

The state of digital transformation in the South African mining industry

Ten insights into 4IR (and ESG)

2023

Our second study on how the Fourth Industrial Revolution is building value in our mining industry and where it's headed, including a focus on ESG



MANDELA MINING PRECINCT
MINDS FOR MINES



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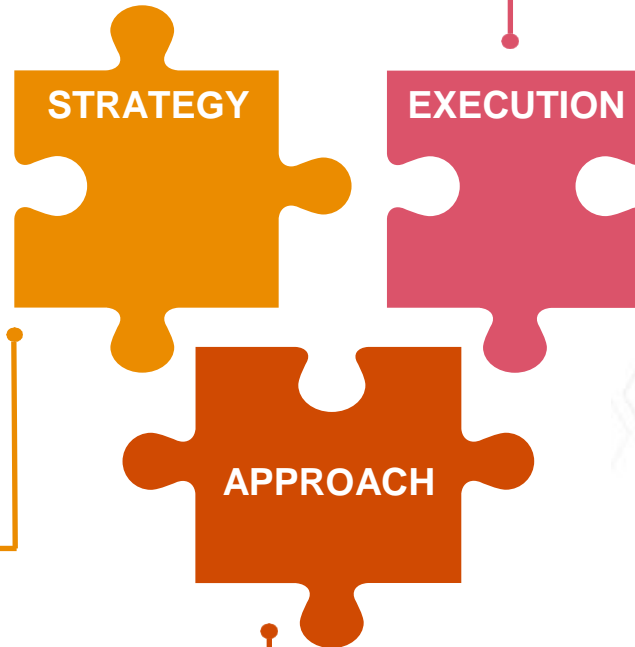
Insight 10: ESG drives long-term value

Insight 1: Mining CEOs and their executives are being deliberate

The CEO guides while the C-Suite searches for value

The CEO is the strategic steward with focus on:

- Delivering on commitments made to shareholders and communities;
- Defining work across mining value chain - finding, mining, treating & trading;
- Carbon neutrality, renewable mines, improved resource & data-driven business strategies incorporating digital enablers; and
- The focus is on measurable value creation, i.e. tracking the real world benefits.

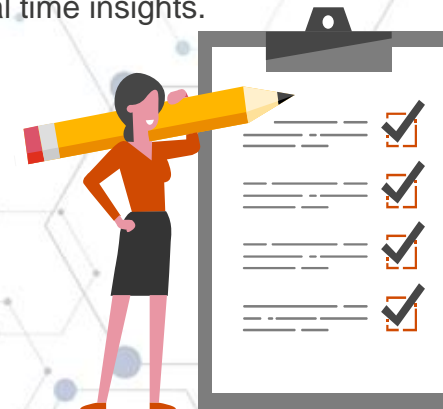


The Executive Team owns and expands the roadmap:

- Equal participation for all in operations = buy in;
- Trust in the leadership team is key to success and adoption of new digital tools;
- The entire management team are involved in the digital programme:
 - Developing the right culture;
 - Setting up the enabling environment;
 - Reducing duplication;
 - Expanding the roadmap;
 - Achieving the roadmap; and
 - Embedding environment for prediction, analysis and real time insights.

How to get there:

- Build your roadmap; and
- Realise you are on a journey.



Insight 1: Mining CEOs and their executives are being deliberate

Digital Champions do it on purpose:

- Nearly all respondents have programmes at various levels of maturity along the value chain with at least a portion at a digital champion level;
- Variations are driven by type of mining, and access to technology above ground is still easier than for underground mining;
- However, the complexity of integrating new technologies into legacy systems has forced miners to identify new revenue models and leverage existing infrastructure; and
- Advancements in technology means the roadmap is never static - our respondents have all developed roadmaps that extend beyond 2025.

Digital novice

- We are seeing a change from 'digital only' projects to 'every project embeds digital'

Digital follower

- Followers are starting to see the value of 4iR and digital (in silos) but it is not yet embedded into strategy

Digital innovator

- There is rise of ecosystems and connected practices backed by a strategy that explicitly utilises digital tools

Digital champion

- Our three digital champions seek mastery of connected digital ecosystems weaving 4iR, innovation, and technology into the critical elements of the future of mining

