Financial Implications of Mining and Quarrying Sub-Sector's Contribution to Nigeria Economy

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Abstract
The study examined the contribution of the mining and quarrying sub-sector to the Nigerian economy. ***Background:*** *Nigeria is a country with abundant natural and human resources. The country has substantial deposit of some natural resources which are mined for export and local consumption. The contribution of this sector (with such huge potentials) to the gross domestic product (GDP) of the country remains surprisingly low. It is worrisome that the sector is under-performing and plagued with issues ranging from inadequate infrastructure to illegal artesian mining and community challenges.* ***Aims:*** *The specific objectives of this study were to ascertain the effect of: crude petroleum & natural gas; coal mining; metal ores and quarrying & other minerals on GDP of Nigeria.* ***Methods:*** *The ex-post factor research design was adopted while data for the period was obtained from CBN bulletin 2022. The descriptive and multiple regression analysis were done and data tested at 5% level of significance. The theoretical underpinning of the study is endogenous growth theory.* ***Results:*** *It was found that crude petroleum & natural gas and metal ores had significant effect on GDP, while coal mining and Quarrying & other minerals had non-significant effect on GDP. Also, crude petroleum & natural gas, coal mining and metal ores had positive effect on GDP, while quarrying and other minerals had negative effect on GDP. The prob(F-statistic) value is 0.000000 and adjusted R^2 value is 0.967000.* ***Conclusion:*** *The*

mining and quarrying sub-sector is therefore found to be contributing but minimally to the Nigerian economy.

Keywords: *Mining, quarrying, mineral resources, economic growth.*

Introduction

Nigeria is a country blessed with abundant natural and human resources. The country has substantial deposit of some natural resources which are mined for export and local consumption. Chikezie-Aga et al. (2022) posits that Nigeria possesses more than 450 mineral-rich sites in which various varieties of commercial-grade minerals are located. The availability of natural resources ordinarily should help boost the revenue growth of the nation and consequently help achieve economic growth. The Nigerian oil and gas sector has played a central role in the Nigerian economy being her major source of revenue since its discovery. Akonji and Wakili (2019) contend that Nigeria has abundant reserves of immobile natural resources spread across its geospatial zones.

The solid minerals in Nigeria include: talc, gypsum, iron ore, lead/zinc, bentonite, gold, coal, salt, gemstones, kaolin, dolomite, tourmaline, quartz, phosphate, molybdenum, emerald, sapphire, lignite, silver, zinc, granite, galena, columbite, tin, diamond, aluminium, magnesium, manganese, kyonite, wolframite, limestone, barytes, lead, clay, feldspar, rutile, diatomite, lithium, coke, tentalites, bitumen and uranium (Orji et al., 2018). KPMG (2023) stated that Nigeria currently boasts of over forty-four (44) priced solid minerals in the mining space, with huge deposits scattered over different parts of the country. It is expected that these huge natural resources should contribute to gross domestic product and eventually economic growth. It is however pertinent to note that sometimes the reverse may be the case where the revenue is not properly invested in growth driving sectors of the economy. Where the forgoing happens, the economy still suffers despite the presence of abundant natural resources that should have been mined for the growth of the economy.

Also, where the nation relies solely on one of her natural resources and neglecting the others, the neglected sectors may not yield the anticipated contribution to economic growth. Nigeria highly rely on crude oil revenue with little emphasis on other sectors that will help drive economic growth. In agreement with the forgoing, Ogbonna et al. (2019) noted that creating an economy that is not dependent on oil revenues and boosting the economy's growth moving forward is a crucial goal, hence, diversification into new revenue streams such as solid mineral exports, and mitigating the oil export dependence by encouraging a rise in mineral exploitation will be required.

The Nigerian domestic mining industry is underdeveloped due to factors as overdependence of the Nigerian economy on oil and gas sector, inadequate legislation and poor law enforcement which has made the sector to be largely informal, inefficient state of operations, environmental degradation, jurisdictional conflicts between federal and state governments, depleted surface alluvial deposits (especially tin) among others (Alison-Madueke, 2009 as cited in David et al., 2016). Indeed, one of such areas that holds the potential for Nigeria’s economic

diversification is the solid mineral sub-sector (Abayomi & Olufemi, 2022). Also, Nwogwugwu et al. (2021) further stated that the events of recent past, especially; the economic recession orchestrated by oil price shock has renewed interest in search of alternative economic sectors that could sufficiently drive the growth process in Nigeria. In accordance with the forgoing, some researchers are of the opinion that one of the sectors that could be a veritable growth driver is the solid mineral sector (Ajie et al., 2019; Edeme et al., 2018).

