Mining

and the fourth revolution

Technology is bound to disrupt mining companies, suppliers, service providers, and manufacturers. By Leon Louw

The run-up to this year’s Mining Indaba in Cape Town has been beset with political uncertainty, regulatory instability, and irreversible technological advances in the mining industry. The exploration space in South Africa has virtually been shut down by hostile government ideology and ludicrous policy changes, while the dearth of significant expansion and new development projects are almost non-existent.

Not only are mining companies hesitant to invest in a country where there is so much uncertainty and confusion, but, added to that, is the challenge of deeper ore bodies that are becoming more difficult to mine. Nevertheless, apart from one or two mergers and acquisitions in 2017, the wheels have continued turning at established operations. But, it was not business as usual. The tough economic environment, complexity of ore bodies, regulatory constraints, and rising costs have forced mining companies to become more efficient and productive. Moreover, it has necessitated the need for mines to ‘modernise’, adapt to continued variability, and embrace technology. Technology is set to become a major game-changer in the mining industry in South Africa, and it might just be the factor that prevents its demise.

What the challenging situation in South Africa has proven, is that all new projects will have to go deeper (which will require better technology and new equipment) or further, and for South African companies, that means venturing into the rest of Africa, which presents immense challenges, yet undeniable opportunities. Africa is the new frontier for mining companies and its suppliers and relevant services. The continent’s geology hosts world-class mineral deposits. Infrastructure in terms of rail, road, electricity, and ports is a constraint, but the situation is slowly improving in most countries.

Mining companies have a clean canvas in Africa, and that is a big advantage. New mines can be designed and planned to integrate modern technology and innovation, taking into account health, safety, and the environment. However, the entire mining industry, including suppliers, providers of services, and manufacturers need to see with new eyes and re-think the traditional ways of doing things. Mining as we know it has already changed substantially, and is set to undergo more profound changes as we enter the Fourth Industrial Revolution. ‘Modernising’ is probably the best way to describe what mining companies and suppliers need to do.

In the lead-up to Mining Indaba, Mining Mirror asked a few miners, thought leaders, manufacturers, and suppliers about modernisation, how it will affect their operations, and what the mine of the future will look like.

Ian Chapman
Engineering manager – Multotec Manufacturing

What is your understanding of the term ‘modernisation of mines’?

Modernisation is the utilisation of new technologies that will result in more efficient recovery of minerals, making the processes used more cost-effective. Such processes involve all parts of the value stream and not just mineral beneficiation. It includes, for example, areas such as improved logistics or HR processes.
Are you involved in any research or development of new products or technology that will play a role in the ‘modernisation’, ‘mechanisation’, or automation of mines?

Yes. One of Multotec’s developments is to automate the measurement of wear on our screening media products. By understanding how products are performing and their expected life, we will be able to better customise our solutions. For example, to be able to predict equipment end of life so we can then proactively ensure inventory is available for replacement.

How should mine managers and operational managers prepare for the future, and what are the major changes they should start introducing?

It’s not just the mines, but the whole industry. The advent of the Fourth Industrial Revolution means getting masses of data from various parts of the business (and outside operations that affect the business) and using it to the advantage of the organisation. Managers need to know what data will provide the most leverage as there will be a surfeit, with varying levels of usefulness, and what combinations of data will provide the greatest benefit. Managers will have to ask which data will be useful and which businesses to partner with. These businesses will have to be able to provide the analytical capability to convert the data into meaningful information that the organisation can act upon.

Which aspects of mining should be prioritised when we talk about modernisation? What are the challenges and opportunities in modernising the industry?

Modernisation has always been there; the difference now, though, is that the change is happening at a more rapid pace. It is an incremental process that identifies the benefits from a range of possible improvements. It requires, however, that the right information is available to enable managers to allocate resources effectively.

