

The Economic Reality of Iron Ore Production amid Diversification: A Case of Niomco (National Iron Ore Mining Company)

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Abstract: *The study projects on average, the profitability of Nigeria's iron ore company, NIOMCO (National Iron Ore Mining Company) in Kogi State, amid her current economic status. In attempt to project the profitability surrounding the company's operations, the Net Discounted Present Value was employed, over a projection of five years. Interestingly, the outcome of the projection revealed that, selling at the current global market price of iron ore (\$62.59), considering Nigeria's current inflation rate and Dollar to Naira market exchange rate will not be profitable to NIOMCO, with 'all things being equal' within a projected period of five years. Therefore, it recommends that the entity be privatized to foreign investors with adequate financial and technical capacity to saddle the operations of the entity throughout five years and a tax holiday of five years should also be granted, as a coping strategy to willing investors. It also recommends that, a new price be set, at least to cover running expenses, if it must be sustained, as Nigeria journeys through a period of economic vulnerability, as she seeks to diversify her economy.*

Keywords: *Diversification, NIOMCO, Iron ore, Itakpe.*

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I. Introduction

Currently, the only company in Nigeria bestowed with, the obligation of exploiting, exploring and processing of iron ore is NIOMCO (National Iron Ore Mining Company) located in Kogi State, a central region of Nigeria. According to the National Iron Ore Mining Company, Handbook (2008), the first official information on the presence of iron ore deposit within the district of Okene, in Kogi State, was given by the **Southern Nigerian Mining Corporation** between the years 1905-1907, while the steel industry in Nigeria started around 1958 when international organizations and some professional consulting firms were commissioned a couple of times to access the possibility of establishing a long-term productive steel plant, under the Ministry of Federal Industries.

According to Adebimpe and Akande (2011), the iron ore deposit has an estimated reserve of over 200,000,000 million tons of iron ore, with an estimated life span of 27 years.

The year 1987, precisely in the month of February, a Federal owned entity, NIOMCO (National Iron Ore Mining Company) was established, to take charge of iron ore mining in Nigeria. The entity is popularly called, '**Itakpe Iron Ore Deposit**', because it was established, in a town called 'Itakpe', located in the district of Okene, Kogi State.

At this time (1987), the obligation of exploring, exploiting and processing and supervision of iron ore production was in theory, until the year, 1992. The Federal entity was vested with the following obligations;

- I. To manufacture and supply 100% of the iron ore requirements of Ajaokuta Steel Plant, in Nigeria, amounting to 2,150,000 metric tons per year of 63% to 64% Fe concentrates.
- II. To produce and supply 40% of iron ore concentrates requirements of Delta Steel Company at Aladja in Delta State, Nigeria, which amounts to 550,000 metric tons per year, which should contain a minimum of 67% to 68% Fe super concentrates.
- III. To adequately and continuously meet 100% requirement of local iron ore concentrate, taking into cognizance the installation of the primary steel plant for capacity expansion and for the exportation of iron ore concentrates to the international market after local needs have been satisfied.
- IV. To promote the interest of the Central Government of Nigeria in foreign iron ore mining projects, for example in the Mifergui Nimba iron ore project in the Republic of Guinea where Nigeria has 16% shareholding.

All the above, were goals set, by the Federal government which were to be accomplished by the entity, throughout its period of existence. Unfortunately, as cited in Osemenam (2017), the company has been down for decades, due to bureaucratic factors. Although workers are still retained, despite the halt in productive activities. At the moment, diversifying the Nigerian economy stands to be one of the strategic priorities, of the present day administration, to stabilize the economy. According to Premium Times (2016), Nigeria having the 12th largest iron ore deposits in the world and 2nd largest in Africa, with over two billion metric tons, yet about 70% of Nigeria's mineral deposit are not proven. These figures represent a gross under-utilization of our iron ore resources, and are vastly inadequate to sustain the country's industrial ambitions.

In sum, the recent move to diversify Nigeria economy, by giving attention to the solid mineral sector inspired the title 'The Economic Reality of Iron Ore Production amid Diversification: A Case of NIOMCO'.

1.1 A SUMMARY OF OPERATION AT NIOMCO

In a personal communication, (Mr. Oladipo), the Assistant general manager, construction at NIOMCO, operations of the entity are divided into three phases or stages; exploration, exploitation and processing of iron ore.

