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From digital dreams to
mining realities

Deloitte Africa ERI

Unlike banking, retail or telecommunications, mining's journey toward digital adoption has been slower. Mining remains one of the most physical and labour-intensive industries in the world, and its very physical nature is its greatest vulnerability. Without a decisive shift toward digitalisation, the sector risks falling behind, unable to attract and retain the skills required to remain competitive and become an attractive industry again. Remaining competitive, in addition to the relentless pressure to improve safety, operating efficiently and sustainably, as well as lowering costs, is forcing mining executives to prioritise a digital transformation.

Digital transformation has moved beyond experimentation; it is now a board-level imperative and leadership priority. In boardrooms, digital transformation is now discussed in the same breath as ESG and operations. What makes this particularly challenging is the scale of the value chain. Exploration, planning, extraction, processing, logistics, marketing and sales are all interconnected. Each stage presents a different digital opportunity and risk, and each requires careful sequencing and integration. In Africa, these challenges are exaggerated due to aging infrastructure, challenges in reskilling and upskilling due to Africa having the youngest workforce in the world, as well as a massive shortage in highly experienced older professionals. Added to this, the increase in production costs, social and environmental scrutiny, and the complexities of integration of emerging technology are colliding with the internal demand for minerals and metals, global trade and economic uncertainty, geopolitical shifts and investor expectations.¹

For the sector, the future hinges on its ability to combine physical operations with data-driven intelligence across the value chain, and ensure humans adopt what we call the 'hard change' to build resilience for sudden changes and assist in making the best decisions.

¹ [Minerals Council South Africa Annual Report 2024](#), May 2025.

Pathways to digital transformation

Around the world, mining companies have typically approached digital transformation in two distinct ways.

The first – the ‘big bang’ approach. Here, the ambition is to reinvent the organisation from the ground up, investing billions to create fully integrated digital mines. The objective is to become a digital organisation focused on mining, embedding technology across exploration, extraction, processing and marketing. This is bold, visionary and capital-intensive.

The second approach centres on targeted digital use cases, where companies apply technology to specific problems, often achieving impressive but isolated ‘digital miracles,’ but they

can be narrow and difficult to replicate at scale. In this way, companies identify specific challenges or opportunities and deploy technology to address them. Examples include optimising processing plants with advanced analytics or using sensors and drones for real-time monitoring.

Neither pathway is inherently right or wrong; in fact, they are complementary. Big bang programmes set the direction of travel, while targeted use cases provide credibility, measurable impact in a short amount of time. They tend to achieve employee and stakeholder buy-in a lot quicker due to the value being seen from the start. In Africa, cost constraints mean cherry-picking is more common. The greatest value lies in blending the two, using smaller interventions to prove value and build momentum, while setting the overall vision and preparing for a more holistic, human-centric digital transformation journey.



Human-centric? The human factor in digital transformation

Technology is rarely the hardest part of digital transformation. The real challenge lies with people.

Mining is a conservative industry. For many miners, the work has been done in the same way for decades. A mine manager with forty years' experience may have risen from underground operations through to the executive suite without ever needing to engage deeply with digital tools, technologies or solutions. Persuading such leaders and their teams to embark on this journey, change their ways of doing things and encourage adoption across every organisational level, remains one of the toughest aspects of digital transformation.

Resistance is not irrational. It is rooted in culture, experience and trust. Miners want proof that digital tools, technologies and solutions are not gimmicks but practical tools that enhance safety, productivity, the operations in general, and at a personal level, job security.

At Deloitte, we see that the most successful projects invest as much in leadership alignment, business readiness and strategic change management as in technology. Critical success factors include a clear case for change, consistent and engaging communication, co-creation of human-centric solutions that have a positive employee experience, practical upskilling, executive buy-in and culture-led change initiatives. Employees must see themselves as co-creators of the digital mine, not passive recipients of imposed solutions.