The modern mine will be data-centric, which means there will be large flows of data from the point of measurement to the database where it can be converted into useful information. Three existing technologies will predominate in the modern mine. Firstly, sensing capability, which is the ability to collect raw data from operating equipment. Secondly, communication of that data. One of the complexities here is the transmission of signals in an environment where the signals will be absorbed, reflected, and attenuated. In addition, with the masses of sensors that are transmitting data, the frequency spectrum could become clogged. Finally, all that data needs to be continuously stored and converted into meaningful information, which can be used either by another machine or for human interaction.

Within such an environment, technologies like artificial intelligence, augmented reality, and machine learning will become more commonplace as miners are forced to remain competitive. A major challenge will be to have the necessary infrastructure in place to handle these developing technologies, as well as the essential expertise to support such infrastructure. Another challenge will result from an increase in automation because of the adoption of such technology, which will have a socio-economic impact as machines replace humans in routine tasks. The opportunities that will arise, however, will be the development of small, technologically capable companies that can partner with the mines in specific areas of data capture and information generation.

What is your vision of the ‘mine of the future’?

Technology will become more complex and, as a result, original equipment manufacturers (OEMs) and service providers will become more specialised in what they do. Miners will become more focused on their core speciality and rely on partners to provide solutions in other parts of the value chain. For example, OEMs may be required to operate their own equipment on behalf of the mines and will thus become more service orientated. Consequently, the service provider will become more intimately involved in sharing the wins and losses of the miner and will therefore be driven towards continuously optimising their products. Perhaps, because of this, the modern mining operation will become a company with a core of essential services to support a matrix of service providers who are technologically capable in very specific areas on the mine.
Do you think mining will be disrupted, and how is your company countering and preparing for the ‘fourth revolution’?
Yes, large-scale disruption will occur. Multotec will continuously scan the environment for opportunities to improve in both our products and processes, as well as continuously improve on our ability to handle knowledge within the organisation. This means identifying the core competencies we will require for the future and ensuring we can develop these (where strategically important) or partner where non-core, but essential skills are necessary.

Faan Bornman
Technology manager – Multotec Process Equipment

What is your understanding of the term ‘modernisation of mines’?
Modernisation means ‘super mines’: large operations that are expected to display the best environmental practices. Modernisation also means automation, mechanisation, and digitisation. Mines will be remotely operated with a fleet of driverless trucks and other equipment. The mines will be more focused on the valuable mineral — concentration at source — to bring just the valuable ore from below the surface and not the waste as well. Modern mining will be high tech: intelligent computing systems to run the mine, the use of renewable energy, energy storage systems, and cleaner operations.

Are you involved in any research or development of new products or technology that will play a role in the ‘modernisation’, ‘mechanisation’, or automation of mines?
Yes, cyclone wear and monitoring of cyclone wear are critical components in any operation. Cyclones must be changed out before a breakdown occurs. This leads to unnecessary downtime. Preventative maintenance is the keyword. The Multotec Technology Division is working on a method to track early wear in ceramic-lined cyclones. The outcome will be a computerised system that eliminates physical inspection of the cone or spigot.

How should mine managers and operational managers prepare for the future, and what are the major changes they should start introducing?
Mine managers and operational managers should be more focused on efficiency and the environment. New technologies will be introduced in the future, and plant operations will be monitored by computers. This, of course, will require highly skilled labour. Education plays an important role, as training will be required to operate at a higher level. Managers need to know that carbon taxes and other factors will put pressure on mining operations to have environmentally friendly operations. Both mine- and operational managers must know what technologies are out there and must use them to the benefit of their operations.

Which aspects of mining should we prioritise when we talk about modernisation?
We should focus on safety — on technologies that will remove people from potentially dangerous areas. These areas must be automated to mitigate risks.

What is your vision of the ‘mine of the future’?
The mine of the future will have technologies to make the operation efficient, safe, and environmentally friendly. It will require less labour, albeit highly skilled labour. I predict that it will be partly off the grid and be powered by renewable energy. Some mines are in arid regions, which makes it ideal for solar power. Water reticulation and aiming to zero discharge will also play an important role. Mines will, to a large degree, be remotely controlled, therefore eliminating the mass transport of people to remote locations. There will be huge savings in terms of cost and time.

