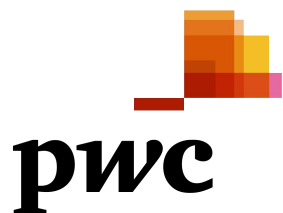


Ten insights into 4IR

Presentation by **PwC & The Minerals Council of SA**
February 2021



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

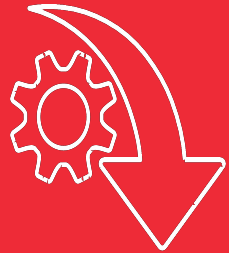
Accelerated
the application of
4IR



mining

28 of 29 elements in mobile phones need

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

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

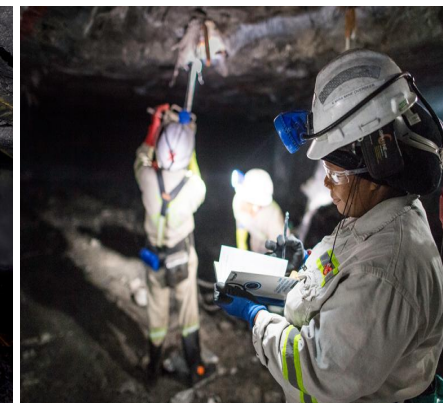
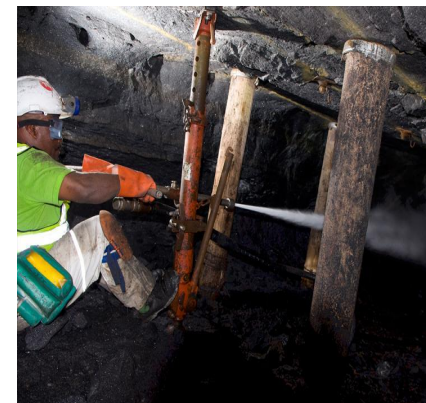
Public-private partnerships like the Mandela Mining Precinct to facilitate modernisation

Multi-source, significant mining innovation investments

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



MANDELA MINING PRECINCT
MINDS FOR MINES



Contents

Insight 1: The CEO drives the digital agenda

Insight 2: Digital champions and innovators are emerging

Insight 3: Investments in digital technologies are growing

Insight 4: Digital technologies are delivering real benefits

Insight 5: The greatest benefit is expected in core operations

Insight 6: Industrial IoT gets the biggest share of the wallet

Insight 7: The workforce is changing

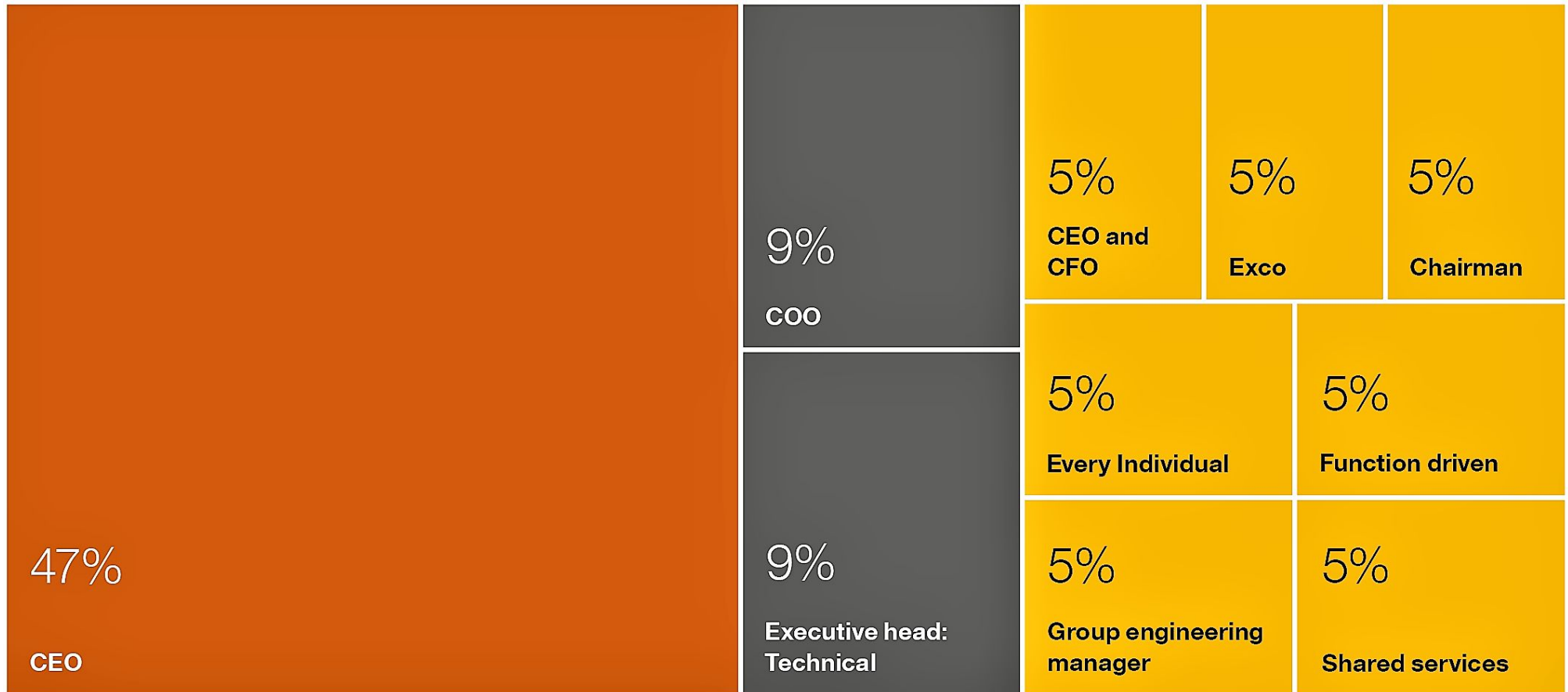
Insight 8: Organisational culture is keeping up with the times

Insight 9: There are challenges to overcome

Insight 10: It's all about the data

Insight 1: The CEO drives the digital agenda

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

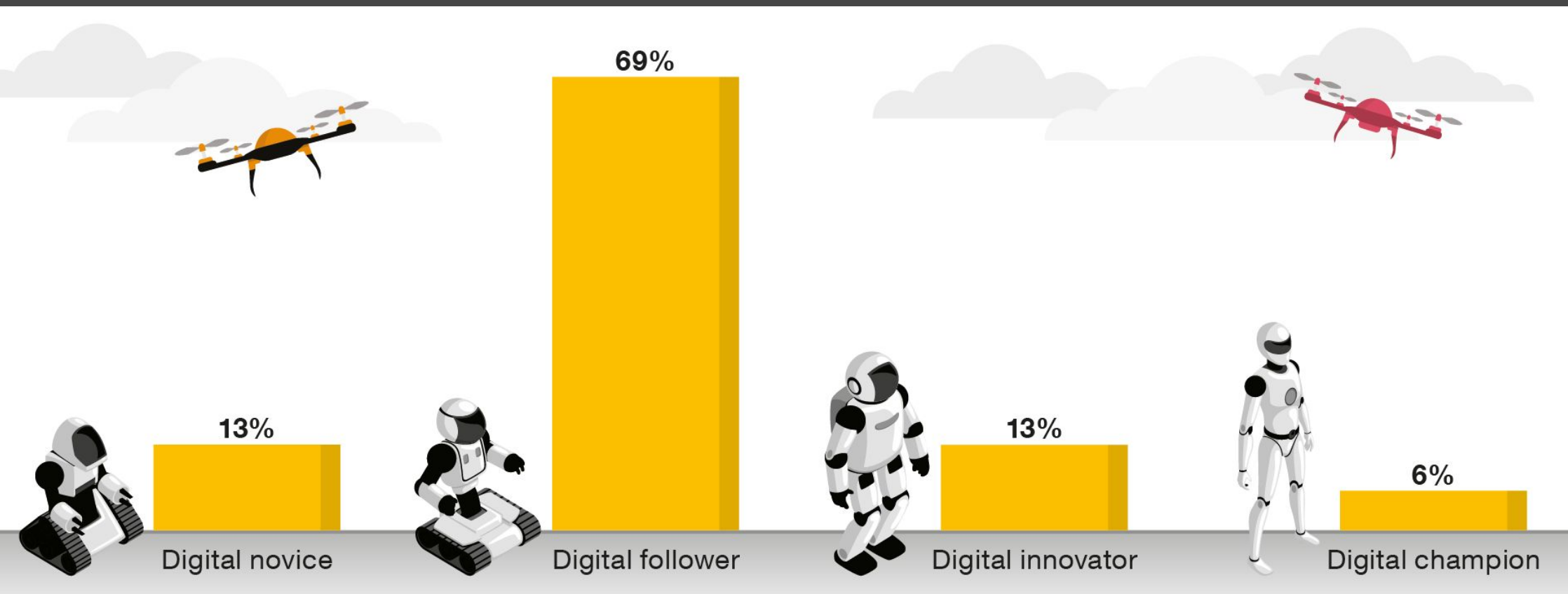


Insight 2: Digital champions and innovators are emerging

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

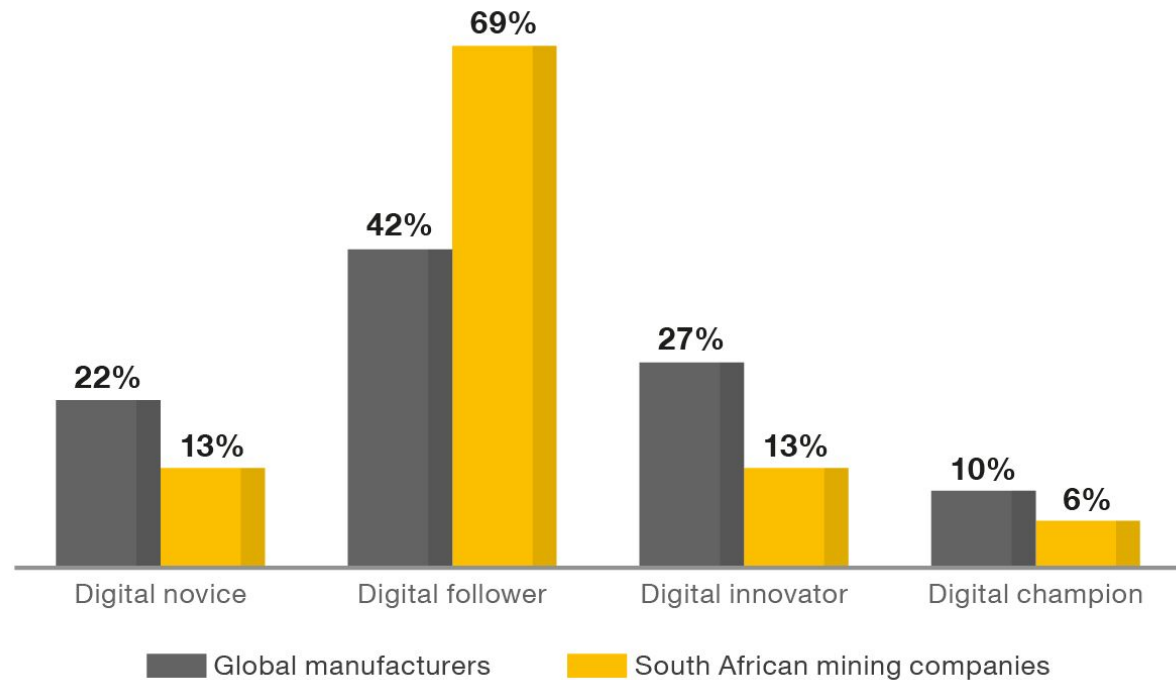


Figure 3: How do we compare globally?