An African mine recognised that its operating model would need to evolve to support the desired digital vision across all key operational and strategic functions. They engaged Deloitte, and rather than focusing only on technology, people were prioritised from Day 0. Working with the client, Deloitte helped create an organisational capability library identifying 200 future smart capabilities that were used to identify human capability requirements across critical jobs that would evolve or new jobs being developed. These capabilities were essential to deliver on the digital initiatives. This approach helped the client understand that aligned leaders, capable employees and introducing a different way of doing things, are required to achieve the desired operating model transformation. A culture-led change journey led to the successful adoption of critical technology tools and solutions, and continue to do so.



Convergence of IT and OT

The most transformative change in mining over the past decade has been the convergence of Information Technology (IT) and Operational Technology (OT). Traditionally, IT handled systems and data management, while OT controlled physical operations such as plant machinery, fleet management and key tasks such as blasting. These two worlds rarely intersected. Today, integration between IT and OT is unlocking exponential value. Linking ore-body data with plant performance, energy usage, workforce deployment and logistics enables miners to optimise processes in real time. Instead of simply collecting data, mines are starting to use it intelligently to improve decisions across planning, operations and maintenance.

Evidence of this is seen in the use of drones, for example. Mines are deploying drones after a blast to assess shaft stability and determine whether it is safe for people to re-enter, greatly reducing the risk to human life in dangerous conditions. Another example includes the proliferation of 3D imagery and computer vision in underground mines. Used to scan shafts for structural integrity and hazard identification, the technology provides real-time data and analytics that allow faster decision-making and provide another layer of safety to miners. In the production cycle, OT is equipped with scanning functionality and advanced analytics² that optimises throughput, which has a direct impact on the overall recoverability while increasing revenue.

A South African mine partnered with Deloitte to assess its digital maturity and create a roadmap for digitising the operation. The mine's digital maturity was assessed over three dimensions: **information maturity**, which considers



how data is acquired and used; **organisational readiness**, which focused on the organisational structure, the jobs and skills required to maximise benefit from digitisation; and **systems and technology**, which interrogates the information infrastructure required for digitisation. The resulting roadmap identified opportunities to integrate IT and OT, creating cost efficiencies and improving safety outcomes, due to a solid human-focused approach.

Another strong example of the impact on profitability is a South African iron ore mine that engaged Deloitte to assist in a comprehensive operational excellence turnaround programme. The off-grade circuit was not achieving its design capacity, leading to a significant loss of potential revenue. The client required a comprehensive intervention targeting all underlying causes of the poor plant performance. The focus of the programme was to increase the throughput of the plant,

to increase saleable tons and ensure that rail commitments are met. Deloitte demonstrated that by increasing the off-grade feed from 10 Million Tonnes Per Annum (Mtpa) to 13 Mtpa, the mine achieved a 30% increase in saleable product, a step-change in output without requiring equivalent new investment.

These examples spotlight the extent to which convergence is shaping how mining companies view their business models. What was once a sector considered to be data-rich but insight-poor is increasingly becoming data-driven and insight-focused.

² [Deloitte's Global Smart Factory network.](#)

Safety, sustainability and profitability

The most compelling argument for digital transformation lies in its ability to simultaneously advance three objectives: safety, sustainability and profitability.

With some of the deepest underground mines in the world, South African miners are increasingly turning to technology to improve their safety programmes. Scanners, sensors, and autonomous vehicles and drones reduce the need for human entry into hazardous environments, lowering the risk of injury and improving proactive risk management.

Above ground, digital technologies are demonstrating the ability to positively impact mines' sustainability track record. Used to reprocess old mine dumps, monitor environmental performance and reduce resource wastage, a plethora of digital solutions provide monitoring and tracking information that provide mine managers with deeper insights into their environmental impact.

Used smartly, the same tools can help to identify new revenue streams and drive innovation, job creation and community engagement in the process. An example of this is the application of technology to identify, explore and extract in new mines that were previously deemed too high-risk or complex.

3 [Tracking the Trends – Leading through transformational change in mining and metals](#), January 2025.

