth and job creation as well as industrialization and the overall growth and development of the economy. The following scenarios can easily be considered as making the solid mineral sector in Nigeria very vibrant, thus:

- An enormous Mineral Potentials for Metallic and Non-Metallic Minerals.
- Enormous Human Capital Base.
- An Emerging Political will by Government to develop the Mineral Sector & Adhere to Best International Practices
- An Emerging Confidence Building Scenario that attracts/and or Enlists International Appeal.
- Constitution of Board of Solid Mineral Development Fund, 2017
- World Bank offer of $150 Million Credit for Mining Sector, 2017, etc.

II. MINERAL DEPOSITS IN NIGERIA

Nigeria as a nation is blessed with abundant solid mineral resources distributed fairly in all the states of the federation (Table 1). According to reports by the Geological Survey of Nigeria Agency, Nigeria has some 44 known major mineral deposits distributed in locations across the country and offers considerable attraction for investors.

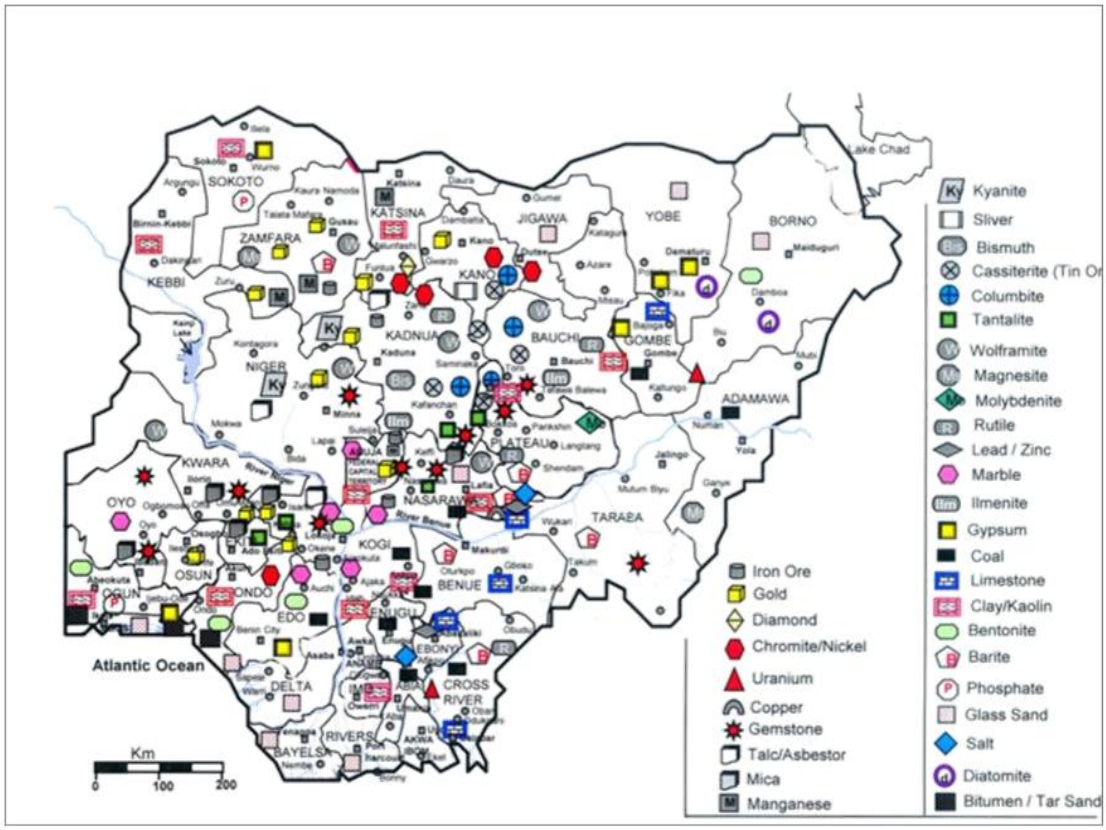


Fig. 1: ***An overview of the mineral resources distribution map of Nigeria (NGSA, Abuja)***

Table 1: Mineral Resources Availability in Nigeria and their uses

S/ No	MINERAL	LOCATIONS	INDUSTRIAL APPLICATIONS	RESERVE ESTIMATES (MT)
1	Barytes	Benue, Cross Rivers, Adamawa, Yobe, Nasarawa, Enugu, Taraba States	Barytes is used in petroleum well drilling, suitable for glass, paint, and paper making. Production of barium metal Used as alloy in vacuum tubes, deoxidizer for copper, lubricant for anode rotors in X-ray tubes and spark-plug alloys.	7.5 million
2	Bauxite	Taraba, Adamawa Kebbi, Sokoto, Borno, Ekiti, Plateau, Benue and Cross River State	Cables, components, alloys	NA
3	Bentonite	Yobe, Abia, Anambra, Adamawa, Edo, Imo, Ebonyi, Akwa Ibom, Cross Rivers, Benue, Borno States	As drilling mud	700 million tonnes
4	Bitumen	Ondo, Ogun, Delta, Edo States	Oil, asphalt and other petroleum products	42 billion
5	Cassiterite	Plateau, Bauchi, Kano, Cross Rivers, Ekiti, Kaduna, Nasarawa, Taraba States	Used in production of solder, electrical components and, chemicals.	300,000

