

CSIR Connecting Science and The Mining Industry

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science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA



CSIR

Touching lives through innovation

CSIR Mandate, Vision and Strategy



CSIR MANDATE

"The objects of the CSIR are, through **directed** and **particularly multidisciplinary research and technological innovation**, to foster, in the **national interest** and in fields which in its opinion should receive preference, **industrial** and **scientific development**, either by itself or in **co-operation with principals** from the **private** or **public sectors**, and thereby to contribute to the **improvement of the quality of life** of the people of the Republic, and to perform any other functions that may be assigned to the CSIR by or under this Act."

(Scientific Research Council Act, 1988 (Act 46 of 1988, amended by Act 27 of 2014))



VISION

We are accelerators of socioeconomic prosperity in South Africa through leading innovation.

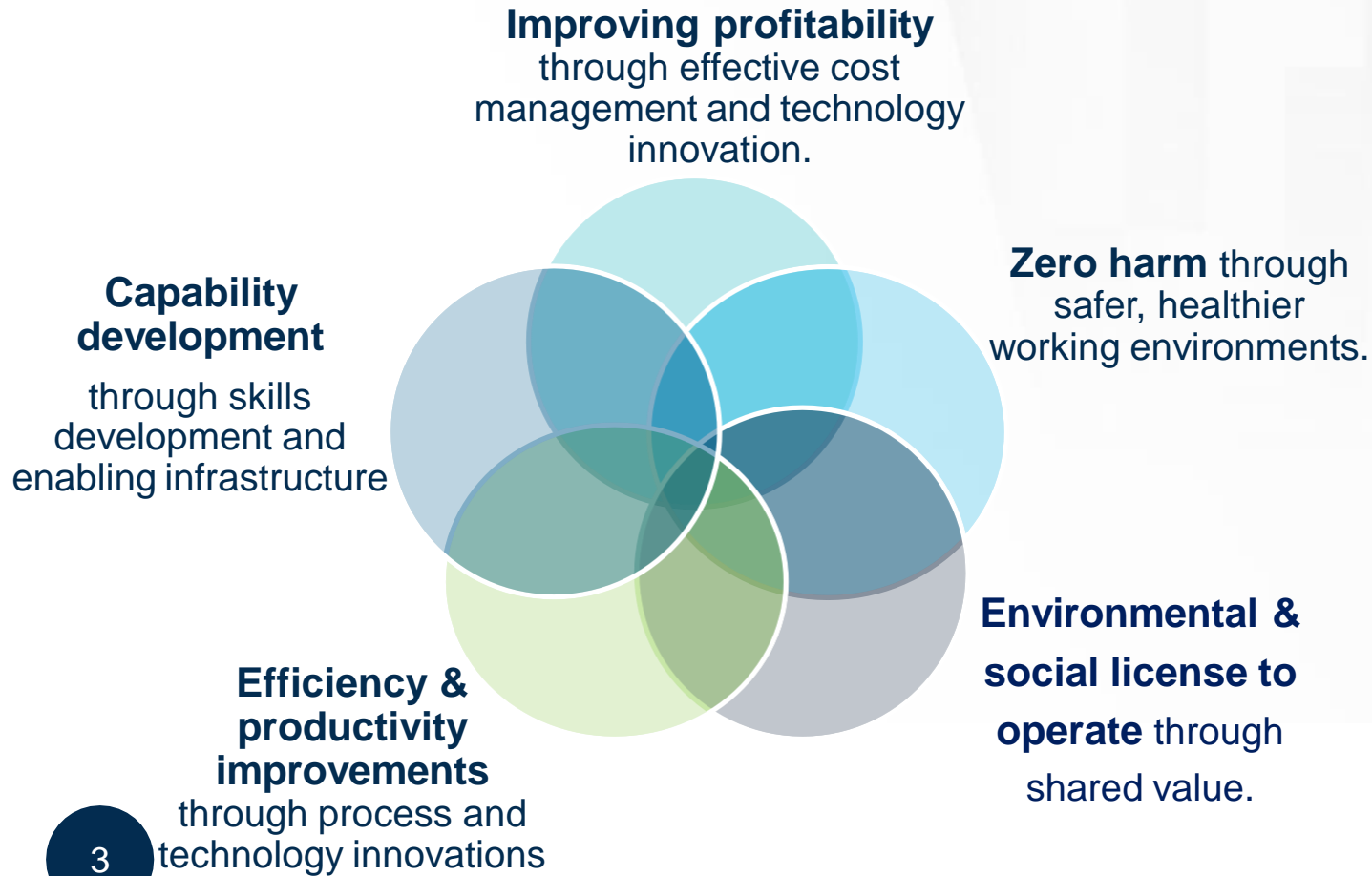


MISSION