The pedestrian performance of the solid mineral sub-sector has been attributed to lack of geosciences data, limited budgetary support, absence of critical infrastructure, federal-state subsidiarity/tensions, illegal mining and community challenges. Others include supervising ministry's weak institutional capacity, limited enforcement of regulations, poor ease of doing business rating and lack of funding, among others (Ministry of Solid Mineral Development, [MSMD], 2016 as cited in Abayomi & Olufemi, 2022). But, since independence, there is lack of proper utilization of resources, while some of the resources remain untapped (Ajie et al. 2019). Corroborating the forgoing, Titus and Muhammad (2018) concurred that for over five decades now, the Nigerian economy has mostly depended on proceeds from the sale of crude oil at the expense of other productive sectors such as Agriculture and solid minerals that hitherto contributed significantly to the economy of Nigeria.

In 1999, the federal government of Nigeria created the Ministry of Solid Mineral Development, which has motivated a lot of interest in the sector and provided alternative sources of foreign exchange to the country, coupled with the fact that petroleum products are unreliable, attributable largely to the crisis in Niger Delta region areas of the country. This gave hope for higher prospects in this sector as many interested parties (both local and international) definitely will patronize this hitherto virtually latent sector. That ministry creation was a hope that Nigeria will get it right in getting this sub-sector to pull the needed strings for substantial contribution to the revenue base of the country.

There are also some emerging threats and potential roadblocks which Nigeria must watch out for, such as:

- Quick revenue vs long-term addition
- Brain drain and human capacity
- Increased competition for Foreign Direct Investment (FDI)

Government must put in place strategies to address these if it must reap the benefits of the mining sector. A roadmap for the growth and development of the Nigerian mining industry was launched in 2016 for the following reasons:

1) To create a globally competitive sector capable of contributing to wealth creation, providing jobs and advancing our social and human security.
2) Focus on using mining assets to drive domestic industrialization initially, and then migrate to winning in global markets.
3) Strategizing with a value chain-based growth plan.
(PwC, 2023)

KPMG (2023) had highlighted that the contribution of this sector (with such huge potentials) to the gross domestic product (GDP) of the country remains surprisingly abysmal. This is evidenced in its contribution to gross domestic product of 0.18%, 0.26%, 0.43%, 0.63% and

0.85% for years 2018 to 2022 respectively. Our country is not maximizing the inherent benefits in these solid minerals as such not reaping the desired results as is being enjoyed by some Asian countries like Japan, Malaysia, South Korea amongst others that are thriving without dependence on crude oil like Nigeria. Chikezie-Aga et al. (2022) stated that one cannot ignore that Nigeria has incredible people and natural resources, but it seems the government prioritizes oil exporting, leaving many businesses in the country hurting for revenue.

Shasore (2016) stated that it is worrisome that the sector is under-performing and plagued with issues ranging from inadequate infrastructure to illegal artesian mining and community challenges. These issues stifle potential by deterring potential investors whose resources are essential to the revitalization of the sector. Orji et al. (2018) noted with dismay that if Nigeria had sustained her productive capacity (boom) in agriculture and solid minerals till today, Nigeria would have been one of the best economies in Africa. They further stated that with the discovery of oil and its rising price cum revenue, the government decided to shift attention from agriculture and solid minerals to oil.

Our country's need for a quick advancement economically is critical, hence the need to quit our mono-cultural economy and grow other sectors for a true and whollistic growth of the nation. In line with the forgoing, the solid mineral, agricultural and services sector needed to be given the needed push and attention they not only require but deserve for a sustainable economic growth of Nigeria. A lot need to be done in the mining sector especially around strengthening the legal, regulatory, and institutional environment to provide the appropriate conditions that attract foreign investments, so it can contribute to economic growth. This will help revive sector that was neglected for decades due to the discovery cum over-emphasis and reliance on crude oil.

Ajie et al. (2019) noted that there are problems of inadequate infrastructural facilities, technical competence and huge investment capital involved in the exploration of the resources. Orji et al. (2018) also stated that this sub-sector faces challenges of insecurity, smuggling, tax, illegal mining, weak value addition, low level of mining mechanization and inadequate funding. It is very important to note with concern that some hitherto major buyers of crude oil from Nigeria (like the USA) are already exploring and diversifying into other sources of energy aside crude oil. Furthermore, there have been downward trend in the price of crude oil in recent years which is affecting Nigeria's revenue and distorting her budget. This will also affect planned growth and development strategies of the Nigerian government. It is therefore high time that the over reliance on crude oil is reduced and diversification to other revenue sources such as solid minerals are taken seriously.