S/ No	MINERAL	LOCATIONS	INDUSTRIAL APPLICATIONS	RESERVE ESTIMATES (MT)
6	Clays: Dickite, Halloysite Montmorillonite, Saponite, Illite and Attapulgite	Different types of clays are widely located all over the country.	Ceramic wares such as, floor and wall tiles, dinner and sanitary wares. Refractory bricks, fillers in paper, rubber and paint industries, Electrical insulator. Foundry sands. absorbent and filtering, insecticide dispersing and Cosmetics	Very large
7	Columbite	Plateau, Kano, Kaduna, Bauchi, Kogi, Kwara, Nasarawa States	Production of electronic components, mainly tantalum capacitors and as alloys with other metals	N/A
8	Coal	Benue, Enugu, Nasarawa, Gombe, Edo, Anambra, Abia, and Ondo States	Solid fuel for industrial heating and Power generation, extraction of iron/steel, production synthetic gasoline and in metallurgy and foundry applications	Over 3 billion
9	Copper Ores (Chalcopyrite, Malachite)	Bauchi, Kano and Nasarawa states	Electrical cables wires and switches.	
10	Dolomite	Kogi, Oyo, Edo, Nasarawa, Kaduna States and FCT	Floor tiles, cement and chemicals	16,540,000
11	Feldspar	Ekiti, Kogi, Kwara, Nasarawa, Ogun, Ondo and Bauchi States.	Ceramic glazing, glass making and tiles	

S/ No	MINERAL	LOCATIONS	INDUSTRIAL APPLICATIONS	RESERVE ESTIMATES (MT)
12	Gemstones (sapphire, ruby, aquamarine, emerald, tourmaline, topaz, garnet, amethyst and zircon)	Plateau, Bauchi, Yobe, Borno, Ogun, Ondo, Kwara, Kogi, Ekiti, Nasarawa, Kaduna, Zamfara and Niger states	Jewelry and decorative objects making	Large
13	Gold	Cross Rivers, Edo, Kaduna, Katsina, Kebbi, Niger,, Osun, Zamfara States	Jewelry, monetary/store of value, electronic instruments and as an electrolyte in the electro-plating industry	N/A
14	Granite	Plateau, Ondo, Ogun, Bauchi, Borno, Adamawa, Kogi, Cross-Rivers, Oyo, Kaduna and Imo states; FCT	Rock slabs for floor and wall tiles, hard core, chippings for concrete products	Very large
15	Graphite	Adamawa, Kaduna and Taraba states.	Carbon electrodes, plates, brushes and dry cell battery; Pencil, crucible foundry pots, dry lubricant, steel hardener and Electrical Components	
16	Gypsum	Adamawa, Taraba, Benue, Edo, Yobe, Sokoto, Gombe, Ogun, Anambra, Imo and Borno States	Cement, plaster of Paris, wall and ceiling boards production	N/A
17	Iron ore	Kogi, Nasarawa,	Steel and steel products, magnets, high-frequency cores, auto parts,	Over 3 billion