Collaboratively innovating and localising technologies, while providing knowledge solutions for the inclusive and sustainable advancement of industry and society.

- CSIR has over 75 years of experience in Research, development and innovation by leveraging world class multidisciplinary teams, with cutting edge 4IR capabilities to deliver **High Impact scalable solutions**
- CSIR organisational strategy has identified high-impact sectors, including **Mining sector, where South Africa could carve out a competitive advantage to stimulate overall socioeconomic growth**
- One of our strategic Objectives is to Improve the competitiveness of high-impact industries to support South Africa's re-industrialisation by collaboratively developing, **localising** and implementing technology

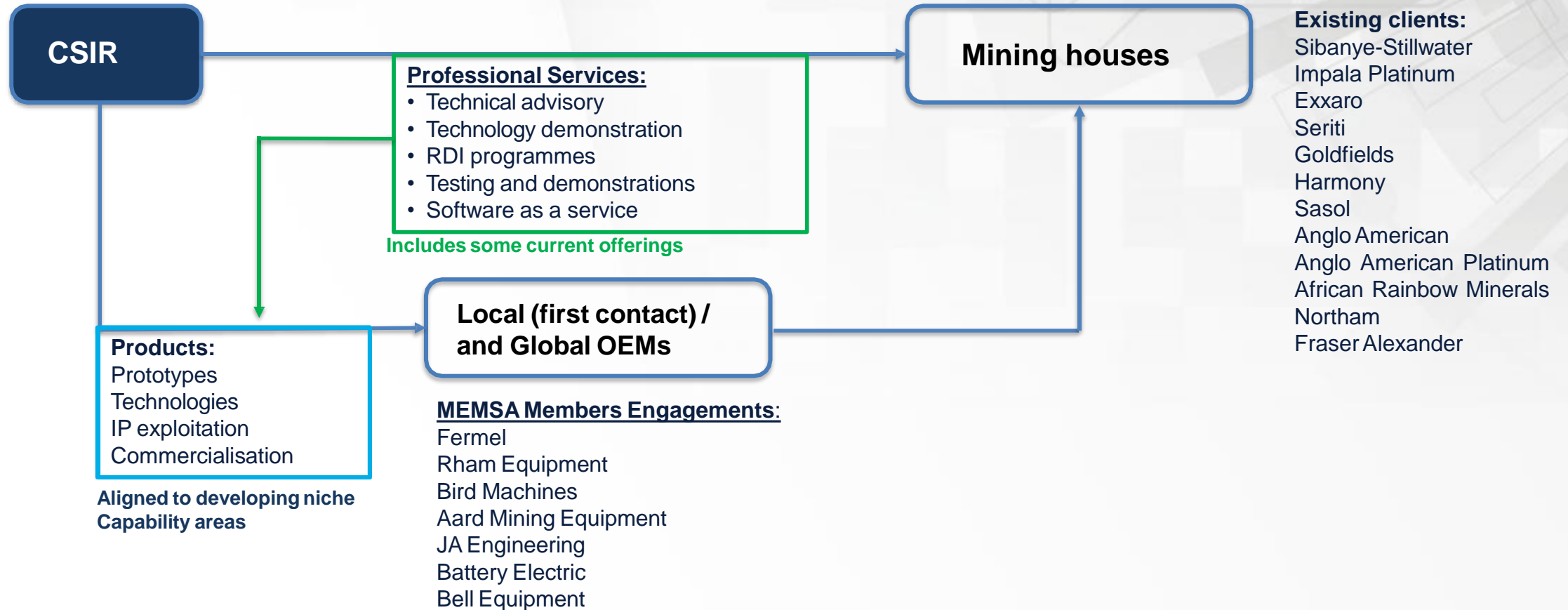
CSIR aims to support the mining industry in achieving its business value drivers



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

- Improvements in safety and health,
- Environmental sustainability,
- Efficiency and productivity drives,
- Lowest cost producer, and
- Resource utilisation & improving life of mine.