- a) **Exploration Phase:** This is the first stage of operation at the company. During this activity, the company utilizes its mine geologists to carry out a survey on the deposit before, exploitation of the iron ore mineral, begins. They employ geophysical and geochemical techniques, such as surface mapping to ascertain, portion of the iron ore deposit to be exploited.
- b) **Exploitation Phase or Stage:** Traditionally, this is the second phase of production at the company. This is popularly regarded as the mining phase. The open pit mining technique, is employed to excavate the mineral (iron ore) from the earth crust. During exploitation, the use of ANFO (Ammonium Fuel oil) explosives are utilized to blast hard iron ore body, as drilling takes place. Heavy, drilling equipment are employed with the aid, of air compressors, to drill down the mapped out, portion the ore reserve. Also, to further exploitation activity, the use of heavy earthmoving equipment, such as excavators, bulldozers, dumpers, hydraulic shovels, soil compactors are utilized.
- c) **Processing Phase:** This is the final stage of iron ore production. This involves the transformation of the exploited iron ore in its raw state into its concentrate state (iron ore concentrate). This includes crushing, grinding, separation, tailing, loading and haulage of iron concentrate to Aladja and Ajaokuta steel companies and other potential buyers. The use of gyratory crushers utilized in reducing or crushing hard iron ore body, before it is transformed into its finished state (iron ore concentrate).

In addition, the company is made up four departments, namely, beneficiation, mines, administrative and estate departments. To accomplish the aforementioned tasks, the company runs a routine shift called, '**four brigade three shifts**', whereby workers (engineers) in the mines and beneficiation departments are engaged in direct production activities on a three shift rotation. The company runs its machines for 12hours for approximately 21 days in a month, excluding weekends. The machine hours economic useful life of mining equipment with respect to, working hours of the entity is 72,000 hours while laboratory equipment has a useful life of approximately 10 years.

Reliance on importation has been the major source of earthmoving equipment and facilities utilized in mineral production. With reference to Engineering Export Info Bulletin (2015), submits that Nigeria's major import partner for sourcing engineering products, spares parts and other commodities are Italy, China, Germany, United Kingdom and USA. The United Kingdom and USA accounts for over 26% of Nigeria's net import for engineering wares. Although USA possesses the greatest share of Nigeria's import in terms items used in her oil and gas sector. India, also ranks one of Nigeria's import partner for engineering equipment, although import transactions with the India is not steady. At NIOMCO (National Iron Ore Mining Company), CAT (Caterpillar), Komatsu, Volvo and Terexare companies from which it source, earthmoving and spare parts for its mining activities.

In other words, if NIOMCO must, start up production again, importing earthmoving equipment cannot be ruled out, despite Nigeria's present unfavorable economic status, in terms of global exchange rates and inflation rate.

1.2 STATEMENT OF PROBLEM

As Nigeria, journeys through a path of economic diversification, by giving attention to her mining sector, it is pertinent that she is guided through this path of economic diversification. In other words, as Nigeria looks up to reviving and sustaining a 'pillar' of her mining sector, taking into cognizance that, importation plays a vital role in rebuilding this 'pillar'. Therefore it is important to project its sustainability on average, in terms profit maximization, especially during this period she battles to keep inflation rate and exchange rate relatively low. This pillar is NIOMCO.

No doubt, the production of iron ore has played a remarkable role, in the sustenance of some industrialized nations of the world today such as Russia, China, France and Australia, as identified in some literatures. But the big question is, how sustaining is iron production in Nigeria's case?

1.3 OBJECTIVE OF STUDY

The recent move by the present administration to diversify, Nigeria's economy, giving attention to the mining sector, which includes NIOMCO's revival, makes it pertinent to expose on average the profitability, surrounding iron ore investment in Nigeria. Therefore, the study seeks to project the profitability accruable to iron ore investment, with respect to the entity's activities, considering the fact, importation of earthmoving equipment (mining equipment) and other facilities is inevitable, if production must start up at NIOMCO.

1.4 DELIMITATION OF STUDY

A projection of the entity's (NIOMCO) profitability will be computed over a period of five years, taking a holistic view of costs incurred on average in running its departments. The current inflation rate of 15.98% and global market exchange rate of \$1 to N359.201 is employed in projection, throughout a five year period. In addition, a 15% interest rate on FGN (Federal Government of Nigeria), CBN (Central Bank of Nigeria). Statistical bulletin is adopted in computing the discount factor, throughout the projection period, owing to the fact, sales of Federal government bonds, is one amongst other source of capital to the government. Worthy of note is, the global market price per ton of iron ore at \$62.59 (N22, 482), is adopted as NIOMCO's selling price, since it sells at the global market, before the halt in production. Included in the computation is the purchase of new earthmoving, due to the exposure of existing ones to long period of rain fall.

