Ten insights into 4IR

Presentation by **PwC & Minerals Council South Africa**
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MINERALS COUNCIL
SOUTH AFRICA

4IR needs mining...

Materials used in most 4IR technologies are mined

COVID-19 pandemic

4IR did not go into lockdown during the COVID-19 pandemic

4IR has **helped manage** the pandemic more effectively

Accelerated the application of 4IR

28 of 29 elements in mobile phones need mining

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SA mining needs 4IR…

Over the last decade mining productivity **decreased by 7.6%**

Costs **rose by 2-3%** in real terms

Two-thirds of SA's mining output in the **upper half** of global mining cost curve

Minerals Council advocates a people-centric 4IR

Focus not only on technology but on work culture, upskilling and reskilling

4IR creates new, better paid, safer, healthier, and more fulfilling jobs

4IR technologies to enable a more modern mining sector

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To accelerate 4IR in mining, we need:

A people-centric, 4IR-enabled modernisation strategy

An accelerated, transforming innovation capacity-building programme to restore SA as global leader in mining

Public-private partnerships like the Mandela Mining Precinct to facilitate modernisation

Innovation infrastructure, such as a Test Mine where innovators can turn research into globally competitive products

Multi-source, significant mining innovation investments

MANDELA MINING PRECINCT
MINDS FOR MINES

MINERALS COUNCIL
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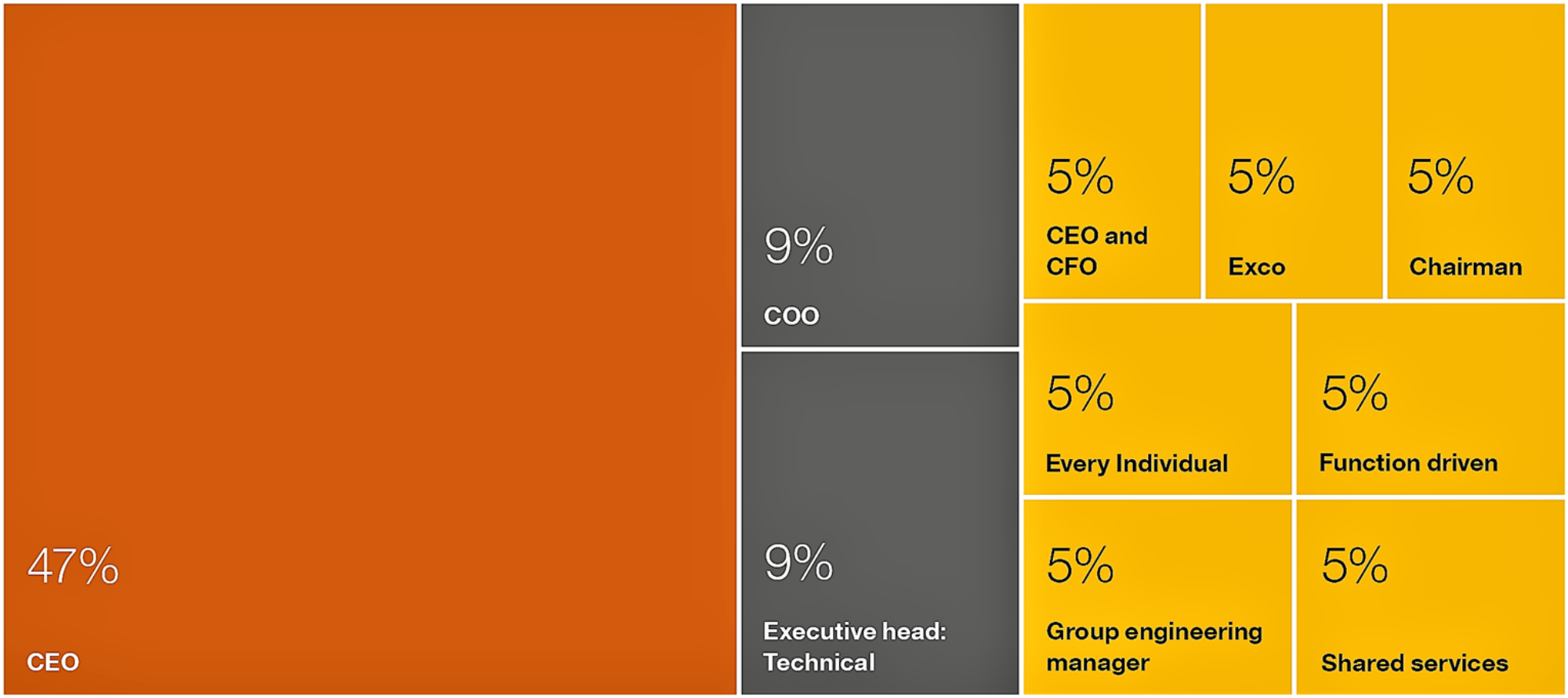
Figure 1: Who drives the 4IR and digital agenda?

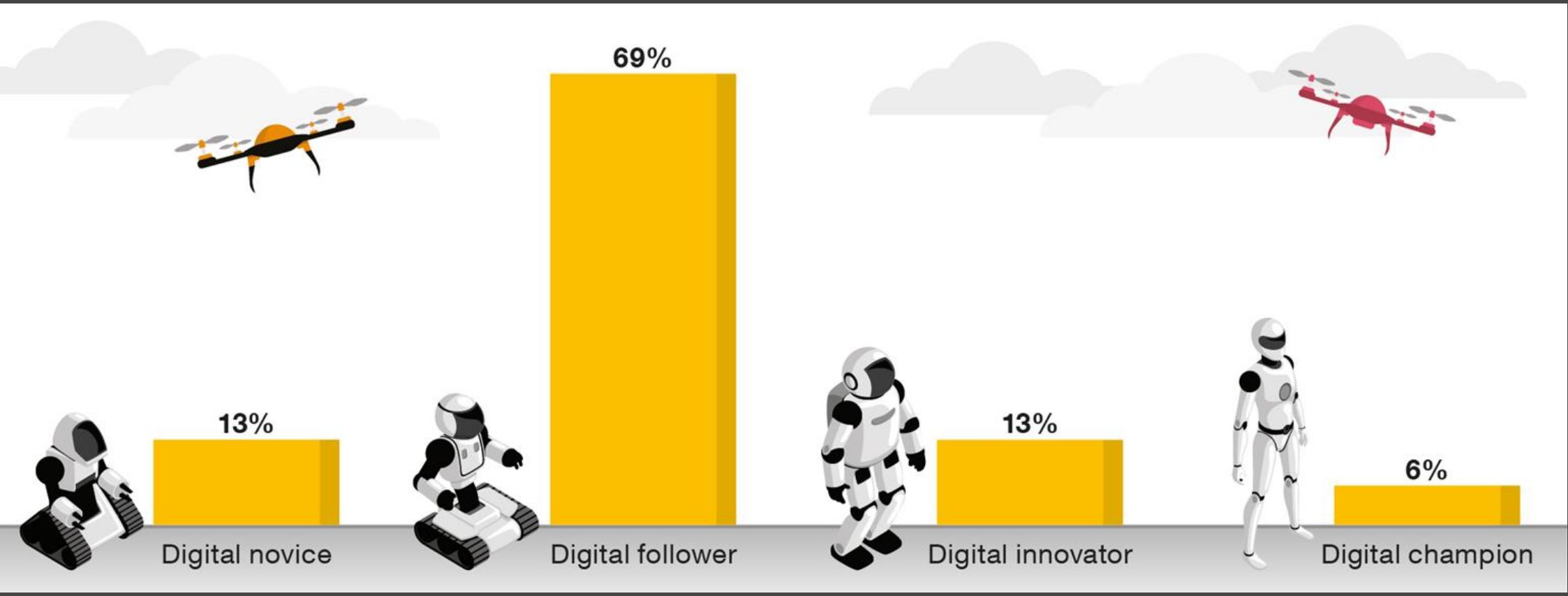


Insight 2: Digital champions and innovators are emerging

We have identified four distinct stages of digital maturity among the respondents to this study:

- **Novice**: functional silos not yet connected
- **Follower**: functionally connected practices
- **Innovator**: cross functionally connected practices
- **Champion**: fully integrated health & safety, people, production and cost ecosystems

Figure 2: Stages of digital maturity



Insight 2: Digital champions and innovators are emerging

How do we compare globally?

- Similar distribution
- Global manufacturing drives digital adoption
- We can learn from the best:
  - Supply chain visibility
  - Digital tools and platforms
  - Intelligent maintenance
  - AI driven endless optimisation

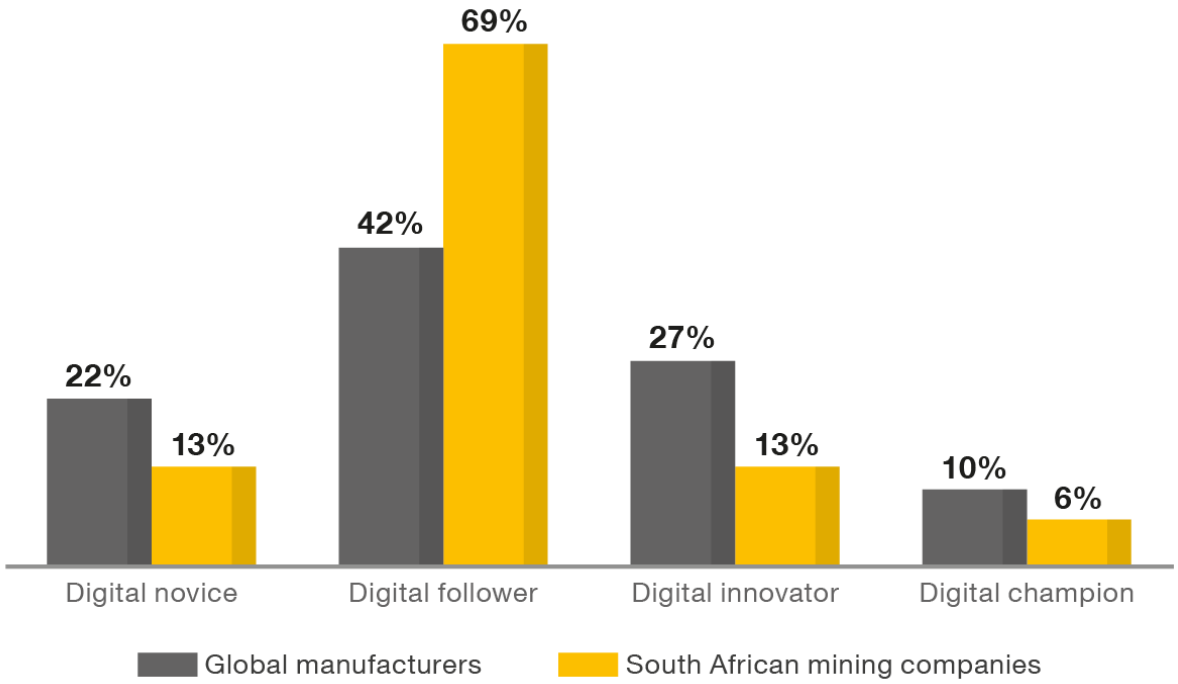


Figure 3: How do we compare globally?