CSIR Mining cluster business model



Rationale

- Mining houses will typically contract directly with CSIR for professional services across various areas.
- Mining houses will not contract with CSIR for products or technologies due to CSIR's inability to provide comprehensive after-market support, spares and wears.

Mine testing and training supporting zero harm and compliance in the mining industry

Strategically supporting the mining industry with independent compliance testing and training capabilities:

- Annual monitoring and legislated performance acceptance testing for Self-Contained Self-Rescuers (SCSRs);
- Bi-annual, legislated destructive tensile testing of mine winder ropes;
- Monitoring and analysis of industrial air pollution;
- Mine fire and explosion suppression testing; and
- Competency-based training using 4IR technologies to support zero harm.



Mechanical laboratory Cottoesloe, established 1935



Wire rope testing laboratory Cottoesloe, established 1967



Kloppersbos fire and explosion research facility, established 1987

Mining Extraction Capabilities to support zero harm, efficiency improvements and maximizing resource use



Extraction Mining Processes

Diverse Technical capabilities to solve Mining challenges:

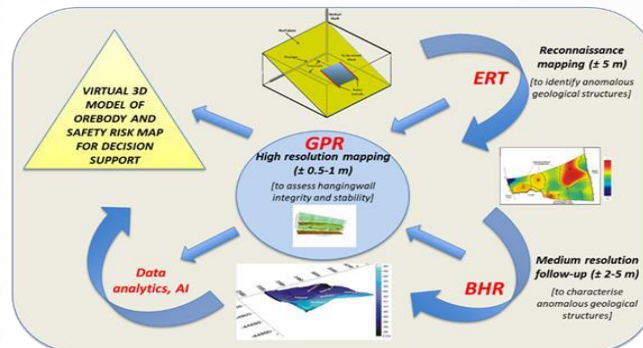
- Mine Planning
- Explosive Engineering
- Technology Adoption models
- Time in motion studies
- Skills/Capability mapping
- Skills development platforms
- Heat Tolerance Testing
- OHS studies



Geophysics

High-resolution geophysical tools (e.g. 3D and 2D GPR surveys, Borehole Radar, Electrical resistance tomography) for mining challenges:

- Orebody delineation
- Reef continuity/topography
- Structural mapping e.g. dykes
- Cavities (natural and man-made)
- Water/pollution mapping
- Borehole geophysics



Rock Engineering

Diverse Technical capabilities to solve Mining challenges:

- Geotechnical data acquisition
- Rock mass characterization
- Mine feasibility studies
- Numerical modelling
- Technical thought-leadership
- Development of novel tools to assist Rock Engineers
- Geo-Technical/Rock Engineering service audits



Building critical mass for Mine Modernization and Decarbonization for current and future mines



Digital and Automation Solutions

Support the mine of the future, OEMs and OTMs we have the following capabilities:

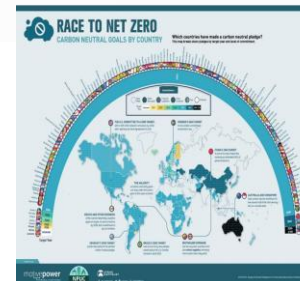
- Digital Twins and Simulations (in development)
 - Trackless Mobile Machinery
 - Track Mounted Equipment
 - Sensors
- Digital Transformation, Digitalization and Digitization
- Data analytics
- Digital platform development



Environmental Sustainability

Support mines with creating an environmentally substantiable mining value chain:

- Mining environmental control services and innovations
- Tailings database and management
- Circular economy ecosystem for mining
- Decarbonization assessments using simulations and digital twins
- Mining Fleet decarbonization RDI and Technology Development



How we are Connecting Science and the Mining industry



AFROX
A Linde company

DEZEGA[®]

Technology patents & license agreements for Self-Contained Self-Rescuers



Independent testing for Mine support products for local and international clients e.g. Fabchem Mining, Mine Support Products (Pty) Ltd , Mohlalefi Engineering



To evaluate the brake liner's ability to stop a high-speed conveyance during an emergency.