S/ No	MINERAL	LOCATIONS	INDUSTRIAL APPLICATIONS	RESERVE ESTIMATES (MT)
18	Kaolin	Katsina, Plateau, Ogun, Bauchi, Ekiti, Ondo and Anambra States	Ceramic wares production, filler in paper, rubber, soap and paint production	Very large
19	Ilmenite	Plateau, Nasarawa and Bauchi States	Used as alloys, for electrodes in arc lights Titanium is a strong lightweight metal often used in airplanes	
20	Kyanite	Kaduna Ekiti Oyo States.	Refractory and ceramic products, electrical insulators , abrasives and glass	NA
21	Lead/Zinc	Nasarawa, Plateau, Taraba, Bauchi, Gombe, Ebonyi, Imo, Kano and Benue states; FCT	Lead/acid batteries, gasoline tanks, and solders, seals or bearings. Electronic applications such as, TV tubes, communications equipment, protective coatings, in ballast or weights, ceramics or crystal glass foil or wire, X-ray and gamma radiation shielding and ammunition	10,000,000
22	Limestone	Enugu, Cross Rivers, Ogun, Edo, Benue, Gombe, Sokoto, Adamawa, Ebonyi, Imo and Yobe States etc	Manufacturing of cement, hydrated lime, soil conditioner, chemicals, extraction of iron ore	1,355,980,000
23	Manganese ore (Pyrolusite)	Plateau and Nasarawa Bauchi Bayelsa and Cross River and Zamfara states	Essential to iron and steel production	
24	Marble	Oyo, Edo, Nasarawa, Kogi, Katsina, Niger and FCT	Calcium based chemicals, floor tiles	80,292,000
25	Mica	Kogi, Kwara, Nasarawa, and Oyo States.	Mainly as electrical insulators	
26	Monazite	Niger, Plateau Nasarawa and Bauchi states	Solar cells and electricity generation	
27	Quartz and Silica sand	All over Nigeria	Glass making, electronic components like integrated circuits, transistor and solar cell	
28	Rutile	Plateau, Nasarawa, Bauchi and Kogi States. .	Production of titanium- a strong lightweight metal alloys used in airplanes and for electrodes in arc lights	
29	Salt	Nasarawa , Taraba, Enugu, Cross Rivers, Benue, and Ebonyi States	Confectioneries, food seasonings and industrial chemicals	1 million tonnes
30	Talc	Niger, Osun, Kwara, Kogi, Kaduna States and FCT	Ceramic insulators, Fillers in paints and fertilizer industries, Talcum powder base in cosmetic industry	100,000,000
31	Tantalite	Nasarawa, Kaduna, Kwara, Kogi States	Production of electronic components, mainly tantalum capacitors. As alloys with other metals.	N.A
32	Uranium	Cross river, Adamawa, Taraba, Plateau, Bauchi and Kano states	Power generation,	
33	Wolframite (Tungsten ore)	Kwara, Kogi and Plateau States	Production of filament in light bulbs, electrical component and equipment	
34	Zircon	Plateau, Bauchi and Nasarawa states	Used in foundry sands	

Source: **RMRDC Industrial studies on Base metal, Iron and steel, and Engineering services sector (5th update, 2006), RMRDC Multidisciplinary committee report of the Techno-Economic Survey on Non-metallic minerals sector (4th update, 2003)**
N/A –Not available

III. NIGERIA'S MINERAL INDUSTRIES

Minerals are substances that are formed naturally in the earth. They are usually solid, inorganic, have a crystal structure, and form naturally by geological processes.

The Nigeria mineral industry consist of earth materials that are grouped into metallic, non-metallic, metals and energy/fuels, based on their common industrial applications and end-uses. The phrase "industrial minerals and rocks" is commonly equated with non-metallic although ores such as Bauxite, Ilmenite, etc that certainly qualify as metallic ores are included because they are also raw materials of important non-metallic substances.

Non-metallic minerals show great diversity in composition, property and physical/chemical behavior all of which account for their tremendous range of industrial applications.

The Nigeria's Mineral Industries are grouped based on the sectorial grouping of the Manufacturers Association of Nigeria, MAN into the following;

Abbrassives
Absorbents
Filters and Fillers
Asbestors
Cement
Ceramics
Chalk and Crayon
Constructional materials
Cosmetics
Drilling Fluids
Fertilizers
Gemstones
Glass
Gravel packs
Insulators
Paints
Refractories
Salts.
Others are Base metals and miscellaneous, Iron and Steel and Cast Iron/Foundries.

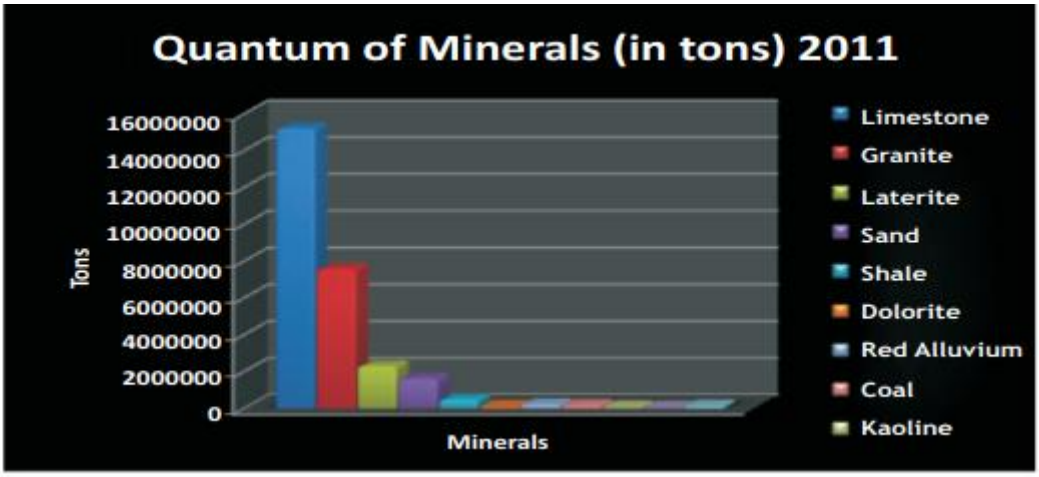
Table 2; Raw materials required by Nigeria's mineral industries