1.5 HYPOTHESIS

HO₁: The importation of earthmoving equipment and other facilities to NIOMCO's production is not positive.

1.6 METHODOLOGY

The Net discounted present value (NDPV) will be adopted to test the validity of the above hypothesis and capture the research objective.

1.7 DATA SOURCES AND ECONOMIC SOFTWARE

Data on departmental expenses accruable to the entity, were sourced from the Budget Office of the Federation (Ministry of Budget and National Planning) on 2017 budget proposal. Costs on procurement of earthmoving equipment and other ancillary facilities utilized for iron ore production were sourced from CAT (Caterpillar) catalogue and Machinery trader online catalogue. Microsoft Excel will be employed for data analysis.

II. Review Of Empirical Literatures

According to Downes, Hanslow and Tulip (2014), in their treatment of the effect of mining boom on the Australian economy, estimated the effects of mining boom in Australia using a large scale structural macroeconomic model (AUS-M). It revealed that, the mining boom in Australia contributed immensely to the appreciation, of the Australian Dollar. The boom was also discovered to other industries within Australia to trade, such as manufacturing and agriculture. In addition, the 'Dutch Disease' usually accompanied by boom was discovered to be weak in Australia's case.

In another study by Kurt and Micah (2015), in their assessment of the market structure differences impacting Australian iron ore and metallurgical coal industries, admitted that, steel making depends on iron ore and metallurgical coal as main ingredients. To ascertain the correlation in industrial trade prices of steel making inputs, data on worldwide resource production and trade quantities of crude steel, iron ore and metallurgical coal were collected over past decades. The study discovered no strong correlation in historical trade prices of steel making inputs. It also submits that China's growth in steel production, has increased the global iron ore demand. This was possible by contribution of Australia's increase in the production and supply of iron ore.

According to Awe and Ajayi (2009), on the diversification of Nigeria's revenue base for economic development emphasizes on the necessity of developing an alternative strategy in other to sustain Nigeria's welfare. The study projects the potential of the non-oil export sector. It utilized a time series data of the following variables for evaluation which are; Gross Domestic Product, Revenue from manufacturing, Revenue from agriculture and Revenue from solid mineral. The OLS (Ordinary Least Square) was employed to obtain numerical estimates on the variables of interest to the study. From the investigation, it was discovered that revenue from solid mineral was significant. Revenue accruing to manufacturing was also found to be significant. The outcome was further subjected to co-integration test. In consonance with further outcomes of the study, it submits that over time the government has contributed significantly to the revival of the non-oil sector subject to policy incentives for investors, emphasizing more still needs to be done to fully revive the non-oil sector.

Also, Nwosu & Nwankwoala (2012), examined the influence of some economic parameters on Itakpe iron ore reserve and cut-off grade. It investigates the impact of fluctuation in production cost and prices of iron ore concentrates with reference to the iron ore deposit at Itakpe in Kogi State. In evaluating the impact of some economic parameters such as price and production cost changes on ore grade and ore tonnage, the mathematical formula for cut-off grade estimation was employed. Variables such as grade of ore, price per ton of smelted ore, stripping cost per ton of waste including administrative costs, cost of mineral processing per ton of ore including administrative costs and cost of smelting per ton of ore including administrative costs were employed for evaluation. Investigation revealed that the cut-off grade lowers with increasing price of concentrates. It was also found that when price is constant and the total cost of production increases, the cut-off grade also increases. In addition a price per ton of concentrate was assumed in the study to show the influence of price on the cut-off grade.

Therefore it recommends that for the National Iron Ore Mining Company to operate at its optimum, it needs to adjust its cut-off grade and mineable ore reserve with changing prices of iron ore concentrates and cost of production.

2.1 THEORETICAL FRAMEWORK

In consonance with this study, the theoretical framework employed as a structure for the study in a bid to investigate the research objective is hinged to Keynes Theory of Investment. The theory identifies three major determinants surrounding any investment decision, they are; expectations, costs and returns. According to the theory decisions are made by comparing the marginal efficiency of capital (MEC) also known as the net rate of return or yield with the real rate of interest (r). So long as the MEC is higher or greater than the rate of interest (r), investment in new plant, equipment and machinery is permitted. Moreover the additional utilization of capital in production results in the diminishing marginal product of capital. Once the MEC (marginal efficiency of capital) equates the rate of interest, this point signifies no further investment will be made in any new revenue producing asset (s).

