DRA

MINING 2.0

The Rise of Smart Mining

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ABOUT DRA'S FUTURE OF MINING SERIES

The mining industry is one laden with contradictions. On the one hand we must produce faster, smarter and more lucratively than before, and on the other we must consider the environment, sustainability and even the end consumer. Is there a common ground to achieve mutually beneficial outcomes on this unchartered and, often unstable, terrain?

We've seen accelerated strategies in environmental, social and corporate governance (ESG), digitisation and automation since the outbreak of the COVID-19 pandemic. Change has become business as usual and compared to a long history of using the past as our compass, the industry is now looking to the future as a driver of fundamental and sustainable change.

Disruptive technologies continue to shape and reshape our picture of the future. There's no clear or definitive image of what that will look like but we unpack some fundamental elements of what success might look like in our next horizon. Share our journey, as we imagine the workforce of tomorrow, explore socially conscious mines of the future, weigh up the risks, investigate new business models and get real with artificial intelligence.

In DRA's Future of Mining Series, we take a look at the challenges the industry is facing. We leverage the knowledge from our expert team of advisors to highlight some considerations for mining companies and its value chain to navigate the future with confidence. Join us as we step into tomorrow.

Overview

In an era of rapid technological advancements and shifting social dynamics, industries across the globe are being called upon to embrace innovation and redefine their practices. The mining sector, often criticised for its environmental impact and labor practices, is no exception. However, the future holds immense potential for innovation within this industry.

As we stand on the cusp of a technological revolution, the convergence of blockchain, robotics, intelligent equipment, and big data analytics promises to radically transform the way mining operations are conducted. These technologies bring benefits, challenges, and also ethical considerations. In a world of man and machine, new skills and expertise becomes paramount.

The future of mining lies in skills innovation, so can the industry adapt to the evolving landscape and equip its workforce with the necessary capabilities to thrive in a technologically advanced environment? By reimagining the relationship between mining companies, local communities, and the environment, could we pave the way for a more sustainable and equitable future?
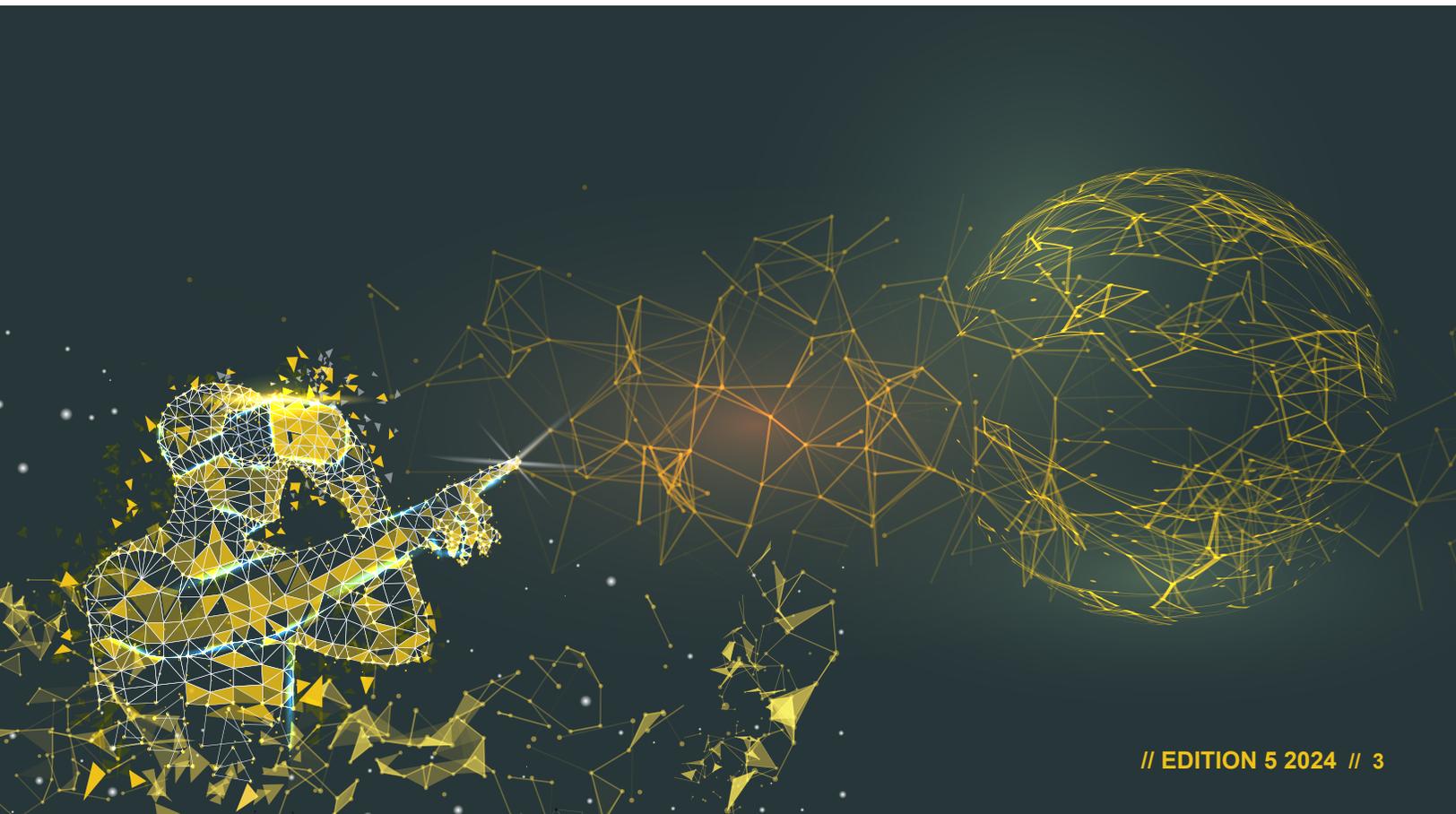
Social innovation

