CSIR Mining Innovation Strategy Roadmap

Date: 02 November **Venue: ICC, Amythyst**

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

CSIR
Touching lives through innovation

Why focus strategic focus in supporting the Mining Industry?

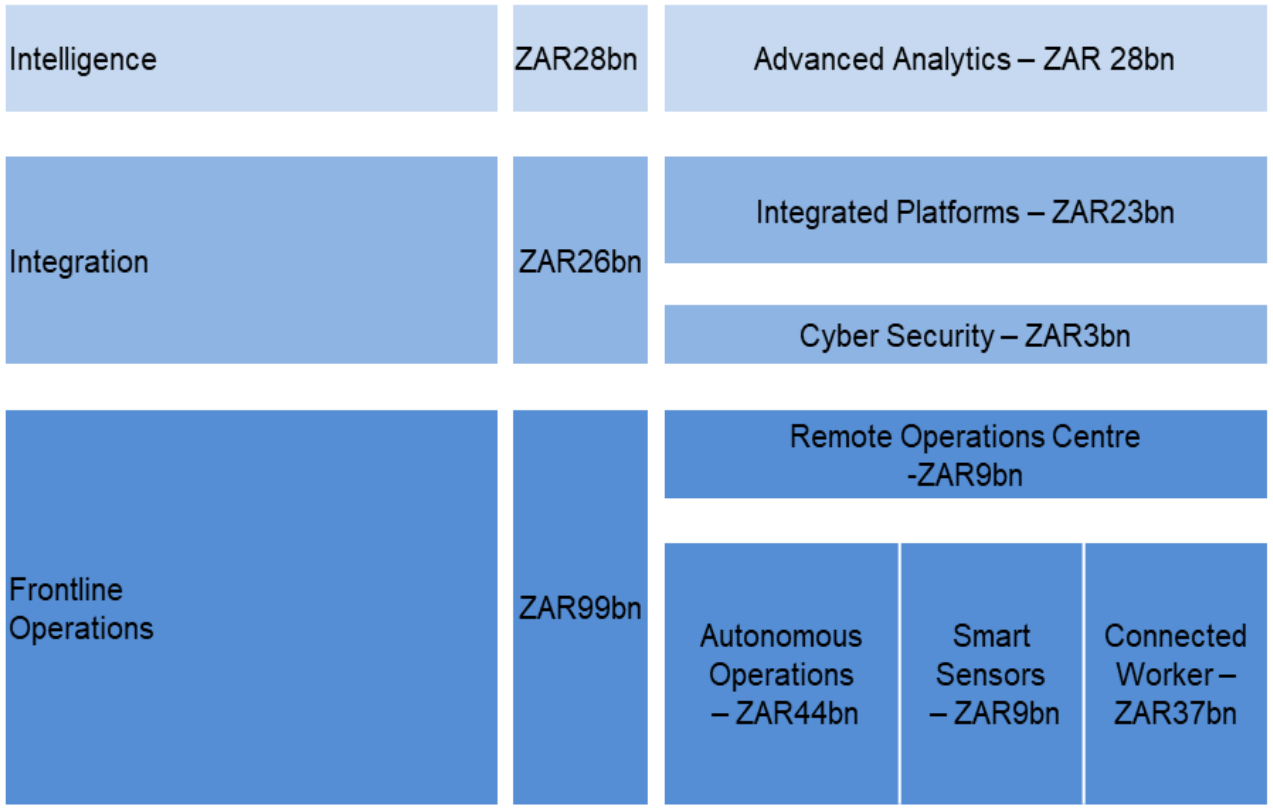
- The Mining industry continues to grow as a significant contributor to the SA GDP, with the percentage contribution improving from 7.1% (2020) to 8.7% (2021), contributing R481 billion in 2021.
- The industry continues to grow with market capitalisation increasing YOY from R840 billion (2019) to R1,280 billion (2020)[2],
- Mining sector continues to be a major employer with over 458,954 people employed in the sector in 2021, with platinum, gold and coal being the top three employers.
- South Africa has unique mineral endowment with large resources e.g., third largest gold reserves in the world, over 50% of platinum group mineral resources.