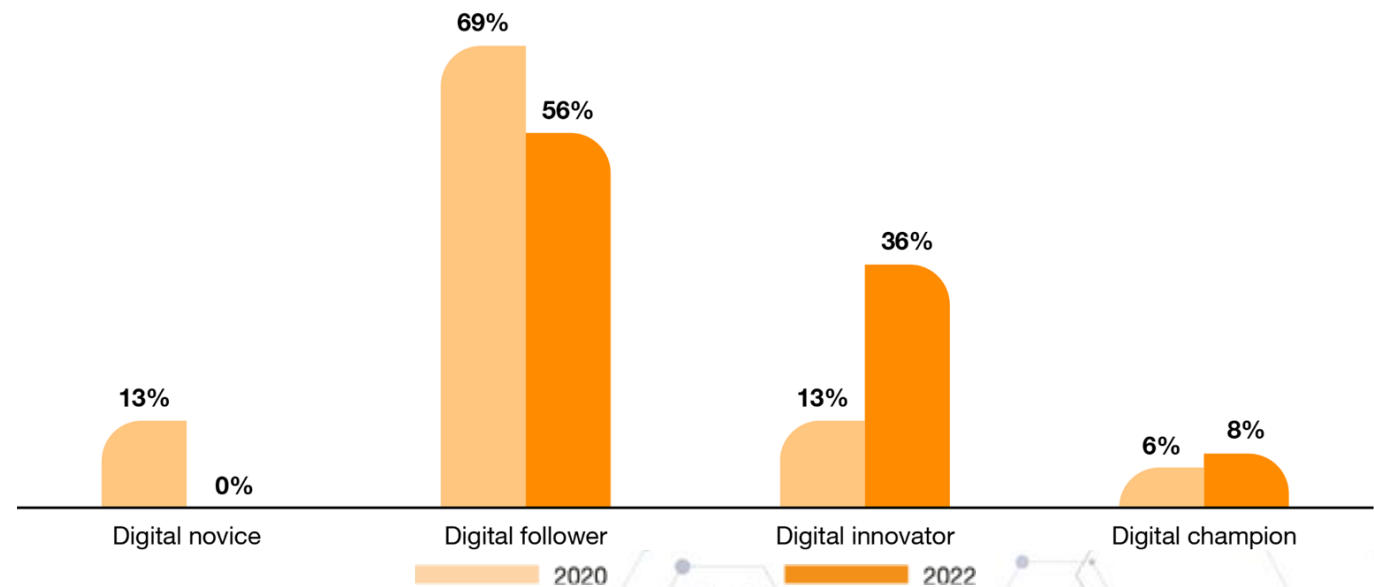


Figure 1: Digital maturity levels (2020 vs 2022)

Insight 2: Technology is being applied where it has the greatest measurable benefit

Key drivers to consider for going digital in mining:

- Older mines can struggle with digital transformation (legacy systems)
- New mines are designed with digital in mind - upfront
- Lack of qualified resources
- Resistance to change from the workforce



Key Initiatives miners are focusing on

- Integrated reporting;
- Integrated mine planning;
- Logistics automation;
- Digitally optimised supply chains,
- Integrated source-to-pay and finance functions;
- HR standardisation, digital training and skills development; and
- Underwritten by platforms within the business used to promote & share innovations.

Insight 2: Technology is being applied where it has the greatest measurable benefit

“ We are still defining value when it comes to digital transformation ”

1

How is value defined?

- ‘Proper integration - driving for value’, and ‘Return in value either through cost saving or increasing returns. Not only short-term returns.’
- Miners have not yet fully quantified non-financial value from perspective of stakeholders, employees and community members

2

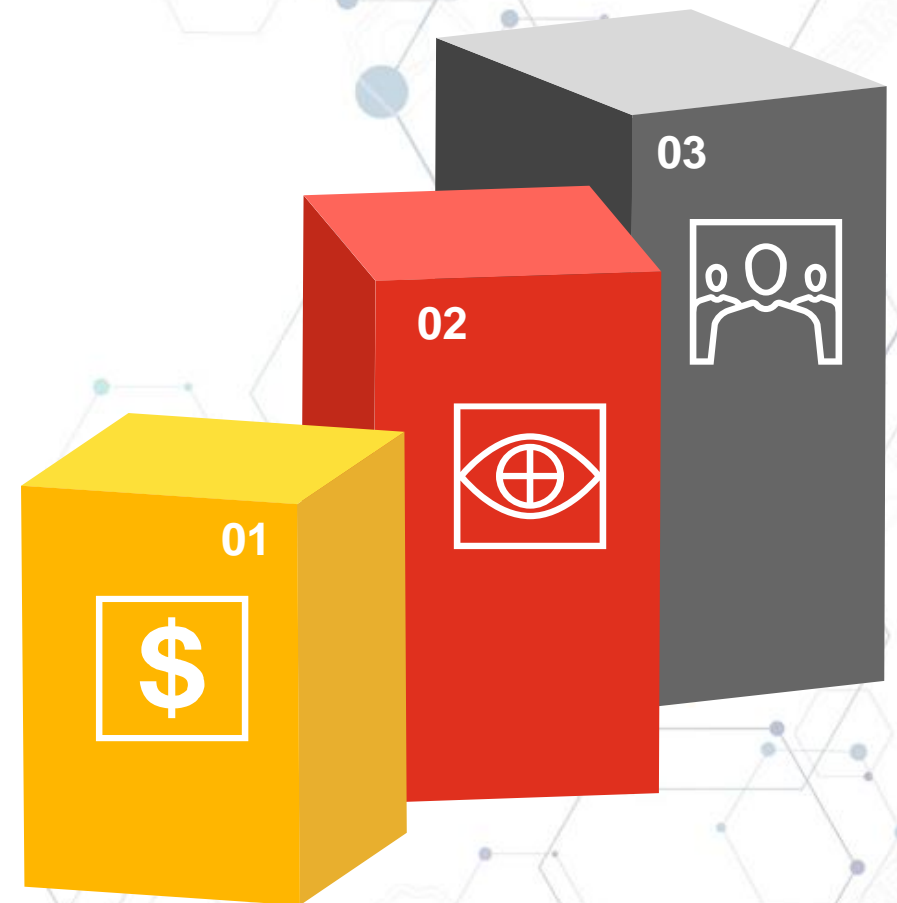
The value of digital transformation is primarily:

- Visibility and transparency (#1);
- Reduction of bureaucracy (#2); and
- Ultimately the ability to make better decisions (the biggest benefit in 3-5 years)

3

Digital is helping miners to:

- Move away from historic siloed ways of working;
- Change the way people think (give them context); and
- Empower people to be successful together



Insight 3: The hunt for value requires cooperation and compromise

Business priorities have changed but cost is still king:

- 38% of respondents put cost leadership, efficiency, and profitability as their number one concern (11% as #2 concern)
- Overall, business sustainability and longevity is the second highest result with 22%
- Key stakeholder impacts are the first priority for 11% of respondents
- Resilience is strong at 11% at first priority
- Sustainability Leadership was selected by 5% as their number 1 concern.
- ESG was not selected as a first priority - but it is present in all decision - making

The competition for capital:


- The fight for capital allocations is based on measured benefits;
- Digital programmes are often difficult to qualify before execution, requiring a 'leap of faith';
- Indirect benefits are difficult to measure, as is the ability to enable future value;
- The most popular value for money programmes are:
 - Safety;
 - Security surveillance;
 - Supply chain;
 - Payroll (function automation);
 - Reporting;
 - Community sentiment tracking (predicting protests); and
 - Maintenance.





Insight 3: The hunt for value requires cooperation and compromise




Five-year forecasts show the ongoing upside of digital & 4IR:

01  **Throughput improvement**
No more low hanging fruit - these benefits are tied to specific programmes and expectations are more precise

Efficiency gain  **02**
There is no guesswork as the data is now drawn from information management systems

03  **Cost reduction**
Precise responses based on data in MIS, with data on each initiative

Others  **04**
Improved metal accounting linked to improvements in control and measurement systems in the processing environments

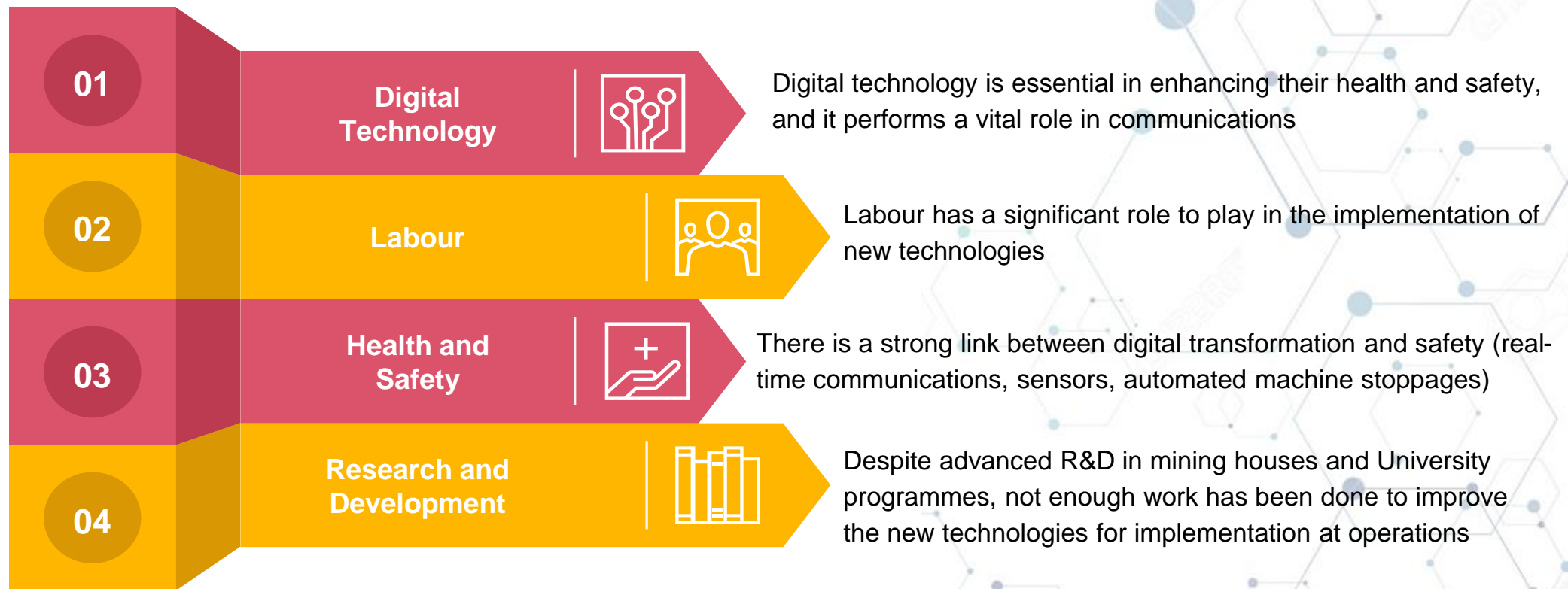
Throughput improvement		Efficiency gain		Cost reduction		Improved safety	
2021	2023	2021	2023	2021	2023	2021	2023
30%	14%	30%	14% (Mining) 1% Concentrator	10%-20%	15%	30%	30%