Insight 3: Investments in digital technologies are growing

Investments are growing as miners see value from their pilot programmes and POC's.

- The greatest benefit derived from production - where it is most challenging to implement;
- Adoption is key - people remain at the centre of digital transformation; and
- Business case driven transformation is most effective according to the survey.
- Average investment across all - R111m p/a

- **Curious (investment < 0.15% of turnover)**
  - Recently started 4IR journey (Piloting);
- **Cautious (investment 0.16–0.3% of turnover)**
  - Moved past experimentation and have clear operational impact goals;
  - R95m spend average; and
  - Will monitor competitors and follow once successfully demonstrated.

- **Confident (investment > 0.3% of turnover)**
  - 25% of those surveyed;
  - Average spend R166 Million p/a;
  - Corresponds to digital innovators and champions in insight 2; and
  - Adoption is a challenge unless it derives benefit for users (not just adding to a role).

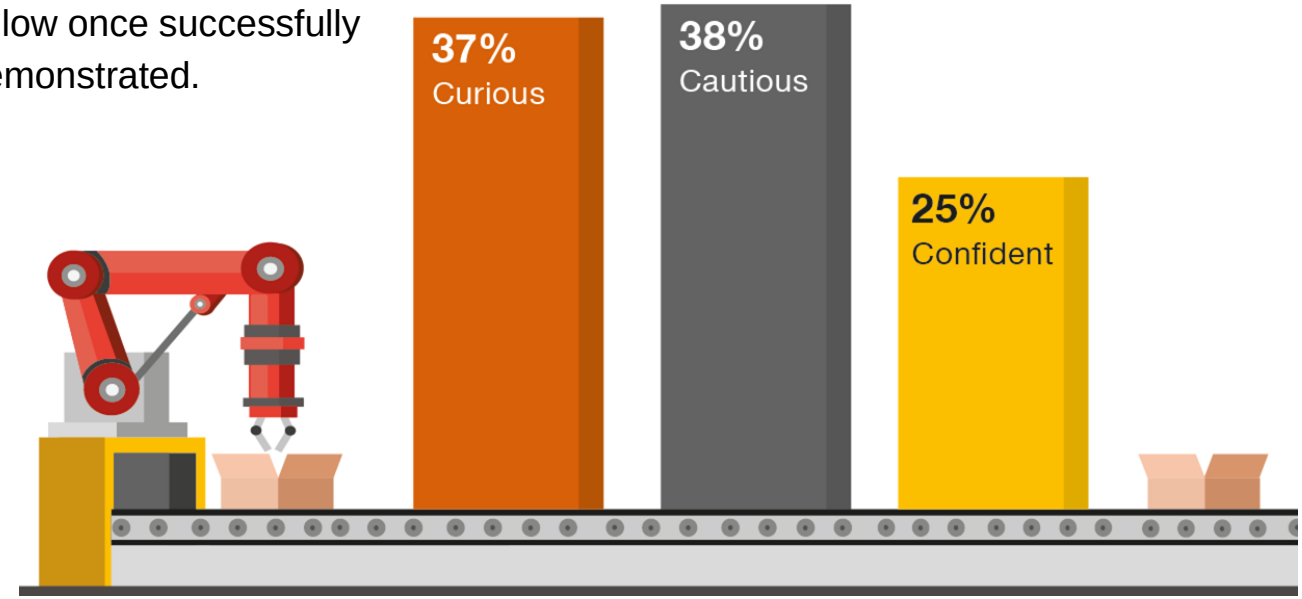
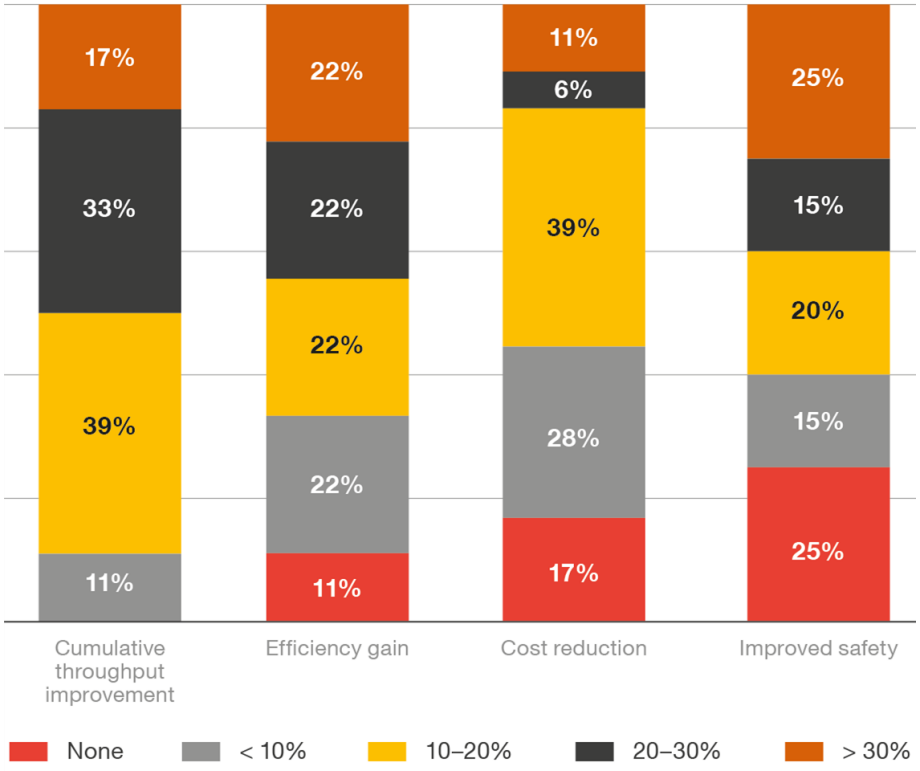


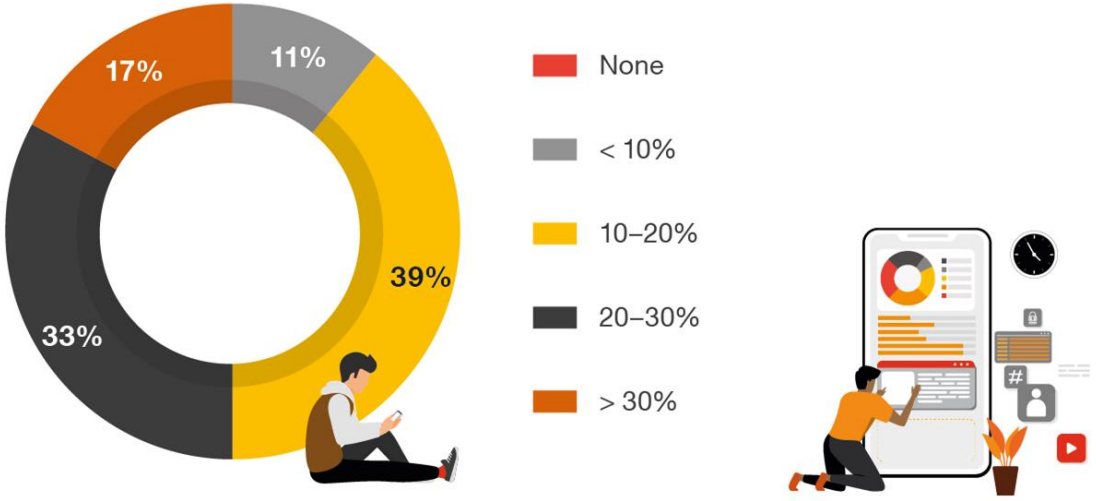
Figure 4: Distribution of turnover spend on digital transformation

Insight 4: Digital technologies are delivering real benefits (1 of 5)

Throughput increase:

- 17% of respondents expect a greater than 30% increase due to 4IR in the next five years;
- One third predict throughput to increase between 20% and 30% in five years;
- 39% predict increases in the more conservative 10% to 20% range; and
- 11% expect less than 10% - however this is linked to external constraints (e.g. Narrow tabular Ore body).
- All respondents expected an increase in throughput over time.





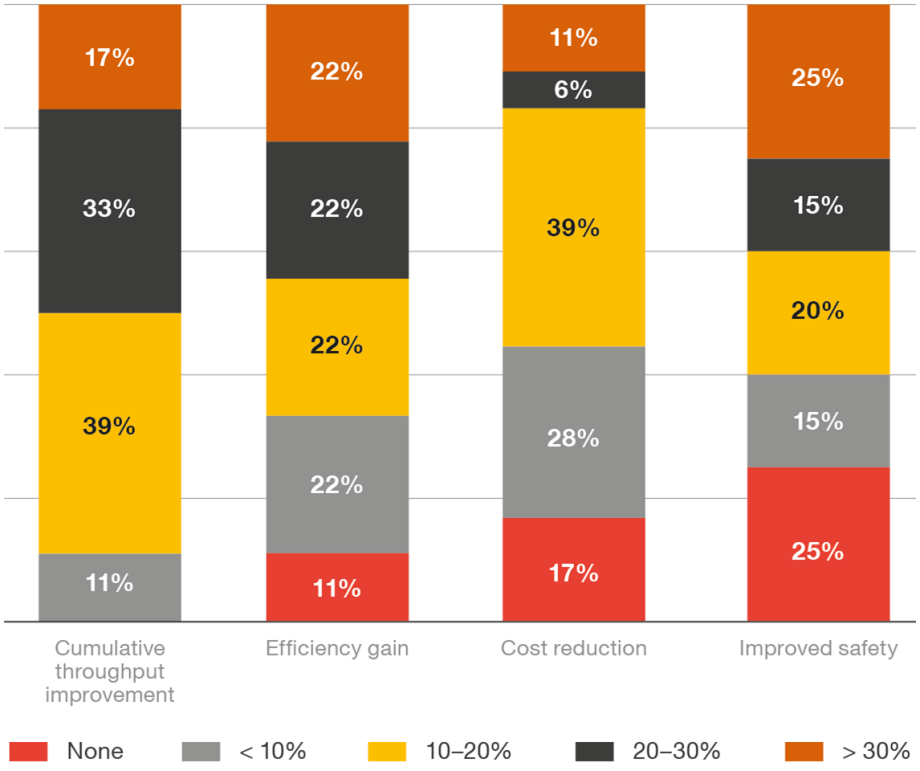
Areas benefiting the most from digital technology

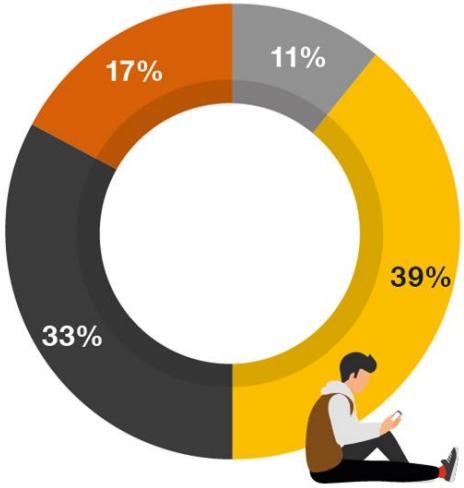
Health & Safety	Throughput	Operating cost	Efficiency

Insight 4: Digital technologies are delivering real benefits (2 of 5)

Efficiency Gains:

- Two thirds of those surveyed expect efficiency gains of at least 10% due to 4IR over the next five years;
- 22% expect to exceed 30% gains, while another 22% expect less than 10% efficiency gains; and
- 11% do not expect any efficiency gains (typically digital novice with constrained investment environment).