With the Mining Indaba coming up in February, what are the major issues in the mining industry that you would like to be discussed, even if it is on other platforms? (In South Africa, Africa, and globally, respectively.)
A critical issue is investment in research and development (R & D). Funding must be made available and opportunities created to spend more on R & D. This will bring more innovation: continuous incremental improvement, adaption of technologies (developed abroad or locally), and greenfield inventions. Also important is the efficient conversion of innovations into commercial products. The Fourth Industrial Revolution also needs properly skilled, qualified workers to meet the challenges.

What is your outlook for mining in Africa in the short, medium, and long term?
During the annual conference of The South African Mineral Processing Equipment Cluster (SAMPEC) and the Economic Research Advisory Network (ERAN) in March 2016, Hoosen Essack said that Africa will account for 12% of global mining investment between 2013 and 2031. There are 52 processing plants in various stages of development, valued at USD17-billion for both greenfield and brownfield projects.

Africa is where the opportunities are — vast resources are untapped. However, Shirley Webber at the financial institution Barclays Africa said that any political or regulatory uncertainty will undermine African countries’ attractiveness as natural resource investment. She also noted that stable political environments, compliance with environmental legislation, labour peace, and democracy in Africa are important to ensure growth and investment in the sector this year.

There seems to be a dearth of new exploration projects in South Africa specifically. Do you feel this is the case in the rest of Africa as well? Do you think it is a global concern? If it is, what are the reasons for it?
No, it is not the case in the rest of Africa. It is not a global concern; there are massive investments in other areas of the world like
South America. The South African economy is not growing.

In your opinion, which constraints are preventing investments in mining projects in South Africa and Africa?
The main reason is political instability. Investors want a return on their investment; hence, the reason for investing in the first place. The risk of losing your investment does not make it worthwhile to invest at all.

As costs continue increasing and mining companies tighten their belts, how can new technology contribute to a more sustainable future?
New methods, like concentration at source, can contribute to a saving in treatment costs. Only treat the ore containing the valuable mineral and leave the waste underground. In diamond operations, for example, it means only processing the 2% kimberlite containing diamonds and discarding the 98% waste upfront. Mines can also save on electricity cost by partly going off the grid and aiming to be self-sufficient in terms of solar power, energy storage systems, and so on.

With buzzwords like ‘modernisation’ and ‘mechanisation’ being used more and more, what role can Multotec play in a more modern mine of the future?
The aim for Multotec is to have equipment that can correct itself; for example, auto adjustment on spiral splitters and an auto-correction product box. This will eliminate the use of manual labour to do the corrections.

In cyclone development, Multotec is also working towards detecting roping conditions using equipment instead of a physical inspection. A warning system will indicate that the piece of equipment is malfunctioning.
Which new, exciting products, technologies, or innovations are your company researching or developing that would improve the traditional methods of mining?

There is a huge need for spirals to treat ultrafine materials (<45µm). This is the size range typically being treated in flotation circuits. However, flotation is costly due to the addition of reagents. Therefore, should Multotec’s spiral plants be able to separate efficiently in this particle size range, it will be a major breakthrough.

Veli Sibiya
Shaft engineer – Sasol’s Middelbult Mine

What is your understanding of the term ‘modernisation of mines’?

The first thing that comes to mind is changing from a traditional state of doing things to a modern state of doing things. It is almost common sense that development and improvement are required for change to take place. Change is inevitable if the mining industry were to be sustainable. The traditional approach to mining is no longer relevant in modern times and in a volatile, uncertain, complex, and ambiguous (VUCA) environment. Any industry not riding the wave of technological innovations will perish.

In essence, modernisation of mines has to do with, but not limited to, the implementation of innovative ideas, particularly innovative technologies, that will bring about improved safety production at low cost.

Are you involved in any research or development of new products or technology that will play a role in the ‘modernisation’, ‘mechanisation’, or automation of mines?