Table 1: Cumulative benefits expected from 4IR over the next five years

Insight 4: Digital tools don't just measure, they contribute (the Union perspective)

The greater purpose of digital is enablement:

- Not just measuring output
- Provide insights and better ways of working
- Help miners achieve the target, don't just mark the homework
- Promote an open culture using technology to communicate / collaborate



Insight 5: The imperatives for sustainability, and the crown jewels

What got us here won't necessarily get us there – the world has changed again:

- The world is starting to de-globalise in 2023;
- The green transition vs the rising cost of living;
- Predictable sourcing ties up capital;
- Miners are tackling these issues head on, establishing Project management offices to deliver:
 - Climate change initiatives;
 - Energy programmes; and
 - Transformative technology projects.

Data is at the centre of business success and sustainability:

- This will be the most intensely managed part of the mining business over the next 10 years;
- Trustworthy information is needed in real-time;
- A change from reactive to proactive requires new tools;
- Better digital tools will move people out of danger into control rooms;
- The rise of remote operations centers corresponds to the hiring of a different skills mix; and
- Attracting scarce skills is a global challenge for miners.



Insight 5: The imperatives for sustainability, and the crown jewels

The mining skills mix will change over time as technology adoption matures:

- The number of skilled workers will increase in the next 5 years
- There is expected growth in new skilled positions such as data scientists
- There is also expected reduction in unskilled employees with aim to use digital tools such as AR/VR to upskill the current workforce
- Mining is expected to become safer with the move towards Zero Harm supported by technology
- Technology is expected to discover new resources, and convert non-economic resources into economic resources in an environmentally conscious way



“ With the digital transformation of mining, we expect new roles to emerge that may not require traditional mining skills or may require traditional mining skills to be supplemented ”

Insight 5: The imperatives for sustainability, and the crown jewels

Asset management leads the way as greatest contributor of measurable value from digital programmes:

- *Supply Chain and Logistics* is now placed as second focus of value from being under-represented in 2020;
- Accurate, real-time information platforms themselves are one of the greatest value drivers in modern mining and are expected to be placed first by 2025;
- *Mineral Resource Mapping, Ore Flow and Yield* are starting to contribute measurable value as they address the fundamental economics of the mines;
- *Employee Wellness* has not dropped in value - it has been overtaken

82% of our respondents are looking for value in **asset management**

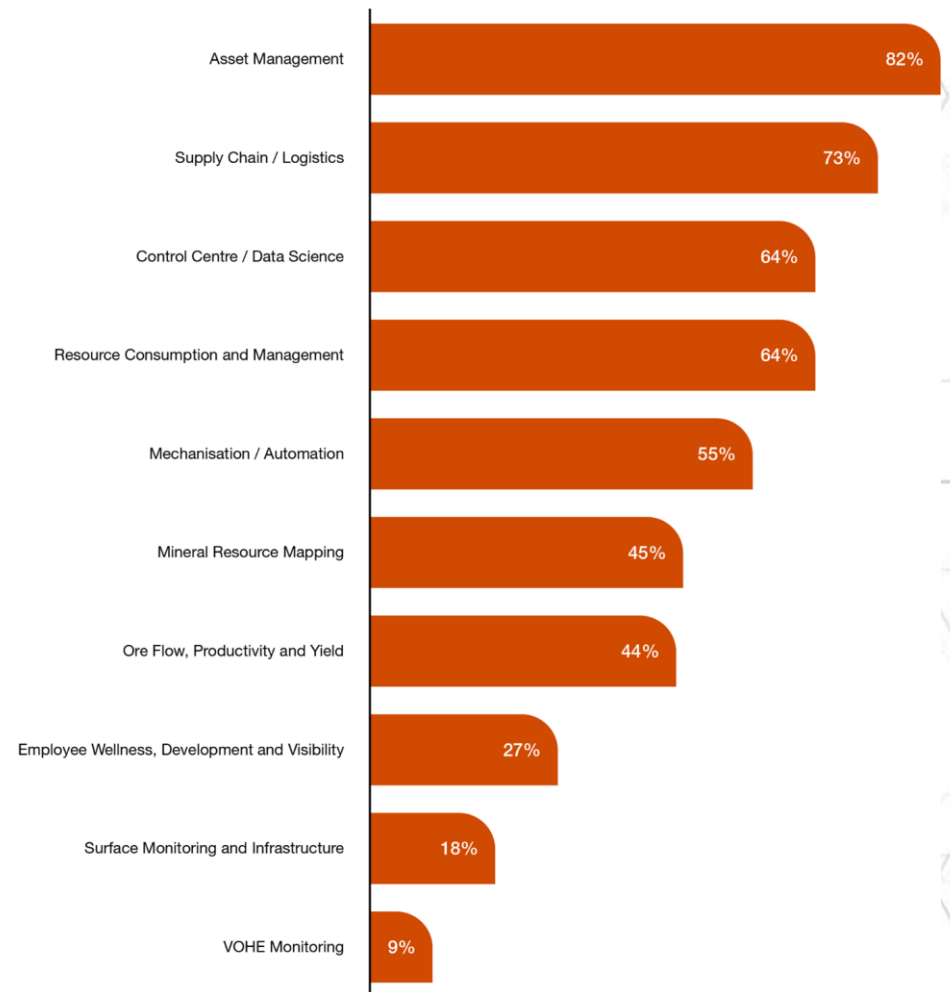


Figure 3: What are the dominant drivers that are being measured?