Independent Brake liner product verification tests



haggie[®]
steel wire rope

Winder rope testing for local and international clients



Conduct independent Design validation tests for local and international clients e.g. Whoppa Engineering

Competency based training using 4IR technologies: *driving zero harm in the mining industry*

DESCRIPTION

Provides mining employees with simulated and immersive training, recreating a safer training environment to improve the know-how of mineworkers and responsiveness in an emergency:

- The training uses Virtual Reality training technology to provide mining trainees with simulated, immersive, and experiential training on how to adequately respond to near-real emergency situations, such as underground fires and explosion



IMPACT AND BENEFITS

- Improves safety and health through enhanced behavioural responses across the mining industry.
- Providing a competency based reskilling method for mining workers.
- Promotes the application and adoption of 4IR solutions in the mining industry.

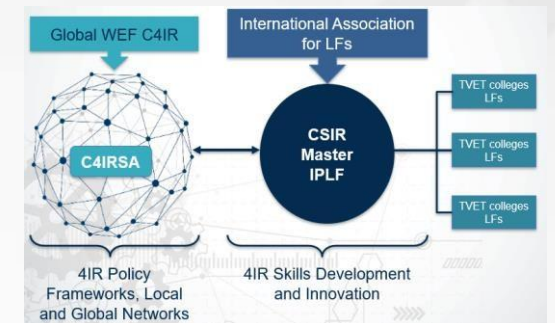
Learning Factory skills development : *Supporting People centred mine modernisation*

Objective of the innovation:

To facilitate skills development thus ensuring the availability of adequate and competent skills to support sustainable and people-centred modernisation in the mining sector.

Application:

- Facilitating skills development (re-skilling, re-training, up-skilling, etc.).
- Using technology to create jobs – low literacy levels.
- Implement systems that support low-skilled labour to perform skilled work.
- Just in time learning (competency development).
- Use technology to support training process.



Mining



Manufacturing



Agriculture

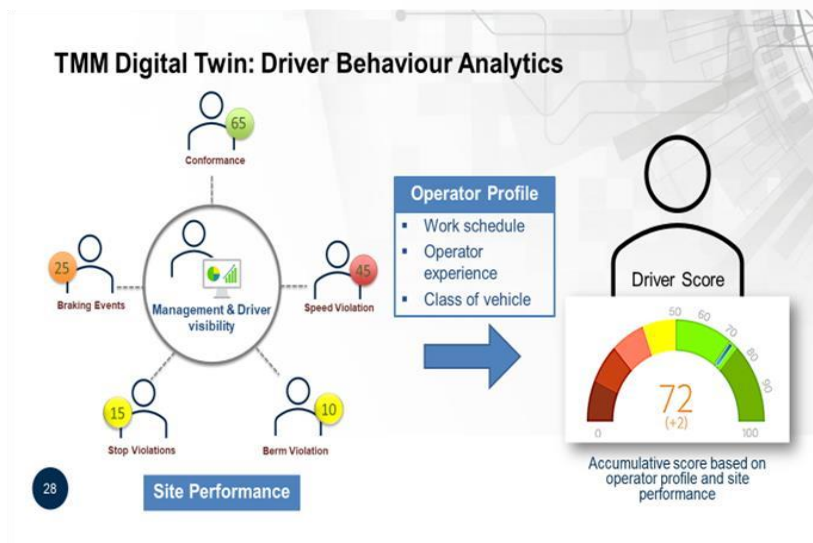
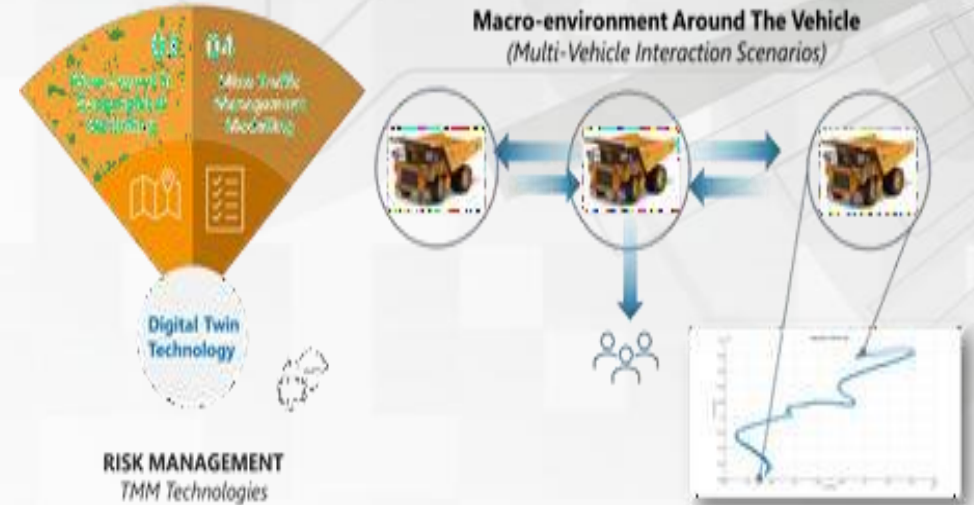


