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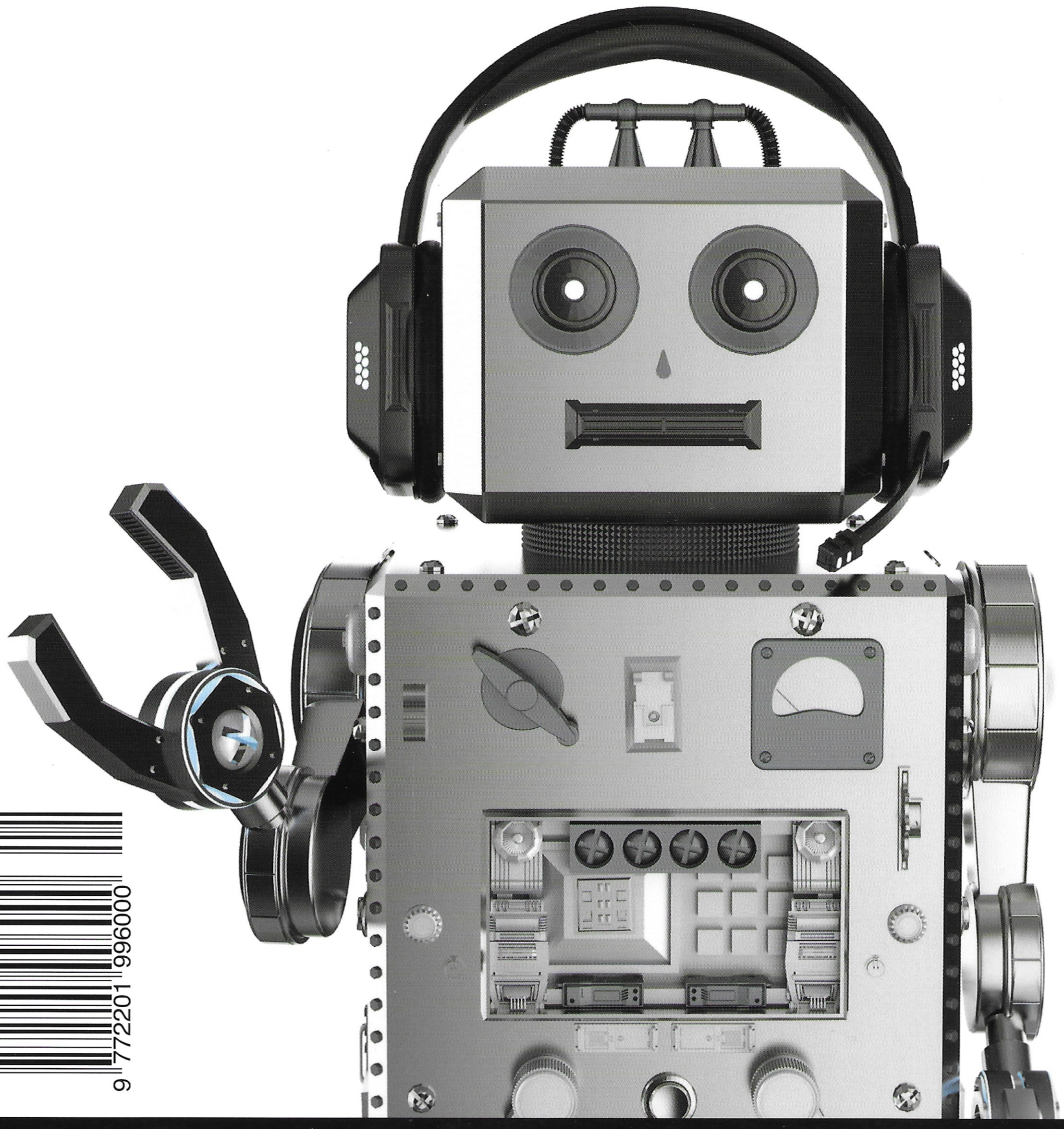

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LIVING IN A DIGITAL WORLD

Why mining companies need a digital transformation plan.