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).

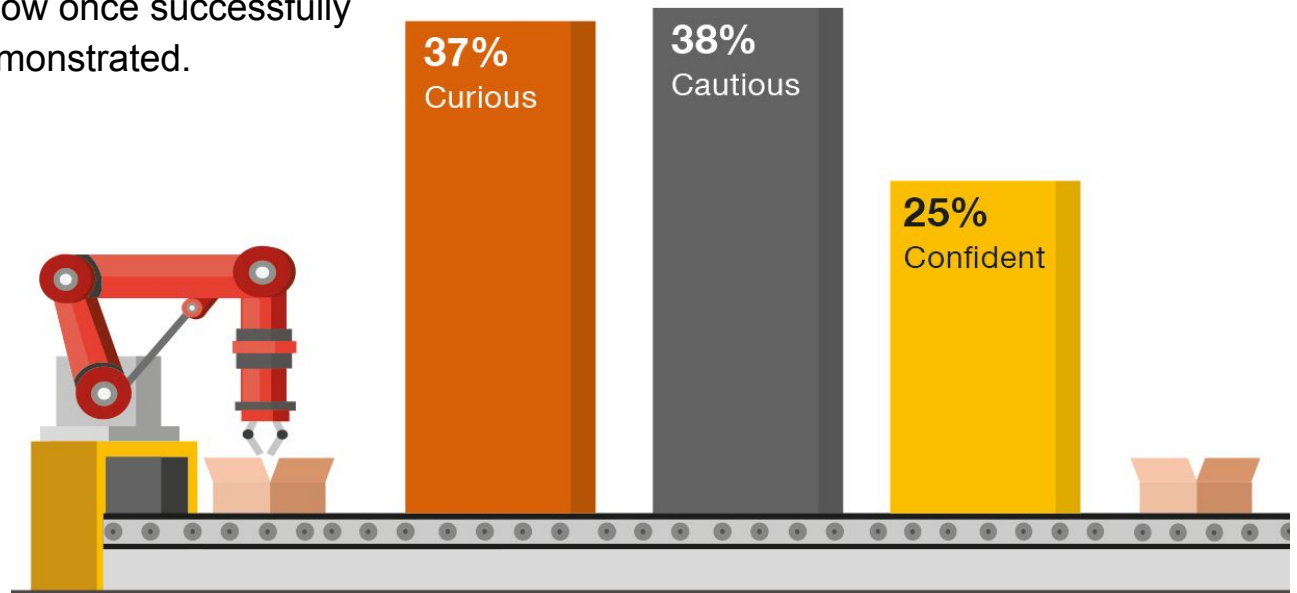
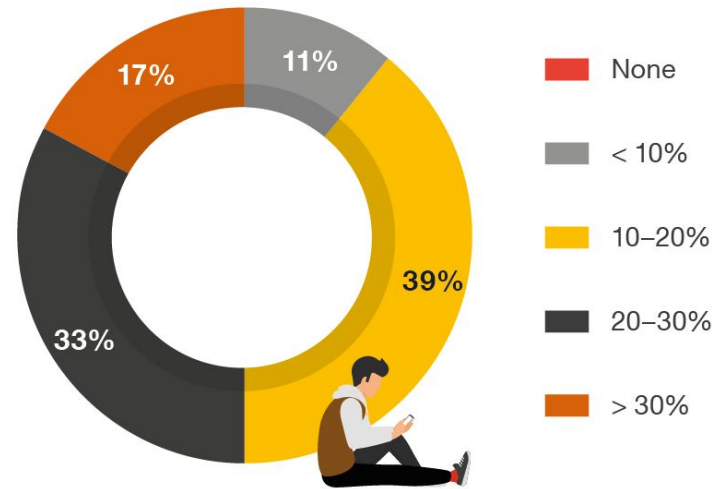
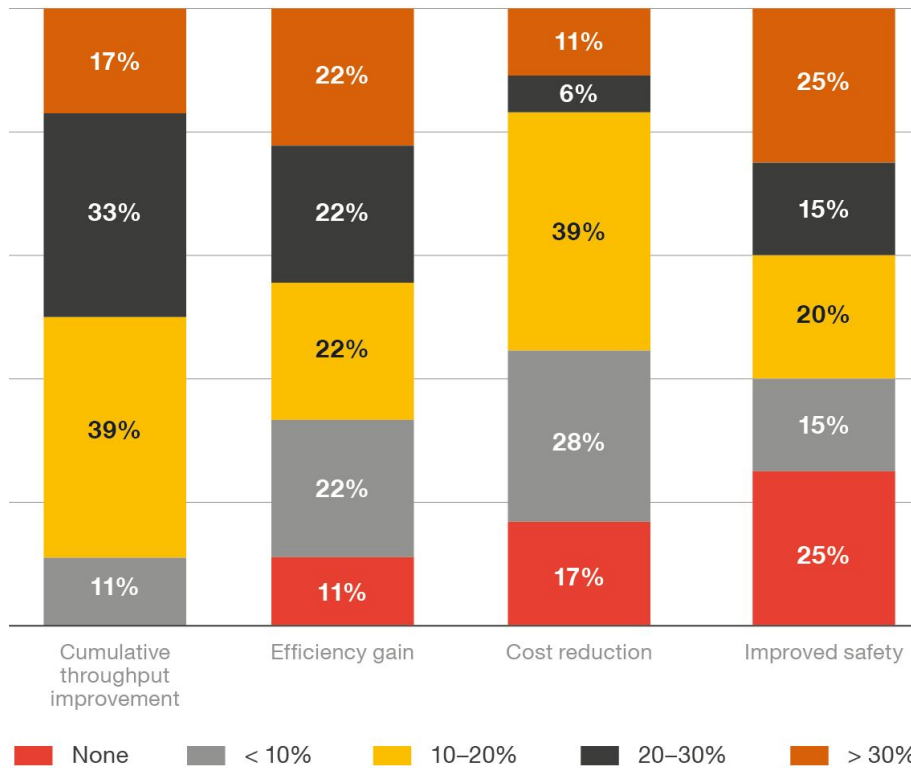


Figure 4: Distribution of turnover spend on digital transformation

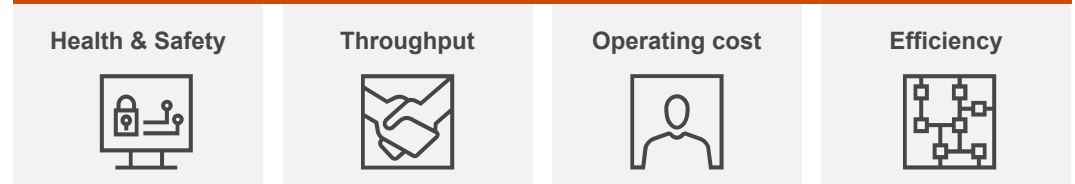
Insight 4: Digital technologies are delivering real benefits (1 of 5)

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.



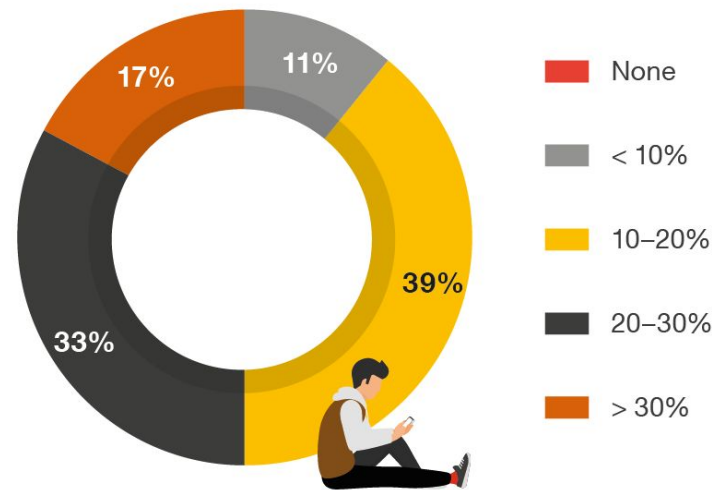
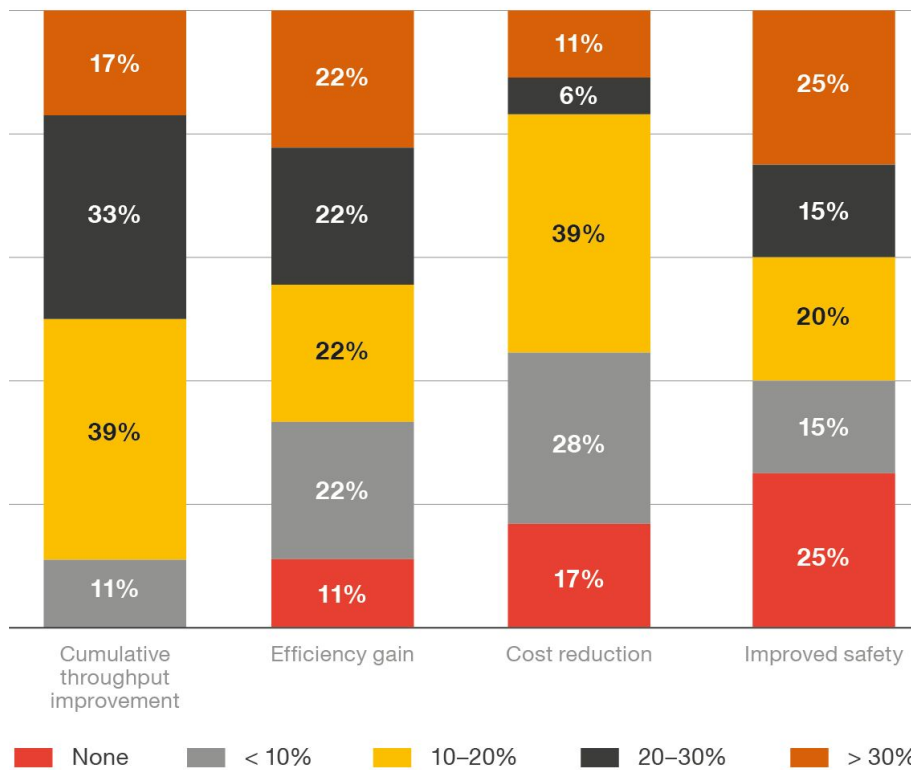
Areas benefiting the most from digital technology