Unlike innovations that are motivated by the profit or competitive business pressures, social innovations are generally triggered by a concern for people and communities over commercial gain[1]. Social innovation in the mining sector essentially lies in embracing responsible mining practices, such as adopting sustainable technologies, reducing carbon emissions, and minimising the ecological footprint of mining operations. By prioritising environmental stewardship, mining companies can mitigate the negative impacts on local communities and ecosystems, while also ensuring the long-term viability of their operations. While technological innovation is recognised by mining companies as strategic for their economic, social and environmental development, why do so many sites in the mining industry remain outside the movement?
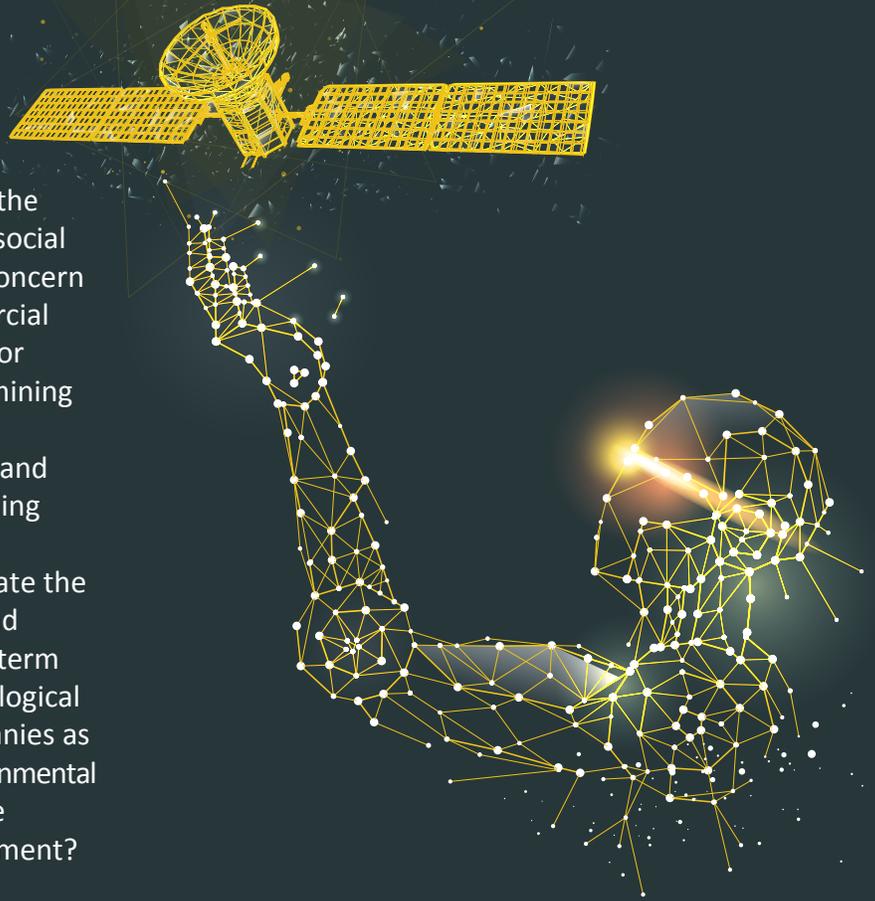
Exposure to human or environmental accidents, the increasing complexity of extraction conditions, difficulties in obtaining operating licences and, above all, the volatility of raw material prices, are all factors that explain the reluctance of some of the majors to invest in innovation over the long term. Conversely, juniors are quick to innovate but the lack of capital hinders the technological transformation of the 3,000 or so juniors listed in the world[2].