MINERALS		RESOURCES		
		Mass	% World	Rank
Antimony	Kt	350	16.7	3
Chromium Ore	Mt	5,500	72.4	1
Copper	Mt	13	2.4	6
Fluorspar	Mt	80	17	2
Gold	T	6,000	12.7	1
Iron Ore	Mt	1,500	0.8	13
Iron Ore – Incl. BC	Mt	25,000	10	*
Lead	Kt	3,000	2.1	6
Manganese Ore	Mt	4,000	80	1
Nickel`	Mt	3.7	5.2	8
PGMs	t	70,000	87.7	1
Phosphate Rock	Mt	2,500	5.3	4
Titanium Minerals	Mt	71	9.8	2
Uranium	kt	435	8	4
Vanadium	kt		32	2
Vermiculite	Mt	80	40	2
Zinc	Mt	15	3.3	8
Zirconium	Mt	14	25	2

1. https://www.mineralscouncil.org.za/industry-news/media-releases/2022.
2. SA Mine 2020 - https://www.pwc.co.za/en/press-room/sa-mine-2020.html.
•Trading Economics - https://tradingeconomics.com/south-africa/mining-production

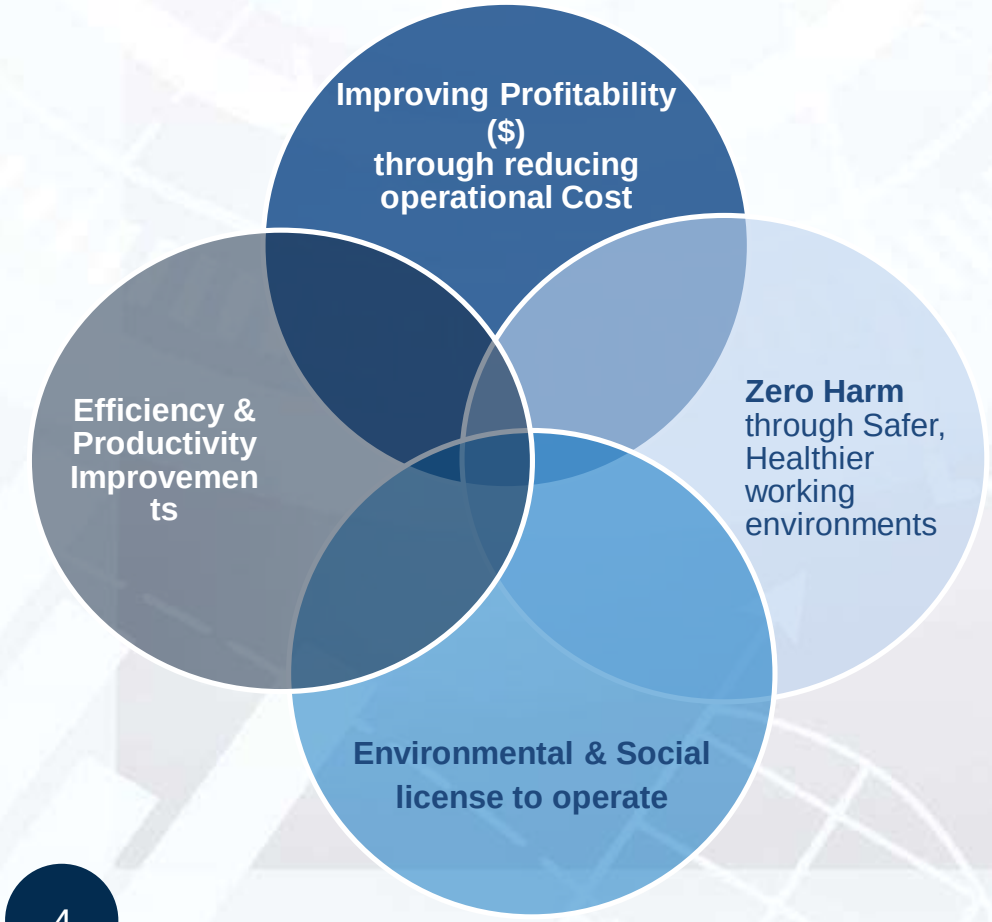
Adoption of Digital Technologies can significantly transform the South Africa Mining Industry

- Digital technologies can help SA mining unlock **ZAR 153 billion in** value by 2026 adding 51 % to current mining size,
- Increase mining's contribution to GDP by 2%,
- Other benefits:
  - ✓ Increased output
  - ✓ Reduced personnel cost
  - ✓ Improved asset utilization
  - ✓ Reduced downtime
  - ✓ Fewer health and safety incidents