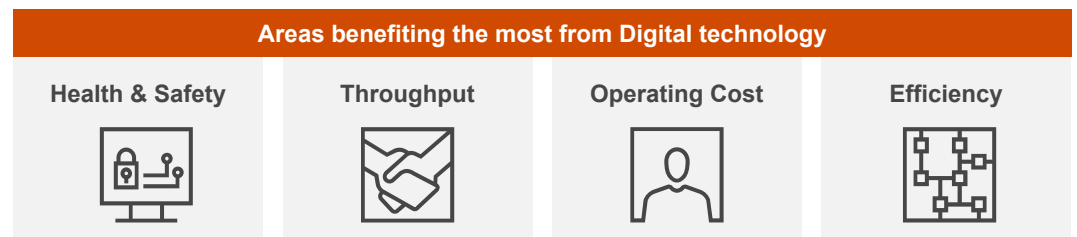
Insight 4: Digital technologies are delivering real benefits (2 of 5)

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).



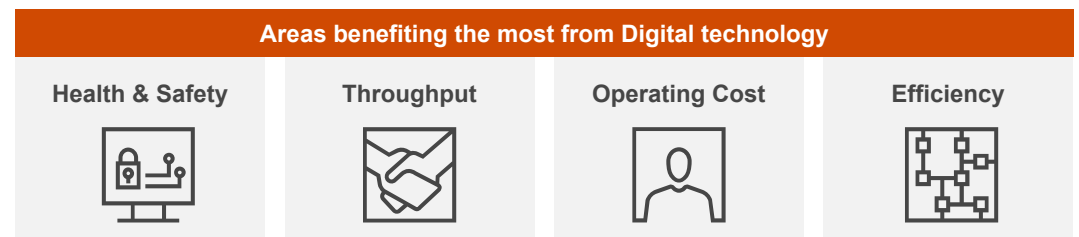
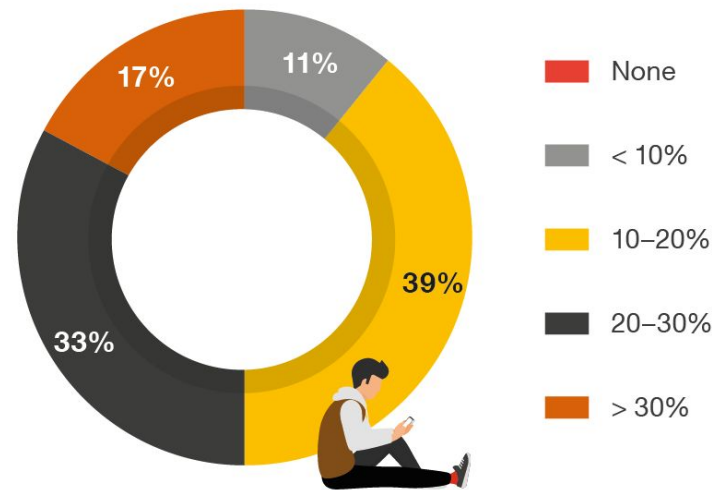
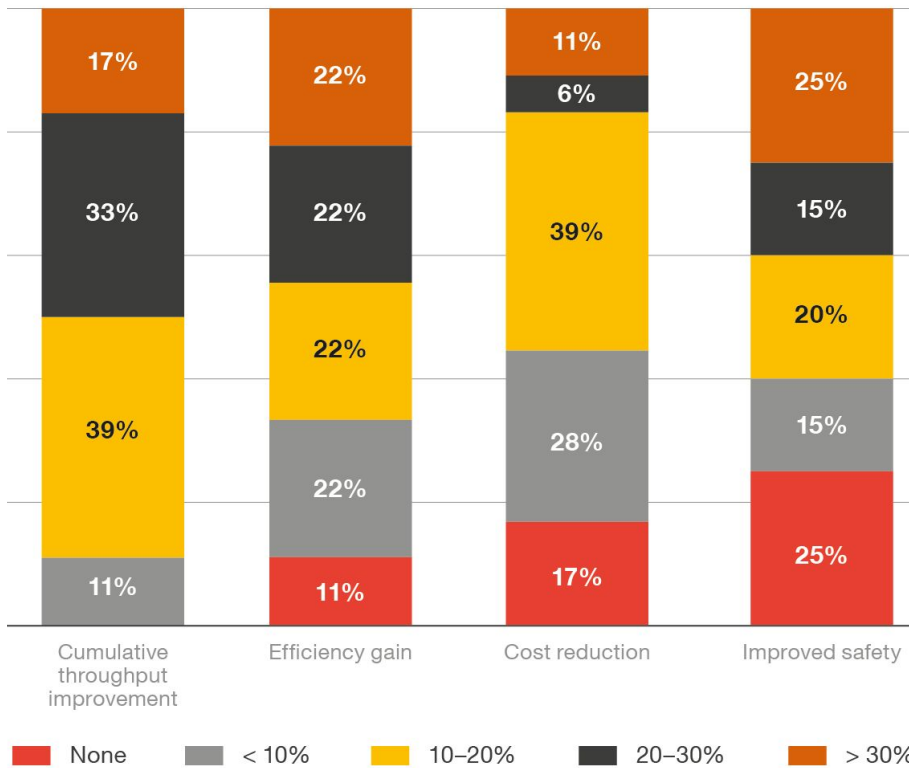
Areas benefiting the most from Digital technology



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

Cost Reduction:

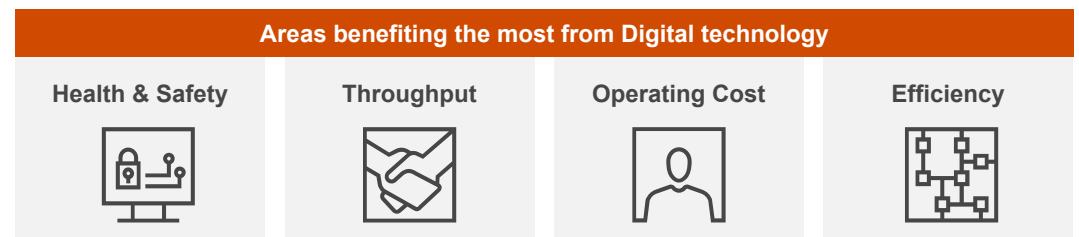
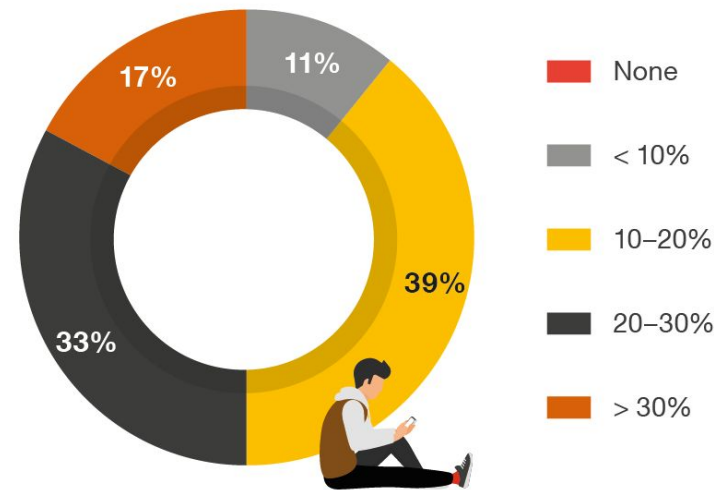
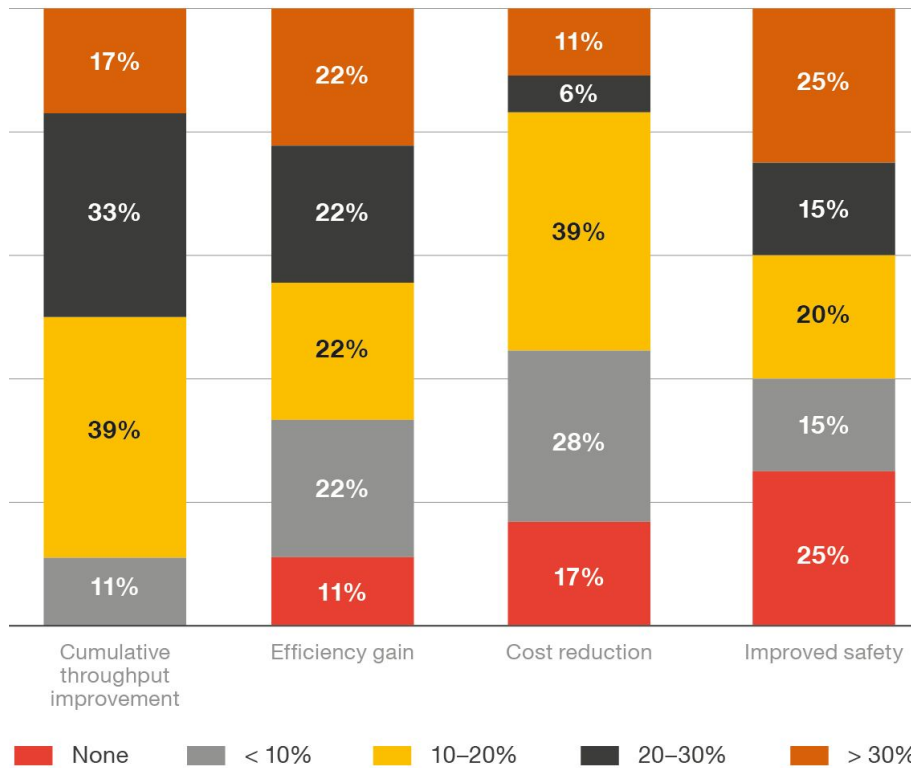
- Some respondents were unsure of the cost in context of a more expensive, more skilled workforce;
- 11% expect a greater than 30% reduction in costs (these respondents had specific plans in mind);
- More than half expect cost reductions of more than 10%; however
 - 17% forecast no cost reductions at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