Insight 5: The imperatives for sustainability, and the crown jewels

Miners do not need to be data scientists, and data scientists need to learn mining:

- The future reliance on data for decision making implies a data literate workforce;
- Some mines have achieved success by limiting the data a worker sees to what is useful to them in their present situation;
- Several success stories point to us not needing scarce skills to read and act on the data - instead we need to focus on information that is useful to the miners;
- Miners 'like' systems such as SAP because of their governance and security - i.e. the data is less likely to have been manipulated.



“Data generation, processing, curation, literacy, and education are the most difficult challenges in implementing data science and management in mining operations”

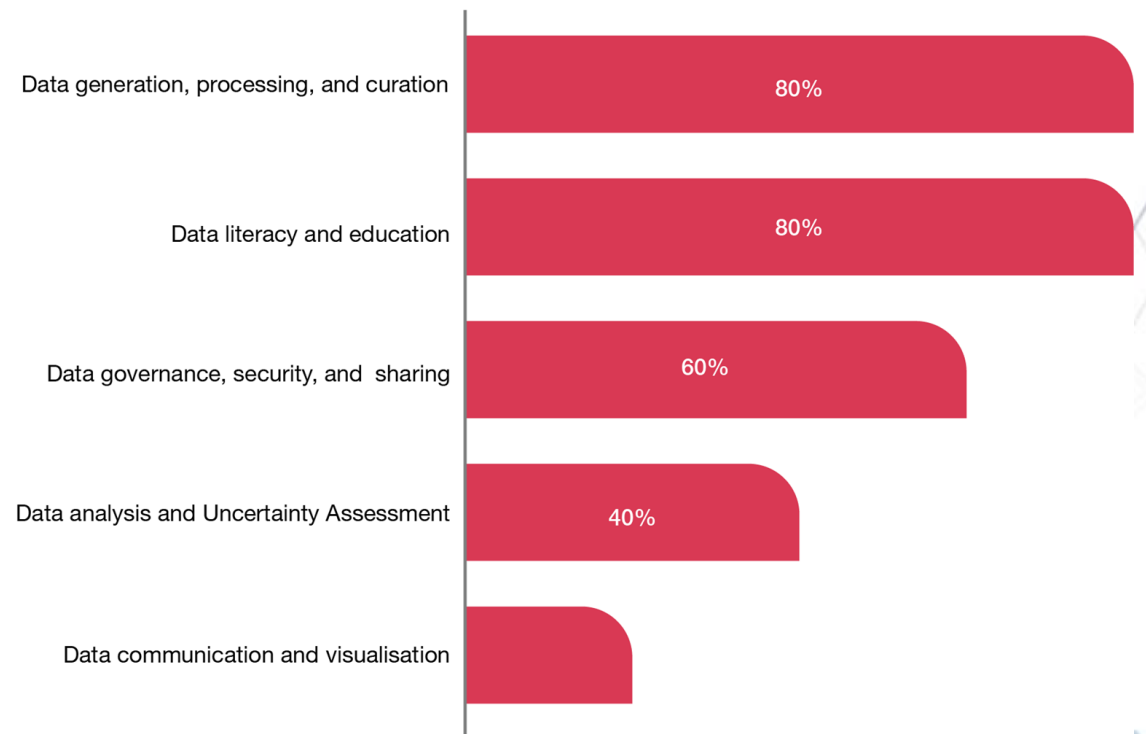


Figure 4: Top challenges in implementing data science and data management

Insight 5: The imperatives for sustainability, and the crown jewels



ICT infrastructure and data are more effectively re-used and the goal is real-time information:

- The CEOs want on-time, real-time data availability;
- The investments are in place and capital budget is increasing;
- However, ICT Strategies are starting to be impacted by scarce skills;
- The CIO's have their own concerns:
 - Improving governance;
 - Architecture Boards & Project Management Offices;
 - Looking to re-use infrastructure & share services across the business;
 - Standardisation (applications and OT) - which also helps with the skills issue;
 - Remove duplication systems and applications for mining operations;
 - Get benefits of economies of scale (licensing).

Insight 6: We are up to the challenge & have the tools we need to win

“ We have spent the last three years gatekeeping and getting people to go to work and get to the face for production ”

SA Miners are not satisfied with progress in digital - there is more to be had from the 4IR:

- We have done a lot, but we could have done better:
 - Safety - our fatal incidents (around 108 per annum) are 50% higher than the global mining average among ICMM members;
 - Operations are still ‘archaic’ - people dependent, behaviour dependent and nowhere near autonomous decision making;
 - OEMs are slow to adopt 4iR technologies - safety systems like proximity detection should be offered with the hardware (not left to mines to integrate).
- We struggle as miners to generate actionable information that is easily consumed by leadership;
- It has become evident that it is immensely complicated to distil information down to pieces of data that are useful in a specific context;
- It takes time and data to start achieving meaningful results - expecting maturity of the first of these platforms in 2025 according to the interviews;
- What to watch out for: make sure the right data is included in your model (be deliberate).



