



Modular plants

A solution for mining in Nigeria

Background

Prior to the inauguration of President Muhammad Buhari as the President of the Federal Republic of Nigeria, he expressed the commitment of his administration to ensure that Nigerian economy is diversified. As part of the diversification process, the solid minerals and agricultural sectors were both consistently identified as two key sectors that will play a major role in the diversification of the country's economy.

The need for the diversification of the economy is also necessitated by the crash in the oil prices, which has had a major impact on the country's revenue, with the country's GDP dropping from USD569m in 2014 to USD481m in 2015 (Trading Economics, 2016).

In fulfilling this mandate to develop this sector, President Buhari appointed Dr. Kayode Fayemi as the Minister of Solid Minerals in November 2015. At the mandate of the President, Dr. Fayemi moved

swiftly into action, giving an inaugural media briefing of the ministry on 21 December 2015, titled, *"State of the Solid Minerals Sector and Way forward"*.

The speech demonstrated that within a short time in office, the Honourable Minister had undertaken a quick diagnosis of the sector, identifying the external (International/global) and internal (local/country based) challenges that have undermined the development of Nigeria's mining

sector, whilst also laying out the vision of the government for the sector.

In addition, the Honourable Minister inaugurated a committee on 1 March 2016, which was tasked with drafting a roadmap for the development of the solid minerals sector. The committee co-chaired by Prof Ibrahim Garba and Prof. Siyan Malomo submitted a draft of the roadmap report to the Minister on 31 March 2016. The report which is currently undergoing a consultation process already has a Mining Implementation Strategy Team (MIST) constituted to oversee the execution of the road map.

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In spite of the government's will to develop this sector, it must be noted that it is the private sector participation that will ultimately boost real development in the sector, whilst government's main responsibility will be to provide an enabling environment for the development to attract serious local and foreign investors.

Traditional Mining Development

Mining companies in the past have tended to adopt a large-scale end-to-end mining and processing development methodologies. The timeline to the start of production has typically been between 8 and 15 years and would have followed the traditional cycle of exploration, evaluation, plant design, project development and project commissioning. It must be noted that the environment has changed and companies are, or should be, fundamentally rethinking the historical methodologies applied in

project developments and processing.

The most impactful change in the mining environment is that the sector is experiencing some of the lowest commodity prices in years. This has led to a number of large mining companies selling off their non-core mineral assets, whilst medium and junior mining companies are experiencing a liquidation of their mineral assets.

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Other changes include increasing production costs, with the costs of power/electricity, among many other costs, all going up. This is further compounded by the fact that mining projects of acceptable grades are now increasingly located in remote areas with little infrastructure, as is the case with a number of prospective mineral assets in Nigeria.

In addition to all of the above, access to capital has also continued to be a challenge faced by all players in the sector. Its effect has however been more severe for junior and mid-tier mining companies, which may not have the reputation or assets to attract the required funds.

This article focuses on a smarter alternative processing method which reduces the typical mine development life cycle and also requires less capital at a given time when compared to historical methodologies.

Modular Plants

We are of the opinion that it is time for a paradigm shift in the industry. This can be achieved by introducing smaller, scalable and modular processing plants which are suited for the current distressed industry and particularly suitable to the mining sector in Nigeria.

The plants are modular in that companies can include various modules that offer downstream processing to the level desired. At a minimum, this would include a base scrubber, but could include various crushing, grinding and concentrating modules that can be added to the plant as and when needed.

The plants are also scalable in that many small plants can be introduced, so that each run in parallel.

Mineral companies would also have the opportunity to start their projects quickly through the use of readily available processing plant items that can be quickly adjusted to mining companies' needs rather than be purpose made. Though this would result in lower recoveries than would typically be achieved through a purpose-made plant, the use of off-the-shelf technologies (with some modifications), will easily reduce the typical mine development cycle to between 6 to 12 months from the proven mineral resources stage rather than the longer timescales that have been associated with process plant development.

The phases in the development cycle for modular plants typically includes gravity recovery test-work, resource categorisation, plant choice/building, execution and commissioning of a ready-made plant that can be shipped and then installed on site within 4 days. Such a plant could process as little as 3tph to as much as 250tph of ore. These modular plants are significantly smaller to the current large scale plants which process between 250tph to 1000tph of ore.

Conventionally, the aim has been to achieve the highest recovery possible, but the capital and operating costs associated with that might make the operation loss making. Recoveries with a modular plant can be 66% compared to the 95% one would expect from a more complex plant, but the total costs might be as low as one fifth.

Modular plants therefore allow mining companies to get a return earlier in the project lifecycle with less capital outlay traditionally required. The returns can then be used to fund expansion, including the introduction of additional mine infrastructure, and in some cases the development of an underground mine after an initial period of opencast mining or acquisition of additional end-to-end modular processing plants/overall recovery improvement.

The modular and scalable model of processing plant design also offers mining companies the flexibility to 'right size' their projects for adverse market conditions, such as the one that is currently being experienced globally. Downstream modules of a processing plant can be shut down as can complete processing streams, where multiple plants have been established alongside one another.

The shutdown of downstream processing units or of entire processing streams would enable mining companies to optimise their processing to cover the costs that they need to recover to stay in business during economic or commodity-price downturns. This approach would allow companies to only mine a fraction of their orebodies and resume higher levels of production when commodity prices recover.

Modular Plants & Operational Risk Management

Modular plants are also important in a mining environment in which "resource control" and early-production requirements are becoming important realities for mining companies to consider. This is not unique to the African mining environment, and is true of many mining jurisdictions. Mining companies are uncertain of their long-term mineral tenure in some countries, and judge it prudent to roll-out their mining plans in a phased way that would not expose them to high financial risk in the event of their tenure being compromised.

Modular Plants & Artisanal Miners

Without doubt, Nigeria, like many countries endowed with mineral deposits, is faced with the challenge of artisanal miners, who beyond



Artisanal Gold Processor

degrading the environment and exploiting the country's mineral deposits, also endanger their lives and that of their communities.

Considering the fact that the challenge of artisanal miners is a

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Modular Plants & Project Economics

The processing model that has been commonly used in the mining industry is one in which ounces (as in the case of gold) were processed for the sake of ounces. With modular plants, this processing philosophy is turned on its head and it becomes important to do a trade-off study to determine the optimal design parameters. This will help determine the cost per percentage recovery.

complex one, government can play a major role of integrating and institutionalising the artisanal miners by providing them with modular processing plants that will assist them in safely processing their mined ores. This can be done through cooperatives and other communal initiatives.

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Conclusion

Modular plants have already been set up in other parts of Africa, including in Cameroon, Zimbabwe and South Africa. These plants have been proven for the processing of minerals that require physical separation methods, such as gravity separation, rather than chemical processing. These minerals are typically the higher grade and lower tonnage output commodities like gold, diamond, gemstone, tin, chromite, tantalite, etc.

We are therefore of the opinion that innovative technologies such as the modular processing technology, which aids quick start operations, more cost effective and adaptable for higher grade commodities, are a worthwhile option that the government and mining companies, particularly local investors, should consider in order to jump-start increased economic activities in the this sector in Nigeria.

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