So where do the opportunities lie in the social paradigm? Mining companies have historically faced criticisms regarding their engagement with local communities. Social innovation bridges this gap through meaningful partnerships, and a social license to operate has emerged as a central measure of the social performance of mining. But a mine's social interest now extends much further than just the immediate community. The inbuilt transparency of blockchain technology has enabled mining companies to start utilising the technology in relation to tracking, recording, and certifying both the origin of minerals and the lifecycle record of minerals, including the traceability of emissions from the mine to the final product.

Practices and initiatives within the umbrella of just transitions can either be "jobs-focused", "environment-focused" or "society focused". Job-focused initiatives concentrate on the impact that just transitions have on workers, including working conditions and levels of employment. Under this approach, the focus is placed on preserving jobs and guaranteeing their quality. Environment-focused initiatives instead look primarily at the role the transition has in promoting a more sustainable natural environment. Lastly, society-focused interpretations adopt a more encompassing approach and focus on the impact on communities, workers and society at large[3]. Transparency and accountability are crucial when it comes to the sourcing and trading of minerals and future-proofing a mine's viability within this integrated and transparent supply chain. By implementing responsible supply chain practices, mining companies can ensure that the minerals they extract are free from human rights abuses, conflict financing, and environmental degradation. This approach not only protects the reputation of the industry but also supports the global movement toward ethical and sustainable sourcing.

Technological innovation

In decades past, the mining industry has faced challenging scenarios for its operations. Improving productivity to overcome natural factors such as decreasing ore grades, deeper deposits, and harder rock mass, combined with an increasing environmental and social awareness, has pushed the industry to constantly enhance their processes along the entire value chain. In this, innovation plays a crucial role by providing suitable solutions to surpass these difficulties, ensuring the continuity and sustainability of the mining activity.

Many debates have arisen around the industry's ability to innovate. Mining is often perceived as a conservative sector, where innovation takes only a secondary position in the concerns of companies. But at the same time, many argue that mining is more likely to be comparable with high-tech industries, considering that it utilises vanguard technologies in its processes, such as automated or remote-controlled machinery, and advanced monitoring systems for the collection and analysis of large amounts of data[4].