This study therefore did an empirical study on the financial implications of the mining and quarrying sub-sector's contributions to Nigeria economy covering the period 1981 to 2022.

The specific objectives were:

1) To examine the effect of crude petroleum and natural gas on gross domestic product in Nigeria.
2) To assess the effect of coal mining on gross domestic product in Nigeria.
3) To ascertain the effect of metal ores on gross domestic product in Nigeria.
4) To examine the effect of quarrying and other minerals on gross domestic product in Nigeria.

The hypotheses were:

1) Crude petroleum had no significant effect on gross domestic product in Nigeria.

2) Coal mining had no significant effect on gross domestic product in Nigeria.
3) Metal ores had no significant effect on gross domestic product in Nigeria.
4) Quarrying and other minerals had no significant effect on gross domestic product in Nigeria.

Literature Review

Conceptual review

Titus and Muhammad (2018) defined mining as the extraction [removal] of minerals and metals from the earth. Shasore (2016) defined minerals as any substance whether in solid, liquid, or gaseous form occurring in or on the earth, formed by or subjected to geological processes including occurrences or deposits of rocks, coal, coal bed gases, bituminous shales, tar sands, any substances that may be extracted from coal, shale or tar sands, mineral water, and mineral components in tailings, and with waste piles but with the exclusion of petroleum and waters without mineral content. The growth in real production per capita over time is what we call economic growth (Chikezie-Aga et al., 2022).

Theoretical review

The theoretical underpinning for this study is basically the endogenous growth theory propounded by Harrod-Domar in 1946. The endogenous growth theory advocates the stimulation of level and growth rate of per capita output from within the economic policies such as tax policies. The endogenous growth theory posits that the driver of economic growth is fundamentally the result of endogenous factors and not external factors. The endogenous growth theory posits that the growth of the economy in the long-run primarily depends on policy measures which have grave implications on openness, competition, change and innovation. The endogenous growth theory further posits that economic growth is generated from within a system as a direct result of internal workings of the system. Specifically, the theory notes that the enhancement of a nation's human capital will lead to economic growth by means of the development of new forms of technology and efficient and effective means of production which are not disrupted by taxes. Proponents of endogenous growth theory argue that the productivity and economies of today's industrialized countries compared to the same countries in pre-industrialized eras are evidence that growth was created and sustained from within the economy.

It is therefore believed that the growth of the Nigerian economy can be achieved through growth of her mining sub-sector. This sub-sector have the potential to drive growth from within the country if given the denied necessary attention that will stimulate its productive capacity and contribution to the gross domestic product of the country.

Assumptions of the endogenous growth theory are:

(i) Government to provide incentives and subsidies for businesses in the private sector who in turn will invest in research and development so they can continue to drive innovation.
(ii) Investing in human capital through education or training programs can improve the quality of labour, which increases productivity.
(iii) Government should enact policies that help entrepreneurs that create new businesses and jobs.
(iv) Investments should be made to improve infrastructure and manufacturing processes in order to achieve innovation in production.

(Ejinkonye, et al., 2023).

Empirical review

Abayomi and Olufemi (2022) examined the influence of solid mineral development on economic growth in Nigeria, using the Auto Regressive Distributed Lag (ARDL) Approach. Time series data which spanned 1981 to 2019 were used in the study. The study tested for stationarity among the time series while all results were tested at 5% level of significance. The result of their study revealed that Solid Mineral Development exerted an insignificant positive influence on economic growth in the study area.

Nwogwugwu et al. (2021) investigated the role of solid mineral sector in driving economic growth in Nigeria using time series from 1980 to 2020. They estimated canonical co-integrating regression model of solid mineral – economic growth nexus in Nigeria. The results they obtained from CCR estimation showed that solid mineral production exerts a significant positive effect on economic growth. Also, increase in solid mineral production translates into increase in investment in intermediate and capital goods which in turn raises the aggregate demand. If this incremental change persists and more than off-sets upward prices, it will translate to economic growth. Furthermore, the result showed that solid mineral export is critical for economic growth. On the other hand, the result showed that solid mineral depletion could retard economic growth.