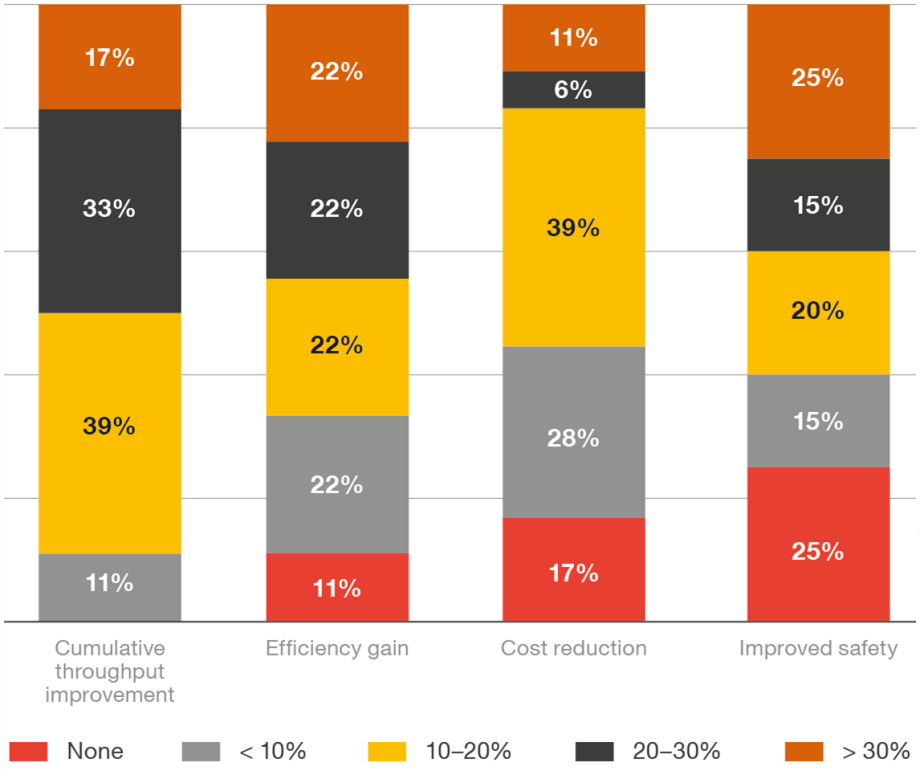
Areas benefiting the most from Digital technology

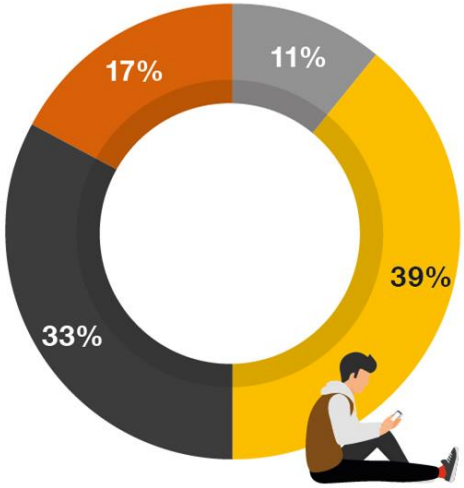
Health & Safety	Throughput	Operating Cost	Efficiency

Insight 4: Digital technologies are delivering real benefits (3 of 5)

Cost Reduction:

- Some respondents were unsure of the cost in context of a more expensive, more skilled workforce;
- 11% expect a greater than 30% reduction in costs (these respondents had specific plans in mind);
- More than half expect cost reductions of more than 10%; however
  - 17% forecast no cost reductions at all - for them the benefit lies not in cost reduction but in increases of productivity per capita, thus justifying the higher paid workforce.





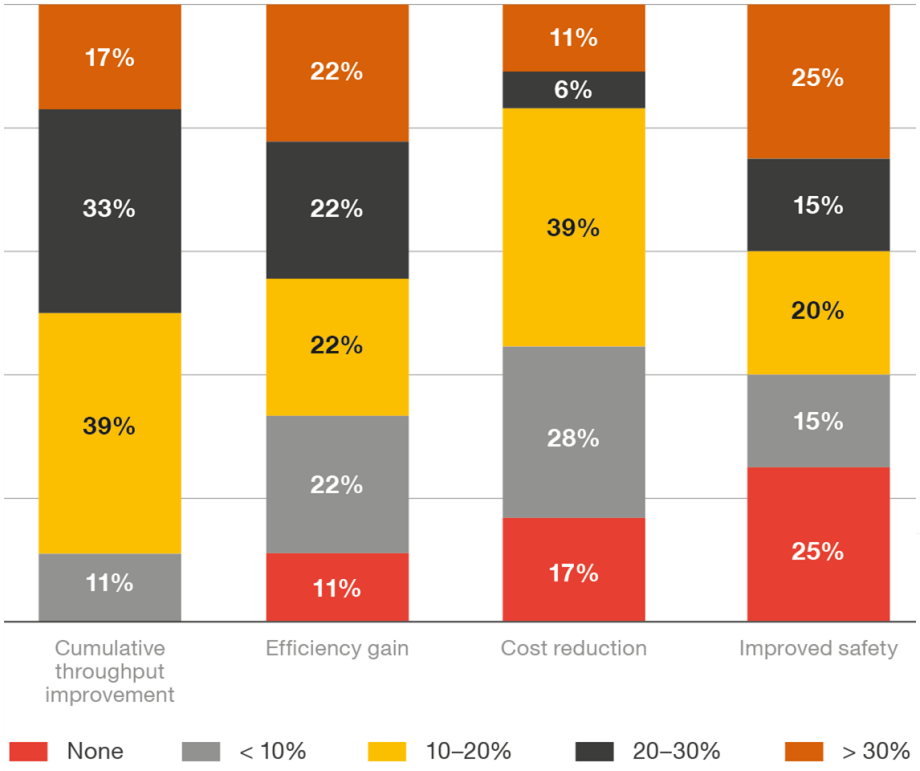
Areas benefiting the most from Digital technology

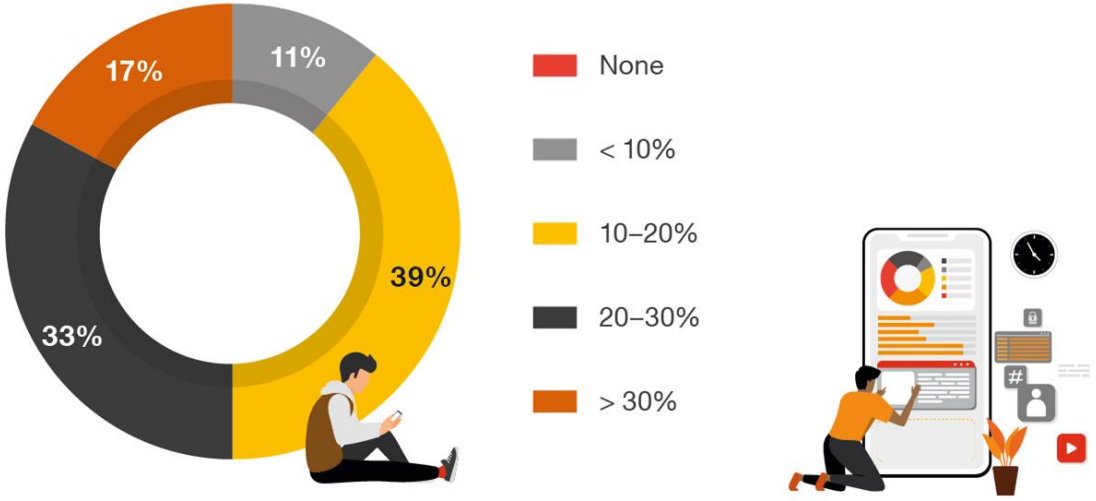
Health & Safety	Throughput	Operating Cost	Efficiency

Insight 4: Digital technologies are delivering real benefits (4 of 5)

Improved Health & Safety:

- 83% of respondents cited a direct relationship between 4IR investment and a safer working environment;
- 25% expect a greater than 30% improvement in their health and safety performance over the next 5 years due to the positive impact of new technology; and
- There are two primary investment types within health and safety - automated fail safe tech (like collision avoidance) and technology supported decision making (digital velocity & Smart systems).