I am, to a certain extent, involved in the co-creation and the development of technology with suppliers. We realised that as a mining house, we need to do more to create the ‘mine of the future’. We came to the realisation that we must be more involved in piloting and implementing various technologies. If we all sit back, the entire mining industry will die a slow death. We see this approach from the perspective of the ‘first mover advantage’ as opposed to the perspective of the ‘guinea pig’. This approach would allow us to get our infrastructure and equipment ready for Internet and Wi-Fi for future technologies.

How should mine managers and operational managers prepare for the future, and what are the major changes they should start introducing?

Mining and operations managers must accept that modernisation is inevitable. They must develop an interest in the technology innovations happening around them and try to pilot certain technologies. Such an incremental approach is good for cash flow, and helps management to understand gaps in terms of infrastructure and equipment upgrade. Not all technologies will deliver results immediately, but will prepare the way for the implementation of meaningful technologies at a later stage. For example, getting the infrastructure and equipment Internet and Wi-Fi ready is a prerequisite for future technology innovations.

Mine managers and operations managers have a direct influence on the successful implementation of change. They have a role to communicate the need to modernise.

Which aspects of mining should we prioritise when we talk about modernisation? What are the challenges and the opportunities in what we refer to as ‘modernisation’?

- Infrastructure upgrade to make the mine Internet and Wi-Fi ready.
- Real-time information — artificial intelligence is crucial for decision-making. With real-time information, one can monitor production and machine performance. As a result, improve safe productivity at low cost. This information would inform future strategy.
- Implementation of gadgets to make the mines paperless. These gadgets would assist with legal inspections, ordering of spares, machine fault finding, connecting to machines and equipment remotely, and performing human resource activities, among others.
- Further mechanisation and automation.

With the Mining Indaba coming up in February, what are the major issues in the mining industry that you would like to be discussed, even if it is on other platforms? (In South Africa, Africa, and globally, respectively.)

The most important for me would be how to create stakeholder buy-in to modernisation; what the future would be without technology and innovation; and what skill set will be required for the modernisation of mines.

In your opinion, how has the mining industry performed in the past few years?

The mining industry has regressed over the past few years. Notwithstanding other factors, the conventional methods used in mining are partly to blame for the decaying sector. These methods are no longer relevant in current modern times. As a result, we have seen a number of mining houses selling their assets due to increased mining costs without an increase in safe productivity levels.

What is your outlook for mining in Africa in the short, medium, and long term?

The mining industry will remain pivotal for Africa’s economy in the future, and commodities will remain crucial in the global economy. To that end, the sector is there for the taking. In the short to medium term, the picture is not looking so bright, and not so dim either. As much as some distressed assets are getting sold, there are buyers willing to buy and revitalise the distressed assets. I think the outlook for mining in Africa in the long term is bright, provided the mining houses invest in technology to modernise the mines. Modernisation of mines will make the mining industry profitable and sustainable, as modernisation would bring about improved productivity at low cost.

How has the downturn and then the subsequent recovery in commodity prices affected your company?

Everyone would get negatively affected by unexpected changes in commodity prices. The downturn in commodity prices served as a wake-up call as we can no longer afford to continue with business as usual. Our strategy focuses on the mine of the future, aimed at improving safe productivity at low cost.

In your opinion, which constraints are preventing investments in global, African, and South African mining projects?

Over and above the lack of investment in technologies that would improve mining methods, mining in Africa is more expensive because of political and policy uncertainty.

Do you think mining will be disrupted and how is your company countering and preparing for the ‘fourth revolution’?

Given the fact that activism on global warming is gaining more and more momentum, the future of coal as a source of energy is debatable. Research on alternative sources of...
energy that are environmentally friendly is gaining momentum. As a result, it is very likely that the coal mining industry will be disrupted.

What are the challenges that you think the mining industry will face in the next few years.
- Increased level of unionism;
- Policy uncertainty;
- Increased labour cost;
- More pressure from the Department of Mineral Resources (DMR) to comply with health and safety;
- More pressure to comply with the Mining Charter;
- Lack of skill set to deal with increasing technology; and
- Fluctuations in commodity demand and prices.