Reference: Extracting Value with Data-led Mining in South Africa | Accenture. https://www.accenture.com/_acnmedia/PDF-126/Accenture-Extracting-Value-And-Building-Resilience-With-Data-Led-Mining-South-Africa-FinalV.pdf

CSIR aims to support the Mining Industry in achieving their Business Value Drivers



Modernisation of mines and adoption of appropriate innovations across the mining value chain has become a key focus area to supporting mining businesses achieve their value drives;

- Improvements in Safety and Health,
- Environmental sustainability,
- Efficiency and productivity drives,
- Lowest cost producer and,
- Resource utilisation & Improving Life of Mine (LOM).

Capability and capacity development to support sustainable growth for the Mining Industry

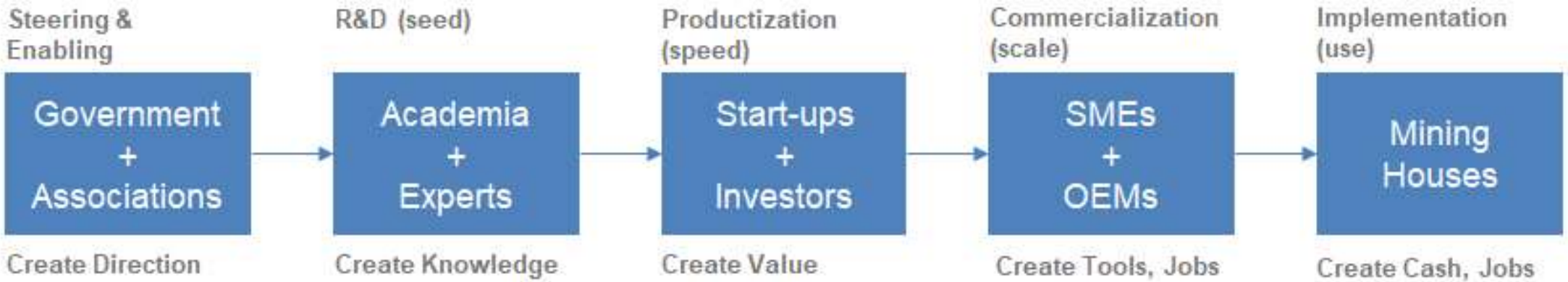
CSIR's Mining RDI capability has experienced a regressive period over the past two decades characterised:

- A sharp decline in size of staff complement and a loss of skilled resources with Mining operational knowledge to develop solutions for the industry,
- Lack of engineering capability to design, develop and test functional solutions,
- A diminished capability base in mining, and limited investment into new technologies.