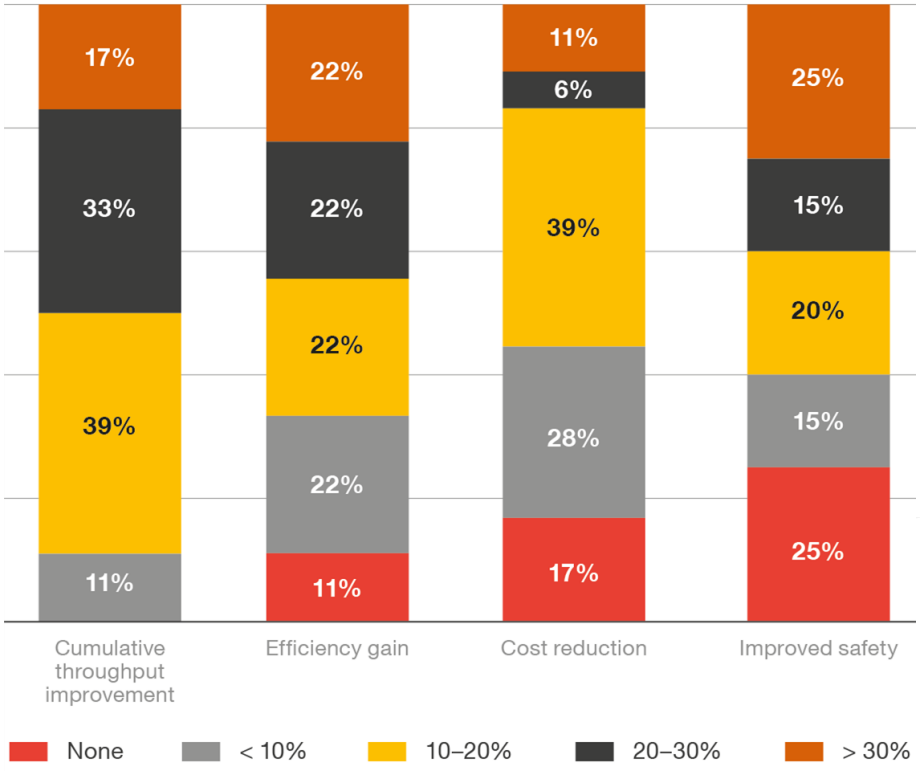
Areas benefiting the most from Digital technology

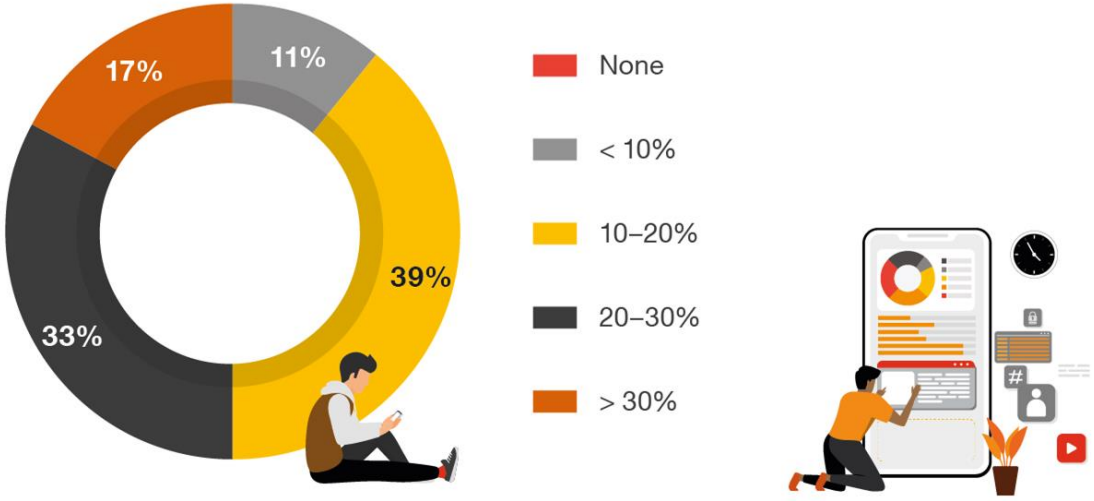
Health & Safety	Throughput	Operating Cost	Efficiency

Insight 4: Digital technologies are delivering real benefits (5 of 5)

Other Expected Benefits:

- Improved metal accounting accuracy (and in real or near real time);
- Radical transparency (benefits both management and investors with real time analytics and insights); and
- Reducing operational variability - improved recoveries, reduction in energy use, improved compliance to plan, greater productivity; and
- The ability (for one miner) to grow down the cost curve.



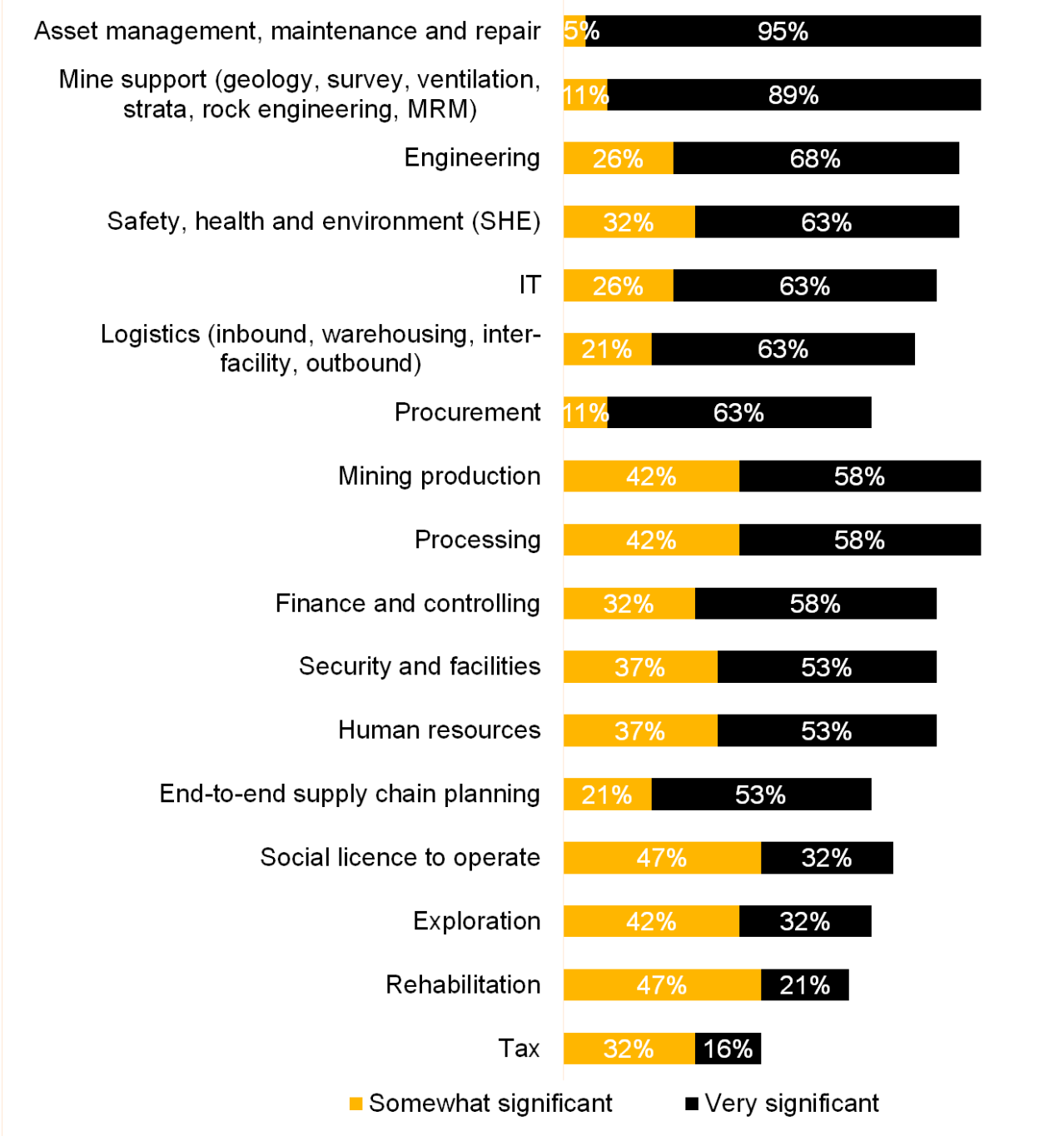


Areas benefiting the most from Digital technology

Health & Safety	Throughput	Operating Cost	Efficiency

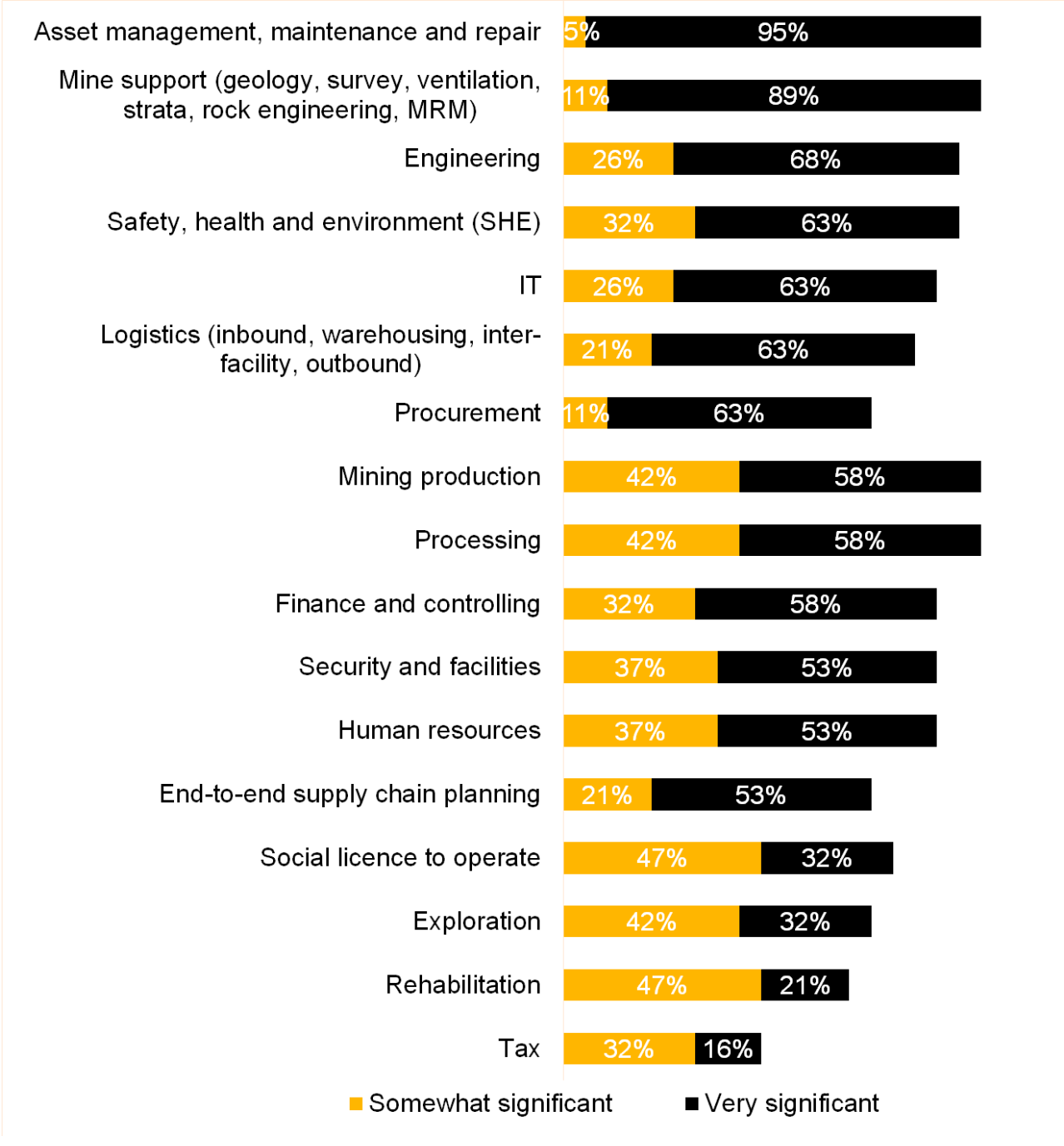
Insight 5: The greatest benefit is expected in core operations (1 of 2)

