The Future of Mining in South Africa

Innovation imperative

The burning question for Mining companies globally and in South Africa is how to grow sustainably and deliver a return to their stakeholders.

Local mining companies and internationals with significant local assets manage unique South African operational complexities while still operating in the context of global pressures. We believe a step change in every respect of the current business is required for survival.

Mining companies face challenges to profitability in the form of unfavourable commodity prices and tougher mining conditions. While commodity prices have improved since their 2008 lows, prices remain stagnant or falling, limiting revenue potential for mining companies. Declining ore grades at current depths also mean that mining companies have to mine deeper to reach new deposits, significantly increasing the cost of extraction. Since the start of 2000, over 75% of new base metal discoveries have been at depths greater than 300m. Mining at these depths also introduces additional safety issues due to the high risk of rock falls, flooding, gas discharges, underground earthquakes and ventilation problems.

To an even greater extent than their global counterparts, South African mining companies’ margins are under pressure. The combination of stagnant or falling global commodities prices and rising input costs are forcing mining companies to make difficult decisions in an attempt to sustain short-term operations, while still aligning these decisions with long-term objectives. In particular, labour and energy costs have exceeded inflation. The annual “strike season” is characterised by ever-increasing demands by unions and mine workers who may not have a full appreciation of the challenging operating environment that mining companies face. Above the requirements of workers, there are rising demands by government and civil society as to the role mines should play in society. There is a real need to find new ways to deal with labour as drivers are pushing towards upskilling and mechanisation in an effort to improve the working environment and reduce dependence on large quantities of low-skilled labourers.

Government increasingly expects mining companies to fulfil social needs typically addressed by government in developed countries, such as the provision of basic services, education and healthcare. These expectations are often not clearly defined, and are compounded by local community demands for employment opportunities, skills development opportunities, education for their families and modern healthcare facilities. The perception of a lack of (or inadequate) progress in these key areas is often met with vocal opposition, strikes and unrest. This can have a significant impact on project development through costly operational delays and reputational damage to mining companies. There is a need to improve the social dividend in an environment where we employ less people as a result of upskilling the existing labour force and create more upstream employment opportunities.

South African mining companies require a deep understanding of shifting community and government expectations and a commitment to a high level of transparency and operational sustainability to address the demands of relevant stakeholder groups. While the government has ultimately declared it has no short-term agenda to pursue resource nationalisation, resource nationalism is not unique and is here to stay.
Innovation is the new key to survival. It’s about more than just cost control. Incremental improvement is no longer enough to sustain this sector. This explains why many leading organisations are rallying behind the innovation imperative.

90% of innovation efforts fail. There are no shortages of ideas, but it’s about finding the right ones and delivering a result. Innovation goes beyond technology. There are a myriad of ways and places to innovate. No single innovation will solve the problem on its own. You need to consider the whole system. Including the socio-economic system.

It is rapidly becoming clear that innovation can do much more than reduce capital intensity. Approached strategically, it also has the power to reduce people and energy intensity, while increasing mining intensity.

Capturing the learnings
The key is to think of innovation as much more than research and development (R&D). While exploratory R&D has the power to streamline processes in the future, innovation revolves around companies’ current capacity to adapt practical applications that already exist in other industries and apply them to fit the needs of mining companies today.

For instance, the tunnel boring machines used by civil engineers to excavate the Chunnel can vastly reduce miners’ reliance on explosives. Until recently, those machines were too large to apply in a mining setting. Some innovators, however, are now incorporating the underlying technology to build smaller machines - effectively adapting mature solutions from other industries to realize more rapid results.

Re-imagining the future
At the same time, innovation mandates companies to think in entirely new ways. Traditionally, for instance, miners have focused on extracting higher grades and achieving faster throughput by optimizing the pit, schedule, product mix and logistics. A truly innovative mindset, however, will see them adopt an entirely new design paradigm that leverages new information, mining and energy technologies to maximize value.

For decades, mining companies have understood the imperative to adopt technologies to accelerate automation and reduce fatalities. That explains why leading companies continue to look at new technologies—such as nanomaterials, 3D printing, modular design, robotics, bioengineering and alternative haulage—in an effort to further improve operational performance.