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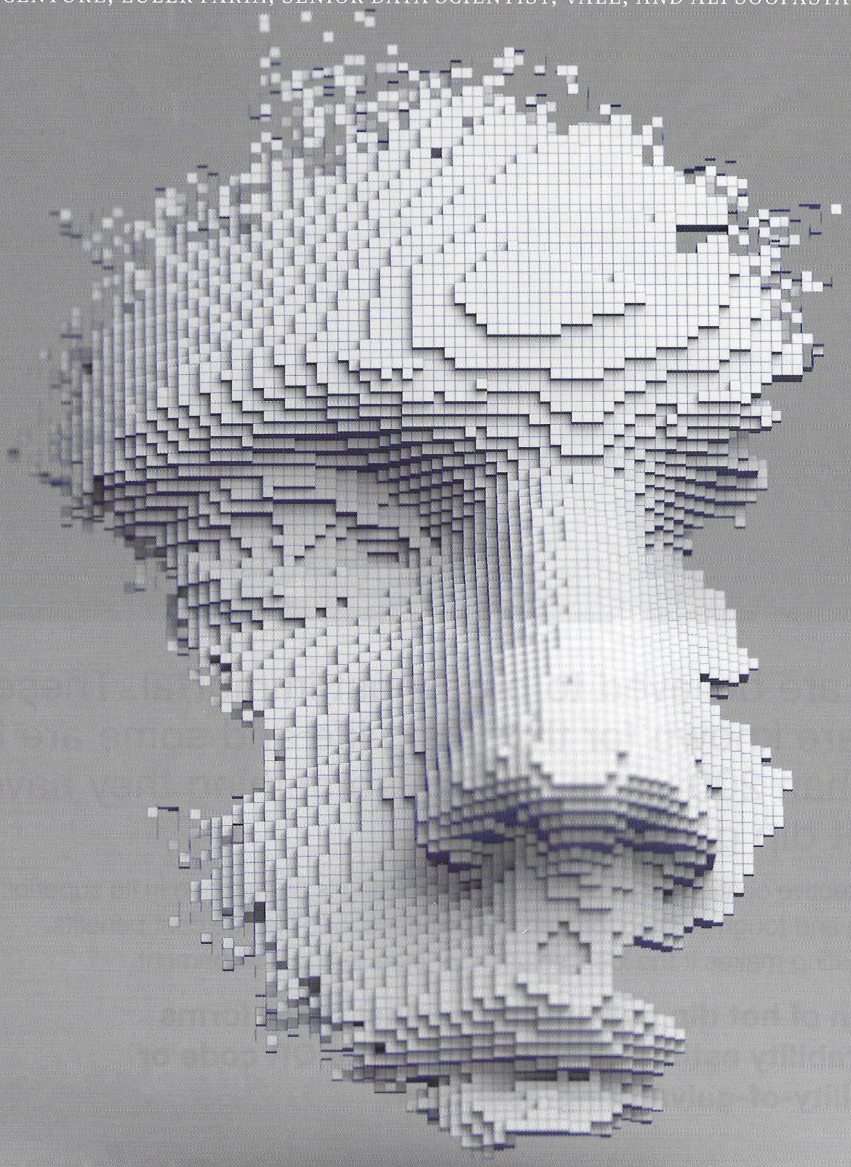


Modern technology is rapidly growing, and companies need to adapt to the new changes. Digital transformation plays a critical role in helping entities prepare for this industrial revolution. Improving digital technology, such as automation, sensors, advanced analytics, intelligent systems, and so on, has forced companies to think more about productivity and efficiency by using new technologies.

The mining industry is facing a significant challenge to make the most of a digital transformation when the maturity of people, technology, data, and management systems isn't enough to open the doors of the digital world for this old industry. To tackle this challenge, not only should mining companies work hard to pass this bottleneck, but universities need to change their curriculum to include better learning and research programs for future mine engineers.

The Fourth Industrial Revolution is already happening, and the world is currently facing a digital decade. The new digital economy is transforming the business environment, and mining companies have been affected by this disruptive movement, caused mainly by a tide of pressure coming from clients and final consumers.

In mining, a massive amount of data is collected from sites, which can potentially result in excellent opportunities to find new solutions for business problems through this digital transformation. The main goal of digital transformation programs is to define how companies adapt to digital changes. Moreover, the definition of digital mining transformation is always different. Figure 1 demonstrates a technology-driven process consisting of three main components of digital transformation: data, connectivity and decision-making.

The pressure on mining companies is on both the supply and demand sides. Although, in general, it starts on the side of the consumers.