- Mine core operations is expected to derive the most benefit from 4IR;
- Asset Management, maintenance and repair are expected to deliver the most significant benefits (Corresponds with IoT, ConMon & PdM 4.0 findings);
- Mine support services like rock engineering, survey, ventilation & safety are expected to deliver significant benefits through digital visibility;
- Safety, health and environment has much to gain - both in automated anti collision and in training, employee engagement and training inter alia;



Insight 5: The greatest benefit is expected in core operations (2 of 2)

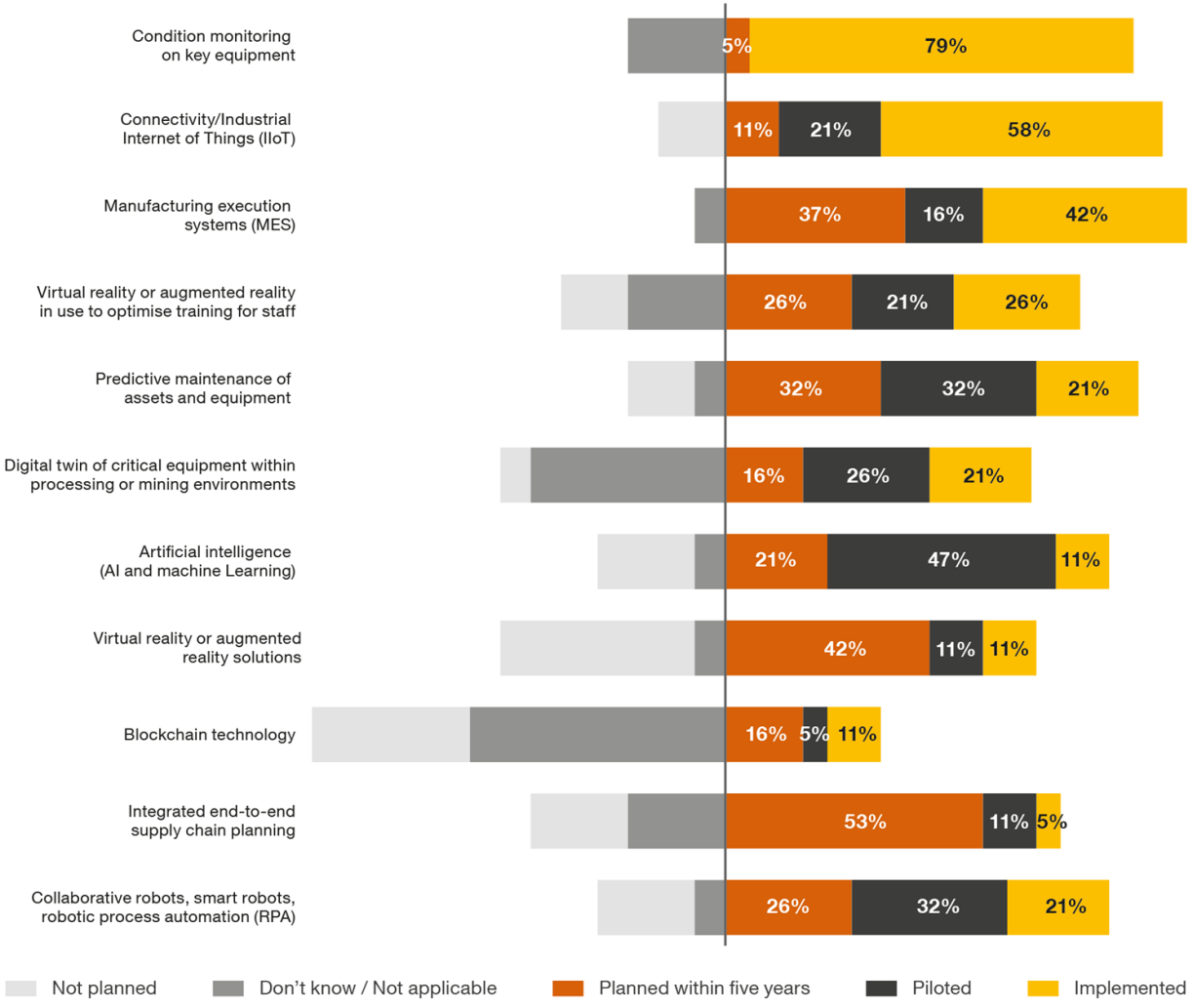
- IT is transforming into a business partner;
- Just 10% of respondents are focusing on end-to-end supply chain planning (potentially largest impact in future);
- Processing is already benefiting from improved MES & process control - real time analytics and visibility of processes is an area of focus;
- HR, Security and Finance stand to gain great efficiencies from 4IR; and
- Social License to Operate is gaining traction - transparency is becoming more important.



Insight 6: Industrial IoT gets the biggest share of the wallet (1 of 2)

The most implemented 4IR technologies:

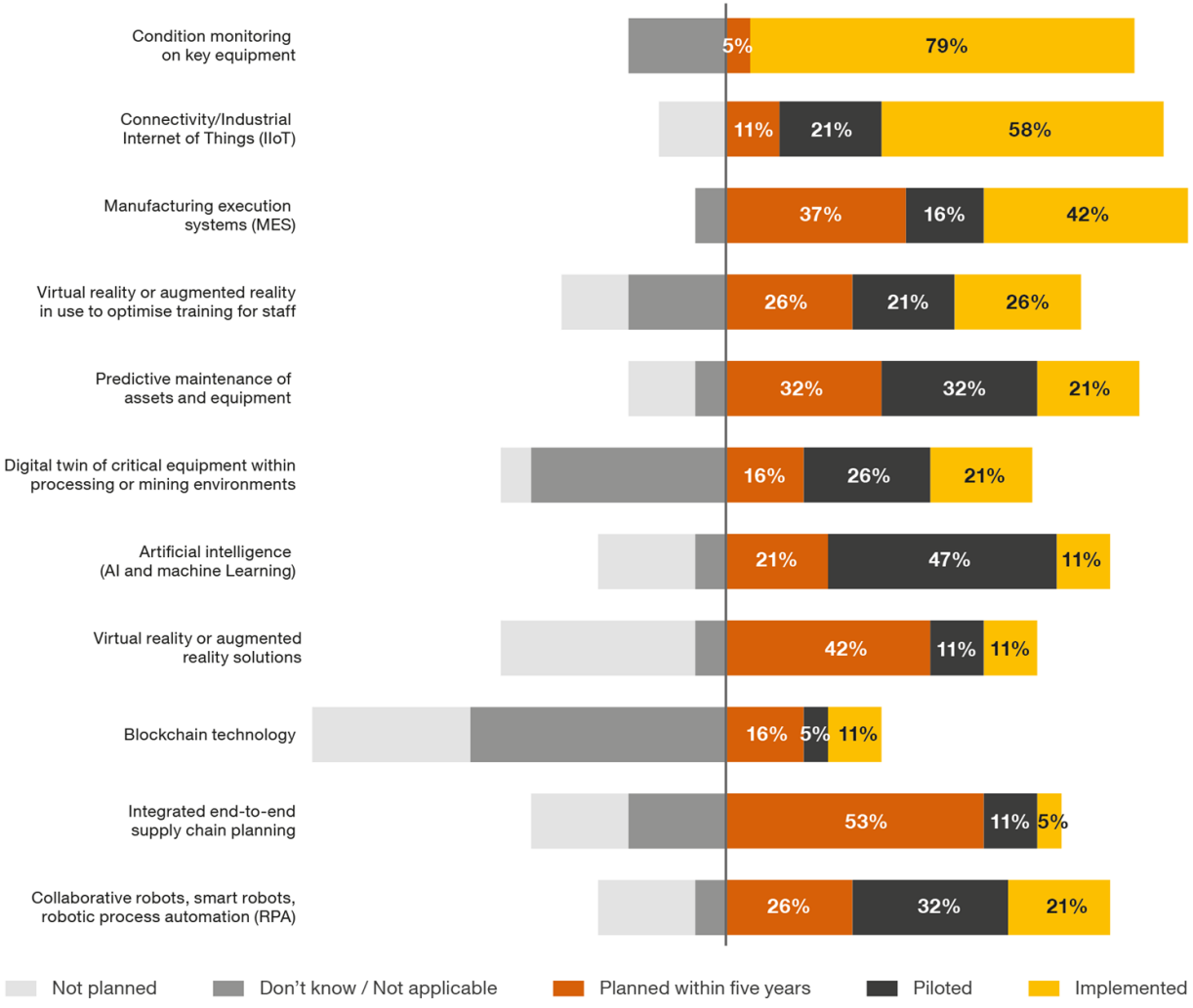
- IoT (79%) & ConMon (58%) lead in terms of investment;
- MES adoption (42%) shows the drive to integrated and efficient operations (using data to derive value);
- Two companies already use AR and 42 % plan to within 5 years;
- Some 26% already use VR for training, while 21% are piloting VR and another 26% plan to within 5 years;
- PdM 4.0 is not yet pervasive despite being proven tech - just 21% have successfully implemented with another 32% piloting and another 32% planning it within 5 years;



Insight 6: Industrial IoT gets the biggest share of the wallet (2 of 2)

The most implemented 4IR technologies (cont.):

- Digital Twin is being implemented by 21% of respondents - while 26% are piloting and 40% have no plans in this regard.
- AI & Machine learning is present in only 11% of respondents - but nearly half are piloting;
- Integrated end to end supply chain Planning is only present in 5% of respondents - 11% are piloting at present with the majority planning to do so within 5 years.