Energy

Collision prevention digital twin: *supporting safer, modernised mining operations*

Project Background

- A near real-time digital risk prediction tool in support of collision prevention of Trackless Mobile Machines (TMM) in the mining industry.
- The technology uses digital twin, artificial intelligence, machine learning to evaluate vehicle interaction risk, driver behaviour and existing control measures to predict possible scenarios to optimise for both safety and production output at mining operations.



Cloud-based interface

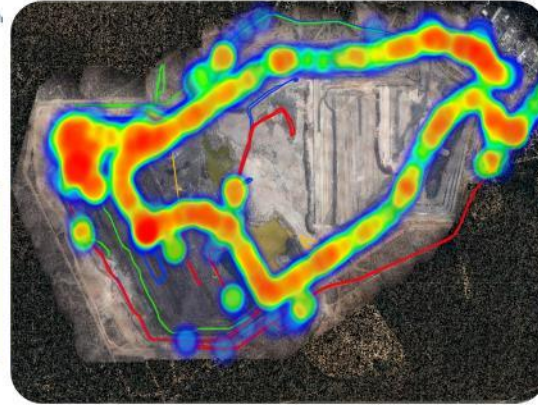
IMPACT AND BENEFITS

- Improves the safety of mining operations, in compliance with Chapter 8 of the regulations of the Mine Health and Safety Act, 1996 (Act 29 of 1996).
- Improves productivity and cost reduction for existing operations
- Prediction application for life of mine planning including evaluating carbon emissions

Translating Science to high-value innovative business solutions - Highlights

Digital and automation - TMM Digital Twin

A Digital Twin is a virtual representation/models of processes that define the performance of the physical/original machine



- April 2021 - Conceptualisation and development,
- June 2022 - Presentation to MRAC DMRE,
- Sept 2022 - Piloting of new tool at largest coal mine in South Africa,
- Oct 2022 – Presented to MHSC Tripartite Summit,
- Nov 2022 – Presented at 8th CSIR Biennia Conference,
- Feb 2023 - Presentation to CEO Zero Harm Forum

24 months from concept to operational pilot
Commercialisation planned in the next 12 -18 months

Competency-based mine safety training



- Sep 2020 – Needs identification through extensive stakeholder engagement,
- 2021 - 2022 – Completed the development of e-learning, virtual reality and experiential training modules,
- 2023 – Launching of training application as part of *Zero Harm offering* to the industry,
- 2023 – Construction of mock mine facility.

30 months from concept to prototype offering
Commercially launching offering in May 2023



Our Contact details for Possible Areas of collaboration

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Thank you