The digital transformation is a widely discussed topic in the industry, with many players acknowledging the first stages of a deep changeover. We explore some of these technological innovations and their impacts.
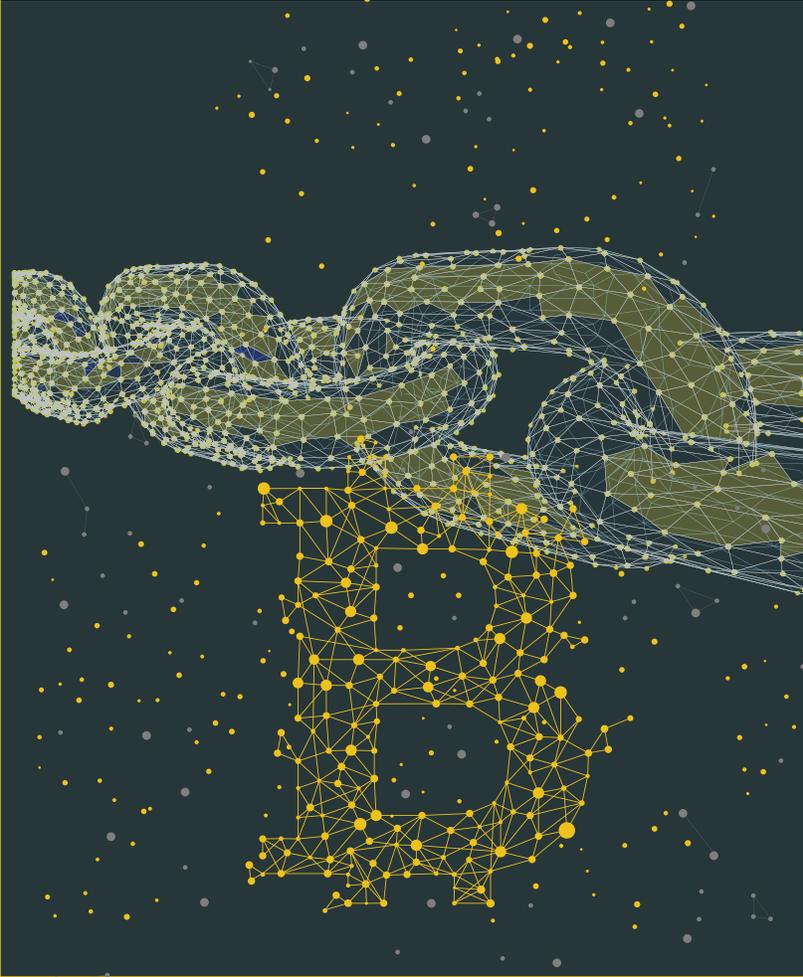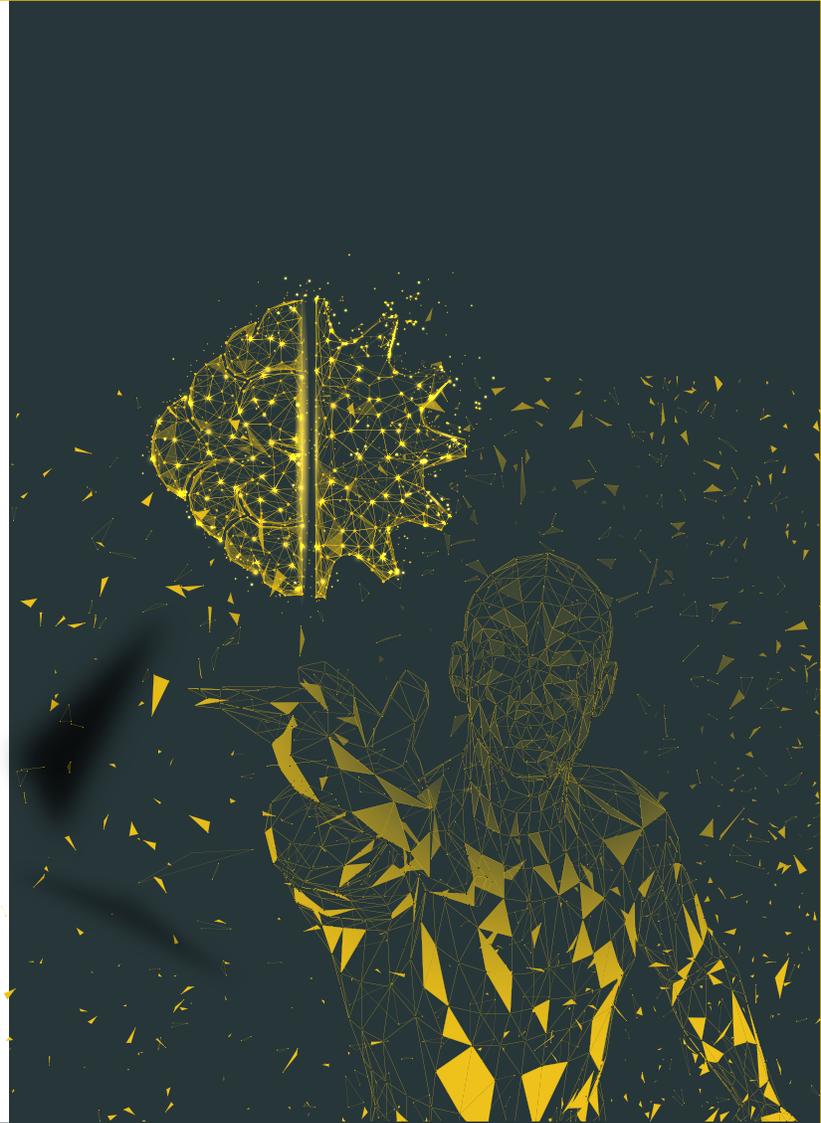
Blockchain Technology