Insight 6: We are up to the challenge & have the tools we need to win

Adoption remains a challenge and the traditional mining process persists:

- Without mature internal capabilities in digital these programs can drive dependency on external experience & complicate adoption and change management,
- Digital has made an enormous impact across three areas of mining:
 - Safety
 - Projects such as digital twinning
 - Processing (automating and digitising processing plants)
- Asset management has transformed due to the availability of data;
- AR/VR training tools are prevalent and are improving on the job safety;
- IoT is implemented by half our respondents and the other half are in pilot stage;
- Predictive maintenance largest challenge outside of sensors and ICT is the OEM itself.

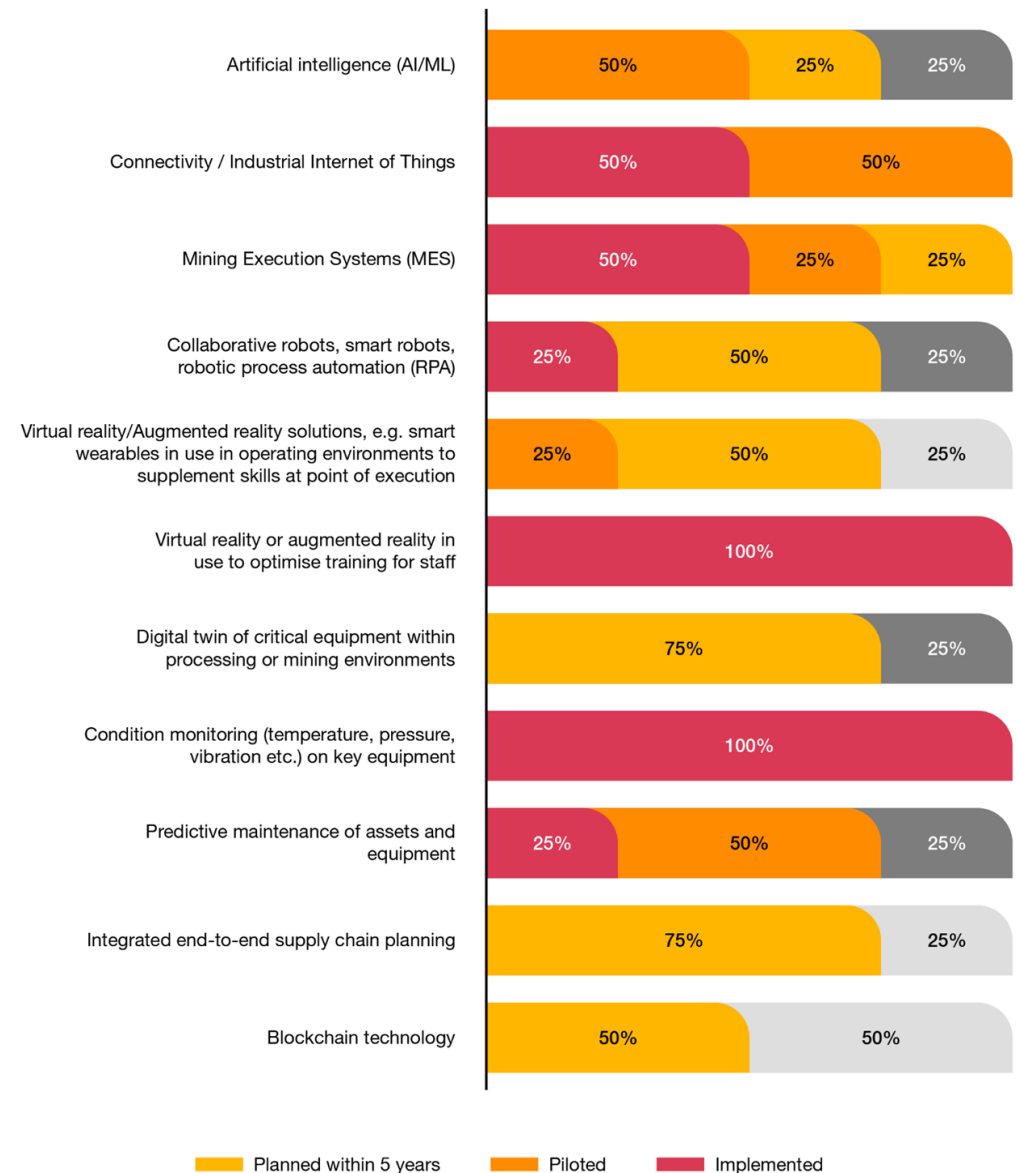
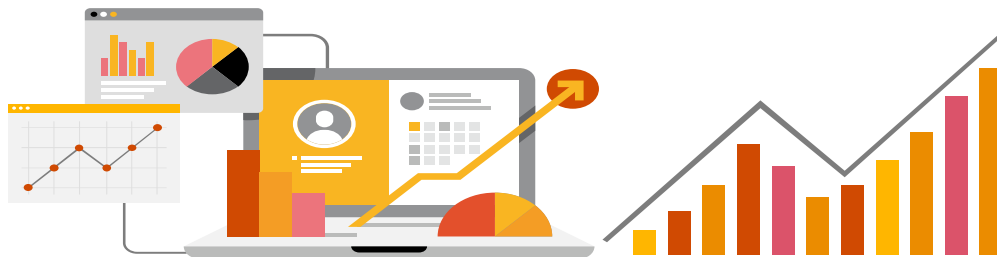