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

Improved Health & Safety:

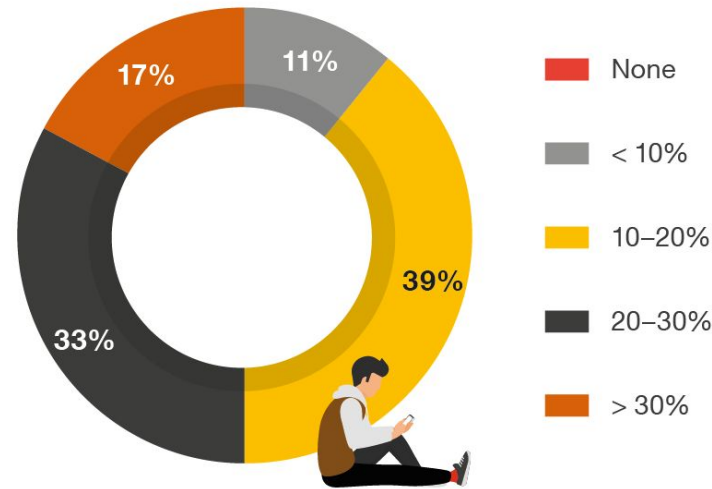
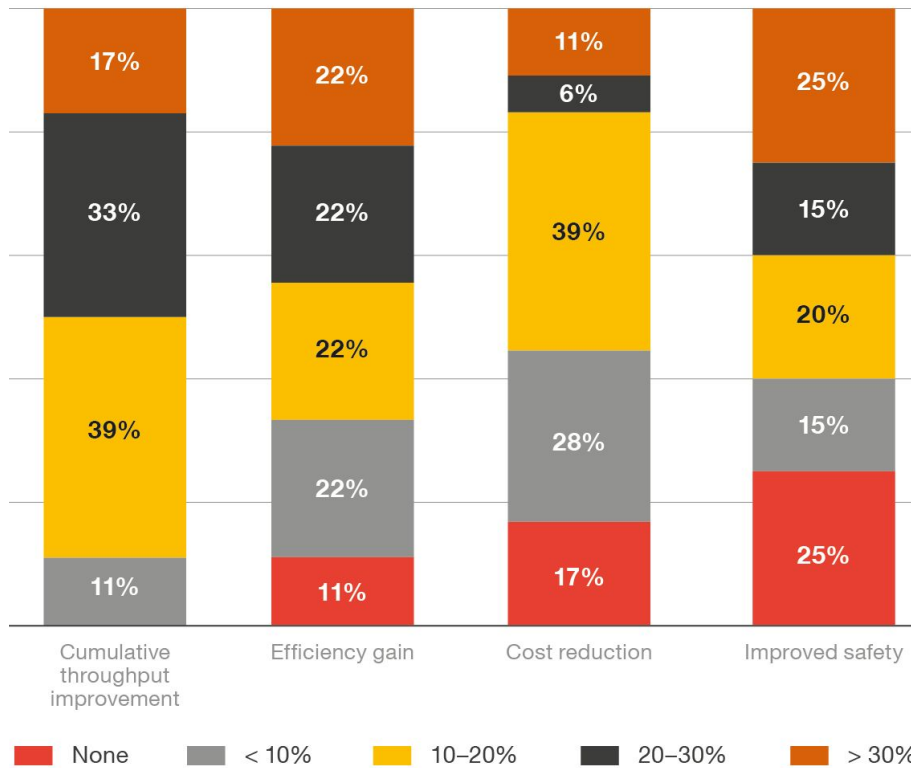
- 83% of respondents cited a direct relationship between 4IR investment and a safer working environment;
- 25% expect a greater than 30% improvement in their health and safety performance over the next 5 years due to the positive impact of new technology; and
- There are two primary investment types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



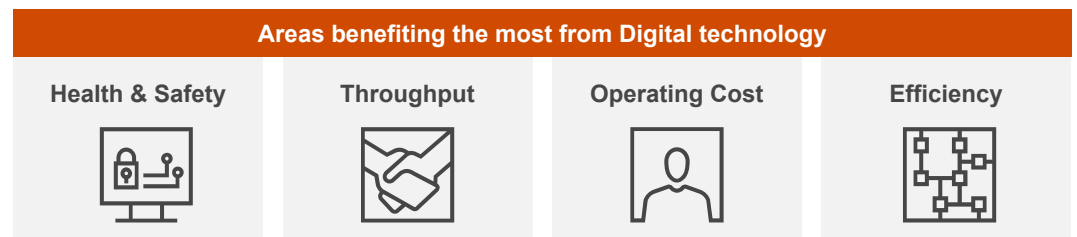
Insight 4: Digital technologies are delivering real benefits (5 of 5)

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.