Professor Fred Cawood
Director – Wits Mining Institute

What do we need to know about modernisation?
Modernisation in South Africa is happening in stages, with phase one being optimisation. Optimisation is a continuous mining objective. It is important to always start with the ore body, which is the fundamental asset, and then work our way through the mine to the market. South Africa’s unique ore bodies require a unique approach for converting them into profit. Phase two of the modernisation drive in South Africa is mechanisation (integrating machines and technology systems with people and processes). Mechanisation is currently underway in South Africa. Phase three is automation, for example robotic rock cutting.

How can mine managers start preparing for the future?
It is a matter of innovation or extinction. New professions that will combine traditional ‘sil/o’ disciplines and skills will emerge, like data scientists who will deal with big data systems. The challenges for managers are how to use big data for decisions on mine safety, worker health, and operational efficiency, and how to convert tomorrow’s ore bodies safely into cash today.

Which aspects of mining should we prioritise when we talk about modernisation?
Understanding mining, people, and systems for profit.

What is your vision of the ‘mine of the future’?
There is no doubt that modernisation will eventually lead to automation. Because the mine of the future will be technology-intensive, there will be less people underground. Going forward, the sustainability of mines and the mining industry will become a big issue. There must be benefits for all stakeholders, and developing a South African meaning of sustainable development is critical. One thing is certain: there can be no sustainable development without mining industry (and mine) sustainability. For this we need a better investment framework that gives clarity and certainty in the political economy space. We also need realistic commodity pricing models that can afford the full cost of mining; for example, stakeholder expectations have a cost and the commodity price has to reflect the total profit left after paying all such costs.
How should mine managers and operational managers prepare for the future, and what are the major changes they should start introducing?

Mechanisation and automation are likely to lead to fewer people on mines, but the roles required to run a modern mine will increasingly require not just a higher level of skill, but also new skill sets in which traditional engineering disciplines will be augmented by modern IT or computer-related skills. Managers are already needing to adapt their staff requirements to include a broader range of abilities within both the professional and other levels of the mine.

Mine managers can also expect to be spending more of their time on stakeholder-related issues, such as engagement with government departments responsible for safety, social, or environmental compliance, for instance.

Which aspects of mining should we prioritise when we talk about modernisation? What are the challenges and the opportunities in what we refer to as ‘modernisation’?

There is often resistance among various stakeholders to new technologies. Trade unions, for example, may see mechanisation as a means of reducing employee numbers on the mines. Getting buy-in therefore needs to be prioritised when new technology is introduced, as stakeholders need to consider that modernisation is imperative to extend the life of mine and thereby to preserve jobs.

What is your vision for the ‘mine of the future’?

There have already been a number of developments that are turning visions of the ‘mine of the future’ into reality. Advances in rapid development in hard rock mines have been made using prototypes capable of reaching development rates of 20m or more per day. These are fairly high-cost solutions, but have the potential to improve productivity and reduce operating costs. They also require the mine to be designed with tunnel profiles to accommodate the machines’ turning radius.

Battery technology is also improving rapidly for use in underground haul trucks and scoops, with the advantage of reducing the high ventilation costs associated with diesel equipment.

Increasing digitisation of communication technology has allowed access to real-time data, location tracking, data management, and the creation of tools that can optimise how mines are planned and managed. Managing ‘big data’ will be a key feature of the modern mine, as this information needs to feed dynamically into varied applications such as resource block models, mine optimisation strategies, and integrated hydrogeological and geotechnical models. Cloud-based systems are becoming popular options for storing and managing such data.

With the Mining Indaba coming up in February, what are the major issues in the mining industry that you would like to be discussed, even if it is on other platforms? (In South Africa, Africa, and globally, respectively.)

The single biggest challenge to South African mining is the lack of investment, arising mainly from the sector struggling with profitability. These forums need to continue raising the policy and procedural obstacles that are preventing explorers, miners, and investors from entering the sector or from continuing their involvement — which is leading to a shortage of significant greenfield projects.

There seems to be a dearth of new exploration projects in South Africa specifically. Do you feel this is the case in the rest of Africa as well? Do you think it is a global concern? If it is, what are the reasons for it?

