

MINING INDABA 2017

Media briefing by the Chamber of Mines: A glimpse at the future: technology as a catalyst for sustainability and growth of the SA mining industry

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An industry of contrasts

The SA mining industry is one of great contrasts – in some cases having to be dragged, seemingly reluctantly – into the 21st century and beyond, and in other areas, leading the way.

Eight of the 10 deepest mines in the world are gold mines in South Africa. The Mponeng gold mine, located south-west of Johannesburg, is currently the deepest, extending over four kilometres below the surface. Sinking shafts to such depths to access these deep-level and narrow orebodies requires extraordinary expertise and knowledge. Shaft sinking is one of the most difficult of all development methods: restricted space, gravity, groundwater and specialised procedures make the task formidable. Hydro-powered rock drills powered – yes, – by water – are faster, more efficient and quieter than conventional drills powered by compressed air, and were developed for our industry, by our industry. I can go on...

Drillers are spending less time at the rock face as wholly-mechanised drills can do the 'heavy lifting'. New water-based emulsions can be loaded quickly and safely into blast holes, and be detonated electronically from surface. Trains that haul broken rock are operated by an electronic control system which incorporates remote sensing. Drones can be used to survey areas where we would prefer people not to be exposed. Virtual reality training centres give novice recruits the opportunity to 'learn on the job'.

Virgin rock temperatures can reach up to 60°C at the depths mined in the South African gold mining industry. Sophisticated cooling methods and equipment, involving some of the largest refrigeration plants in the world, use ice and chilled water to reduce ambient temperatures to reasonable working temperatures, with hundreds of tons of ice being made and sent underground every day.

On the flip side, however, our sector has, for more than 100 years, been considered a labour-intensive industry using physically demanding manual drilling methods with blasting and cleaning on a stop-start basis, predominantly in narrow reef, hard-rock mining for gold, platinum and chrome. Working conditions are popularly characterised as Dickensian, hampered by abrasive rock, confined workspaces, seismicity, noise, dust and heat.

In reality, most deep level underground mines are aging with travel times to the face sometimes reaching an hour-and-a-half or more. With increasing depth and distance from the shaft, actual drill time at the workforce has contracted, health and safety challenges have increased, production has shrunk and has contributed to burgeoning costs. Volatile price environments, rising costs and decreased productivity have added to our woes.

And our employee structures, levels of trust and the way in which we relate to one another as human beings, leaves much to be desired. The mining industry is a microcosm of South African society – it is the most segregated, and the most diverse; it is the most sexist, yet has probably the most focussed programmes to promote the interests of women. I could go on.

So, where does this take us?

Technology in mining

The application of mining technology in South African deep level gold and platinum mining has three main aims: firstly, to assist the industry and its employees to work safely; secondly, to ensure that we work more efficiently and productively; and thirdly to mine resources that would not be safe or technically feasible to mine with conventional methods.

A great deal of attention is currently being focused by mining companies on the development of processes and technologies that will remove – as far as possible – people from the rockface to minimise the threat of injury. Technology will also contribute to increased skills development, rising employment particularly in the technology sector, exports and revenue, better jobs for better compensation in the mining industry; and not to mention the knock-on positive impact on local communities.

Without a shift in mining methodology, the industry will fail to mine South Africa's deep-level complex orebodies profitably, resulting in the sterilisation of resources, accelerated and premature mine closures, and of course, accelerated job losses. Research suggests 200,000 job losses by 2025 could affect 2,000,000 people indirectly if we continue on the current trajectory. Contrary to popular perceptions that are sometimes expressed, I have no doubt that technology will create a substantial number of sustainable jobs and more than offset the inevitable continuing decline if we continue to rely only on conventional production methods – not to mention the jobs that will also be created in the manufacturing supply industries.

And we see that technology should act as a catalyst for transformation of the mining industry of yesteryear and today to that of tomorrow in *all* aspects. To do this, we must recognise that people are at the heart of our industry and we have to focus on improving skills, health, quality of life and fulfilment of employees.

To be successful, introducing technology will need to be addressed in a holistic manner, adopting a systems and people-centric approach. All elements of mining – including reporting structures, skills development, change management, stakeholder engagement, community development and environmental management – will need to evolve to suit the requirements of mechanised operations.

Within the Chamber of Mines we have a cohesive leadership group that is driving these concepts through the Chamber's Office Bearers and Council. A number of commodity leadership forums have been established and collaborative work on key issues such as innovation, employment relations and market development are being discussed. As the Chamber, we mean business in terms of enabling mining to realise its true economic and transformational potential in South Africa. But leadership is key.

