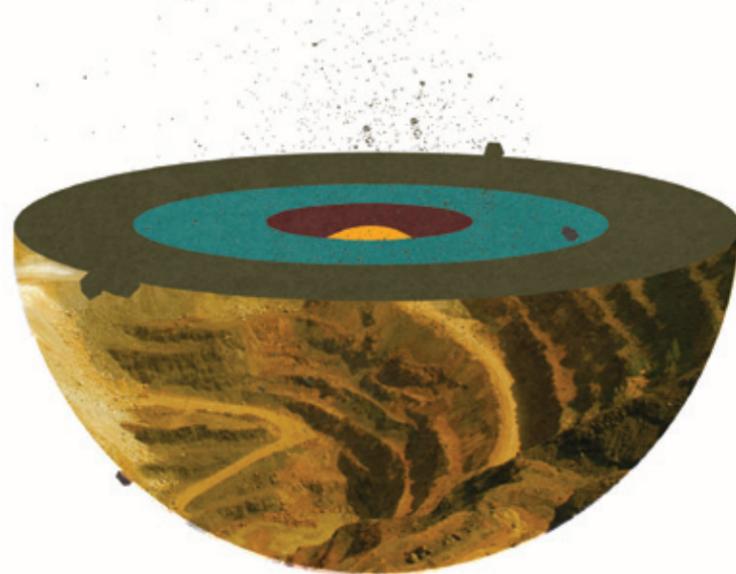


THE NEW JOURNEY TO THE CENTER OF THE EARTH

Mining in the new world



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Did you know that 70 elements out of the periodic table's 118 elements are used in making the iPhone that we use! It is not surprising then to know that 40% of the global economy is directly or indirectly dependent on the mining sector.¹ Today, driven primarily by large scale industrialization, urbanization of emerging economies and advances in consumer technology, we are witnessing the biggest boom in the global mining and energy industry in the last 50 years. This demand for metals and other mineral resources is predicted to continue to rise in coming decades as more and more nations join the growth story. However, the mining model that most companies

operate under has not seen a significant "step-change" in the last 20 - 30 years. This has been partly driven by a super cycle of profits and therefore no real 'compelling event' to evolve.

Challenges plaguing the sector

There are a host of challenges plaguing this sector ranging from a lack of investments in innovation, financial unsustainability due to stringent environmental regulations and a shortage of skilled talent. For example, the annual investment in innovation

is only 0.2% for mining,² but this scenario is set to change. As we enter a period of lower margins, higher costs and a longer-term need to scale up to meet the requirements of the new world, mining companies will be forced to review investments in innovation.

The recent drop in the Iron Ore spot price has highlighted the volatility of the market and, due to their high internal costs, exposed companies that have previously been profitable. Spot pricing means being in the lowest cost quartile is more important than ever, and may even mean continued existence. In addition to these challenges, the industry must also contend with issues like accessing ore bodies at increasing depths, in more remote locations or in more extreme environments. Further compounding these challenges, is the increasing external stakeholder & environmentalists' scrutiny.

The next few years in mining will be about extracting higher margins in an environment of escalating costs, and may be more demanding than the last 50 years. The ability to do business better lies with companies that respond to these changes.

Background and Drivers for Change

Mining is increasingly becoming more difficult with traditional tools and execution models. This is being driven by several factors:

- » Established mines, which have historically been relatively close to the surface, are increasingly being forced to go deeper.³ For example in South Africa, it is forecast that by the year 2015, 40 per cent of South Africa's gold production will be sourced from depths greater than 3000m.⁴ It is expected that this will have a significant impact on costs including heat, energy and water management.
- » Easily accessible ore bodies of high grade have already been found.⁵ While ore bodies of lower grade are progressively being considered, the recovery costs associated with using existing mining tools and technologies will not support the business case for developing a traditional mine.
- » New deposits are increasingly being found in areas that are

more inhospitable and exposed to more extreme conditions (altitudes, weather, seasonality etc.).

» As miners establish operations in remote locations, access to skilled resources in these environments is becoming more difficult. The Mining Industry Human Resources Council (MIHRC) estimates show that about 40% of the resource extraction industry's workforce is at least 50 years old and one third of them are expected to retire by 2022. Under current models, many of these skills and resources are required "on site". Therefore organisations are constrained by availability of skills or, alternatively must face rising costs and additional complexity to access these critical skills.

» The marketing model is moving from supply driven, where the focus has traditionally been on driving efficiencies of "disconnected" phases of production, to demand driven where the focus is on agility and the ability to alter and control integrated production (end-to-end) to meet customers changing demands (blending etc.).

The problems identified are significant and simply doing the same things faster or "scaling up" existing models and equipment will not work in tomorrow's mine.