Aggravating the difficult economic climate has been the procedural difficulty of obtaining exploration permits in South Africa. One of the country’s oldest and most established mining companies recently engaged in litigation with the DMR over the non-granting of a number of exploration permits. The cost of obtaining permits is also prohibitive, and time delays in receiving permits make it difficult for start-up explorers — whose position is made more onerous by the Mining Charter’s ownership requirements at exploration stage.

In your opinion, which constraints are preventing investments in global, African, and South African mining projects?

South Africa recently dropped again on the global rankings in terms of ease
of doing business. Along with the regulatory uncertainties surrounding the Mining Charter and issues related to the issuing of permits by the DMR, this is certainly reducing the attractiveness of mining investment in South Africa. The process of licensing in the exploration and the development of mines continues to be an issue in many parts of Africa. Globally, there currently seems to be a dearth of the very large and exciting deposits that attract investors to the sector.

Andrew van Zyl  
Partner and principal consultant — SRK Consulting (SA)

How should mine managers and operational managers prepare for the future, and what are the major changes they should start introducing?  
On an operational level, the challenges facing mine managers will remain people-focused — whether this relates to people on the mine or people around the mine. This impacts significantly on the social licence to mine, and needs to be carefully managed to enable an efficient operation and a sustainable enterprise. The development of technology itself will not be the direct concern of mine management; rather, they will be managing the human and social impacts of these changes.

Which aspects of mining should we prioritise when we talk about modernisation? What are the challenges and the opportunities in what we refer to as ‘modernisation’?  
The priorities will vary by country and depend on the type of mining and the maturity of the industry. In South Africa, we have several mature, deep-level mines that are increasingly difficult to mine safely, productively, and profitably. Technology has the potential to extend the life of these operations. While it might appear to lead to job losses, the reality is that the industry is likely to employ more people if it can modernise through the selective introduction of appropriate technology, than continuing on its current path.

With the Mining Indaba coming up in February, what are the major issues in the mining industry that you would like to be discussed, even if it is on other platforms? (In South Africa, Africa, and globally, respectively.)  
Industry events like the Mining Indaba need to be addressing the variety of emerging risks to mining companies in Africa; these range from water shortages, population growth, famine, agricultural production, and climate change, to the power of social media affecting your reputation among stakeholders and the public. These issues are growing in importance and can unexpectedly affect — and even threaten — a mine’s social licence to operate. These are challenges that cannot readily be resolved by individual players and will require increasing cooperation between all stakeholders.

There seems to be a dearth of new exploration projects in South Africa specifically. Do you feel this is the case in the rest of Africa as well? Do you think it is a global concern? If it is, what are the reasons for it?  
Due to South Africa’s isolated past during the apartheid years, the country benefited from high levels of exploration spending within the country, when mining profits were reinvested locally as the avenues for investing globally were restricted. It is therefore unlikely that any major finds will still be uncovered, although there is some potential for certain assets to be developed as and when the necessary infrastructure is put in place to exploit them. Given how well we know the geology, combined with the general uncertainties that surround mining ventures, South Africa is not high on the list of prospective countries. From the point of view of a global mining company, they would not prioritise exploration spending here.

The rest of Africa is a rather different story, but it does need to be examined in terms of whether the potential project would be constrained by a lack of infrastructure or not. Bulk commodities like iron ore, for example, require substantial infrastructure to be viable. At current commodity prices, such expenditure would be difficult to justify, and this has a dampening effect on exploration in these minerals. It is more likely that exploration into precious metals like gold will continue in Africa, and also into copper, cobalt, nickel, lithium, and graphite — these are commodities where there are either established producing regions or where juniors are able to raise funds on the back of renewed investor interest.

In the absence of substantial price increases, the greenfield development of bulk commodity mines elsewhere in Africa is likely to be focused on places where there is existing infrastructure or where deposits can be found closer to the coastlines of African countries.