S/N	Industry	Raw Materials Required
1.	Asbestos	Asbestos, Fibre, Cement, Pulp
2.	Cement	Clay/Shale, Gypsum, Limestone
3.	Ceramics	Ilmenite, Borax, Tin Oxide, Talc, Soda ash, Zinc Oxide, Zircon, Sand, Calcium oxide, Quartz/Sand, Feldspar, Kaolin/Clay
4.	Crayon And Chalk	Gypsum (Plaster of Paris), Calcium Carbonate, Kaolin
5.	Construction Materials	Granite/hard crystalline rock, Clay, Limestone, Grave, Marble, Sand
6.	Cosmetics	Talc, Kaolin Caustic soda, Magnesium carbonate, Petroleum jelly, Silica, Soda ash,
7.	Drilling Fluid	Bentonite (Na-Montmorillonite), Barytes (Barium sulphate) additives
8.	Fertilizer	Phosphates, Potash, Sulphur, Alumina, Limestone/Marble, Fine sand, Kaolinitic Clays, Natural gas.
9.	Glass	Silica sand, Soda ash, Limestone/Marble, Feldspar, Selenium, Chromite
10.	Paints	Limestone, Kaolin, Titanium dioxide, PVA and Alkyd, Resin colourants.
11.	Refractories	Fireclays, Bauxite/Bauxitic clay, Dolomite, Magnesites, Silica, Chromium, Kyanite, Sillimanite
12.	Salt	Crude NaCl, salt (Brines)
13.	Iron And Steel	Iron ore, Bauxite, Limstone/Marble, Felspar, dolomite, Kyanite, etc.

MINERAL PRODUCTION

Today, mineral production data and revenue in Nigerian mining is unclear and inadequate. A reasonable conclusion can be drawn that the industry is constrained through under-reporting of production figures and returns. Even at that, local consumption, which accounts for majority of the market, contributed about 0.02% to GDP in 2012 and had steadily improved to about 0.60% in 2018. Nigeria's total export in 2016

was ₦8.53trillion while the non-oil sector contributed ₦330.01billion. The contribution of the solid minerals sub-sector was ₦11.16 billion representing 3.38% of the non-oil export in 2016. It is however, evident that from available statistics and production revenue data there are a lot of leakages in that sector, thereby creating loop holes in assessing and determining actual contribution to the National Economy.