In sum the marginal efficiency of capital is the rate of discount which equates the cost of a fixed capital asset with its present discounted value of expected income. The MEC is calculated using the formula;

$$PV = \frac{R_1}{(1+r)^1} + \frac{R_2}{(1+r)^2} + \dots + \frac{R_n}{(1+r)^n} - \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} \dots \frac{C_n}{1+r^n} \dots \dots \dots (1)$$

Where, PV = Present value of expected return or gain from a project or investment,

R₁, R₂, and R_n = Expected cash flows from the investment on a machine or asset for the first year, second year and subsequent period the machine or asset is to be utilized, (r) is the Market rate of interest rate which equates the cost of a fixed capital or asset with the present value. C₁, C₂, and C_n = Non- recoverable expenditures or costs made on the investment of an asset in the first year, second year and subsequent periods the machine or asset is to be utilized.

2.2 MODEL SPECIFICATION

With respect to this study, the model employed is adapted from Akande & Adebimpe (2011) in their investigation of the engineering economy of Itakpe Iron Ore Deposit. For this study, the equation meant to capture the study's objective is specified as;

$$NDPV_{NO} = \frac{\beta_1}{(1+r)^1} + \frac{\beta_2}{(1+r)^2} + \frac{\beta_3}{(1+r)^3} + \frac{\beta_4}{(1+r)^4} + \frac{\beta_5}{(1+r)^5} - \frac{\epsilon_1}{(1+r)^1} + \frac{\epsilon_2}{(1+r)^2} + \frac{\epsilon_3}{(1+r)^3} + \frac{\epsilon_4}{(1+r)^4} + \frac{\epsilon_5}{(1+r)^5} = 0 \dots \dots \dots (2)$$

Where; NDPV_{NO} = Net discounted present value or worth of NIOMCO's operation taking into account importation of earthmoving equipment. **β₁ through β₈** = on average the total returns before tax obtainable from utilizing importation of earthmoving equipment for NIOMCO's operation throughout a period of five years. **ε₁, through ε₅** signifies on average total costs accruable to NIOMCO's operation. Applying the summation notation to equation (2) above, equation (2) can be re-written as;

$$NDPV_{NO} = \sum_{t=1}^n \frac{\beta_t}{(1+r)^t} - \sum_{t=0}^n \frac{\epsilon_t}{(1+r)^t} = 0 \dots \dots \dots (2.1)$$

Costs includes exploitation and processing costs, procurement of earthmoving equipment and administrative costs.

2.3 PRESENTATION OF RESULTS

Table .1: Estimated cash outflow for iron ore production for five years in US' (\$)

Source: Excel Computation

s/n	Items	Start of 2017	2017	2018	2019	2020	2021
1.	Initial capital	15,929,274,973.6034	-	-	-	-	-
2.	Personnel cost	-	4,197,407.84	4,197,407.84	4,197,407.84	4,197,407.84	4,197,407.84
3.	Miscellaneous Expenses @ 15.98%	-	1,614.416432	1,872.400178	2,171.609726	2,518.63296	2,921.110507
4.	Utilities	-	16,862.3862	16,862.3862	16,862.3862	16,862.3862	16,862.3862
5.	Maintenance@15.98%	-	10,525.99519	12,208.04922	14,158.89549	16,421.48699	19,045.64061
6.	Supplies@ 15.98%	-	2,195.60636	2,546.464256	2,953.389244	3,425.340845	3,972.710312
7.	Repairs@ 15.98%	-	191,469.7514	222,066.6177	257,552.8632	298,709.8107	346,443.6384
8.	Explosives@ 15.98	-	8,567.48904	9,947.011989	11,536.5445	13,380.08431	15,518.22178
9.	Diesel@ 15.98%	-	6780.549052	7,864.080791	9,120.760901	10,578.25849	12,268.6642
10.	Production cost@15.98%	-	225,686,684,700	261,751,416,900	303,579,293,300	352,091,264,400	408,355,448,500
11.	Production electrical cost	-	1,074,074,074	1,074,074,074	1,074,074,074	1,074,074,074	1,074,074,074
12.	Security services	-	9,743.8482	9,743.8482	9,743.8482	9,743.8482	9,743.8482
13.	Cleaning & fumigation@ 15.98%	-	6,457.665764	7,487.600753	8,686.438953	10,074.5319	11,684.42952
14.	Local training	-	1,391.978307	1,391.978307	1,391.978307	1,391.978307	1,391.978307
15.	Transport& trips@15.98%	-	16,144.1644	18,724.00187	21,716.09737	25,186.32973	29,211.10522
	TOTAL	15,929,274,973.6034	226,765,227,935.7	262,829,999,096.3	304,657,920,676.7	353,169,944,174.6	409,434,189,045.6