INFLUENTIAL FACTORS ON DEMAND

- *Consumers that are more connected have more decision-making power*
  The digital economy produced a cultural transformation that has set a higher level of expectation and user experience from consumers. This change redirected the decision forces from mining companies to the final consumers.
- *Consumers are more focused on user experience than with the possession of the property itself*
  New business models developed by the digital economy lead a transformation in the consumers' preferences, mainly among the younger generation, with the focus shifting from owning to using.
- *Liquid expectations*
  The more developed a digital economy is, the more consumers extrapolate the consuming experience of a determined category of mining product to other markets, thus significantly amplifying what the market traditionally defines as 'competitor'. Currently, the competitors are not necessarily inside the mining industry.
- *Faster adoption cycles of new ideas and technologies have made markets quickly disappear*
  The classic curve of mining innovation diffusion is facing a significant change. The process of transmission that once slowly flowed between the social system participants nowadays quickly converges between the winning solutions.

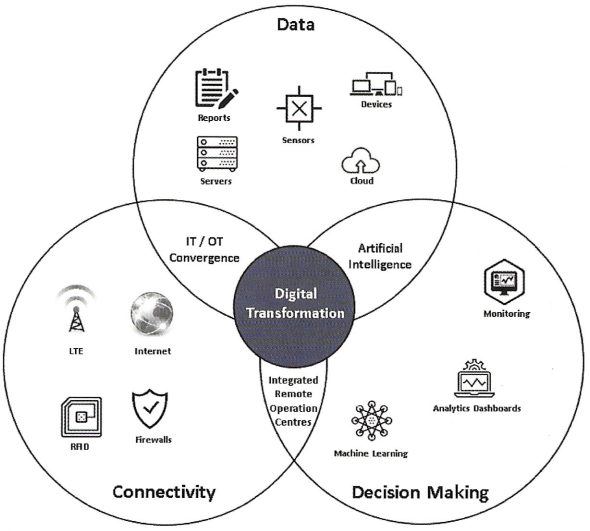
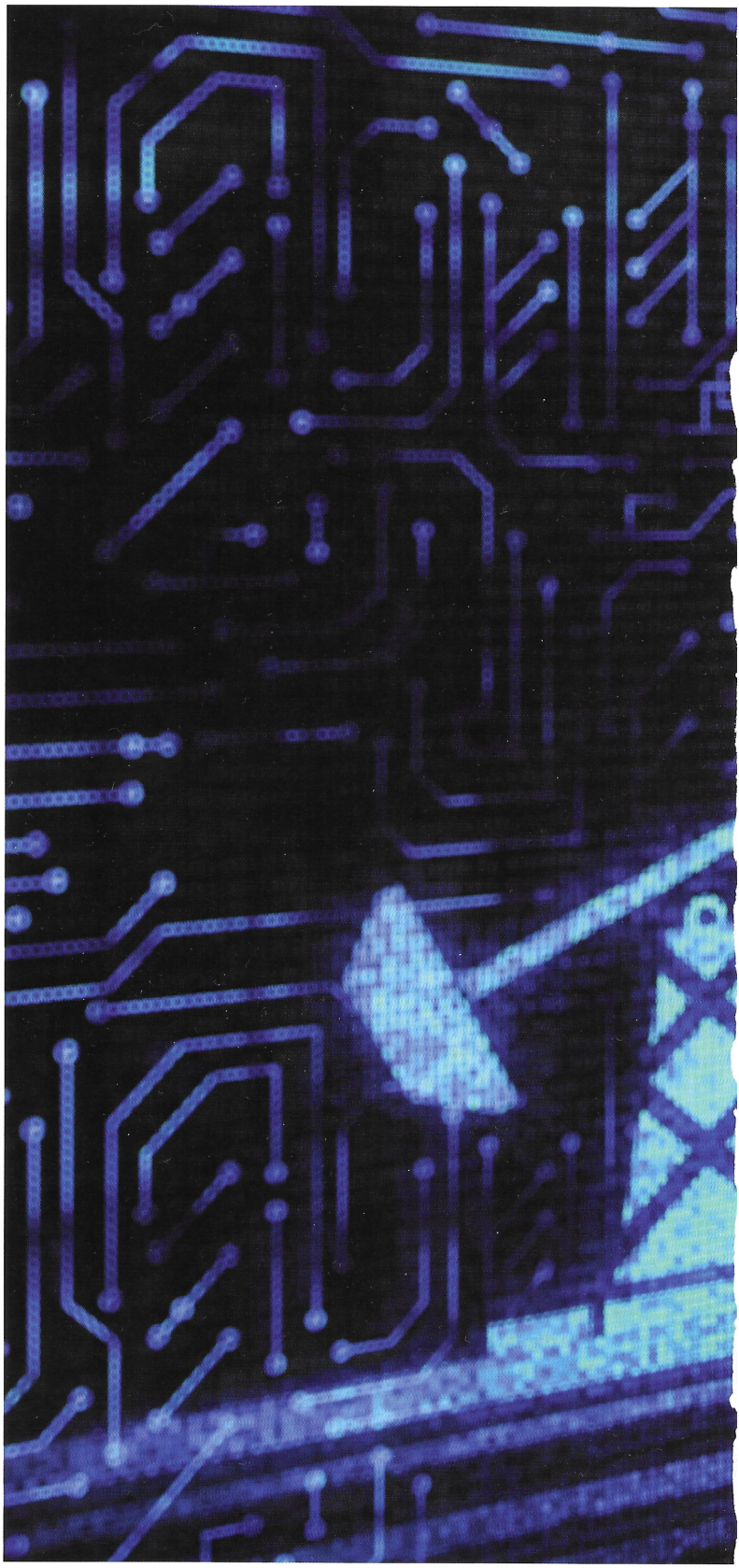