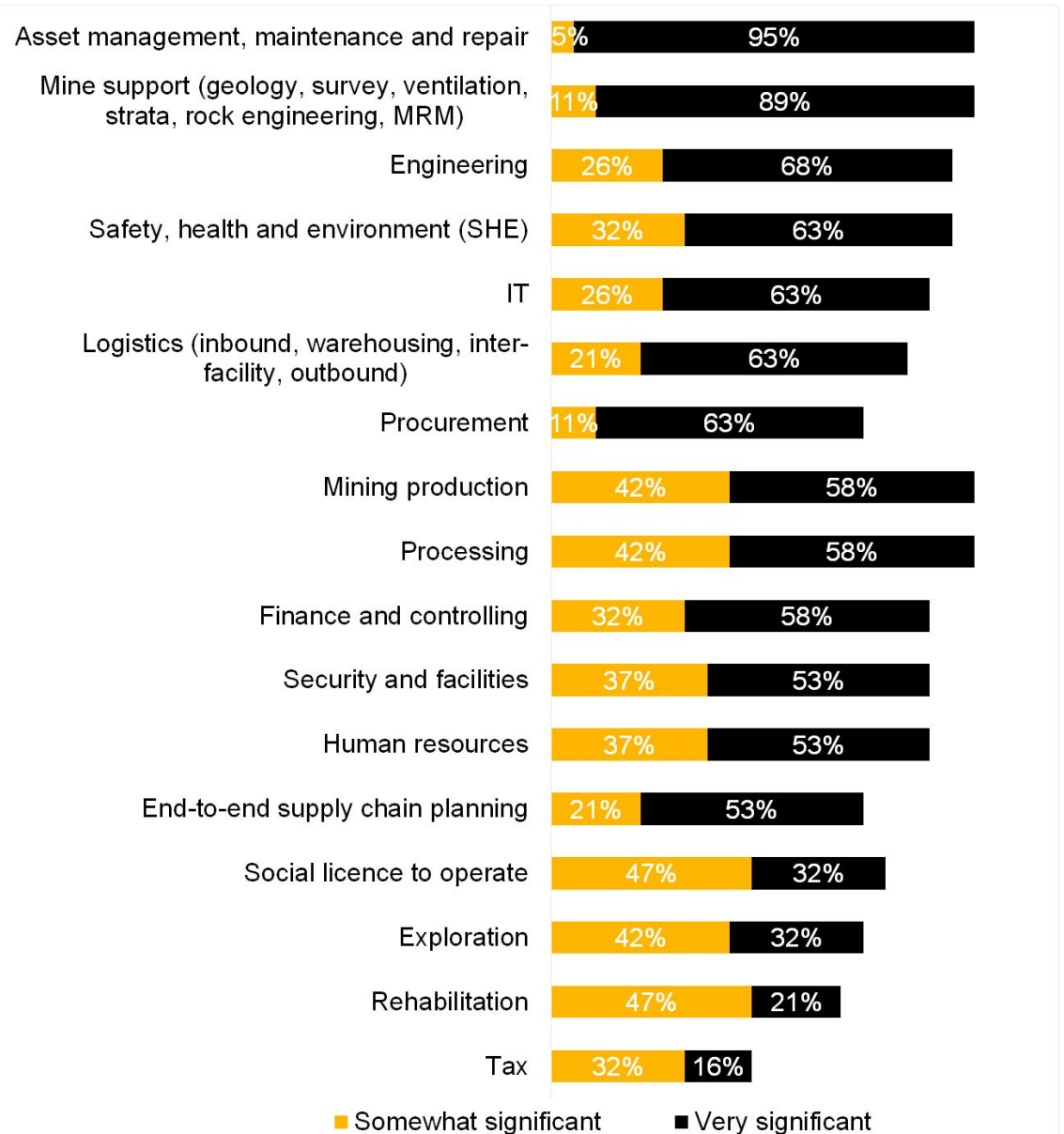


Areas benefiting the most from Digital technology



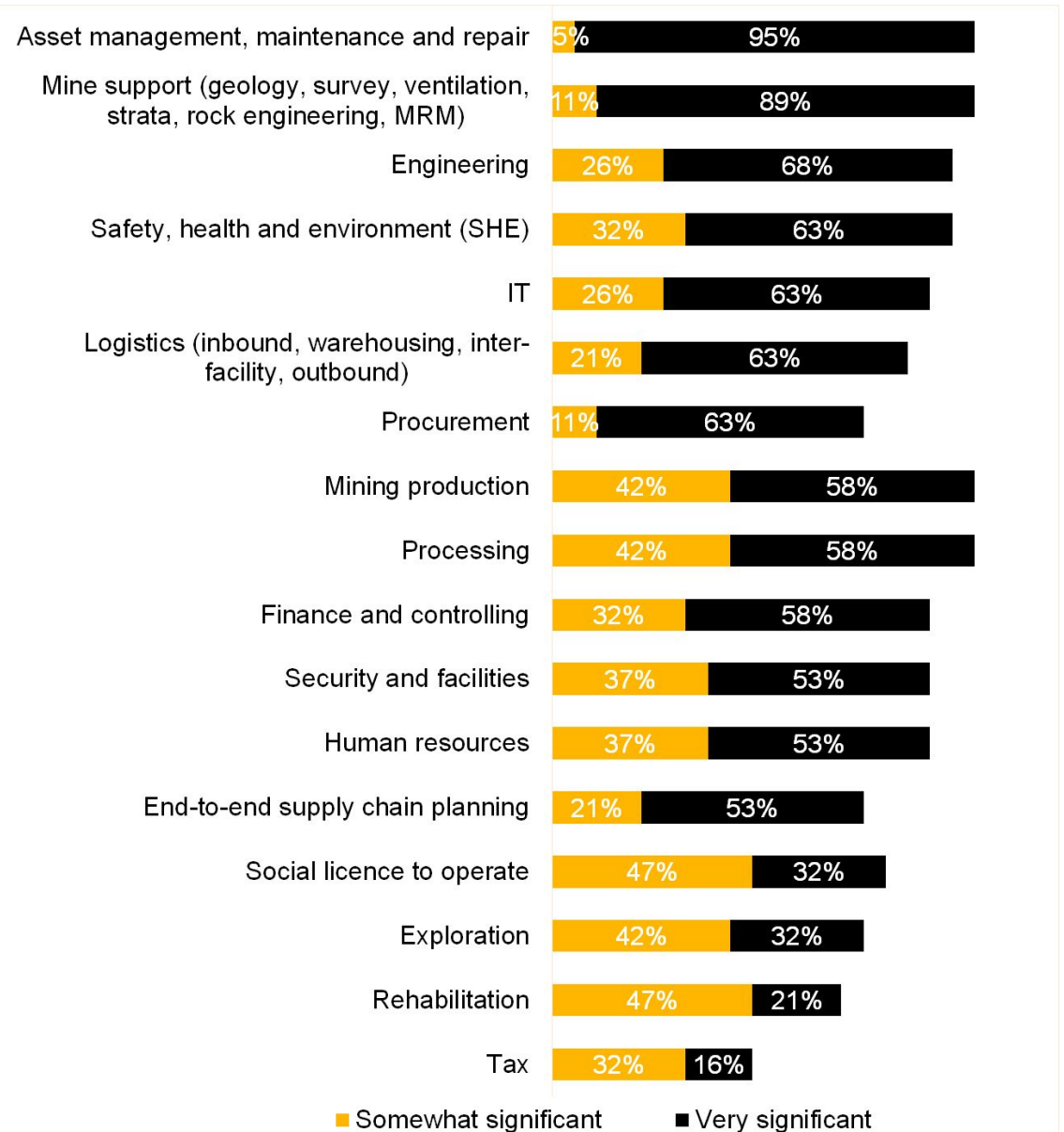
Insight 5: The greatest benefit is expected in core operations (1 of 2)

- 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)

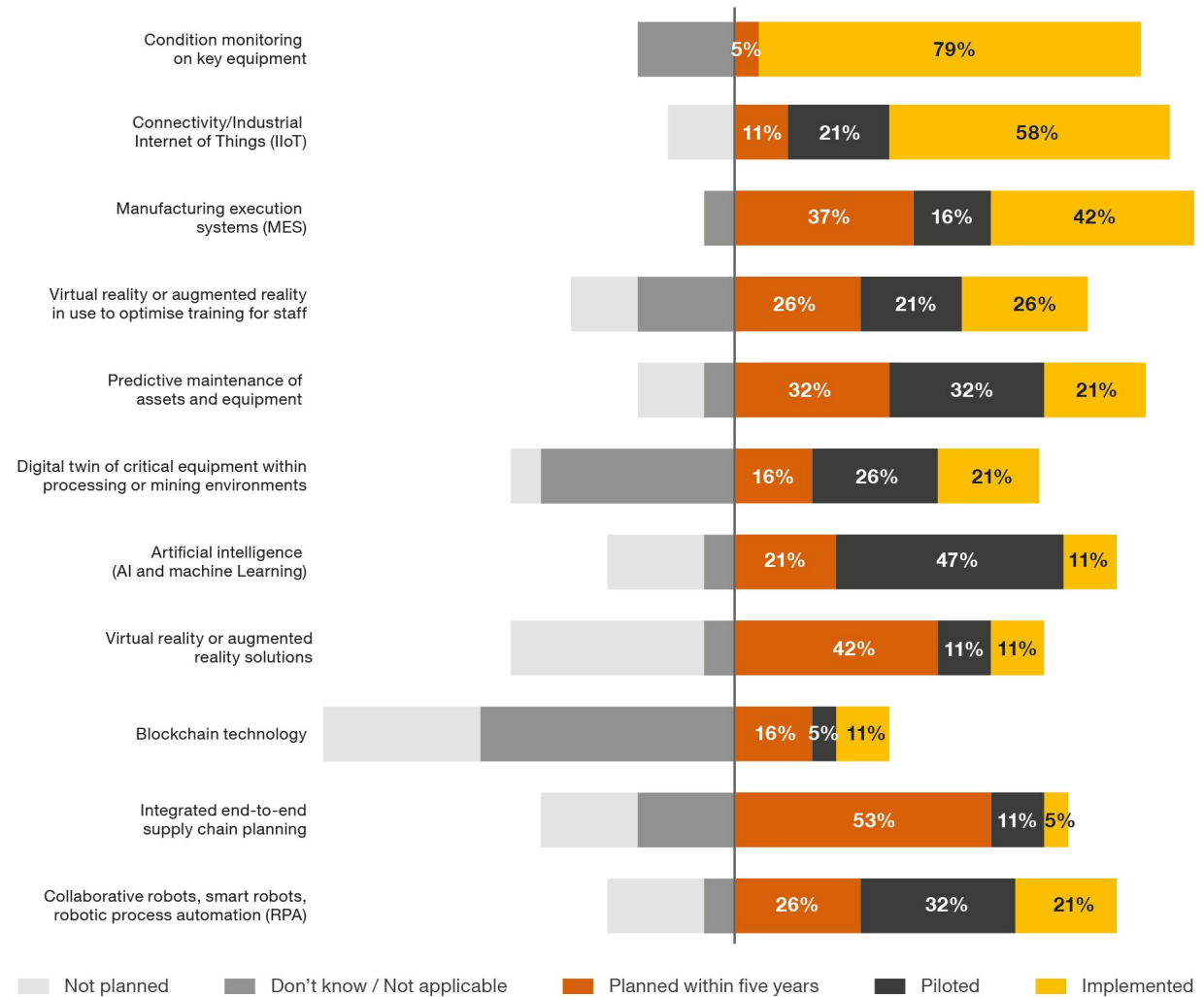
- IT is transforming into a business partner;
- Just 10% of respondents are focusing on end-to-end supply chain planning (potentially largest impact in future);
- Processing is already benefiting from improved MES & process control - real time analytics and visibility of processes is an area of focus;
- 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:

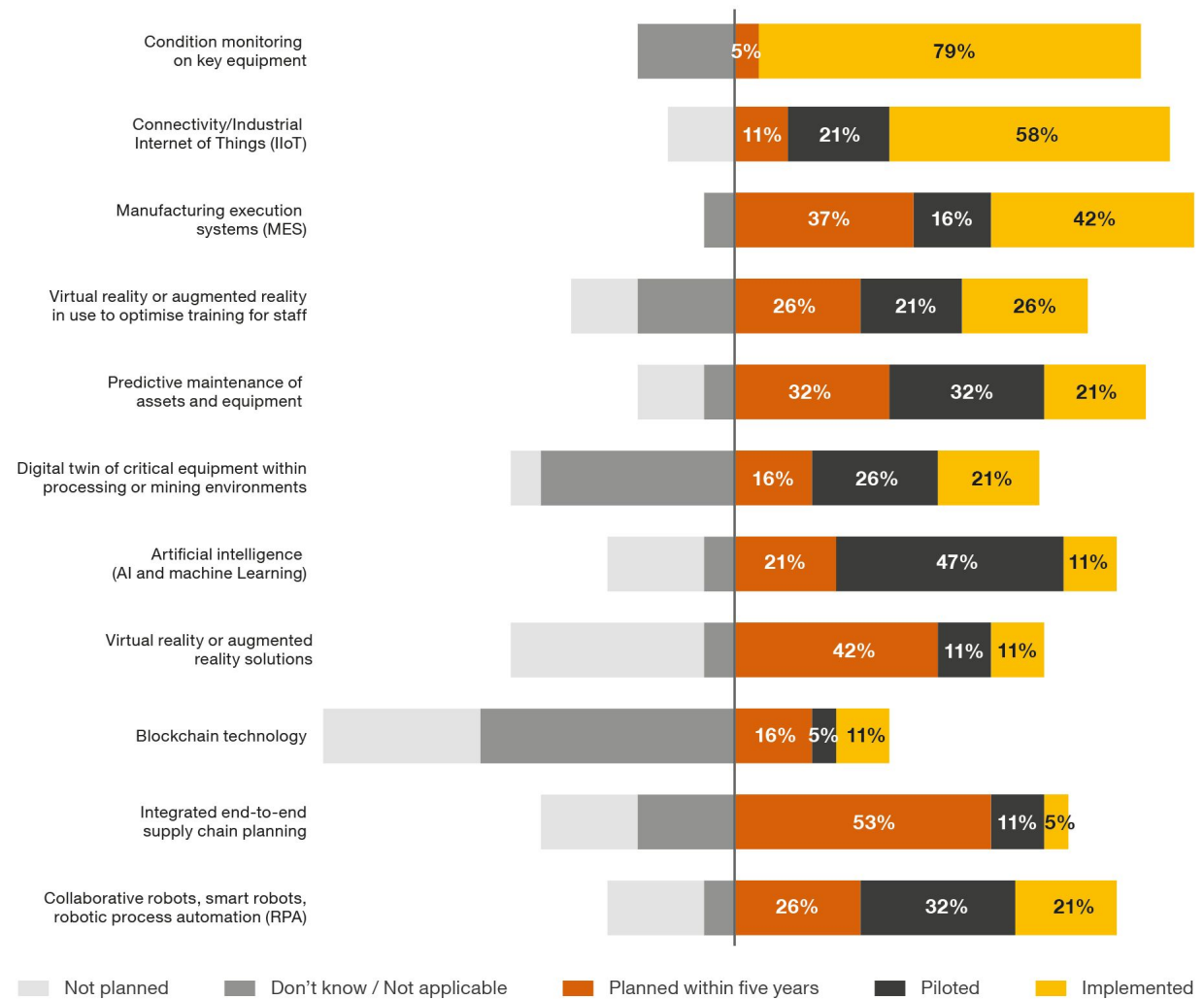
- IoT (79%) & ConMon (58%) lead in terms of investment;
- MES adoption (42%) shows the drive to integrated and efficient operations (using data to derive value);
- Two companies already use AR and 42 % plan to within 5 years;
- Some 26% already use VR for training, while 21% are piloting VR and another 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.):