Figure 5: To what extent have you implemented

Insight 6: We are up to the challenge & have the tools we need to win

We need one voice to enact real change:

- Miners are great contributors to South Africa, supplementing government services in places
- The 'good' is not fully recognised by the public
- This has given rise to further expectations - unrealistic expectations?
- Our respondents feel that there is a need to define mining in the modern context alongside the right social partners (labour, communities, regulators)
- The unanimous choice of medium for this discourse was the Minerals Council of South Africa - the trusted face of SA Mining.
- On the technical side the same goes for standards in technology led by Mandela Mining Precinct.



We are all feeling anxiety as we address South Africa's challenges:

- SA is less attractive as an investment destination due to energy, rail, water, transport, security and port issues
- Mining CEOs are concerned about the lack of political will to deal with crime & a failing legal system.
- On top of these challenges CEOs face social and digital tension as we transform to new ways of working.
- The two single biggest challenges the CEOs are facing are:
 - Regulations - because safety and regulation are linked and we need strengthened regulations to 'force' long term thinking; and
 - The cost of Labour because Sa was "losing its competitive edge on the international stage"
- The mining leaders discussed:
 - Working together through a common industry body - the Minerals Council - to effect change; and
 - Integration of bulk water, mining, energy, transport, education and labour systems

Insight 7: Mining is about people - and we need to fight globally for talent

“ Our leadership and workforce of the future are not in sync with the changes digital is bringing to mining ”

Leadership is key, while culture can replace scarce skills:

- Resistance to change is a large issue for our miners;
- Miners see a need for changes in leadership to be able to operate in a digital environment because “Our leadership and workforce of the future are not in sync with the changes digital is bringing to mining”;
- Miners cannot deal with this in isolation - the future world of work and what changes are required to modernise at all levels (school, university & workplace) involves a wider set of stakeholders;
- Miners do see an opportunity to work better with one another in this respect - at present they all have their own future world of work concepts;
- The ‘bad reputation’ of mining is driving away potential talent - we are dealing with a shrinking talent pool coming to mining, and from that talent pool people are being promoted earlier in their careers.



Insight 7: Mining is about people - and we need to fight globally for talent

Digital is bringing leadership into a new space:

- Providing real-time data that makes jobs easier to manage while holding people to account 'Don't impose, let them find it';
- This was supported by the Unions who see these tools as enabling - i.e. instead of telling you the hourly target they help you to reach it;
- Culture can be just as powerful as new skills;
- We are 'future skilling' because the tools we will use to run the business in future will be different;
- We need to find the balance (Management by exception based systems);
- This is a primary driver for collaboration through the Mandela Mining Precinct
 - Standards
 - Consolidated skills base
 - Agreed technologies
 - Long term skills programme (Universities & Technical colleges).

Six Insights into Engineering Graduates:

- The general worker problem
- Exposure to other opportunities
- Specialisation is not seen as an advantage
- Culture shock
- Job security / messaging
- Same sequence jobs



Insight 8: ESG - critical for business survival or tick-box?

Theme

Response

Preparing for the big ESG

- ESG is not a new concept to mining, but the way we need to engage with these drivers is changing
- To embed ESG as a strategic driver, our respondents told us:
 - ESG starts with the right structure and resourcing;
 - Is best to be a part of international societies/councils where best practices are shared & applied by member companies; and
 - Reporting to management helps to drive the process forward practically for all respondents (behaviour change)

ESG drives strategy...

- Continuous challenges of ever evolving reporting & ESG requirements;
- Challenging when ESG pillars are managed in silos;
- Compliance led process is complex;
- Therefore, the majority view from our mining houses is to actively avoid the temptation to view ESG in silos and just for compliance;
- SA Miners strongly advocated an Integrated value-led approach.

...but the application is fragmented

- 29% incorporate ESG issues into business risks;
- 43% say ESG is part of the core business strategy and operating model;
- 14% view ESG as a measure of sustainable development;
- The remaining 14% say there is still no common unified standard definition of ESG or its goals.



Insight 8: ESG - critical for business survival or tick-box?

“ ESG may be time-consuming and costly to undertake, but it will be worth the time, effort, and money in the long run our South African miners tell us. ”



Those serious about ESG add it to their KPIs:

- Is ESG going to shorten the life of our mines?
- If ESG was working properly, would it not be producing sustainable businesses?
- Is it a Social Licence to Operate with extra E and additional G?
- If we did the minimum to comply would that be sufficient?
- Mining executives do not want compliance or assurance mechanisms - they want a true strategic shift
- To them - this means KPI's cutting through the organisation - down to individual level
- Without that, how credible is our ESG strategy?