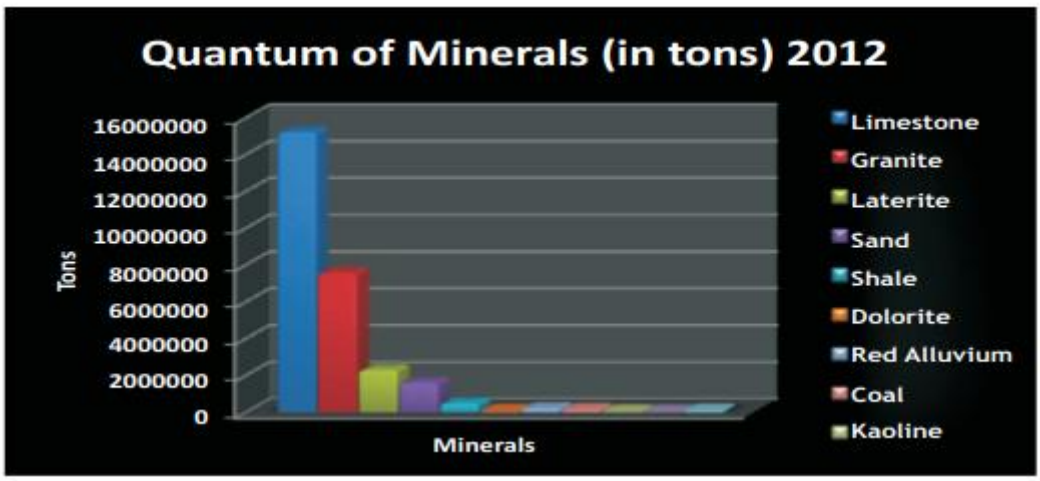


Table 3: Mineral production 2011 and 2012, NEITI, 2012 Report

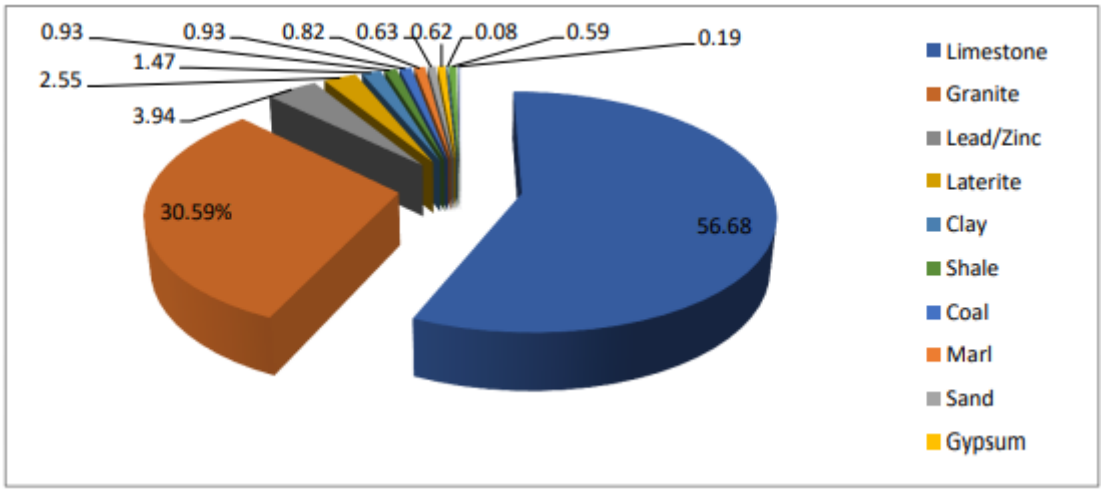


Fig. 2: Mineral Production, 2014, NEITI, 2014 Report

S/N	MINERALS	GROSS WEIGHT (TONS)	NESS FEE ADMIN (USD)	FOB VALUE (USD)	% of FOB Value
1	Lead and Zinc Ore	67,164.02	1,869,213.80	23,561,886.63	90.15
2	Columbite	960.00	60,520.69	721,806.60	2.76
3	Gold Ore and Concentrates	500.00	46,422.00	600,000.00	2.30
4	Copper Ore	773.80	36,308.41	466,568.90	1.79
5	Crude Mica	1,076.90	19,829.57	245,420.80	0.94
6	Zircon Sand	1,034.00	17,307.71	207,176.59	0.79
7	Barite	550.00	8,896.00	113,520.00	0.43
8	Beryl Ore	52.00	5,532.20	67,200.00	0.26
9	Quartz Ore	100.00	3,503.25	45,000.00	0.17
10	Tin Ore	68.70	2,413.89	27,458.80	0.11
11	Manganese Ore	183.00	3,192.01	27,275.55	0.10
12	Tantalite	20.00	1,558.00	20,000.00	0.08
13	Kaolin	90.00	947.82	11,518.00	0.04
14	Monozite Sand	104.00	769.31	9,880.00	0.04
15	Calcium Carbonate	50.00	464.25	6,000.00	0.02
16	Granite Block	18.00	500.17	5,760.00	0.02
Total		**72,744.42**	**2,077,379.08**	**26,136,471.87**	**100**