Blockchain technology has the potential to revolutionise transparency and traceability in the mining sector. By creating an immutable and decentralised ledger, blockchain can digitally track the entire lifecycle of minerals, from extraction to processing and distribution. This enables the industry to tackle issues such as illegal mining, human rights abuses, and environmental degradation. With blockchain, consumers and stakeholders can verify the origin and authenticity of minerals, ensuring ethical sourcing and responsible supply chains.

The adoption of blockchain in the mining sector does face challenges such as cost, scalability, and interoperability. Overcoming these hurdles requires collaboration among industry players, governments, and technology experts to develop standardised frameworks and robust infrastructure that can support the widespread implementation of blockchain solutions.

Robotics and big data

The integration of robotics and intelligent equipment holds immense potential in enhancing operational efficiency and safety in mining. Autonomous vehicles, drones, and robotic systems can perform hazardous tasks, reducing the risk to human lives. These technologies can also optimise mining processes, enabling continuous and precise operations, and minimising downtime.

Moreover, intelligent equipment that is equipped with sensors and data analytics capabilities can collect real-time data on equipment performance, environmental conditions, and worker safety. This data can be leveraged to improve maintenance schedules, reduce costs, and enhance overall productivity. The deployment of robotics and intelligent equipment does, however, raise concerns about job displacement and the need for reskilling the workforce to adapt to these technological advancements.

According to Forbes, the most recent research indicates that a combination of AI (artificial intelligence) and big data can automate nearly 80 percent of all physical work, 70 percent of data processing work, and 64 percent of data collection tasks[5]. Big data is most assuredly here to stay at this point, and AI will be in high demand for the foreseeable future. Data and AI are merging into a synergistic relationship, where AI is useless without data, and mastering data is insurmountable without AI. The mining sector generates vast amounts of data from various sources, including sensors, machinery, geological surveys, and supply chain information. Big data analytics can unlock valuable insights from this data, enabling mining companies to make informed decisions and optimise operations. By applying data analytics algorithms, patterns can be identified, leading to better resource allocation, improved energy efficiency, and reduced environmental impact.