Insight 9: ESG - Regulations shape ESG requirements (for better or worse)

Commentary on ESG frameworks and application to the mining industry:



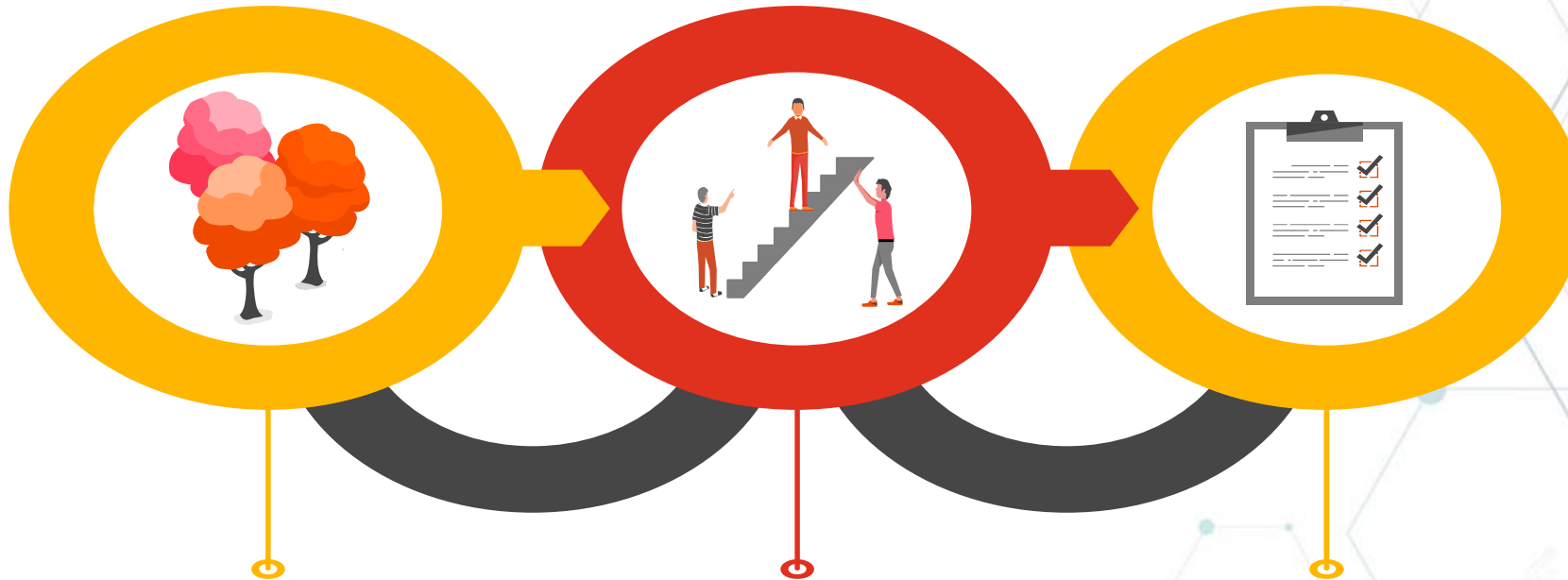
What the mining industry needs:

- A uniform and consistent reporting framework – one developed by the mining industry for the mining industry;
- Drive informed decision-making amongst stakeholders;
- Drive accountability and shared responsibility towards a sustainable industry while holding us equally to account; and
- Automation (systems and eliminating data silos).



Insight 10: ESG drives long-term value

E, S and G opportunities as identified by the mining industry



Environmental

1. New Market Opportunities
2. Green premiums
3. Fundamental shifts in competitive landscape
4. Tax savings by shifting supply chains

Social

1. Job creation & Upskilling in new and evolving markets
2. Greater trust and fewer business disruptions
3. Inclusive Projects
4. Job creation & Upskilling
4. Job satisfaction.

Governance

1. Increased security and lower borrowing costs
2. A resilient company that can adapt to changing market conditions
3. Digital Systems Resilience
3. Improved Brand recognition
4. Responsible technology innovations



Insight 10: ESG drives long-term value

From point solution to integration - how miners are tackling ESG and their ICT:

- Without a blueprint or clear regulations, miners have chosen their own preferred path and reporting for ESG;
- Many are looking to point solutions such as:
 - Operations
 - Rehabilitation
 - Blasting
 - Drones
- The 4IR tools in use for ESG at present include:
 - Digital tools for life cycle costing, life cycle impact assessment, material passports, and circularity measurements
 - Shift from planned to predictive maintenance by using various detectors and monitors
 - Remote sensing in environmental monitoring and Geographic Information Systems (GIS)
 - AI cameras for dust level detection in operations.
 - Use of drones for tailings dam management.

The Union perspective on ESG:

- Unions recognise the relationship and interdependency between sustainability, community development, economic progress, stakeholder relationships, and production;
- Labour is becoming more conscious of the environmental and social impact of mining - and they want mining operations to be more sustainable;
- In their minds digital has a very real impact as it improves the environment in which people work - literally protecting them;
- The emphasis on the environment:
 - The unions argue that there is less focus on social and governance issues as larger attention is given to environmental protection
 - The unions contended that for ESG to be fully realised, there is a need for key stakeholders including the workforce, the community itself, and social partners to collaborate in developing mining communities.

Thank you

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