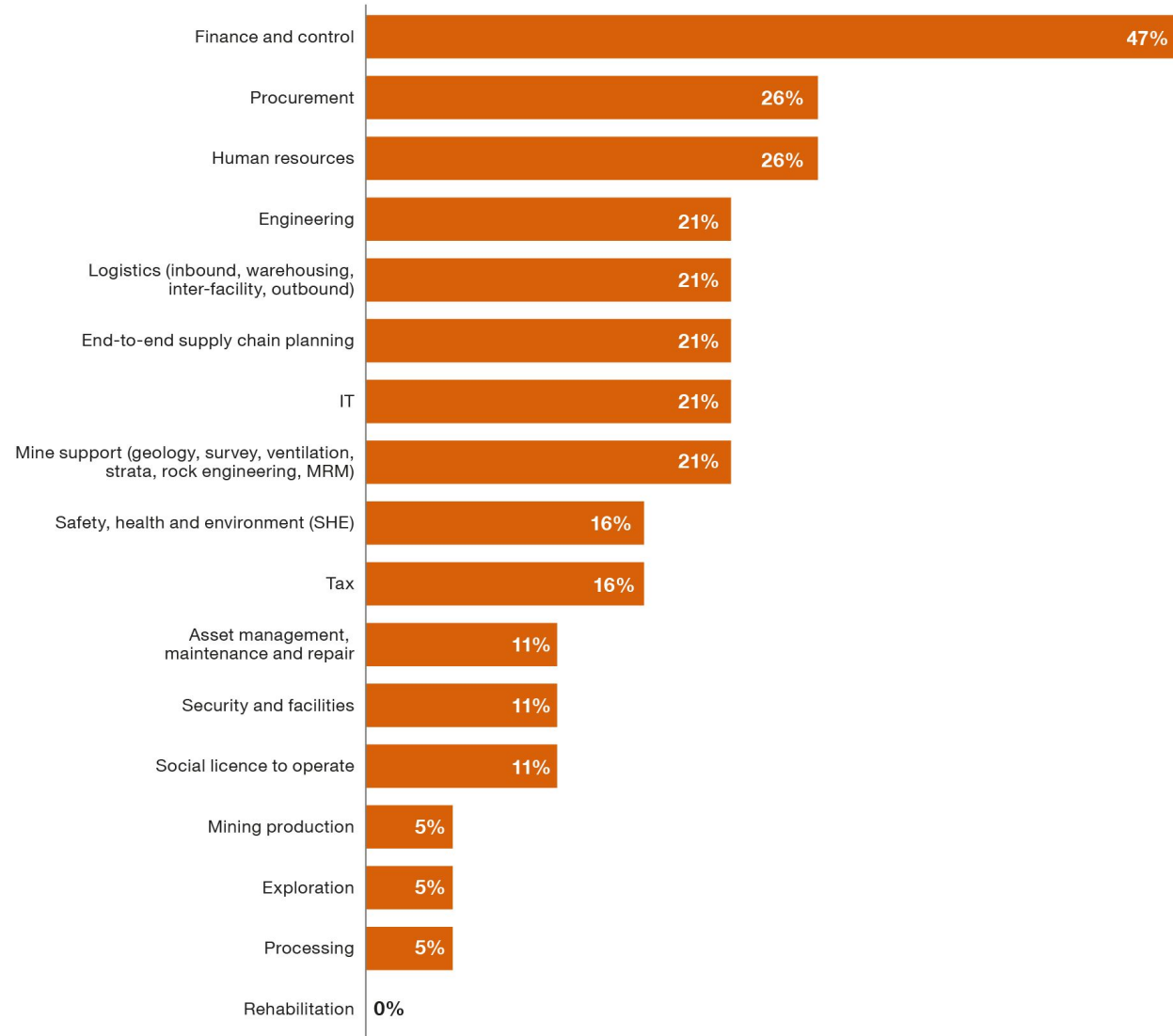
- Digital Twin is being implemented by 21% of respondents - while 26% are piloting and 40% have no plans in this regard.
- AI & Machine learning is present in only 11% of respondents - but nearly half are piloting;
- Integrated end to end supply chain Planning is only present in 5% of respondents - 11%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



Insight 6 deep dive: Robotic Process Automation

Robotic Process Automation

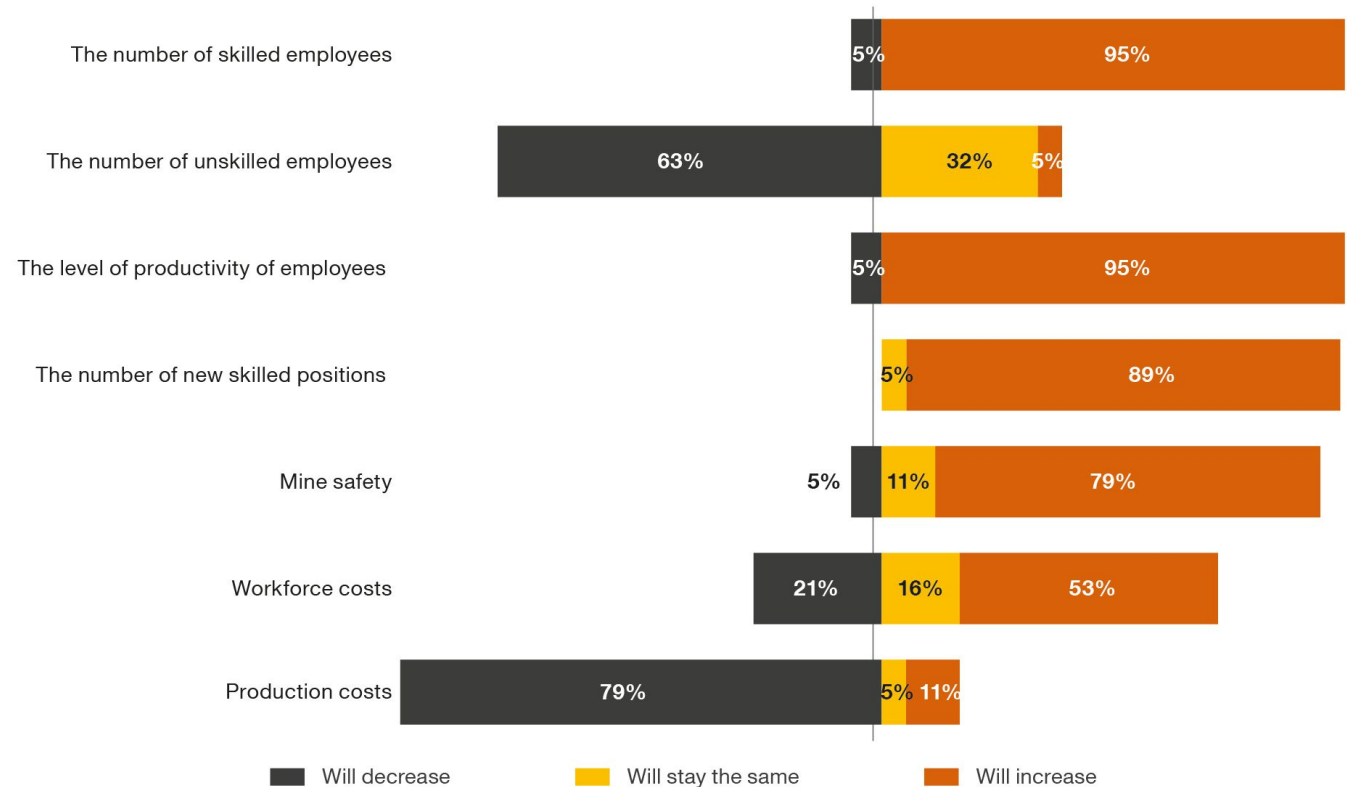
- RPA primarily in Support & Control Functions
- Cautious / incremental implementation approach in core mining functions
- Common thread – “takes too long” – careful planning/consideration
- Human-replacement? No
- Freeing up human capacity of 20-30% improvement
- Looks promising for more implementations



