



The future of mining

An update on technology and what to expect in one of South Africa's foundational industries

There will always be two sides to a story, and the predictions about the future of mining, especially in South Africa, are no different. There are the nay-sayers who don't see any positive indicators of a bright future for mining, and those who claim that, on the contrary, it is has never been better.

With the latest technology available and a new way of doing business, the mining industry can be safer, more productive and even more lucrative. This is an overview of what can be expected in the future of mining, the latest technology available now, and how mining business should change for the best.

Reality check

First, we need to take a step back to look at the hardships in the industry and the reasons why mining is experiencing a tougher time now than about six years ago. Prof Fred Cawood, director, Wits Mining Institute, recently shared



"21st Century mining is a new game" – Prof Fred Cawood, director, Wits Mining Institute

his knowledge in a presentation called *21st Century Mining: Side-Stepping Mining's Demise in South Africa*. In this presentation, Prof Cawood states that falling commodity prices bring hard times to mining and can cause its demise. He also states that there is a limit to how (good) ore bodies can help to survive hard times.

"But, something is wrong! Rising commodity prices are no longer bringing good times to South African mining. In a country like South Africa, not only its ore bodies and mining companies must be competitive," says Cawood.

Competitiveness seems to be a solution that can revive mining to a steady state, albeit not to its former glory. If each mining company in South Africa is productive, competitive and showing profit, then the South African economy can grow again, as mining is one of the foundations on which the economy is built.

New business model

If being competitive is a road to better business, the question is: how can mining companies and mining houses be more competitive? The main message from Prof Cawood's presentation seems to speak of doing business differently in the future, to embrace new technology and innovation, and increase safety.

"The short answer is – any technology that will put distance between mine workers and risk. Examples of technology include underground drone applications to mining, reliable, multi-purpose (two-way) communications systems for the underground environment, and software applications to mining," explains Cawood.

According to Cawood, to change the future of mining, a number of industry issues must be altered.

- Companies either have to grow reserves or go remote.
- If infrastructure is not improved, it will continue to restrict growth.
- Improvements in sustainable development objectives are needed.
- Competitive prices are required.
- State participation is a must in the mining industry.
- Technology-intensive mines must be prioritised.
- Less worker vulnerability is necessary.

A different world

In short, Cawood says that the mine of the future will be and look different, will be funded and managed in new ways, will require different skill-sets and will be staffed by new professions that do not exist today.

"As humanity, our journey over time has been 'disrupted' by technology several times. In the beginning, man was machine. During the agricultural revolution, which started around 8,000 BC, man wanted machine. In the industrial revolution, which started around 1,760 BC, machine was man's muscle. The information revolution started around 1940 and during this period machine made man happy – or sad. Now, in the 4th industrial revolution, information is forward-looking, smart and visual: machine is almost man," explains Cawood.

He adds that the result at the start of the 21st Century is a sustained increase in standards of living around the world over time. With that, a mechanised, digital world full of machines is generating a lot of instant information. "This world of technology is going underground ... and we cannot stop it. Machines already do work for us where we 'instruct' from a safe space, and with machine becoming man, man must become smarter," warns Cawood.

"There will be people underground in the future, but there will be fewer than today. Mines must create more benefit for all, but for that we need realistic commodity pricing models. We also know that a 21st Century mine is a technology-intensive mine," says Cawood.

Noddy McGeorge, principal mining engineer, SRK Consulting, says that there are a range of world-class technologies in place in South African mines – depending on the mining conditions – which make life easier and safer for workers.

"In open-cast environments, this can be taken to another level – with autonomous trucks and loaders being operated by drivers who don't even need to be on the mine site. This also allows for a broadening of workers' skill-sets and creating more interesting job functions," says McGeorge.

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“Developments in electronics and digital communication have made proximity sensing – which is now regulated in SA mines – more effective and versatile. This makes it easier for operators to focus on their core function, as the proximity sensing can help minimise the risk of contact between machines, or between machines and workers.

“While not a specific technology, there has been a marked change in management philosophy in mines, which prevents any work being authorised without the appropriate tools; today’s training emphasises that the right equipment is vital before any activity can be initiated,” says McGeorge.

Mine modernisation

Another question: what does mine modernisation mean for a country like South Africa?

“First, we need to understand our mining-specific problems, like deep mining at high costs. Next, we must understand our country’s problems, like poverty and its link to mining. Then, mine modernisation becomes difficult because the political economy for mining is ‘charged’ and industry is cyclical. These issues make it difficult to invest aggressively in mine modernisation,” says Cawood.

While deep, narrow-reef underground mines in South Africa have been traditionally difficult to mechanise or automate, there are steady advances in underground technology, according to Marcin Wertz, partner and principal mining engineer at SRK.

“It should be remembered, however, that older mines are difficult to ‘retro-fit’ with new systems and equipment. It is preferable to base a mine’s initial design on modern technology so that systems can integrate more effectively. Opencast mines present fewer constraints to modernisation,” says Wertz.

Embracing mine modernisation

With a few changes, South African mining stakeholders can make a huge difference. But one of the biggest changes lies in embracing mine modernisation.

“Machines and sensors are now doing what people did in the 20th Century. In the future, technology systems will become more than that. We need to implement the roadmap for mine modernisation in South Africa, adopt and adapt new technologies for intelligent mining systems and decisions, and we need to develop comparative statistics for technical and machine efficiencies,” advises Cawood.

“While automation holds opportunities for mining, it also carries a range of new risks. Not least among these is the question of responsibility or liability when automated

In the future, mining will be managed from a control room



Robert Armstrong,
partner and
principal geologist
(geotechnical), SRK
Consulting (SA)



Andrew van Zyl,
partner and principal
consultant, SRK
Consulting (SA)



Marcin Wertz, partner
and principal mining
engineer, SRK
Consulting (SA)



processes fail for one reason or another,” says Andrew van Zyl, partner and principal consultant, SRK.

He adds that it takes time to safely roll out new technologies in the working environment, and to fully address the details of application.

Conclusion

“Despite a long history of extensive mining, South Africa still has good future mineral potential. Sustainability within the mining industry will come about if we lure capital into mining with an enabling investment framework,” explains Cawood.

He adds that anything ‘digital’, including big data handling, is part of the 4th industrial revolution, and it is influencing mining in many ways. For example, new technology allows for:

- real-time collection of data of all types.
- real-time analysis of big data warehouses for decisions of all types along the entire mining value chain.
- better economics, health, safety and mine security.
- realisation of industry goals on zero harm and waste.

Wertz says that many new technologies related to improved methods of collecting and using data, allow mining companies to modernise the way that mines are

planned or operated – by speeding up certain processes and improving the use of data in making better decisions.

Robert Armstrong, partner and principal geologist – geotechnical, SRK, says that technologies such as photogrammetry, for instance, enable safer mapping of pit slopes and allow the mapping of geological features on areas that are not accessible.

“This results in greater quantities of quality data, which require the use of spatial databases and improved methods of processing data. Geotechnical models are then developed to visualise and analyse the data, which leads to better decisions.

“Near real-time slope monitoring data can be analysed remotely, when high-speed internet connections are available, which enables us to analyse the data timeously and recommend critical thresholds for evacuation of personnel,” explains Armstrong.

“21st Century mining is a new game. But then we must get better at working together. As a first step, better collaboration between stakeholders through developing a common mission. Simple is better, such as converting mineral resources into mineable reserves. In South Africa’s context, it means reigniting of the tripartite system for it to happen,” concludes Cawood.

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