Figure 1. A technology-driven process

INFLUENTIAL FACTORS ON SUPPLY

- *Unbundling phenomena by the start-ups*
  The entire process of a productive chain, which before was executed for a big mining company, can be achieved by hundreds of small companies performing each of the small steps of the whole process in a more efficient way.
- *Exponential cost reduction of the technological process*
  This pattern, which has been observed since the end of the 1950s, has become economically feasible in a series of projects that previously didn't leave the drawing board.
- *New competitors being created every day*
  It is essential to develop a digital transformation plan to predict the effect of market conditions on the mining value chain. The companies that don't review their operational models – especially their business models – will not have space in this dynamic competitive environment. This digital transformation plan can be reached through three strategic drivers:
  - *Digital business transformation*
    Attending the new demands of business models. The primary investment area to implement this strategical approach is a junction of the technological parks with the relevant set of new and existing data to foster the use of big data and artificial intelligence (AI). This approach can help to identify new trends and market demands.
  - *Digital clients transformation*
    Revision of the client experience; business-to-consumer (B2C) or business-to-business (B2B). The integration of different platforms to guarantee clients' information unification, jointly



> “In the past, mining companies could choose to be late or early adopters of new technologies; however, this is no longer the reality”

with the digital transformation of the marketing function, are the necessary condition to implement this strategic driver. The application of AI combined with mobile technologies and social media is essential to customising the offerings to guarantee higher client engagement.

— *Digital company transformation*
Operational excellence of production process and technological park. Each productive process automation is required to implement this part of the strategy, which ranges from the operation itself, to the decision-making process. The usage of the Internet of Things (IoT), robotics and AI are some of the elements that enable automation and opportunities for identification of efficiency improvements.