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

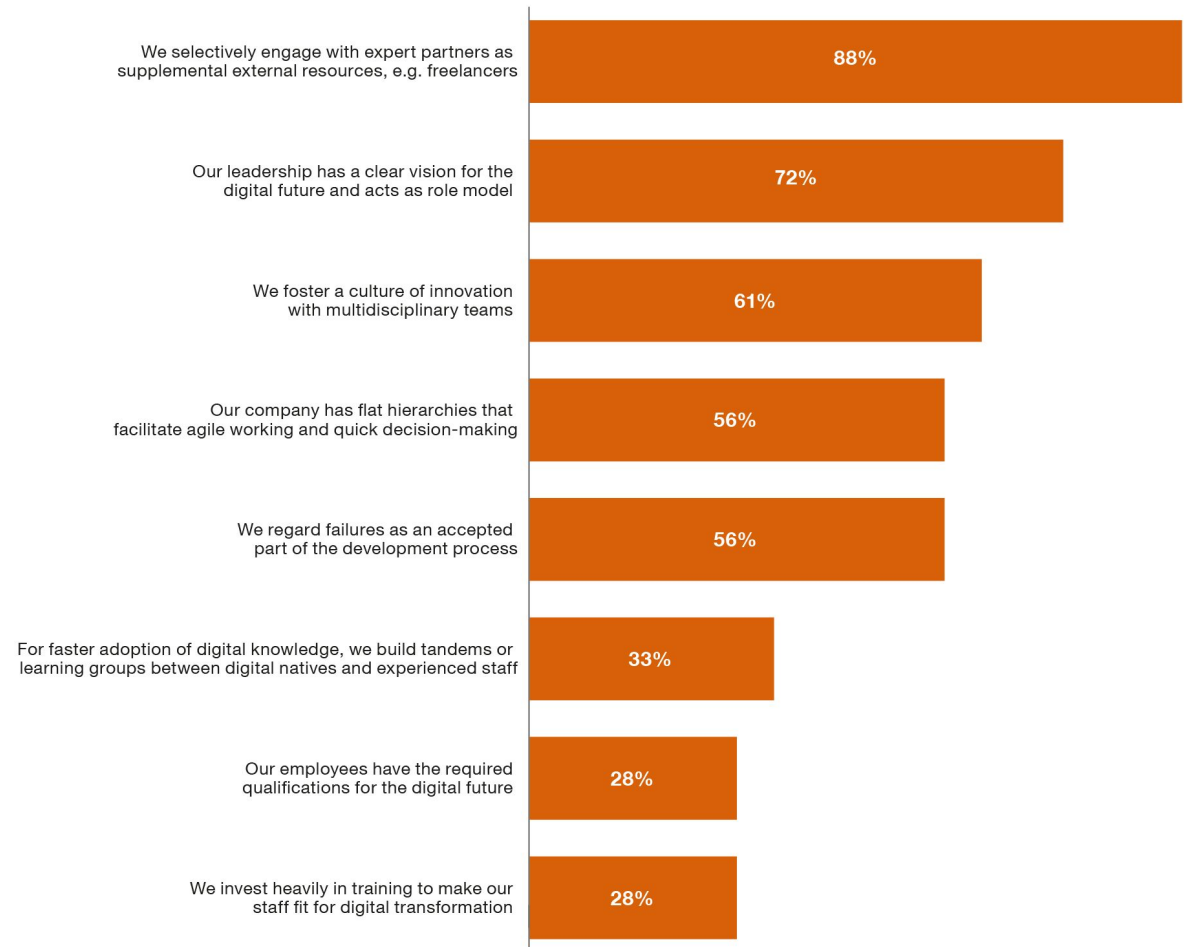


- Nearly 95% of *new* positions created are expected to be for skilled workers;
- 63% expect the number of unskilled workers to decrease, while only 5% expect this to grow;
- 95% expect the level of productivity per capita to rise significantly;
- More than half expect a higher wage bill over the next 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?

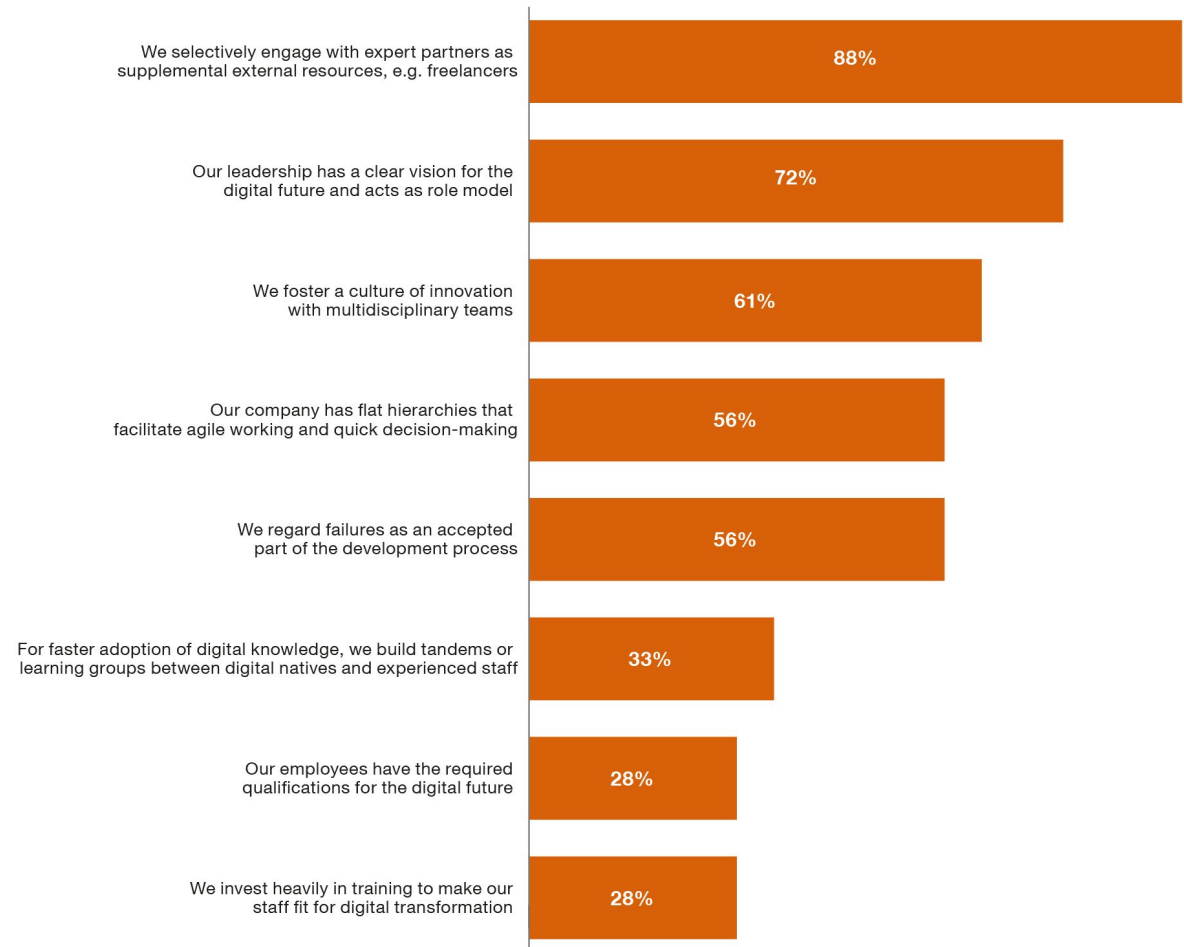
- $\frac{1}{3}$ of respondents believe their employees have the skills to realise a digital future;
- 72% believe their leadership has a clear vision for the digital future and acts as role models for digital transformation;
- A third are creating tandems or working groups that team up digitally proficient 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.

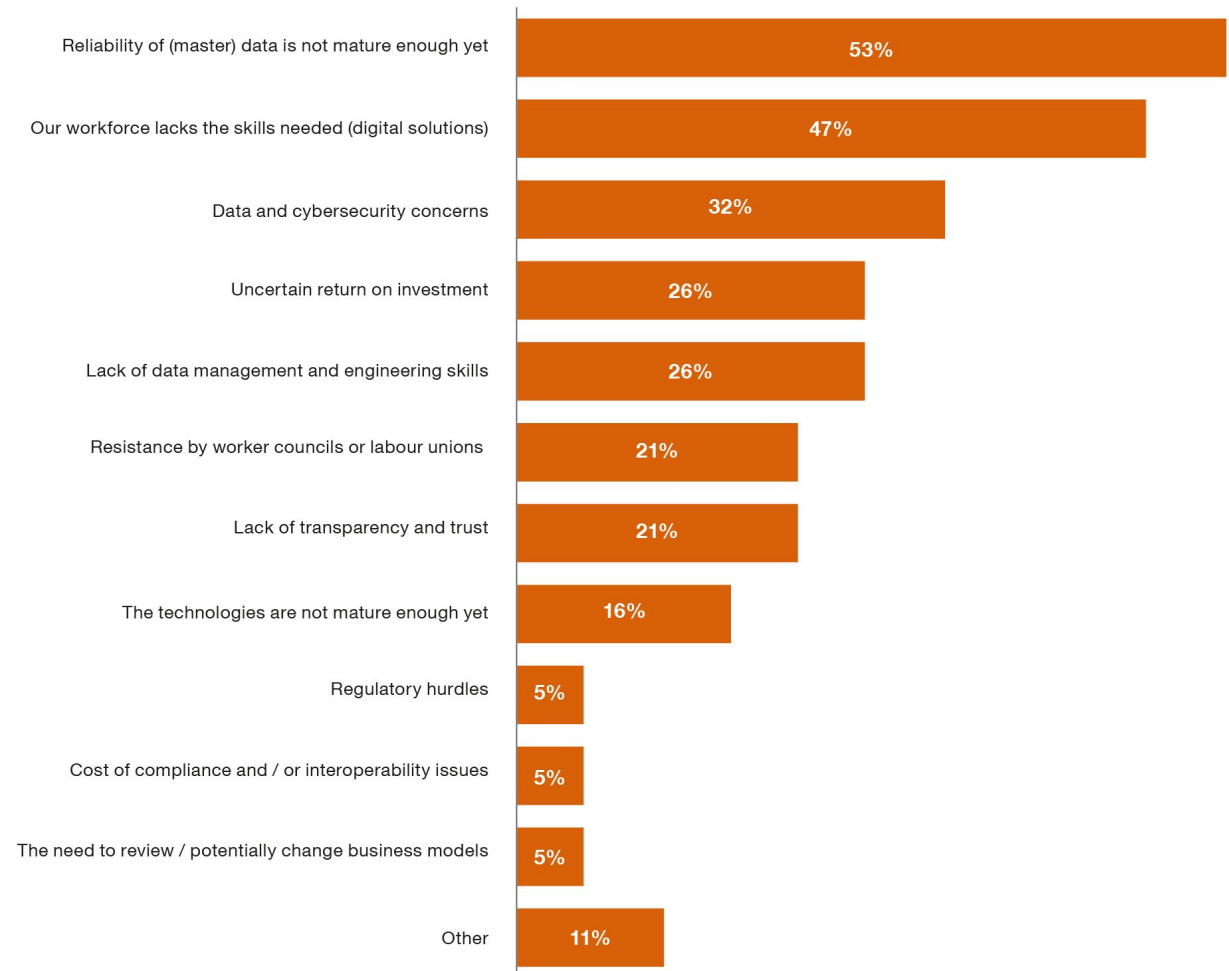


Insight 9: There are challenges to overcome (1 of 2)

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.