1. COMRO - Chamber of Mines Research Organization established in 1964, was the largest privately funded

Reposition the CSIR Mining Capabilities

The knowledge value chain



CSIR

DSTI
DMRE
DTIC

ICMM

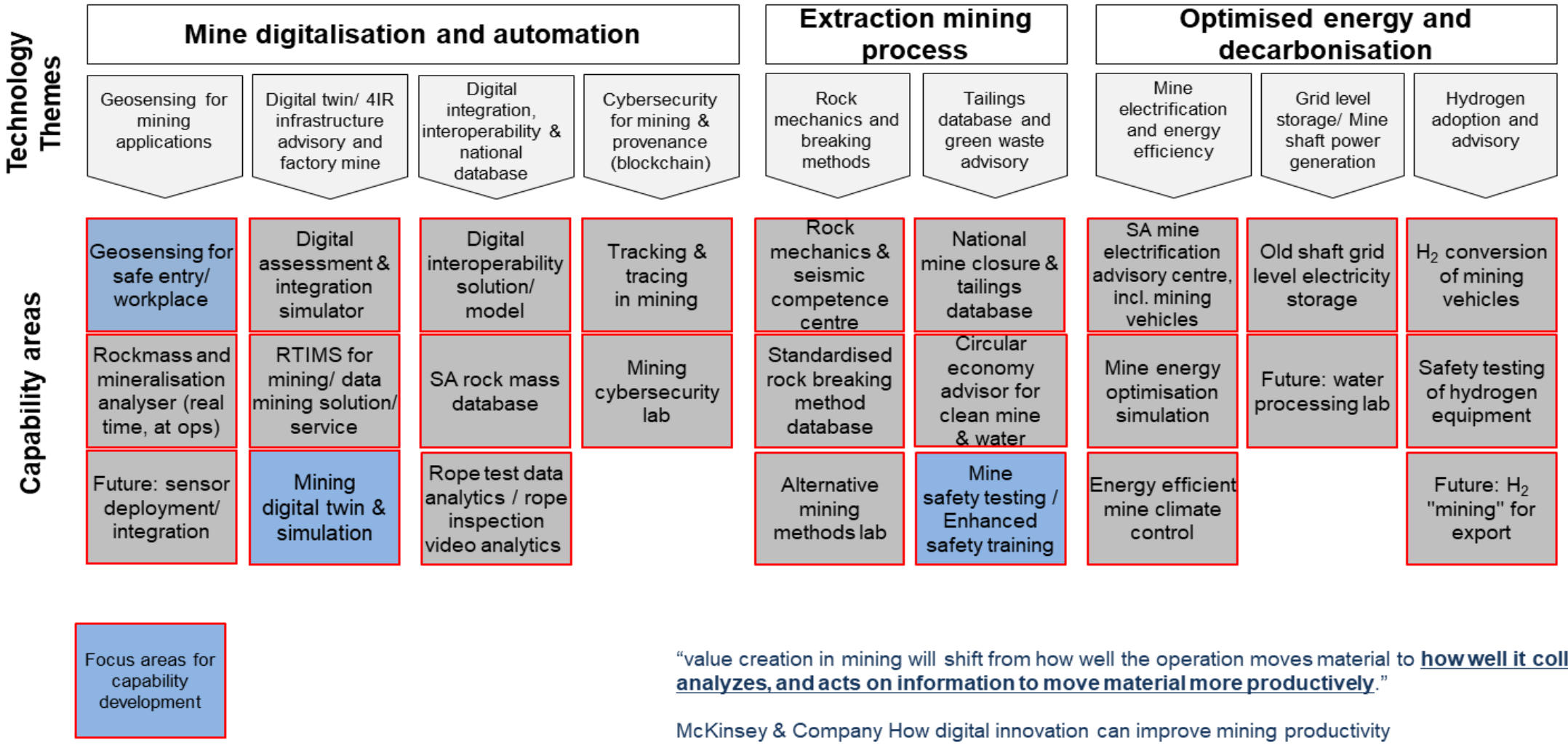
AngloGold Ashanti
exxaro
ARM
Anglo American
Kumba Iron Ore
Sibanye Stillwater
SERITI
...

Extensive engagements and Global technology benchmarking

The technology roadmap development process, followed a systematic approach which included

- Extensive stakeholder engagements with Mining industry CEO's, Executives, Technical experts, Technology suppliers (OEM's), Government, Research organisations
- Global technology benchmarking,
- Identifying niche opportunity areas to develop relevant capabilities.