In your opinion, which constraints are preventing investments in global, African, and South African mining projects?  
The global focus has been on cost containment and improving cash flow to manage debt ratios and generally to reduce leverage. The recent downturn has left investors sceptical of promised returns and reluctant to invest in risky projects, particularly greenfield projects. Locations perceived as risky have also suffered, as capital has pursued brownfield opportunities in less risky settings. Some rebound is likely though, as there are limits to how long this strategy can maintain supply, and this is positive for African mining. South Africa may not benefit, however, as the uncertainty around the regulations and the extensive exploration that has already been carried out limit the potential upside.
Vis Reddy  
Managing director – SRK Consulting (SA)

With buzzwords like ‘modernisation’ and ‘mechanisation’ being used more and more, what role can your company play in a more modern mine of the future? SRK’s leading role in visualising and achieving the modern mine starts with attracting the best minds and capabilities in the sector, so that we can embrace and advance the available technology in a way that adds value to our clients’ operations. We therefore focus on finding and retaining people who appreciate the power of technology and have the specialised skills to pursue new ideas in a practical way.

It is important to create an environment where this approach can be nurtured and also be guided by the experience of other experts. In addition to the depth and breadth of our in-house expertise, we also foster close ties with research groups and universities — both locally and globally — to augment and test the latest ideas and best practices.

Do you think mining will be disrupted, and how is your company countering and preparing for the ‘fourth revolution’? Mining in South Africa today continues to be a very labour-intensive enterprise, and the Fourth Industrial Revolution will undoubtedly disrupt the industry’s current modus operandi. Mining companies are visualising — and where possible, actually implementing — a more technology-driven model of operation.

“Industry events like the Mining Indaba need to be addressing the variety of emerging risks to mining companies in Africa.”

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mining process that potentially employs very little labour. This will of course require the continual improvement of communication technology in terms of IT infrastructure — not just at mine level but in-between mines and service providers.

This trend will also disrupt our conventional occupational structure, with fewer semi-skilled workers being required and more highly skilled people being employed. The traditional mining-related disciplines will need to be increasingly infused with IT skills, and the skill sets most in demand are likely to be those that merge engineering ability with technological insights. These are the skills that will implement the use of driverless vehicles, for example, or the use of robots underground.

As a company that welcomes the opportunities of the Fourth Industrial Revolution, we also look forward to improved levels of profitability in the mining sector through a more sustainable recovery. This will create more space for consultants like SRK to focus on high-level strategic and technical interventions that could move the mining sector forward and help place it on a more productive footing.

Which aspects of mining should we prioritise when we talk about modernisation? What are the challenges and the opportunities in what we refer to as ‘modernisation’?

A key element of the mine of the future will be the absence of humans working in dangerous conditions; rather, they would be replaced by robots doing the ‘coalface’ work in these high-risk areas.

**Hennie Theart**
*Partner and corporate consultant (Geology) – SRK Consulting (SA)*

There seems to be a dearth of new exploration projects in South Africa specifically. Do you feel this is the case in the rest of Africa as well? Do you think it is a global concern? If it is, what are the reasons for it?

Exploration worldwide is at a low level, as recovery since the last financial meltdown has not really filtered through to the exploration industry. This slowdown is largely confirmed by the high unemployment figures among exploration geologists in the world’s prominent mining countries.

The investment market is still very hesitant to commit to new exploration projects, as a result of the implosion of many large expenditure projects. These projects failed at the end of the last boom period, due to the inherently low grades of the mineral deposits considered, or overly optimistic cost estimates for establishing infrastructure.

The lack of exploration activity in South Africa is caused by various factors, including uncertainty in the regulatory environment, with the associated lack of confidence in the security of mining project tenure. Other factors are the deteriorating or inefficient infrastructure, and the expected future costs of electricity and water. There is also a lack of investment in new exploration targets in other African countries where similar regulatory uncertainties exist.

In terms of mining projects, there does seem to be some uptake in advanced downstream projects where there is already a known reserve estimate; this is very much the case in Africa.

In those African countries where the economies were in the past based largely on oil revenue, there is some interest in stimulating exploration for other natural resources. However, expectations in these jurisdictions are yet to be adjusted for the different business models required, the returns, and the timing of the returns expected from a non-oil based minerals industry.