Insight 6 deep dive: Robotic Process Automation

Robotic Process Automation

- RPA primarily in Support & Control Functions
- Cautious / incremental implementation approach in core mining functions
- Common thread – “takes too long” – careful planning/consideration
- Human-replacement? No
- Freeing up human capacity of 20-30% improvement
- Looks promising for more implementations

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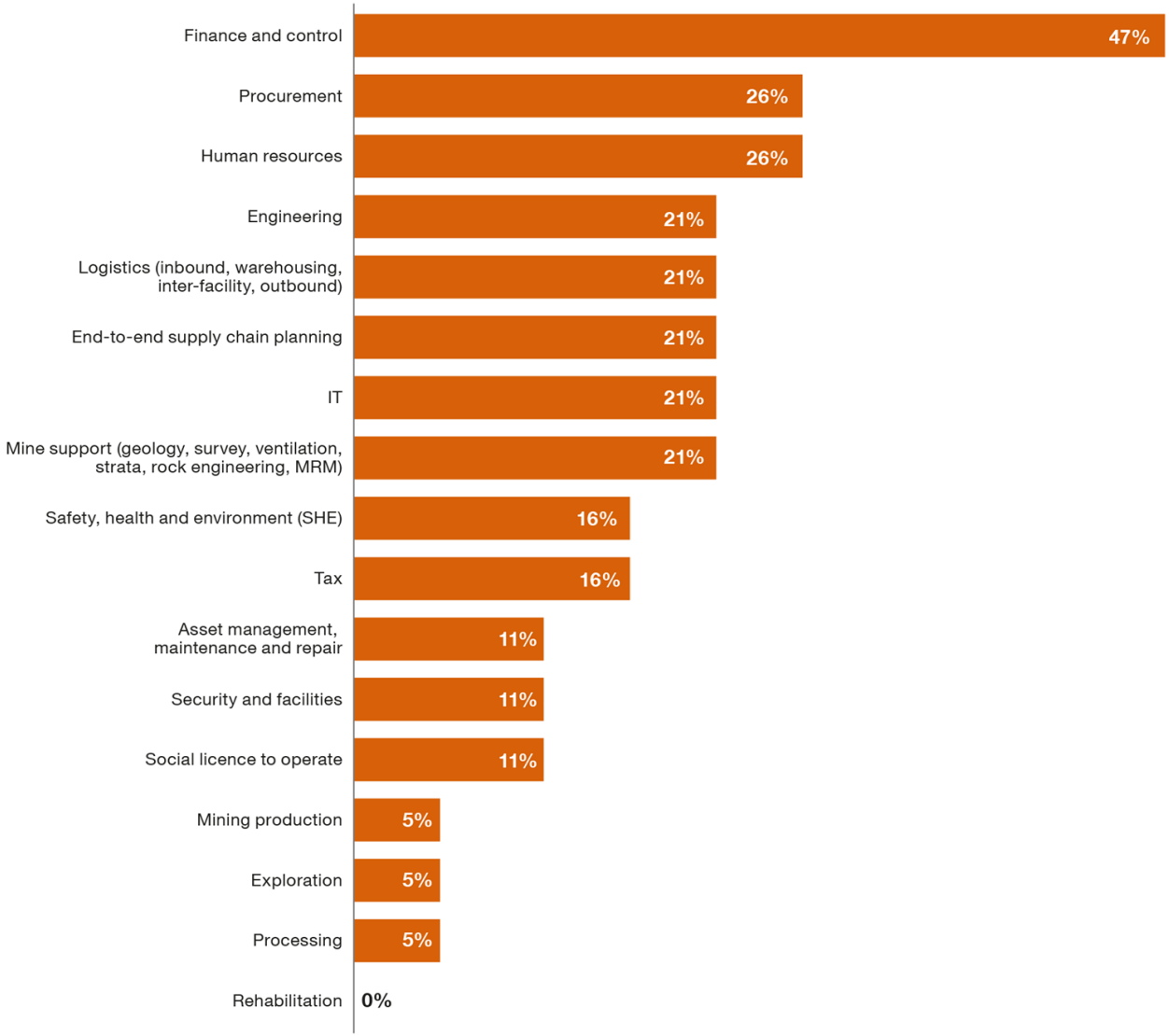
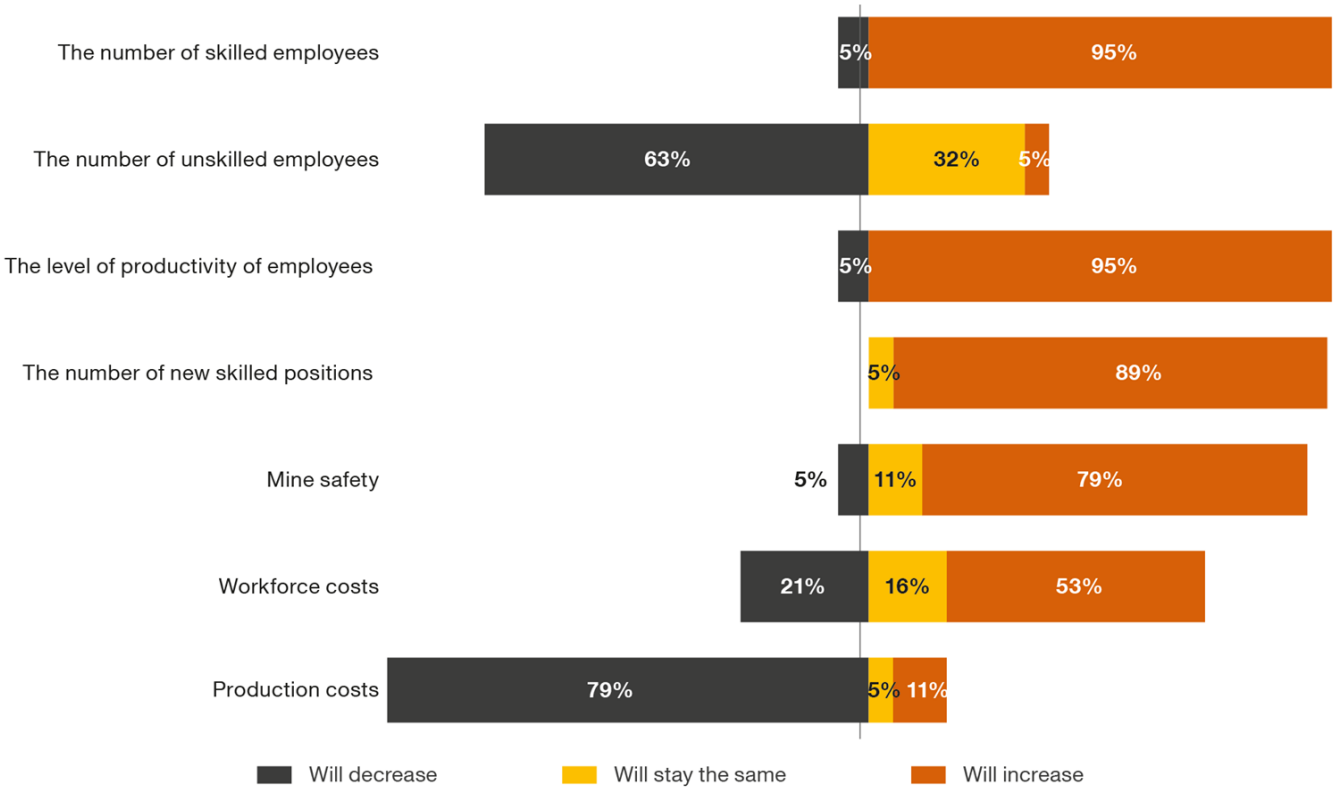


Insight 7: The workforce is changing

95% Of respondents believe that there will be a change in the nature of the workforce to more skilled employees over the next 5 years

79% Of respondents expect production costs to decrease over the next 5 years

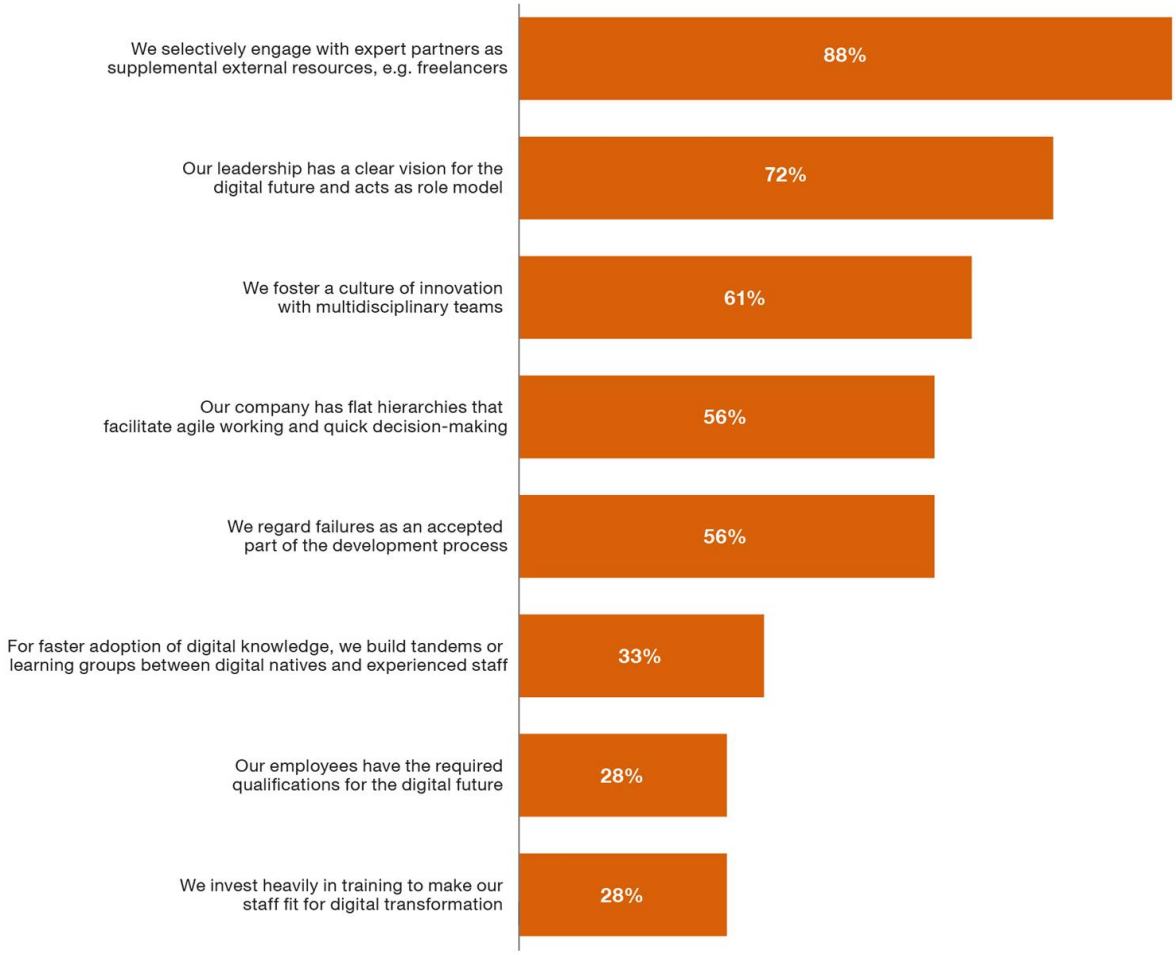


- Nearly 95% of *new* positions created are expected to be for skilled workers;
- 63% expect the number of unskilled workers to decrease, while only 5% expect this to grow;
- 95% expect the level of productivity per capita to rise significantly;
- More than half expect a higher wage bill over the next 5 years, while 16% expect it to remain static, 21% expect a decrease and 10% are unsure;
- Health and Safety - 79% predict an increase (the right thing to do - this a key focus area)

Insight 8: Organisational culture is keeping up with the times (1 of 2)

In what ways does your corporate structure enable digital transformation?