4 Artificial Intelligence News, [The GenAI Divide State of AI in Business 2025](#), June 2025.

New dimensions of AI in mining

AI is rapidly becoming a cornerstone of mining's digital journey. Companies are looking to smart operations as a solution to manage complex processes and priorities. AI, GenAI, digital twins, and predictive analytics offer mines the potential to become more cost-effective and resilient³, generating measurable gains in efficiency, safety and sustainability.

In Africa, many miners see the potential but struggle to translate AI into measurable outcomes. AI can enhance exploration targeting, predict equipment failures, optimise plant operations and support environmental monitoring. With the rise of GenAI, there are new dimensions becoming a reality in mining, such as scenario modelling, report generation and virtual training. However, its value depends on integration with operational processes and human decision-making.

When it comes to AI, African miners are cautiously optimistic. Many are experimenting with AI pilots but face challenges in scaling due to data quality, infrastructure and workforce readiness. According to a recent MIT publication, billions of dollars are spent on GenAI interventions, but only 5% of organisations are extracting value while 95% of these organisations are failing due to brittle workflows, lack of contextual learning, and misalignment with day-to-day operations.⁴

Deloitte's role is to help bridge this gap, combining technical expertise with deep industry understanding to ensure AI is not hype but a tool for tangible value.



African realities shaping digital transformation in mining

For African mining leaders, it is vital to understand how technologies such as generative AI (GenAI) could reshape competitiveness, and how to support their workforce through the transition. Deloitte has identified four roles that are essential to the future of work in mining and metals operations: maintenance technicians, engineers, geologists and drillers. These roles could change with AI, and priority should be given to skills upliftment and cultural adoption of new ways of work⁵.

Across Africa, miners continue to battle infrastructure constraints and deficits⁶. Electricity shortages, unreliable water supply, stable connectivity and logistics bottlenecks complicate operations, and mining companies continue to seek solutions that reduce their reliance on grid outputs, such as alternative energy and water sources. In the long-term, however, these challenges significantly disadvantage the global competitiveness of Africa's miners. Public-private partnerships must be leveraged to co-create solutions that will benefit mining operations and surrounding communities.

Another factor is the growing social scrutiny of mining. Communities, governments and shareholders demand greater transparency and accountability, particularly on ESG matters. The global trend is becoming critical for mining operations on the continent, increasing the importance of monitoring, tracking and reporting ESG performance.



5 [Tracking the Trends – Leading through transformational change in mining and metals](#), January 2025.

6 [Minerals Council South Africa Annual Report 2024](#), May 2025.

Steps toward digital maturity

Relying on digital miracles is not sustainable. The journey from digital miracles to digital maturity requires more than technology alone. Critically, it requires leadership, strategy and resilience.

There are a few priorities for mining companies to accelerate their path toward digital maturity:⁷

- Lean into **hybrid architectures**, where cloud and on-premise solutions co-exist, and are tailored to site conditions, connectivity and regulatory requirements.
- Activate **workforce transformation and change journey** by measuring business readiness, building transformation capability and investing in digital fluency across the organisation, at all levels and roles.
- Adopt **integrated digital strategies**, moving from pilot projects to enterprise-wide strategies to ensure that digital transformation creates sustainable value. Involve employees in core projects and start adapting their behaviour to be more digitally inclined.

- Take bold steps to integrate OT and IT to unlock end-to-end visibility across the value chain, enabling data-driven decisions that enhance safety, productivity and profitability.
- Ensure a culture-led journey that is built on the required digital characteristics evident in organisations that are successful in digitisation.

The question for mining leaders is no longer whether to digitise, but how to do so in a way that creates quick but lasting value. The future mine will not simply be a digital organisation that happens to mine, nor a traditional miner dabbling in digital. Success will belong to the hybrid miner that is connected, data-driven, and most critically, human-centred.



⁷ [Deloitte: Tech Trends 2025](#), December 2024.

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