Ajie et al. (2019) empirically assessed the potentiality in solid mineral resources as viable alternative to the petroleum sector. They used various econometric tools to analyze the variables for the study. The test for stationarity showed that all variables became stationary at first difference. In the same vein, evidence revealed that series in the model exhibit long-run equilibrium relationship judging from the Johansen co-integration result. They OLS output showed that, a billion naira increase in solid minerals development e.g. quarrying, bauxite, metal ores, iron ore, coal etc will contribute 0.26 billion naira to the GDP of Nigeria.

Orji et al. (2018) studied the diversification of Nigeria economy through solid mineral sector by examining the effect of policy guidelines on solid mineral mining to economic diversification of Nigerian. The study further studied how ethnicity affects the production of solid mineral to economic diversification of Nigeria. One hundred and thirty five (135) questionnaires were administered in Zamfara and Taraba states to generate data and one hundred (100) were returned successfully within one year. Hypotheses used for the study are: (1) policy on artisanal mining has no direct relationship with economic diversification of Nigeria. (2) Funding of the solid mineral sector does not positively affect economic diversification of Nigeria. The researcher used parametric –z test at significant level of 0.05% to accept or reject the hypotheses and Probit analysis to confirm results. A survey design was adopted in analyzing the hypotheses which led to the findings that: funding was greatly retarding the mining of solid mineral in Nigeria and lack of necessary laws and policies also affects solid mineral mining in Nigeria. Furthermore, that estheticism also contributed adversely on solid mineral mining to economic diversification. Finally, that poor funding, ethnic sentiment and inadequate laws and policies of government were some of the factors that militate against development of solid minerals and hence diversification of the Nigeria economy.

Titus and Muhammad (2018) analyzed the impact of Agricultural and Mining sector on economic growth in Nigeria between 1999 and 2017 using ordinary least squared (OLS) regression model. The variables were first subjected to unit root test using Augmented Dickey-Fuller test. The result showed that both agriculture and mining outputs have significant and positive impact

on economic growth in Nigeria. However the result of mining sector shows only small marginal contribution to GDP due to the over reliance on oil while neglecting the other sectors of the economy.

David et al. (2016) carried out an empirical analysis of the contribution of mining sector to the economic development in Nigeria covering the period 1960 to 2012. The study employed Error Correction Model (ECM) to examine the short-run and long-run effect of mining sector's contribution to Nigeria economic development. The independent variables were; crude petroleum and gas, solid mineral, manufacturing and agriculture while the dependent variable was per capita income. The finding revealed that the value of solid mineral have strong impact on economic development in Nigeria.

This study covered the period gap by using data up to 2022 which is the latest available data as at when the analysis was done. The variable gap was also covered as this study used four mining sector variables as against some studies that used one or two variables.

Methodology

The research type is *ex-post facto* and data was obtained from Central Bank of Nigeria statistical bulletin, 2022. The descriptive statistics and the OLS technique were used to analyze the data collected. The *a-priori* expectation is that the independent variables should have significant effect on the dependent variable. The decision rule is to accept the null hypothesis where the t-statistic probability value is greater than 5% otherwise reject

This relationship is expressed thus:

$Y_t = b_o + b_1x_1 + b_2x_2 + b_3x_3 + \ldots\ldots\ldots b_tx_t + e_t$

Where:

Y = dependent variable

b_o = intercept

x_1 , x_2 , x_3 are the independent variables

e_t = random error term

b_o, b_1, b_2, b_3 are the parameters of the model

This study used the model:

GDP = f(CRPNG, COMIN, MEORE, QOMIN)

The above is estimated as follows:

$GDP = b_o + b_1$ CRPNG $+ b_2$ COMIN $+ b_3$ MEORE $+ b_4$ QOMIN $+ e_t$

GDP = gross domestic product

CRPNG = crude petroleum and natural gas

COMIN = coal mining

MEORE = metal ores

QOMIN = quarrying and other minerals

Results of analysis:

Table i: Descriptive statistics

	GDP	CRPNG	COMIN	MEORE	QOMIN
Mean	40981.46	3856.978	5.177886	3.111003	112.4096
Median	9766.840	1154.332	3.950867	0.745231	6.610802

Maximum	199336.0	13423.87	22.19963	23.66571	1629.641
Minimum	137.9300	4.280034	1.419344	0.110761	0.242865
Std. Dev.	55220.83	4543.806	4.366969	5.002661	307.7725
Skewness	1.331917	0.809068	1.981288	2.567218	3.796550
Kurtosis	3.682571	2.072176	7.395959	9.438967	17.29830
Jarque-Bera	13.23335	6.088639	61.29630	118.6898	458.6687
Probability	0.001338	0.047629	0.000000	0.000000	0.000000
Sum	1721221.	161993.1	217.4712	130.6621	4721.203
Sum Sq. Dev.	1.25E+11	8.46E+08	781.8873	1026.091	3883681.
Observations	42	42	42	42	42

The above table displayed the descriptive statistical behaviour of all the parameters that were subjected to estimation in this study.