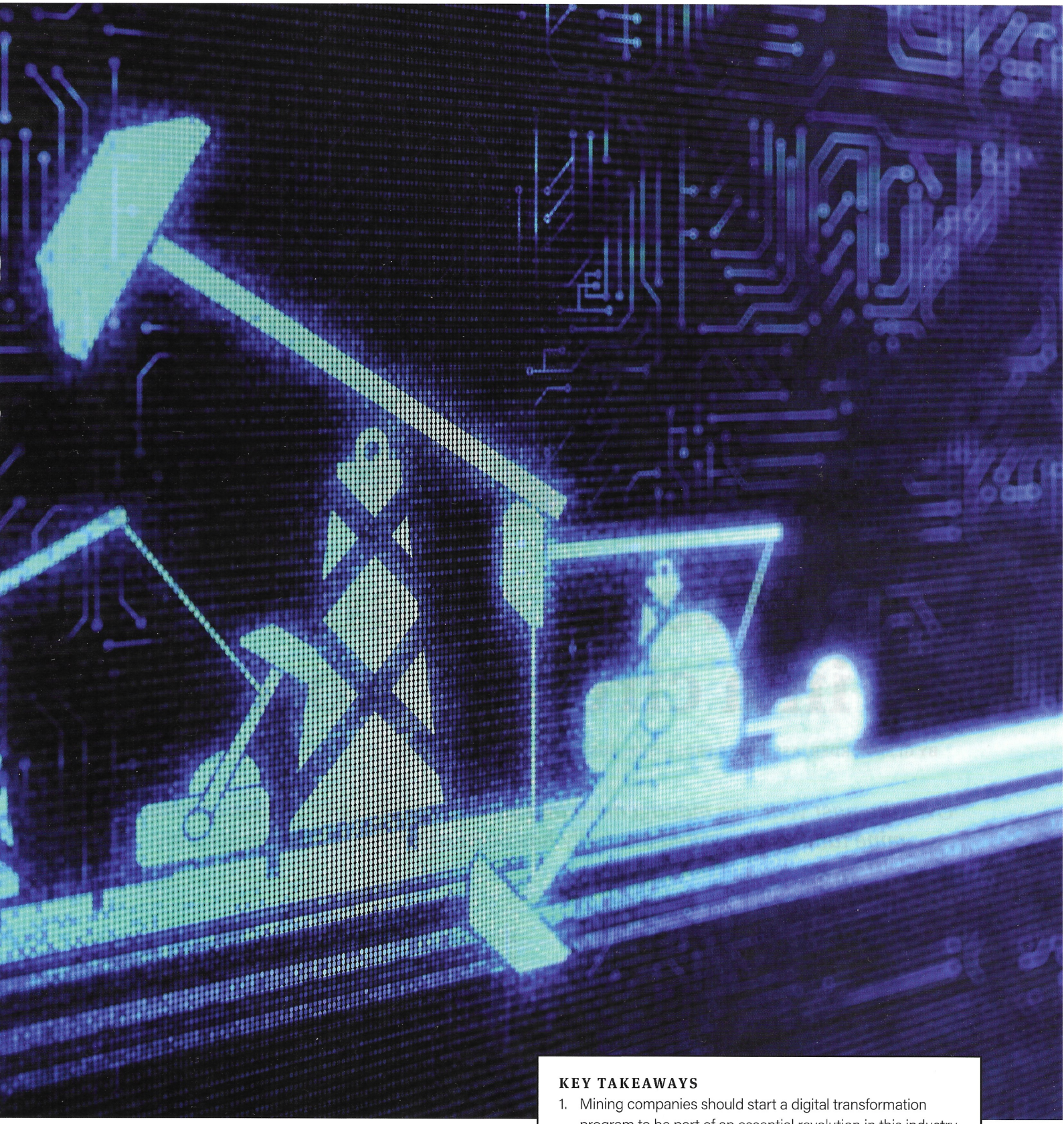
To maximise the return on investment in a digital space, a focus on some leveraged strategies is a requirement, such as:

- *Agile leadership*
  Strategic views and a fast-paced decision-making process.
- *A workforce that is focused on innovation*
  A digital mindset infused in the workforce.
- *Networking*
  Keeping the mindset of ecosystem collaborating inside the value chain (suppliers, logistics and clients) and outside (start-ups and universities).
- *Access, management and usage of data*
  The capacity for creating knowledge to improve the decision-making process.
- *Appropriate technological infrastructure*
  Guaranteeing processing capacities, data and business security, and interoperability among systems.

In the past, mining companies could choose to be late or early adopters of new technologies; however, this is no longer the reality. Consider what is highlighted above, and the journey to a digital transformation becomes an essential plan for all companies working in the mining industry.

A successful digital transformation plan can increase digital capabilities and develop the sociotechnical capacity in a mining company. Digital transformation can also alter all aspects of the business to change mining operations and maintenance; however, mining companies are struggling to start their digital transformation.

In order to successfully progress in the digital transformation journey, it is essential to define a clear responsibility for digital investments. Companies should also invest in use cases, not just in technologies, and it is necessary to use result-based



actions according to a theoretical-designed approach. Further, it is important to take full advantage of the low hanging fruits, like low-cost and fast, successful opportunities, which will help companies create a digital culture. Taking risks in assessments that identify common problems of several company sectors will make it easier to scale and re-use the lessons learnt. Finally, having a successful digital transformation plan means thinking about a multidisciplinary concept, and this approach needs innovative discoveries in all company sectors. AR&I

KEY TAKEAWAYS

1. Mining companies should start a digital transformation program to be part of an essential revolution in this industry.
2. There are three foundational components of the digital mining transformation process. These components are data, connectivity and decision-making.
3. Digital transformation provides a discussion on how it will be an essential part of the success of mining companies into the next decade.
4. Digital transformation identifies strategic areas in which higher education institutions can provide the required resources to support the mining industry.