Table 4: Mineral Export, 2014, NEITI 2014 Report

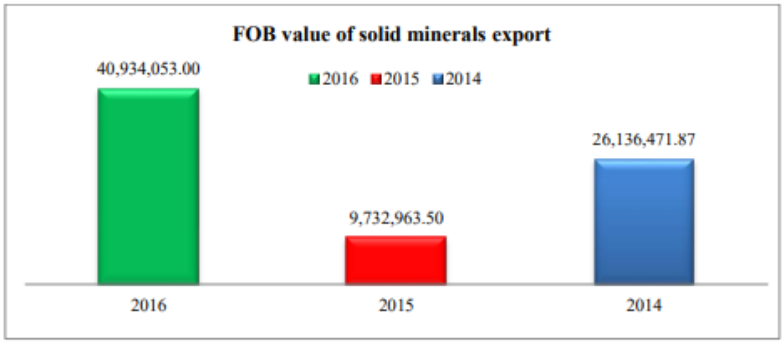


Fig. 3: Value of Mineral Export (2014-2016), NEITI, 2018

S/N	Types of minerals	Production (Ton)	Value of production ₦
1	Limestone	26,996,568.74	16,197,941,246.80
2	Granite	7,458,238.09	10,277,942,050.98
3	Laterite	2,074,013.29	1,244,407,976.20
4	Sand	1,508,705.29	1,206,964,234.00
5	Shale	1,882,675.56	941,337,779.60
6	Clay	1,646,011.72	658,404,688.40
7	Tin	3,625.37	906,341,933.33
8	Manganese	70,106.67	701,066,666.67
9	Lead / Zinc	5,794.59	521,513,250.00
10	Columbite	1,044.04	417,614,600.00
11	Coal	104,424.86	261,062,158.33
12	Feldspar	35,092.00	105,275,990.00
13	Gold *	0.025	159,487,592.00
14	Tantalite	28.949	144,744,000.00
15	Marble	22,648.96	67,946,870.00
16	Kaolin	26,710.00	66,775,000.00
17	Tourmaline *	0.139	55,695,500.00
18	Topaz *	7.174	35,868,375.00
19	Dolomite	33,364.00	33,364,000.00
20	Lead Ore	700	31,500,000.00
21	Baryte	1,712.04	13,696,320.00
22	Wolframite *	15.333	15,333,333.33
23	Zircon	1,072.50	6,435,000.00
24	Aquamarine *	0.005	4,940,000.00
25	Gypsum	720	3,600,000.00
26	Iron	665	4,322,500.00
27	Talc	666.67	2,000,010.00
28	Amethyst *	0.001	2,100.00
		41,874,611.02	**34,085,583,174.64**

Table 5: Mineral Production, 2016, NEITI 2018 Report

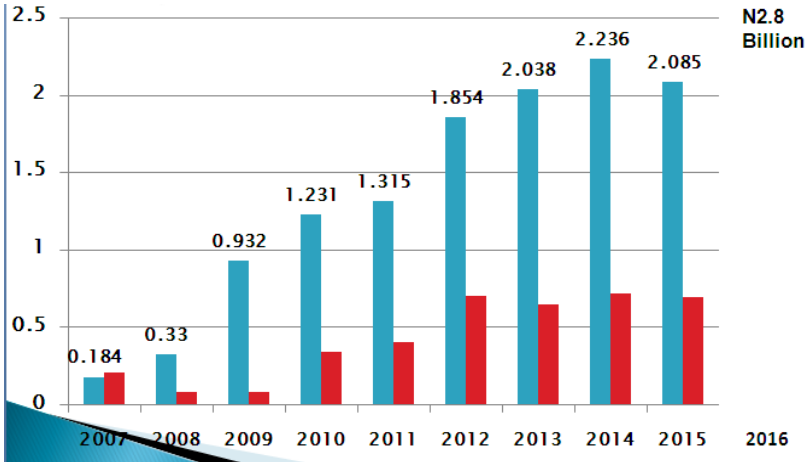


Table 6:Mining Production and Revenue to Nigeria (2007-2016), NEITI, 2018.

Although their contribution to GDP has been marginal, they have the potential to be major growth drivers, employing significant proportion of the labor force.

Mineral importation and utilization

Nigeria is highly dependent on imports of some industrial minerals. In 2016 Nigeria imported more than 600,000t of industrial minerals at a value of about 46 million USD (Mindiver, 2018).

From the Table 7, there is the urgent need to redress the excessive import bills on industrial minerals in the face of high abundance of the materials in Nigeria. This should be through immediate enactment of policies that will ensure activities in the construction industry (providing housing) through the utilization of limestone, gypsum, shales, dolomite and dimension stones producers, iIdustrial minerals to sectors that are considered vital to the Nigerian industry, such as the Oil & Gas (consuming mica, bentonite, barite, calcium carbonate), the steel industry (consuming limestone, dolomite quartz, manganese), the water treatment industry (consuming limestone and calcium carbonate) and agriculture (consuming phosphates and carbonates) should also be considered. Kaolin, Mica, etc, requiring low investment efforts to create value-added products feeding the global market should be given the needed attention.

Imports in weight (total 614,605t)	Imports in value (total 46,330,620 US$)
Gypsum (83.7%)	Calcium carbonate (25.4%)
Calcium carbonate (8.4%)	Mica (20.3%)
Titanium dioxide (1.3%)	Titanium dioxide (15.7%)
Quick Lime (1.2%)	Dimension stones (granite & marble; 12.5%)
Quartz (1.0%)	Gypsum (9.1%)
Kaolin (0.7%)	Talc (3.9%)
Bentonite (0.7%)	Baryte (3.6%)
Hydrated Lime (0.6%)	Quick Lime (2.1%)

Construction	Gypsum (cement production and plasters) Dimension stones Lime (hydrated and quick)
Steel	Quartz Calcium carbonate
Oil & gas	Mica Bentonite Baryte Calcium carbonate
Water treatment	Calcium carbonate Lime
Other industries (e.g. paper, ceramics, paints, water treatment)	Calcium carbonate Mica Titanium dioxide Talc Quartz Kaolin Lime (hydrated and quick)

Table 7: Nigeria's industrial minerals demand /gap analysis, 2016, Mindiver, 2018.

