Mining industry in need of transformation

The mining industry is widely acknowledged to be in need of new business models and methods, both to improve its bottom line and better protect itself from inevitable downturns in demand and prices, finds Jax Jacobsen

Automation and digitisation are opening up the potential for diversity in the mining industry

Technological and systemic innovation is of particular importance to mining as the industry faces substantial threats – whether it be the diminishing number of at-surface mining deposits, price and sustainability pressures on energy use, a looming staffing shortage and the continued need to work with local communities in moving forward with projects.

Upgrading and refining exploration and development processes are a critical component to improving the industry's productivity and bottom line, but the diminishing number of near-surface orebodies remains a troublesome reality.

"The rate of discovering large near-surface deposits is far too slow," Centre for Mining Excellence and Innovation (CEMI) president and CEO Doug Morrison says. "We have to find new targeting techniques to find deposits under deep cover."

Digital technologies won't help miners locate orebodies, he explains, but can provide enormous amounts of information about the rock where the metals are located.

"With advanced geophysical techniques we will be able to get more information out of drill holes," he says.

The same technology used for analysing drill data can be applied to brownfield sites, according to Morrison.

"It will enhance our understanding of deposits that already exist, that are currently being mined, so we can find more orebodies close to existing mining operations," he says.

Research centres, such as the Deep Exploration Technologies Cooperative Research Centre in Australia, have made huge progress in improving the speed and cost of drilling, he notes. "But we still have a problem in finding the target in the first place."

"The industry needs to find a way to invest in innovation"

For mining-focused economist Dr Peter Warrian, the industry must do much more to embrace transformation, by refocusing on research and development in making technological advances.

"Over the last 15 years, productivity in mining has gone down 28%," Warrian says. "Unless someone repeals the economic law of gravity, that can't be allowed to happen."

Artificial intelligence and robotics will be key to meeting those productivity challenges and catapulting underground mine designs to the next level, with few or no people working underground and as close to zero emissions as possible, he predicts.

To get to this stage, the industry needs to find a way to invest in innovation, particularly since Warrian believes there will be an explosion in demand for copper as more mines become electrified.

"Mining is risk-averse, partly because of the scale of the risks, and more and more so now compared to 40 years ago," he says. "But the ironic summary of successful innovation is, 'to increase the curve of innovation, accelerate the cost of failure.'"

The need to embrace risk in innovation is particularly an issue with base metal miners, he notes.

"In Canada, robotics is being led by precious metal miners such as Barrick and Dundee," Warrian says. Base metal miners, which rely much more on metallurgy, have been lagging behind in adopting new technologies and processes, and have gutted their R&D departments due to financial pressures.

Miners also need to take care not to depend too much on innovation from equipment vendors, he adds.

"Just like car companies, equipment vendors keep within the suite of their current product lines," he explains. "R&D effort can't just depend on that channel."

Mining operators will have to make a renewed commitment to establishing research centres with government bodies and mining schools, for example.

"It's the kind of research infrastructure we don't effectively have," Warrian says.

ENERGY

Energy availability will be a critical issue for mining companies in the coming years, as operators move away from fossil fuels to diminish their carbon offsets and improve their sustainability practices.

The most effective way to slash this dependence, according to CEMI's Morrison, is to cut down on ventilation in underground mining operations.

"The biggest single source of energy use in underground operations is the ventilation system," Morrison says. "We're on the verge of beginning to reconsider how to keep mining operations cool and how we provide ventilation."

Shifting human workers above ground will allow companies to use less ventilation, and spend less money on bringing high temperatures down to more comfortable working conditions.

"Highly automated mines will have very few people underground, mining companies can spend less on cooling the entire mine, and spend more money on suits that will protect people from heat and humidity," he suggests.

The move towards automation and autonomous, self-operating machines will have dramatically lower operating costs making it possible to mine lower-grade ore and deeper more expensive ore. This will push innovation-averse mining firms towards new technical solutions, Morrison says.

"Mines will not be able to afford the amount of energy to keep extending the mine deeper and deeper, with current production systems," he explains, which will encourage operators to embrace new technologies. These can range from protective 'space suits' for underground workers to experimentations with compressed air and liquid air to cooler and dehumidified vehicles.

As underground mines embrace electrification, it will be easier to integrate renewable energy into operations, Morrison adds.

"In future we will have to mine smaller deposits in more remote locations – and this will mean less permanent infrastructure – so alternative power systems will become the order of the day," Morrison says. "It will mean all equipment will be driven by electricity, not diesel."

Goldcorp has already taken the lead in designing Canada's first fully electric mine, replacing equipment for drilling, blasting, bolting and transportation that had relied on diesel with battery power. Though the underground gold mine's capital expenditure was higher than gold mines using diesel, the mine expects to halve the cost of ventilation because of its use of battery-powered systems, according to a report called 'The Renewable Power of the Mine' published in December 2018 by the Columbia Centre on Sustainable Investment (CCSI).