In today’s world, however, value is measured on more than these metrics. To improve long-range planning and forecasting, companies must explore emerging information technologies, such as cloud computing, embedded logic, sensors, GPS systems, cyber security, big data, simulation modeling and 3D visualizations. To reduce emissions and accelerate electrification, they must also look towards energy technologies such as advanced materials, energy storage, smart grids, renewable energy conversion, superconductivity, non-detonating solutions and high-energy lasers.

By integrating mining, energy and information technology into mine and process design in an innovative way it is possible to achieve radical performance improvement breakthroughs.

This approach is applicable to new and operating mines. First create a lean mine and then enable high performance with information technology.

Integrated system design typically leads to new performance levels that are not possible on an incremental basis.

By focusing on maximising value for the environment and society as part of the mine and process design, new levels of improvements in value to shareholders are created in a substantial and sustainable way.

With a system of interconnected components and processes it is often easier, less risky and more profitable to solve many problems at the same time.
Taken together, these technologies can help companies reduce people, capital and energy intensity, while increasing mining intensity.

By integrating mining, energy and information technology into mine and process design in an entirely innovative way, miners can achieve radical performance breakthroughs. They can improve safety standards, save money, optimize their energy mix and vastly enhance operational performance. To achieve these big breakthroughs, however, miners must articulate a bold vision of the future, one that hinges on achieving radical leaps rather than incremental shifts.

Innovative thinking needs to influence the way we engage with workers, government, community and all other stakeholders. New solutions need to be found to improve and prepare us for delivering in a changing employment landscape.

As mining companies begin to apply innovation to their full operational ecosystem, they stand to realize significant gains. Here are some ways to accelerate this process:

**Think big, test small and scale fast.** Because mining companies typically prefer to test new systems at scale, they frequently take a narrow focus to system upgrades to keep costs constrained. Innovators turn this formula on its head by looking at the components of an entire system to uncover the biggest opportunities for structural improvement and then running small tests to establish proof of concept. This allows companies to cost-effectively eliminate operational risk before rapidly scaling to realize big gains. With modular technologies, the advantages conferred by economies of scale disappear, allowing companies to think big, test small and scale fast.

**Leverage emerging technologies.** New technologies hold the promise of vastly altering mining sector fundamentals. 3D visualization tools can help companies track their people, equipment and changing environment at each mine site, in real time. New mineral processing technologies are emerging to reduce the safety hazards associated with gold extraction and to unlock previously uneconomic mineral deposits. Social media is helping companies to facilitate electronic booking at mine sites and enhance employee access to information, no matter where they’re located. Some companies have even launched SMS messaging platforms as a way to foster two-way communication with employees, solicit feedback and improve workforce engagement. New production and logistics technologies also promise to reduce both the use of natural resources and emissions. For instance, when up and running, Vale’s S11D project’s mine and plant in Carajás, Brazil will consume 93% less water, use 77% less fuel and produce 50% less greenhouse gas emissions than a comparable operation using conventional methods.

**Become part of an innovation ecosystem.** Organisations cannot develop an innovation strategy in isolation. To drive true industry change, miners should consider entering alliances or joint ventures with technology providers and other companies already taking steps to harness organisational intelligence. By pooling talent, ideas and insights, collaborative organisations heighten the odds of identifying innovation breakthroughs capable of benefiting all industry players.

**Prepare for new operational realities.** By fundamentally altering industry realities, innovation often threatens the status quo. This mandates mining companies to think through its implications in advance. As companies rely increasingly on automation, for instance, they will likely require fewer mine workers. While this will improve safety, it can also raise community concerns in countries where mining is seen as a creator of employment. As such, in the future mining companies must consider other ways to create jobs by using its purchasing power to spread mineral wealth and provide social benefits across a broader community ecosystem.
Conclusion
Innovation can drive more than cost reduction. It can help mining companies mitigate and manage risks, strengthen business models and foster more effective community and government relations. It can help mining services companies enhance their value to the industry by developing new products and services. Longer-term, it can even position organisations to move the needle on such endemic issues as corporate social responsibility, environmental performance and sustainability. Mining companies need to be prepared for divergent future scenarios where collaboration is a key component and consider how to move from business of today thinking to business of tomorrow success.

What could a mine look like in the future?