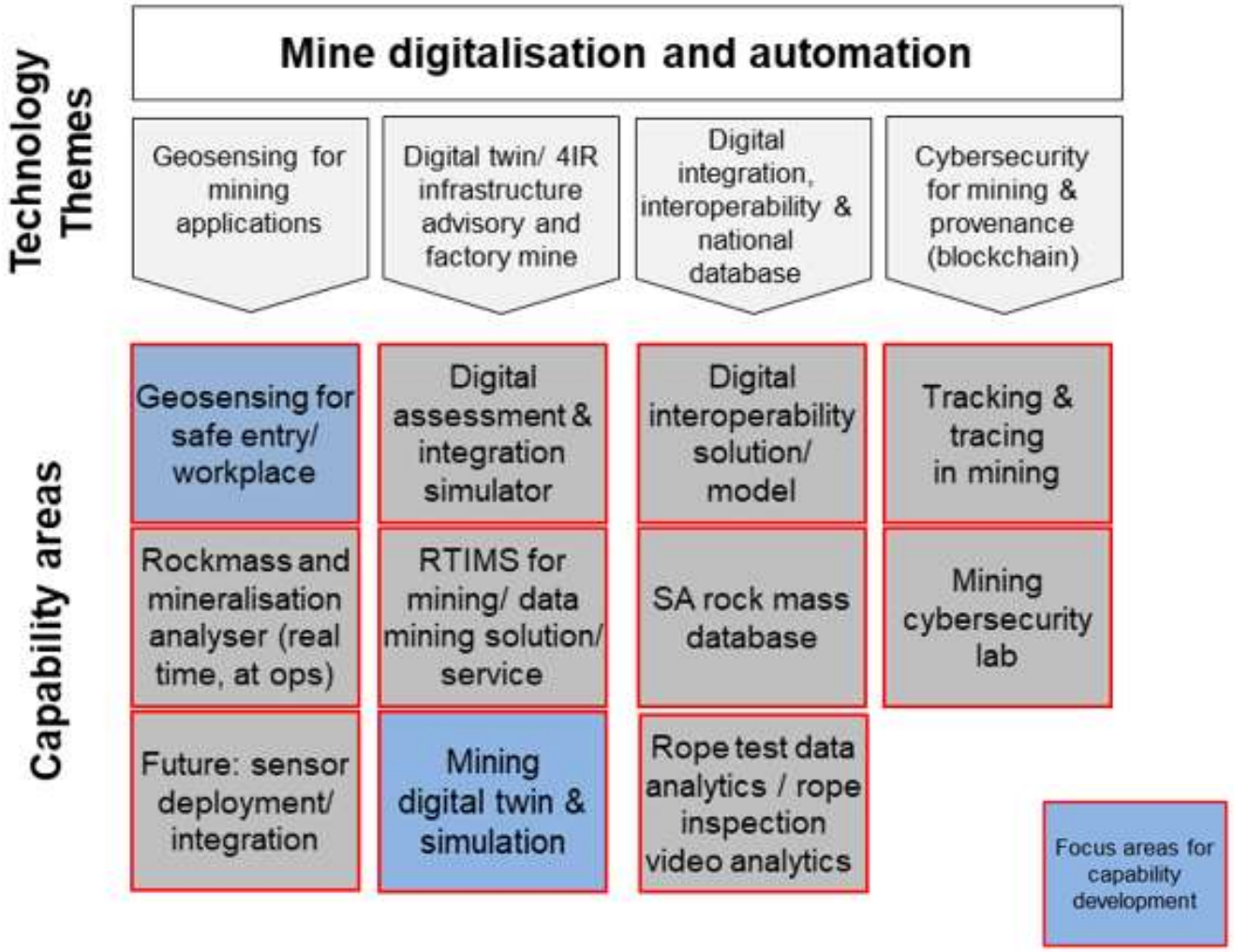
Technology roadmap showing capability development opportunities



"value creation in mining will shift from how well the operation moves material to **how well it collects, analyzes, and acts on information to move material more productively**."