Table .2: Cash flow for iron ore production for five years in US' (\$)

Year (s)	2017	2018	2019	2020	2021
Revenues@ 15.98%	537,717,644.4	623,644,924	723,303,382.9	838,887,263.5	972,941,448.2
Cash outflows	(226,765,227,935.7)	(262,829,999,096.3)	(304,657,920,676.7)	(353,169,944,174.6)	(409,434,189,045.6)
Net cash flow	-\$226,227,510,291.3	-\$262,206,354,172.3	-\$303,934,617,293.8	-\$352,331,056,911.1	-\$408,461,247,597.4

Source: Excel computation

Table. 3: Net Discounted Present Value of Iron Ore Production in US'(\$)

Years	Start of 2017	2017	2018	2019	2020	2021
Initial capital	(15,929,274,973.6034)					
Net cash-inflows	-	537,717,644.4	623,644,924	723,303,382.9	838,887,263.5	972,941,448.2
Net cash-outflows	-	(226,765,227,935.7)	(262,829,999,096.3)	(304,657,920,676.7)	(353,169,944,174.6)	(409,434,189,045.6)
Discount factor @15%	1	0.8696	0.7561	0.6575	0.5718	0.4972
Net cash flow	-	-226,227,510,291.3	-262,206,354,172.3	-303,934,617,293.8	-352,331,056,911.1	-408,461,247,597.4
Present value	(15,929,274,973.6034)	-196,727,442,900	-198,254,224,300	-199,837,010,800	-201,462,898,300	-203,086,932,300
Net present value	-\$1,015,297,783,573.6					
Naira equivalent (NPV)	-N364,695,979,157,420.7					

Source: Excel computation

III. Discussion And Summary Of Results

Tables 1 and 2 presents a projection of cash outflows and cash flows accruable to NIOMCO's iron ore production within a span of five years. The initial capital comprise of mining equipment and ancillary facilities needed for NIOMCO's operation. Material costs and revenue were adjusted for inflation. Net cash outflows in Table.3 were discounted at a 15% interest rate. In Table 2. Revenues (gross) through the five years projection period increased significantly but were insufficient to cover expenses through the projection of five years. In effect, this yielded negative present values, throughout the period, as present values accruable to NIOMCO's

production on average, declined progressively through the years of projection, as shown in Table.3. Also in table.3, the summation of present values through a five years period resulted in a negative net present value. Hence, HO_1 , is deemed valid. In addition, it will be observed that, the computation in Table. 3 did not account for the residual value accruable to mining equipment. According to Adebimpe and Akande (2011), the iron ore reserve at Itakpe has an estimated life span of 27 years. The entity's operation has been off and on, which have not lasted ten years. Now, the federal seeks to revive it. By implication the idea of generating revenue through the sale of mining equipment at the fifth year is inadequate. For this reason the residual value takes zero, as a value.

In summary, if inflation rate remains at 15.98% or further increases, global price of iron ore stands at \$62.59 or further declines with a global market exchange rate at \$1 to N359.201 within a period of five years, revenues generated on average within this period, will be insufficient in sustaining NIOMCO's operation within a projected period of five years. With 'all things being equal' it will not be profitable for the entity to sell at the global market, as the entity will be at a loss.

3.1 RECOMMENDATIONS AND CONCLUSION

The entity should be privatized by the Federal government to foreign investors, with financial and technical capacity to withstand, expenses emanating from NIOMCO's operation. It is also imperative that the Federal government grant a tax relief of five years to willing foreign investors, in order to cope with the vulnerable nature of Nigeria's economy, in terms of material expenses. In addition, if the entity must start up, a new price has to be set to absorb costs on average, in other to sustain its running expenses over time.

In conclusion, Nigeria's mining sector still remains a 'toddler', as over 70% of her mineral reserve are unexplored, Premium Times (2016). Hence, it is imperative that more researches relating to Nigeria's mining sector are carried out, especially on how to cope with iron ore production, in a society like Nigeria, irrespective of the multiplier effect globally accompanied by iron ore production, as presented in some literatures.

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