Table ii: Regression output

Hypotheses	Variable	Coefficient	t-statistic	p-value	Decision
One	CRPNG	4.947574	7.211673	0.0000	Reject H0
Two	COMIN	620.6134	0.656588	0.5155	Accept H0
Three	MEORE	8584.519	4.789818	0.0000	Reject H0
Four	QOMIN	-36.71297	-1.938637	0.0602	Accept H0

Source: Researcher's extract from the regression table (Eviews10).

Hypothesis 1: H0: Crude petroleum and natural gas had no significant effect on gross domestic product in Nigeria.

The above result showed that crude petroleum and natural gas had probability value of 0.0000. The null hypothesis is therefore rejected and it is concluded that crude petroleum and natural gas had significant effect on gross domestic product in Nigeria for the period reviewed.

Hypothesis 2: H0: Coal mining had no significant effect on gross domestic product in Nigeria.

The above result showed that coal mining had probability value of 0.05155. The null hypothesis is therefore accepted and it is concluded that coal mining had non-significant effect on gross domestic product in Nigeria for the period reviewed.

Hypothesis 3: Metal ores had no significant effect on gross domestic product in Nigeria.

The above result showed that metal ores had probability value of 0.0000. The null hypothesis is therefore rejected and it is concluded that metal ores had significant effect on gross domestic product in Nigeria for the period reviewed.

Hypothesis 4: H0: Quarrying and other minerals had no significant effect on gross domestic product in Nigeria.

The above result showed that quarrying and other minerals had probability value of 0.0602. The null hypothesis is therefore accepted and it is concluded that quarrying and other minerals had non-significant effect on gross domestic product in Nigeria for the period reviewed.

Discussion of findings

Crude petroleum and natural gas had coefficient of 4.947594 and probability value of 0.0000. This showed that this sub-sector had a positive and significant effect on Nigeria's gross domestic product. This sector is therefore doing well as it is today still the highest earner of foreign exchange for our economy. Also, coal mining had a coefficient of 620.6134 and probability value of 0.5155. This sub-sector's positive effect is not significant. Hence, there is the need to fine-tune the sector so as to ensure its positive effect is also significant for a better contribution to gross domestic product. Furthermore, the result on metal ores showed that it had coefficient of 8584.519 and probability value of 0.0000. Hence, this sector's positive effect is also significant as expected in the a-priori expectation of this study. Finally, quarrying and other minerals had a coefficient of -36.71297 and probability value of 0.0602. This sub-sector's negative effect is non-significant. This sub-sector need to be re-visited and even overhauled so as to tap from its potentials. Nigeria have to get her policies right in this sub-sector so as to tap from its potentials. This will help not only reverse its negative effect but as well reverse its non-significant effect on the gross domestic product of Nigeria.

The prob(F-statistic) value of 0.000000 showed that the model was statistically fit for the estimation and are jointly statistically significant in explaining the changes in gross domestic product in Nigeria for the period reviewed. Furthermore, the R^2 value was 0.970220 with adjusted R^2 value of 0.969000. This implies that the independent variables in real terms could account for about 97% of changes in the dependent variable.

Conclusion

This study has shown the effect of the mining sub-sector's variables on the gross domestic product of Nigeria for the period reviewed. The CRPNG, COMIN and MEORE had positive effect while QOMIN had negative effect on GDP. Also, CRPNG and MEORE had significant effect while COMIN and QOMIN had non-significant effect on GDP. It is pertinent to note that these sub-sector's activities need to be better fine-tuned for more productive results. This is imperative as we look at other sectors that have the potentials to support and contribute to the economy aside crude oil.

Recommendations

1) The Nigerian government need to sustain and increase her crude oil exploration and sales. This will help maintain its positive and significant effect on the economy as expected.
2) The coal mining need to be revamped and revitalized. This will enable it be able to make significant effect on the Nigerian economy in view of the untapped potentials.
3) The metal ores sub-sector growth need to be maintained. That will ensure its continued positive and significant effect o the Nigerian economy.
4) The quarrying and other minerals sub-sector need adequate concentration and over-haul as it is not aligning properly with the measuring indices as expected. This will help reverse its negative and non-significant effect on the Nigerian economy.

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