Meeting the challenge

To meet the challenges identified, the mining industry must learn from industries that have faced similar problems (e.g. Oil and Gas). Below are a few steps to consider when future proofing your mining company:

STEP 1 CHANGE THE MINDSET OF MINERS

The single and most important change required for mining companies is the culture within the organisation. These companies need to start with a 'clean sheet of paper' approach to their business models. The first question to ask should be if they started their business afresh today, knowing what they know now, and knowing what is possible, would they construct their business the same way? Some old school thinking they need to remove includes:

- » A need to have dedicated resources on site
- » Being close to the operations to be considered "real miners"

1. <http://nordicinnovation.org>

2. <http://nordicinnovation.org>
 3. <http://online.wsj.com>
 4. <http://lib.hpu.edu.cn>
 5. <http://www.csiro.au>

» Having operators who work on computers exclusively on site for no reason

» This is the way we've always done it.

A new operating model will only be considered when the business acknowledges that the old model cannot continue. To do business better in the new world, the mining model must change, and this change must be significant.

STEP 2 DESIGN A NEW OPERATING MODEL

This involves, but is not limited to a review of processes, educating and communicating proposed changes to staff, and potentially implementing changes to the management structure and internal capabilities. A new operating model should be designed around these principles.

» To get to this new world of mining, we will need to make some hard decisions

» Staff will only be permitted on site if they need to physically touch something that cannot be eventually automated or managed remotely

» All necessary information will be available in a collaborative environment, remote from the mine

» We are miners, implementing the new model will be difficult, and we will need support to design and ensure this change occurs

STEP 3 STANDARDISE WHERE POSSIBLE

While traditionally, areas such as process design, engineering and safety have been geographically siloed with bespoke solutions and processes, tomorrow's mine will focus on standardisation and consistency. More specifically, the future of mining will emphasise standardised management of the Mining/Manufacturing Execution Systems (MES). This approach will bring significant advantages to the areas of mine planning, and operations. Advantages of this approach include:-

» Simplification of procurement and associated cost management

» Increased flexibility in staff deployment and management

» Reduced mine design and build times

» Reduced staff training and more consistent performance, reduced risk around accessing staff with specialised "critical" skills

» Standardised operational data from mining systems and processes

» Increase confidence and consistency in management of safety, CSR, governance and management of the environment (energy and water etc.)

We see this maturity of mining systems following the same evolution and development of ERP systems from one that was initially managed internally and perceived to be unique, to an externally provided service that is integrated and commoditised.



STEP 4 INTEGRATE AND GAIN A FULL VIEW

A significant advantage of establishing a standard MES layer within the organization's mines is that the miner is now more easily able to consistently integrate and coordinate all phases of mining operations. Similar to the way that other industries used ERP implementations to gain a full end-to-end view of previously independent non-core activities, tomorrow's mine will provide the ability to coordinate and manage all phases of mining operations from a single, integrated system. This integration and standardisation both relies on, and will provide better data, and better data allows deep investigation and sophisticated analysis techniques to identify hidden patterns and relationships between process elements. Advantages of this approach include:

» Elimination of "butterfly effects" where independent processes are managed in isolation of impacts to other parts of the mining operation

» Improve efficiencies and reduce costs through better understanding and measurement of the relationships between production systems

» A single view across all mining assets allowing increased ability to respond to market demands (product agility), load and cost management.

STEP 5 AUTOMATE AND CENTRALIZE CONTROL

The future of mining is likely to be in a more remote or extreme locations. Underwater mining for example, is increasingly becoming more commercially viable based on technology advances. Irrespective of the conditions, tomorrow's mine will be based on managing operations with less people on site.

Automation and robotics will play a significant role in mine operations. Similar to the challenges faced by the aerospace industry, miners will need to establish centralized operations centers to manage and control remote systems. It is expected that the implementation of automated systems along with the establishment of remote operations centers in capital and/or major cities will bring significant advantages including:-

» The increased ability to attract experienced staff to work in major cities as opposed to remote mining centres. Remote Operations Centres will provide a 24x7 manned operation in city locations and drive optimisation of staffing both on site and in the back-office.

» Increased safety and production growth based on remotely operated equipment and the move from human to machine based labour and systems

» Improvements in energy, water and waste management through improved automation and monitoring

As identified, the mining industry is in a position to learn from other industries and to implement significant improvements in the remote management of operations. Many lessons already exist for designing, building and running Remote Operation Centres from the Oil and Gas industry. ■

CONCLUSION

The next few decades will witness increased global demand for almost all metals. The rapid growth of population and resource intensity will put pressure on miners to bring more capacity on line. Tomorrow's mines will almost certainly need to have fewer humans resulting in greater efficiency, lower costs and improved safety and environmental performance. But this will rely upon standardised, integrated and automated systems that can manage remote sites. This urgent change is upon us, we need to plan for it today to do business better tomorrow.