McKinsey & Company How digital innovation can improve mining productivity

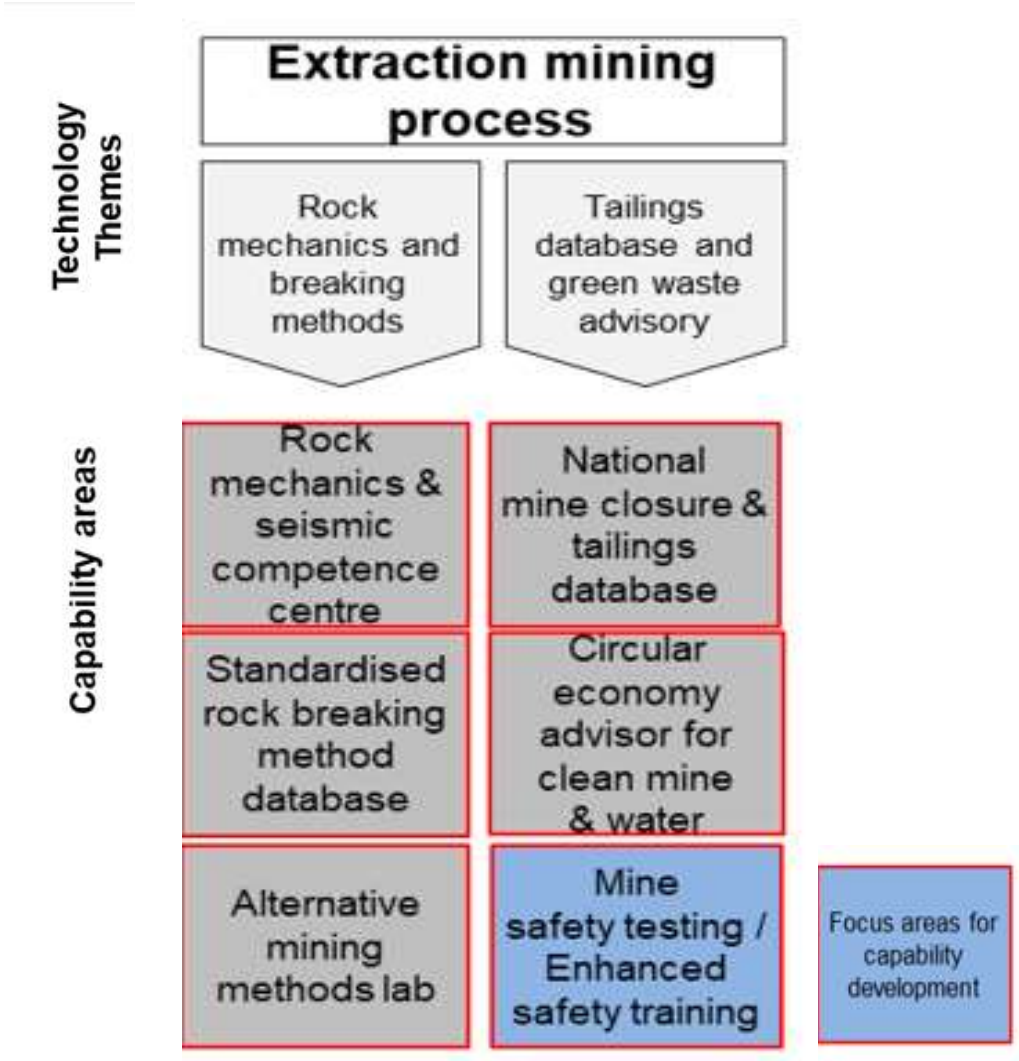
Technology roadmap showing capability development opportunities



Mine digitalisation and automation include but not limited to:

- Digitisation and automation of the mining value chain through design and deployment of IoT sensors,
- Digital integration as a force multiplier to the industry
- Application of big data analytics to enable better decision support.

Technology roadmap showing capability development opportunities



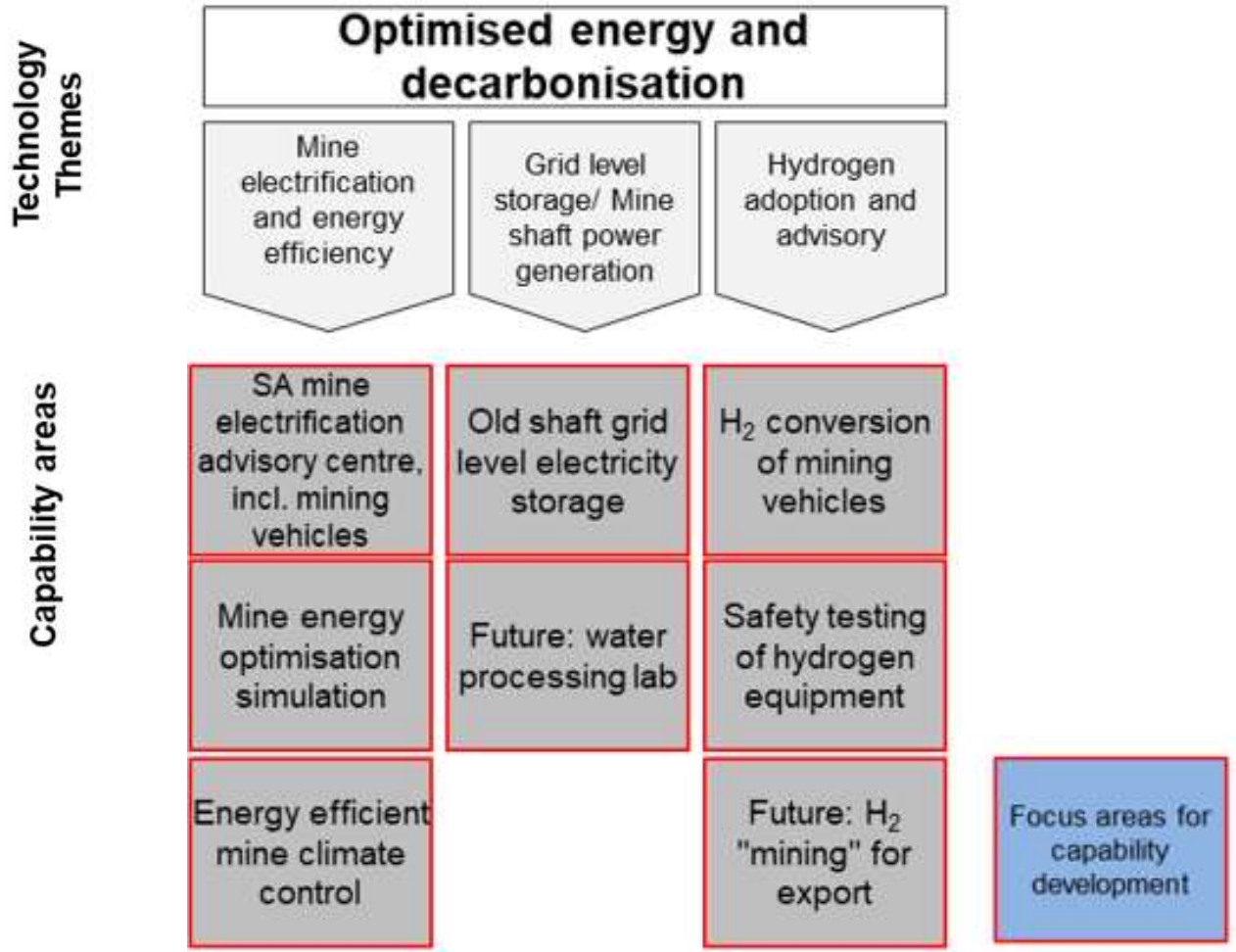
The enhancement of current capabilities optimum extraction which includes but not limited to:

- Advancement of the independent testing and training offering e.g. competency based training
- Preventing fall of ground, supporting structural mapping of resources to improve mining, extraction of resources,
- Improve safe conditions supporting building a circular economy ecosystem

Technology roadmap showing capability development opportunities

Optimised energy and decarbonisation supporting the Mining industry with:

- Decarbonisation drive involves supporting mine electrification,
- Improving energy efficiency and grid stability.



TMM Collision Prevention Digital Twin _Proof of concept study

Duration

End March 2021/ Start → Proof of Concept → Nov 2021- Project closure report Submitted to DSI

Development – 6 months + Testing – 2 months = **≈ 8 months**

Partnerships

(DSI + CSIR + Minerals Council + Mining Operators+ OEM)

4IR Application

Big Data analytics, Machine Learning, Engineering Design

Product Growth

Initial Use Cases

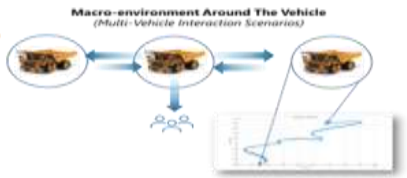
- Risk based safety tool
- Art of the possible efficiency improvements

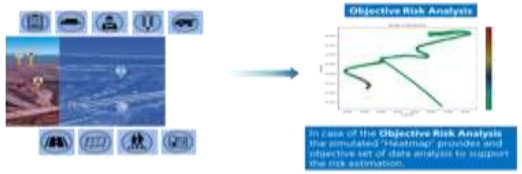
Current tool use Cases

- Dynamic safety risk evaluation
- Dynamic traffic management
- Improved Operator training
- Possible integration to improve efficiencies

Current Operational Testing

Design testing application of designed tool in an operational mining environment





Growing dynamic capabilities

- Geophysics
- Mining Engineering
- Rock engineering
- Mechanical testing engineering
- Mine ventilation engineering
- Explosives engineering
- Controls and instrumentation

Current capabilities: based on traditional mining extraction technical disciplines

- Robotics engineering
- Software engineering design
- Systems performance modelling
- IoT Sensor, signal design and testing
- Data analytics and AI
- Explosives Real time integration platforms/systems tools
- People centred adoption

Common capability gaps to support Mine Modernisation

Dynamic capabilities & multidisciplinary teams

Capabilities defined as :

1. Skills set or proficiency of technical expertise ,
2. Tools for professional practice e.g. systems engineering ,
3. Infrastructure e.g. Prototype

Way forward

- Fostering strategic partnerships to support rebuilding RDI ecosystem,
- Driving Capability development, to support the Mining industry business value drivers,
- Rapid development of bespoke solutions with Industry,

THANK YOU