It also notes that the coming switch to fully electrified mines will lead to a substantial increase in electricity demand; the report says: "Energy demand [at mines] is estimated to increase by 35% by 2035."

To seize leadership in this realm, CCSI urges mining companies to set ambitious renewable energy targets, offer training courses to their staff to ease integration of mining processes and new energy alternatives, and be more open to procuring green products for energy requirements.

Mining companies would also benefit from reviewing existing mining processes.

"In greenfield mining projects, there is an opportunity to re-design sites to better cater for the characteristics of renewable energies, [while] brownfield projects can review their processes to asses where energy efficiency can be improved and load shifting be implemented," the report states.

"The biggest single source of energy use in underground operations is the ventilation system"

HR TRANSFORMATION

One part of the mining industry which is most in need to adopt new strategies is in its human resources (HR) practices.

There is an 'exodus' of workers leaving in the next decade due to retirement, says Ryan Montpellier, executive director of Canada's Mining Industry Human Resources Council (MiHR).

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The perceived volatility of the industry and memories of the down period of the supercycle are some

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of the challenges the industry must contend with in attracting new talent, he acknowledges.

University enrolment in mining-related courses has declined substantially over the last five years because mining is now perceived as a sector with unstable employment patterns, comments Andrew van Dinter, EY global mining and metals tax leader.

"There's also other challenges," Montpellier adds. "We are without question a rural and remote sector. Most youth today tend to migrate to large urban centres."

There are ways for the industry to increase its attractiveness to job-seekers, van Dinter says. "Cross-sector collaboration has the potential to accelerate rebuild of the talent pipeline."

Event sponsorship, scholarships and new vocational courses are options to attract potential hires.

HR practitioners in the mining space will also need to alter their requirements for employees, as the sector increasingly embraces automation and digitisation, according to van Dinter.

"Technology innovation is changing the skills mix required by miners. The finite supply of data scientists, predictive modellers and mechatronics engineers are also in growing demand across other industry sectors," he says.

This will require regular scanning, assessment, and review of the skill-sets required to build a greater resistance to commodity cycle fluctuations, he adds.

"Mining organisations that can anticipate and reduce the variability of employment patterns will be best positioned to attract talented employees in the future," van Dinter predicts.

These changes will also bring more diversity to the workforce, CEMI vice president of business development Charles Nyabeze says.

Automation and digitisation are 'opening up' HR potential for diversity, he suggests, with the possibility of attracting more women and more workers with disabilities to the sector than ever before.

MiHR's Montpellier agrees. "The nature of work is changing, the types of positions will be quite different," he says. "There will be more need for STEM-related occupations, and that tends to attract a more diverse workforce."

"The advent of social media has allowed companies to provide information about their projects"

STAKEHOLDER ENGAGEMENT

Not every aspect of the mining industry will see substantial change from digitisation.

"There isn't a magic bullet to this," Gus Macfarlane, a VP at Verisk Maplecroft who specialises in above-ground risk, comments.

"It's ongoing work that needs to be managed on a constant basis," he says. "Ultimately it's about human relationships, which are governed by rules that tend not to change over time – such as the importance of responsiveness, trust and respect in generating positive dynamics."

In many ways, advanced operators in the mining sector are already leaders in stakeholder engagement, he adds. They have learnt through long experience that their impacts on local stakeholders can easily translate back into material risks and opportunities.

"There has long been a realisation that stakeholder engagement is as much an issue of risk management as it is corporate responsibility," Macfarlane explains.

Advanced operators – which Macfarlane estimates to be around the top quarter of mining operators – have implemented advanced practices which move beyond allocating one team to engage with local stakeholders. Instead, they understand that effective engagement means involving everyone from the general manager to the hiring manager in managing relationships with locals.

If there has been one digital change to how stakeholder engagement is managed, it's in the social media realm. The advent of social media has allowed companies to provide information about their projects and interact more directly with locals and other external stakeholders. However, it also presents a range of potential challenges to some operators in terms of the wide dissemination of negative narratives, coordinated activities by anti-mining activists and (as with much of the social media world) possible misinformation, Macfarlane says.

But some stakeholders maintain that the industry may have to go back to basics before it can be seen as a leader in managing relations with external groups.

Hans Matthews, director of the Canadian Aboriginal Mining Association, emphasises that miners are still struggling to get the fundamentals of stakeholder engagement right.

He acknowledges that the problem in Canada is compounded by the government, which has resisted demands to define what counts as consultation, which puts mining companies in a tricky position.

"Companies are caught in-between [the government and Aboriginal communities] in defining these terms and how to proceed," Matthews notes, pointing to a company which lost 50% of its share value in two days due to a community conflict.

Other mining operators are using consultants to meet with local communities, which erodes trust in operators and creates ill will in communities.

"If companies deal directly with the community, and really look to the community to find out what they desire, then I think that company is not only providing a service to itself, but is also providing a service to shareholders," Matthews concludes.