Additionally, big data analytics can facilitate predictive maintenance, enabling mining companies to anticipate equipment failures and schedule maintenance activities proactively. This not only reduces downtime but also enhances safety by preventing accidents caused by equipment malfunctions. However, the implementation of big data analytics requires robust data governance frameworks, data security measures, and skilled data scientists to extract meaningful insights from the vast volumes of data.

As the mining sector embraces these transformative technologies, ethical considerations come to the forefront. The responsible use of blockchain, robotics, intelligent equipment, and big data analytics requires careful navigation to avoid unintended consequences. This includes addressing issues of data privacy, cybersecurity, and the potential impact on local communities.

Furthermore, the adoption of these technologies should prioritise the wellbeing of workers and communities affected by mining operations. Ensuring equitable distribution of benefits, protecting worker rights, and fostering community engagement become crucial elements of responsible technological integration.

Skills innovation

The rapid transformation of the industry necessitates a workforce that is proficient in emerging technologies. To meet this demand, skills innovation must prioritise the development of digital literacy, coding, data analysis, and technology management. By equipping workers with these skills, mining companies can unleash the full potential of technology, fostering efficiency, safety, and sustainability.

Driving innovation beyond just technology requires us to mobilise innovation beyond the technology and research and development groups, and into the wider organisation - it is here that some of our traditional organisation systems work against us.

Skills innovation in the mining sector necessitates a shift towards interdisciplinary collaboration. The integration of technology with traditional mining practices requires professionals with diverse backgrounds, including engineering, geology, environmental science, data science, and social sciences. By fostering collaboration among these disciplines, mining companies can leverage a wide range of expertise to address complex challenges and drive innovation.

Skills innovation in the mining sector should prioritise the cultivation of attributes among its workforce. Encouraging employees to think critically, explore new ideas, and develop innovative solutions to mining challenges can drive progress and unlock untapped potential. Innovation thrives in an environment that values creativity and problem-solving skills. Talk of innovation has rapped on for years, often only within boardroom walls. Now is when mining houses will succeed or falter based on whether their innovation strategy is brought to life and whether it is integrated across departments.

Skills innovation in the future mining sector demands a shift towards a culture of lifelong learning. The pace of technological advancement requires professionals to continuously update their skills and knowledge to stay relevant. Companies in the mining sector should invest in ongoing training programs, professional development opportunities, and partnerships with educational institutions to foster a learning ecosystem within the industry.

Additionally, skills innovation should emphasise adaptability and agility. The ability to embrace change, learn new technologies, and adapt to evolving roles will be crucial for mining professionals. By instilling a growth mindset and promoting a willingness to learn and adapt, the industry can cultivate a workforce that is well-prepared for the challenges and opportunities of the future.

Conclusion

The future of the mining sector is being shaped by the convergence of many innovations across social and technological reforms, all of which hold immense promise in revolutionising transparency, efficiency, and safety in mining operations. However, their implementation requires careful consideration of ethical implications, including the protection of human rights, environmental sustainability, and the equitable distribution of benefits.

To truly unlock the potential of innovation in the mining sector, companies need to be clear about what they are working on and to be exact in how they envision their business of tomorrow. Are we future proofing our collective prospects through innovation? Are we integrating our strategies? Are we building an adaptable, future-focused workforce? Are we keeping up with the pace of innovation in line with industry growth? If not, have we measured the impacts?

Innovation as a concept is widely understood but the realisation of tangible benefits has been slow. By joining the dots on the extensive research that has been done to date, mining companies can capitalise on this groundwork and understand innovation and broaden the focus beyond technological advancement. The sector is starting to understand that there is scope to do things differently, and to innovate across the organisation and stakeholder set.

Generating ideas is the easy part of innovation, generating value means aligning these ideas correctly to a business problem or objective and driving them effectively to conclusion. The innovation mandate needs to start with innovation goals which ultimately contribute to the creation of a sustainable mining community.

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