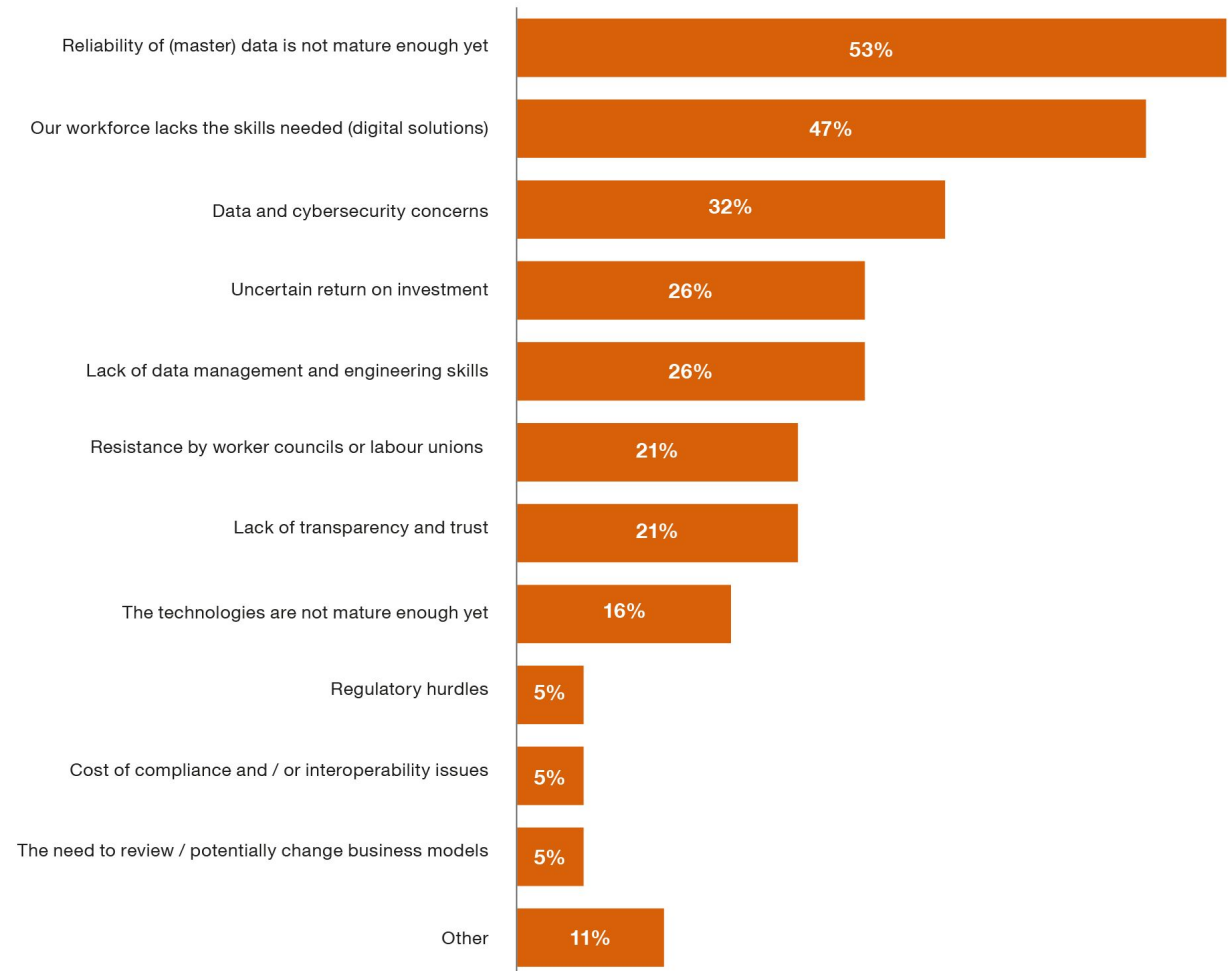


Insight 9: There are challenges to overcome (2 of 2)

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)

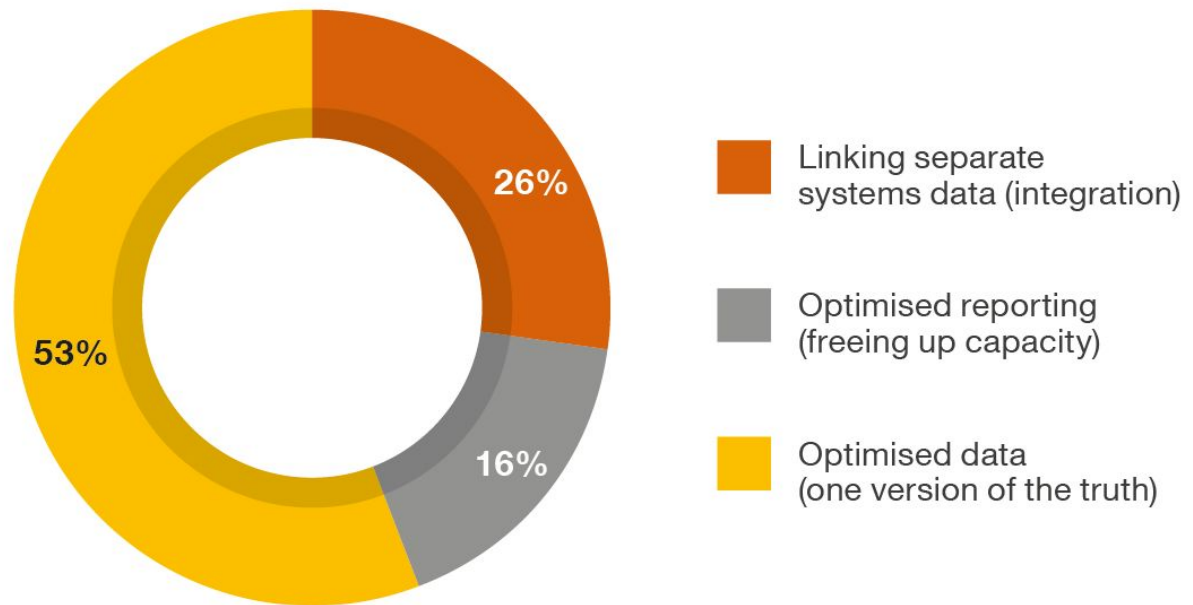
Using data for effective and efficient decision making

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)

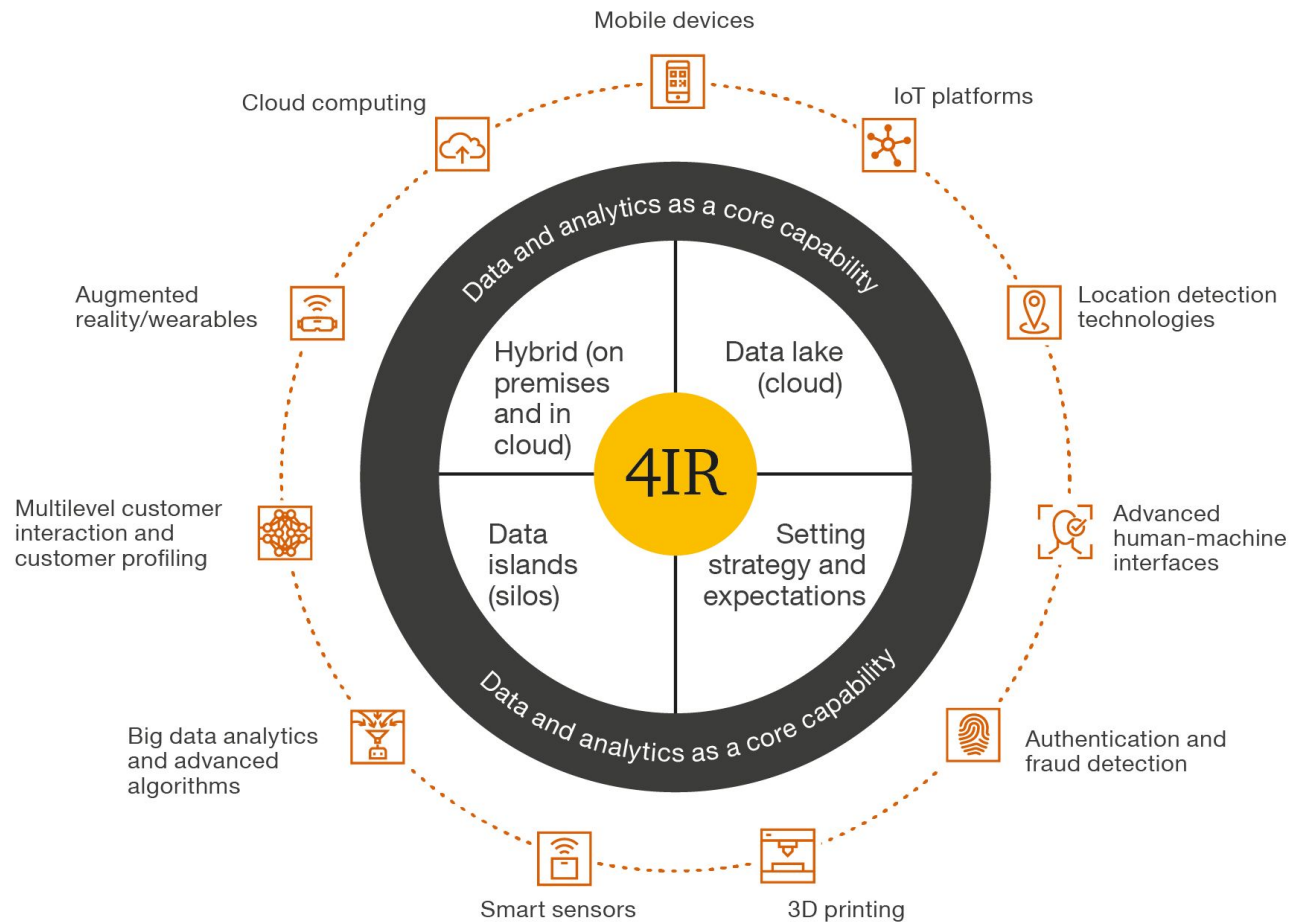
Data Infrastructure - 4 categories

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

pwc.co.za

This proposal is protected under the copyright laws of South Africa and other countries as an unpublished work. This proposal contains information that is proprietary and confidential to PricewaterhouseCoopers Incorporated, which shall not be disclosed outside the recipient's company or duplicated, used or disclosed in whole or in part by the recipient for any purpose other than to evaluate this document. Any other use or disclosure in whole or in part of this information without the express written permission of PricewaterhouseCoopers Incorporated is prohibited.

At PwC, our purpose is to build trust in society and solve important problems. We're a network of firms in 158 countries with more than 250,000 people who are committed to delivering quality in assurance, advisory and tax services. Find out more and tell us what matters to you by visiting us at www.pwc.com.

PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see www.pwc.com/structure for further details.

© 2021 PwC. All rights reserved