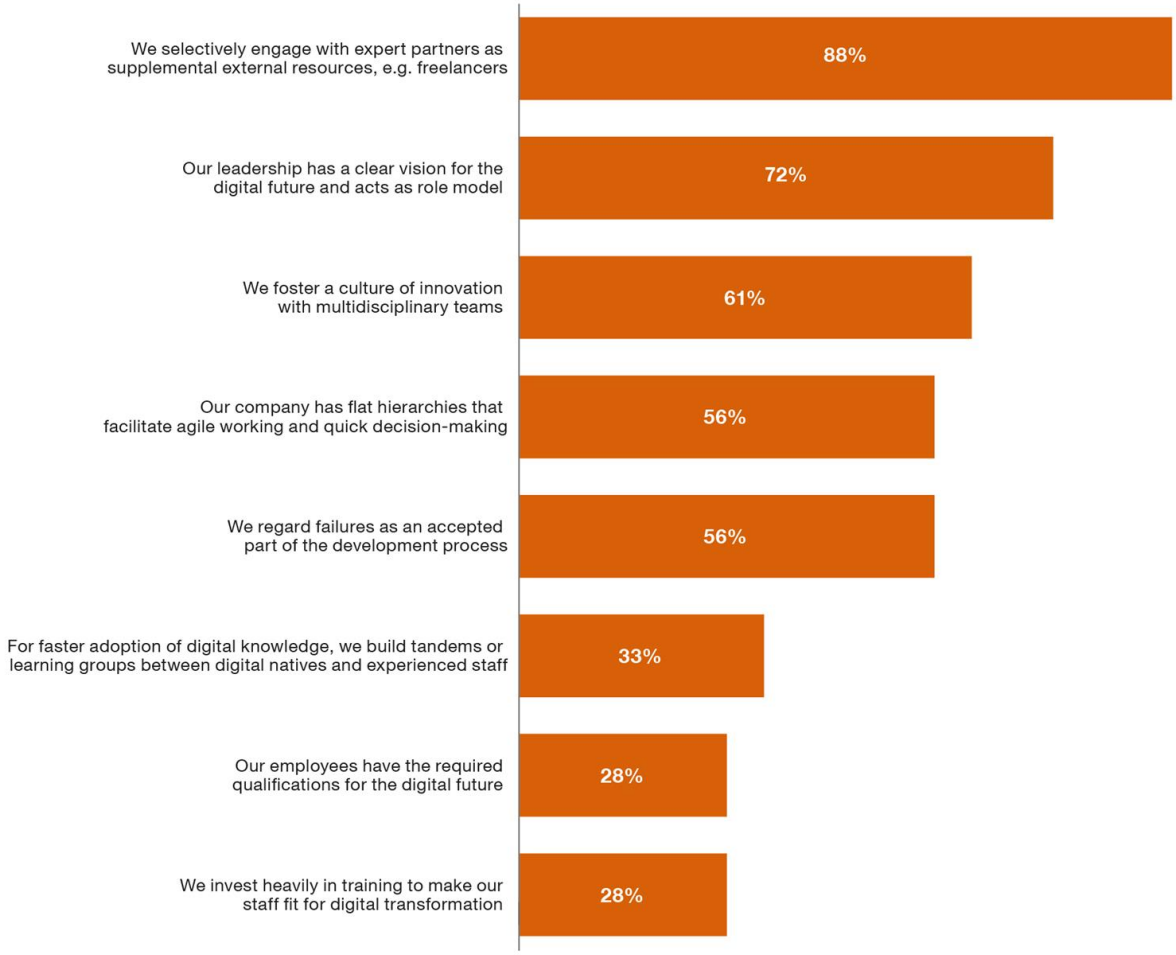
- <⅓ of respondents believe their employees have the skills to realise a digital future;
- 72% believe their leadership has a clear vision for the digital future and acts as role models for digital transformation;
- A third are creating tandems or working groups that team up digitally proficient staff with those less skilled;
- Almost 30% are investing heavily in training to make their staff fit for digital transformation;



Insight 8: Organisational culture is keeping up with the times (2 of 2)

In what ways does your corporate structure enable digital transformation?

- 61% have established a culture of innovation with multidisciplinary teams (Areas of digital excellence that may be leveraged);
- 56% of respondents regard failure as an accepted part of the development process for technologies; and
- Just 10% believe they have the skills internally.

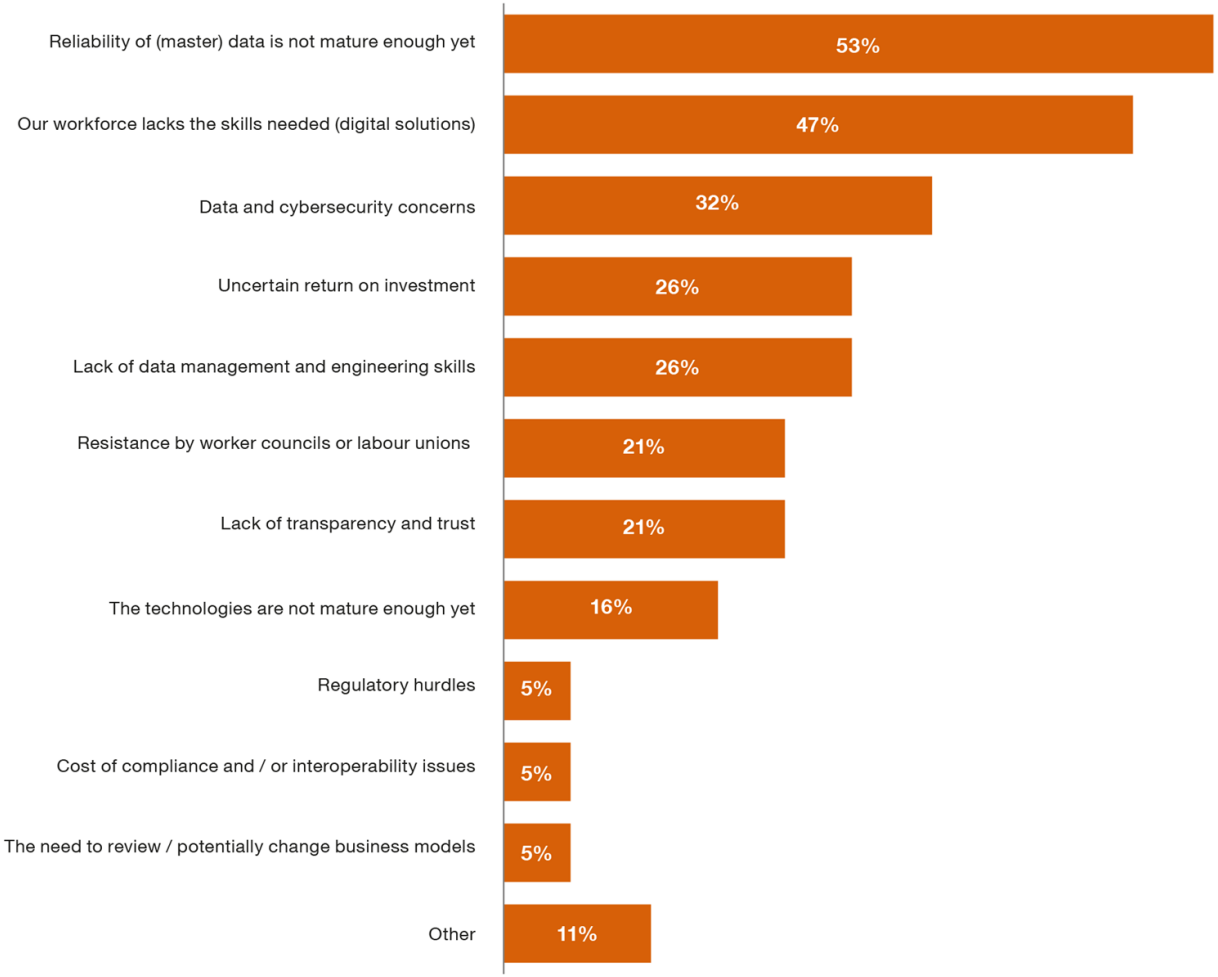


Insight 9: There are challenges to overcome (1 of 2)

The top 3 challenges to implementation of 4IR technology in SA mines are:

1. Low data management maturity
2. Low work force skills
3. Concern about cyber security

- Just 26% cited ROI as an obstacle to digital transformation; and
- Another 26% identified the lack of data management and engineering expertise as their greatest challenges.