Calcium carbonate is being mainly used in water treatment, and the value of its imports represents more than 25% of the total cost of imports of industrial minerals to Nigeria. Considering the population growth coupled rapid urbanization of Nigeria, safe drinking water systems are essential to underpin the health and security of cities, protect economies and ecosystems and minimize the risk of pandemics. In this context, the provision of calcium carbonate for water treatment becomes highly crucial,

IV. DOWNSTREAM PRODUCTS AND MARKETS

The mining sector is mainly divided into three major activities:

i. Upstream (when minerals are explored and mined)
ii. Midstream (when minerals are processed)
iii. Downstream (when processed minerals are marketed and transported).

There are more than 2000 firms and individual workers who have the license to work in the upstream and downstream sub sectors (MCO, 2018).

Processes involved in mineral value chain development

Dominant feature in Nigerian mining is the large number of artisanal miners which makes mining very laborious and sometimes not profitable. Artisanal mining & mineral processing is simply mining and mineral processing done by subsistence miners in an environment where there are deposits of mineral ores. They usually make use of crude tools like hammers, pick axes, shovel etc. Their production rate compared to that of large-scale miners is poor.

Mineral Processing

This involves Comminition, Sizing, Separation and Concentration.

1) **Comminition** and **Sizing**

This is the process of liberating mineral of interest from their associated gangue. Machineries for the process include, crushers, cyclones, tumbling mills (ball, rod & pebble), High pressure grinding rolls (HPGR), stirred media mills, etc. Separation of mineral particles according to required sizes and shapes, liberate valuable minerals & increased surface area for chemical reaction. Machineries for Vibratory screening machine the process are Grizzlies, bar screens, wedge wire screens, radial sieves, multi-deck screens, vibratory screen, fine screens, flip flop screens and wire mesh screens.

2) Concentration

This includes Gravity concentration, Froth floatation and Magnetic separation. Machineries for this process are Jigging, Washing tables, Spirals, froth cells, High Gradient Magnetic flotation cells Separator (HGMS), High Intensity Magnetic Separator (HIMS), Low Intensity Magnetic Separator (LIMS), etc.

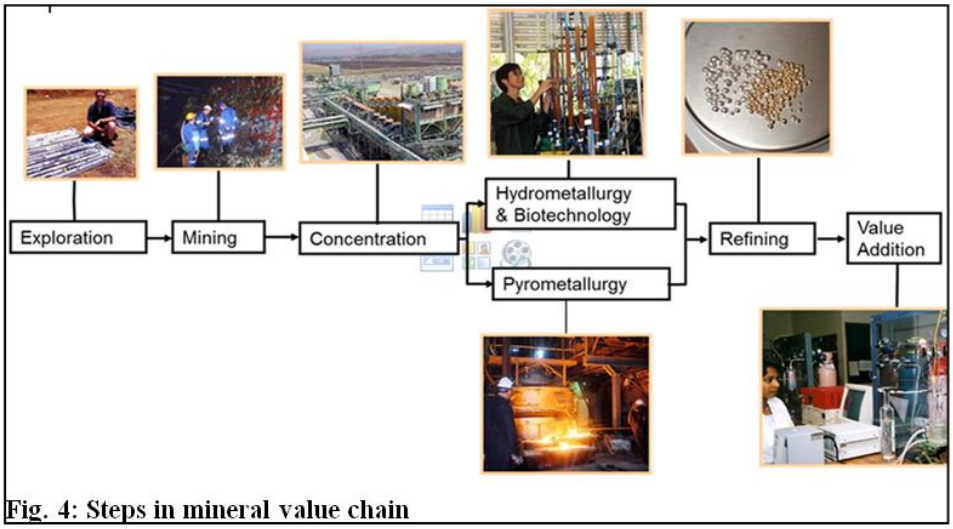


Fig. 4: Steps in mineral value chain

Fig. 4: Steps in mineral value chain

A combination of two or more of the above techniques is necessary to concentrate an ore economically. Methods chosen will depend on the relative physical and surface chemical properties of the mineral and the gangue.

A lot of investment opportunities exist in the processing of mineral resources into intermediate raw materials for industrial application in Nigeria.

Limestone Downstream Development in Nigeria

There are abundant deposits of limestone occurring across the major sedimentary basin of Nigeria. Limestone is the most produced mineral in Nigeria with about 27,195,278.76 tonnes in 2016, representing about 49% of the total tonnes of minerals produced. It is mined mainly for cement production.

There are various value chain processes involved in the cement industry, Fig. 4 and Table 8. From Table 8, we can see that the Cement industry inputs include raw materials from the mineral and mining sector such as limestone, silica, clay, coal, gypsum, magnesia, copper, zinc, etc. Considering the raw materials stage in the cement value chain which plays a critical role, the processing, output and the distribution stages means that Cement industry in Nigeria adds value to the overall economy through the activities of the different players in its value chain.