Through the Mining Phakisa, new connections and commitments were made between companies, the state, academic institutions and original equipment manufacturers. In less than six months after Phakisa, the old COMRO campus in Richmond was redesignated as a mining innovation precinct, with the aim of transforming the South African mining industry into a safer, more productive one, with better skilled and better paid employees. Government recently allocated R150 million towards mining R&D, supplementing the R500 million spent by industry in recent years.

While a number of individual products have been developed by private companies, mining companies and manufacturers, an integrated suite of locally manufactured products with realtime monitoring and control is needed. The industry has set a milestone for the implementation of a cyclical drill and blast suite of equipment that mechanises all activities in the stoping and development cycle, including remotely operated equipment.

Work done to date indicates that such mechanisation significantly extends mine life, preserves mining employment, improves safety and health, and allows mining of lower-grade orebodies and deeper resources. This also creates an environment conducive to 24/7 operations until 2045 and beyond in the gold sector, higher skills utilisation and job preservation. With new equipment, which allows the conventional drill, blast and clean cycle of working, work can be done 24/7 by miners skilled in the use of remotely controlled equipment from safe, healthy sites.

While all mines differ from one another, it is possible to predict the effect that this might have on a standard operation. The latest estimates indicate that South Africa is still endowed with a low-grade gold ore resource, totalling 400Mt, that is amenable to profitable extraction using mechanised techniques. In addition, there are some 160Mt of high-grade ore locked in underground support pillars, accessible from current infrastructure. At least double could be mined below current infrastructure using appropriate technologies. A low-grade mine with a current conventionally mined life expectancy of some four years, using semi-mechanised methods, could extend operations to 15 years and, with full mechanisation and 24/7 operations, to as much as 25 years. Accessing these incremental resources is central to delivering on the excellent core intent of the MPRDA, which is to generate superior value from South Africa's mineral resources to the benefit of all stakeholders.

The Chamber has identified the products, technologies, people and infrastructure required to mechanise the stoping and development cycle with remotely operated equipment by 2020. Similar requirements have been developed for a 24/7 mechanised mining system that operates without explosives by 2025.

The potential impact is significant. A study, drawing on the estimates of South Africa's three principal gold companies – AngloGold Ashanti, Harmony and Sibanye – indicates that, for one mine, every 1g/t reduction in the cut-off grade would result in 10Mt of additional ore containing 200t of gold to be mined

over the operation's extended life. This is an indication of the benefits of using full-mechanised mining techniques operating 24/7. Extrapolating this across the industry as a whole – to its currently working and dormant mines – profitable gold-mining operations might be expected to continue well beyond the year 2045.

Looked at as a whole, with conventional mining, the industry can look forward to a sharp decline in gold production by 2019-20 and for mining to die out almost completely by 2033. The picture changes radically with mechanisation: annual output persists at current levels until at least 2025 and until 2030 or even beyond with 24/7, mechanised operations.

If this process of introducing new technology and the manufacture of high-tech, robust and specialised mining equipment is to be achieved, then industry, manufacturers, researchers and developers will need to collaborate to the full, sharing their knowledge and skills for a common good. The process cannot be completed overnight, so we have to prepare for a staged approach that may differ in the gold and PGMs sectors.

So what are the critical factors that we must work on to realise this future? While there is significant detail, I would like to isolate three critical elements that I see as the make or break.

- First and foremost, we must pursue R&D programmes with the active involvement of mining companies, equipment manufacturers and R&D scientists and engineers and the welcome support from government. The establishment of the mining innovation precinct with multi-stakeholder support at the old COMRO site in Richmond is an excellent start.
- Second, we require strong programmes of technical skills development that provide a suitably qualified workforce, not only for the mining operations but also to staff up the supply industries. Our national education system together with the company skills development programmes must rise to this challenge in collaboration and partnership.
- And third, we need a collective will among all stakeholders to realise this future with a shared understanding on how it delivers superior benefits and value. There needs to be recognition that continuation of status quo will only see a prolonged decline in mining activity, and progress

is required, not only to promote sustainability and growth, but also to satisfy the aspirations of a modern workforce who grew up with Play Stations and smart phones and are comfortable with technology.

In closing, while I have been largely talking about the concept of mechanization, it's important to remember that this fits into the industry's overall approach of modernization. And what do we mean by a modern mining industry - "in brief, a modern mining industry will optimally extract and beneficiate the country's natural resources, causing no harm to people or planet. It benefits both the local community as well as the national economy. It procures locally, is a preferred employer of well-skilled people and creates appropriate risk adjusted returns for investors. Regulations, taxation and incentives are consistent, transparent and recognise mining as a long term driver of economic growth."

This is the future we want to see.