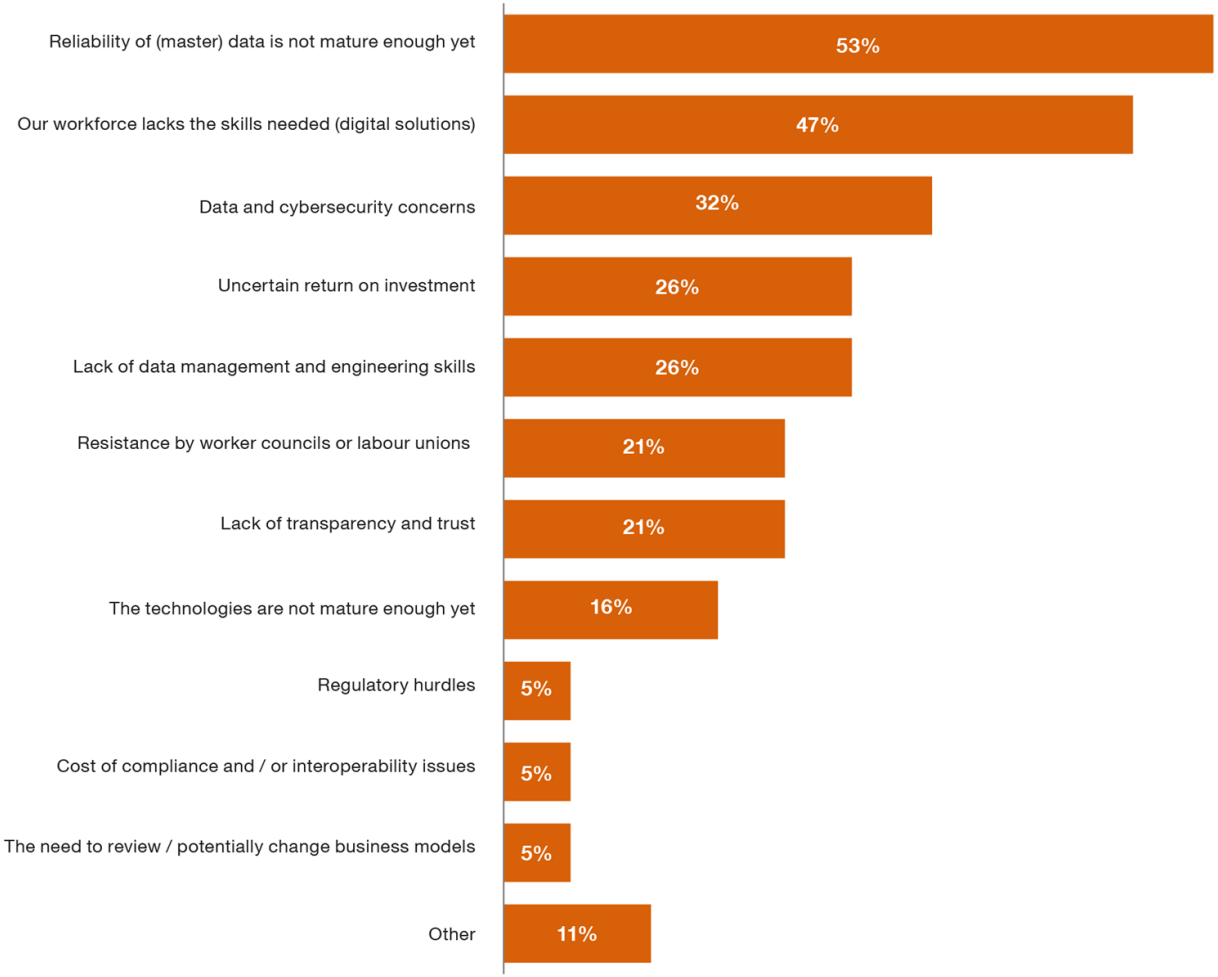


Insight 9: There are challenges to overcome (2 of 2)

Top 3 challenges to implementation of 4IR technology in SA mines

Key statements:

"**It's all about the people**" - adoption is related to the ability to communicate the benefits and get leadership support; Lack of **knowledge**, lack of **alignment** and lack of **shared vision** are limiting factors in the minds of 4IR leaders; and The age of operations impacts the ability to deliver 4IR solutions due to sheer scale.



Insight 10: It's all about the data (1 of 2)

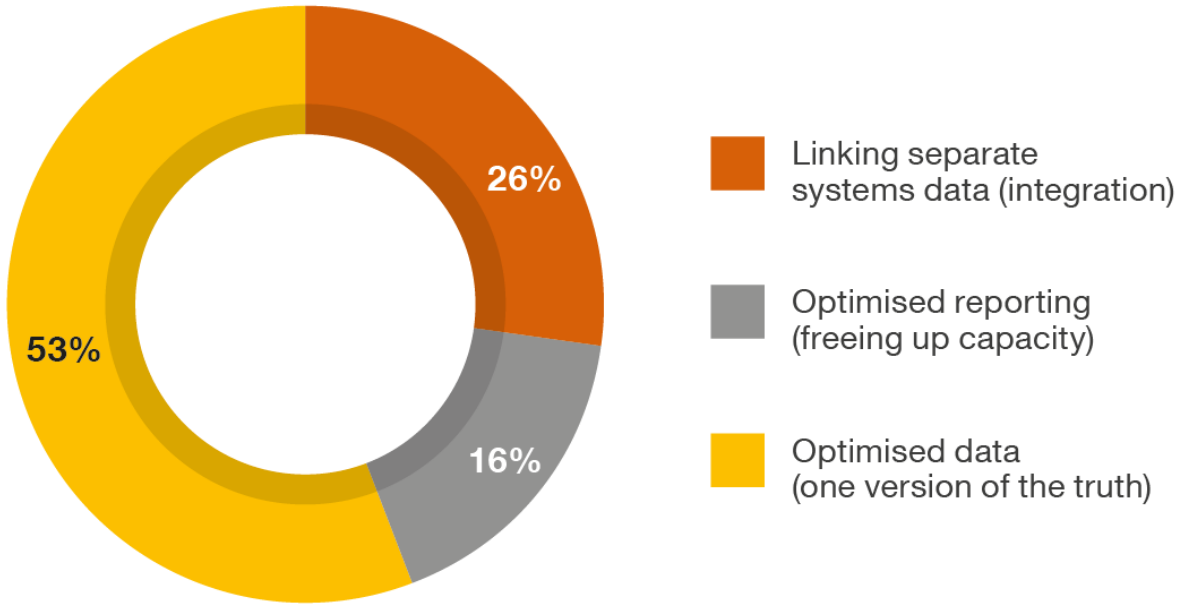
Using data for effective and efficient decision making

Challenges to overcome:

- Many of our local mining companies are yet to master their data and unlock its potential.
- Workforce profile/skills – Computers, Data
- Cyber security and resilience concerns
- Impacts related to new skills/tools in/for the Workforce
- Technology adoption rates
- Technology Reference Architectures
- Front-end design of data

Data , Data, Data...

- Connectivity infrastructure is key
- Formal Data Strategy (evidenced through e.g., a DMO) being implemented



Insight 10: It's all about the data (2 of 2)

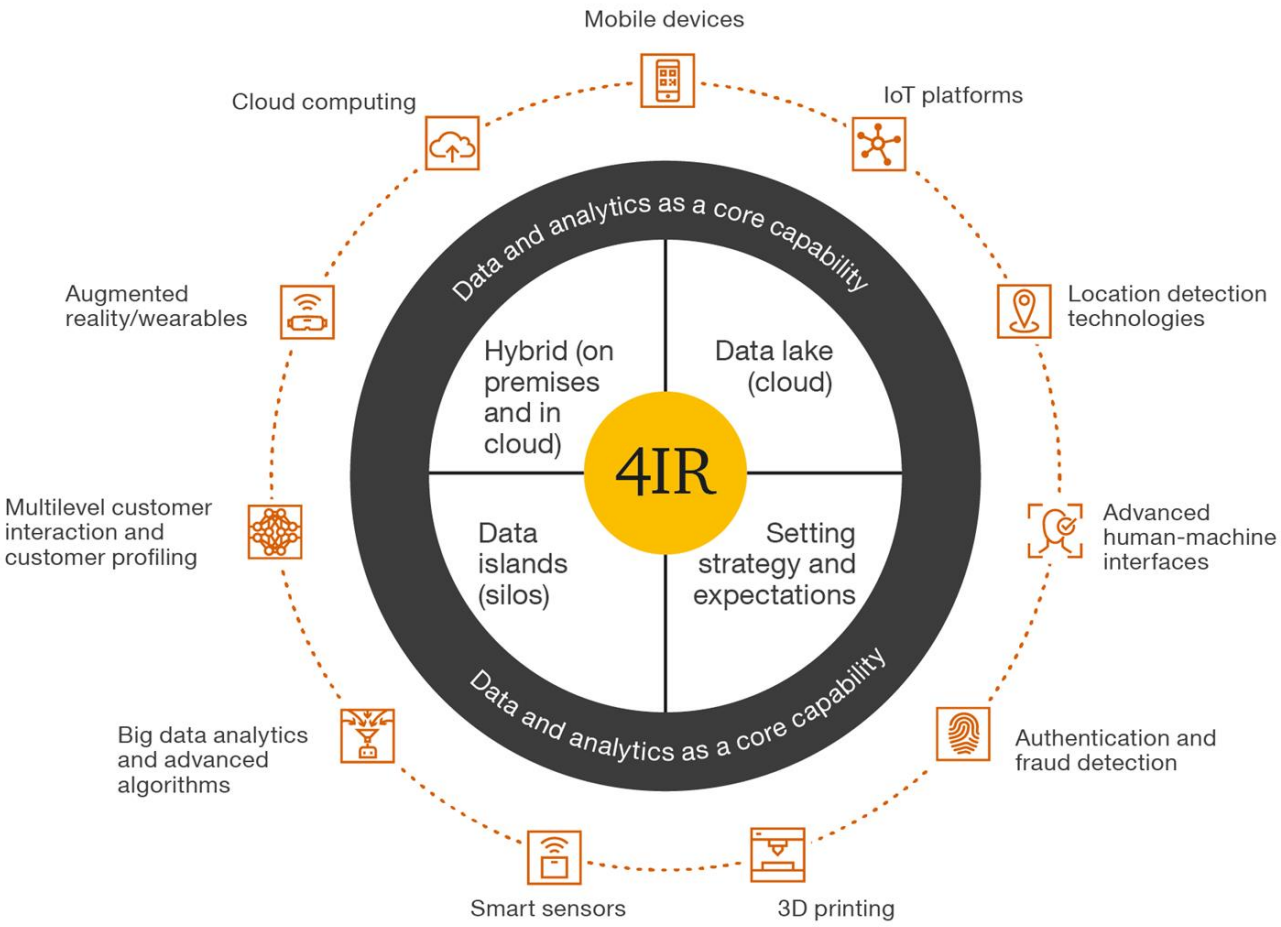
Data Infrastructure - 4 categories

Challenges to overcome:

- The Lake – one version of the truth;
- The Hybrid – let the data stay where it is;
- Getting there – we know we have to, but the business case is unclear, or hindered; and
- Islands of Trust – data for decision support from credible pockets.

Data Management by Design:

- The 'management/ownership' of data (centralised/de-centralised)
- Level of Enterprise-wide coherence
- Core functions and their ***credible*** data
- Data and Technology Reference Architectures
- Understanding the potential business value and how to 'extract' it



Thank you

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