CEMENT – INDUSTRY & PLAYERS VALUE CHAIN				
INDUSTRY CHAIN	**INPUTS** • LIMESTONE o Lime, silica • SHALE/CLAYS • MINOR COMPONENTS o Magnesia, zinc, copper • GYPSUM • EXTENDERS • FUEL- coal, gas, oil	**PROCESSING** • RAW MEAL PREPARATION o Limestone crushing o Raw milling-ground to powder • HEAT TREATMENT o Dry process o Wet process o Semi wet o semidry processes • CEMENT MILLING o Grinding clinker with gypsum o farming	**OUTPUT** • CEMENT o Stored in silos for packaging • PACKAGING • Paper bags • Polypropylene bags	**DISTRIBUTION** • On loading to trucks • Off loading • warehousing
INDUSTRY PLAYERS	• Quarry Owners • Importers • Transporters • Fuel Dealers • Labourers • Equipment leasing/selling/ maintenance coy	• Equipment leasing/selling/mai ntenance coy • Engineers • Technicians • Labourers • Chemists • Quality Analysts • Operations managers	• Quality Analysts • Equipment leasing/selling/m aintenance coy • Labourers	• Truck Owners • Realtors • Contractors • Labourers • Brick Layers

Table 8: Cement industry value chain

Challenges in the Minerals Downstream Products' Sector

The Nigerian economy continues to grapple with a number of generic challenges that have hampered efforts at economic transformation.

First, the economy is yet to achieve the necessary structural changes required to jump-start rapid and sustainable growth and development. Aside disarticulated and narrow productive base, sectorial linkages in the economy are weak.

Primary production comprising agriculture, mining and quarrying inclusive of oil and gas dominate national output while the manufacturing sector role in the economy is decidedly small in terms of share of gross output, contribution to growth, foreign exchange earnings, government revenues and employment generation.

The economy also confronts monumental challenges in form of dilapidated and chronically non-functional infrastructure. The decay in the country's infrastructural base reflects decades of poor maintenance and weak technological base. The weak technological base is a consequence of low research and development efforts and disconnect between research findings and industry. The private sector is equally weak and diffuse with poor response record to industrial incentives.

The narrow base of government revenue and the near monolithic nature of exports constitute additional challenges confronting the sector.

Of particular note are the following;

i. The dearth of technical geoscientists and the need for continuous training of same in the field of mining and processing;
ii. Non Value addition on mineral resources prior to sale
iii. Marketing and investment in mineral resources is low.
iv. No clear focus (policy) on value addition and beneficiation
v. Infrastructure development plans are not consciously linked to national development plans.

V. Recommendations

This paper is of the opinion that all the steps government is taking in the quest to actualizing its diversification policy is right and apt, especially in the systematic execution of the Minerals and Mining Act, 2007, the Road Map for the Growth and Development of the Nigerian Mining Industry, 2016, through (NISU), Nigeria's Industrial Minerals Roadmap, 2018 most specifically. We need to deepen our diversification efforts and policy implementation strategy, if we are to attain the lofty objectives enshrined in these policy documents. Therefore the paper will like to recommend as follows:

i. The Ministry of Mines and Steel Development, in collaboration with relevant Government agencies, development partners and stakeholders, should initiate policies to specifically facilitate the mining and processing of identified strategic minerals to meet domestic demands of the country as well as optimizing export and foreign exchange earnings;
ii. Government at all levels should continue to demonstrate strong will and commitment to developing local content in the Minerals and Metals sector to contribute to its Economic Diversification Agenda;
iii. There is the urgent need for Government through the Ministry of Mines and Steel Development, in collaboration with relevant government agencies to establish mining clusters as well as privately driven Mineral Buying Centres as a means of further enhancing the formalization of Artisanal Miners for optimum revenue collection;
iv. The Ministry of Mines and Steel Development should review and re-enact policies that encourage value-addition in the downstream mining sector, which is expected to generate employment, wealth creation and economic growth;
v. The Ministry of Mines and Steel Development, in collaboration with relevant Government agencies should promote and sustain research collaboration with Tertiary Institutions in the area of minerals development, especially beneficiation and value addition;
vi. The Ministry of Mines and Steel Development should promote investment in beneficiation/smelting plants through Public Private Partnership (PPP) initiatives;
vii. The Ministry of Mines and Steel Development, in collaboration with relevant government agencies should review policy on importation of some selected minerals and their derivatives with a view to encouraging local production;
viii. The Ministry of Mines and Steel Development and private investors are implored to establish Mining and Metal sector value-chain activities for specific Minerals that would drive economic and social growth;
ix. There should be robust advocacy and awareness campaigns on the vast potentials of Nigeria's Minerals and the new policies to be carried out by all the three tiers of government and other relevant stakeholders, on a continuous basis.
x. Government should support the creation of Standard Laboratory with International Certification standards to service the sub-sector.

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