The CSIR’s role in mining

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CAM Mining and Mineral Resources
CSIR
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Outline of presentation

- The value of mining in SA
- The challenges facing the mining sector
- The collective solution - Mining Phakisa
- Advancing the cluster
- The SAMERDI strategy
- CSIR in mining
- Conclusions
Mining in South Africa - the value

Abundance of mineral wealth reserves
- All minerals
  - US$ 4.7 trillion
- Non energy related minerals
  - US$ 2.5 trillion
  
  Source: Technology Innovation Agency 2015/2016

World number #1 in:
- PGMs (87.7%)
- Chromium (72.4%)
- Manganese (80%)
- Gold (12.7%)

- SA mining industry has been the cornerstone of the economy
- Mining led the first industrialisation in South Africa
- Contribution of 8% to GDP
- More than 13% of all expenditure on manufactured items came from mining
- 25% of exports
- 15% of FDI
- Dependency ratio of 1:15 for every mine employee

Source: Chamber of Mines of South Africa
Mining in South Africa - in crisis

"If we do nothing"

Status quo

- Increased Cost
  - Hard-rock narrow reef
  - e.g. Silicosis Compensation
- Decreased Productivity
  - e.g. Mine Closure & Job losses
  - e.g. Abandoned Mines
- Environment & Social Issues
- Zero Harm

"DO NOTHING"

- 200 000 jobs losses directly
- 3 million impacted

Source: Chamber of Mines- Mining Phakisa 2015
Mining in South Africa - collective solution

National objectives
- Zero Harm Industry,
- Globally competitive & Sustainable
- Need to maximise the mineral endowment
- A diversified strong economy
- Stimulate the local mining manufacturing sector

Key stakeholders
- Government (DST, dti, DPME, DMR)
- Mining companies
- OEMs
- Universities
- Research institutes
- Organised labour

Mining Phakisa outcomes
- Advancing the cluster
- Reviving investment into mining
- Sustainable communities
- Cluster employment
- Win-win beneficiation

...to keep the industry afloat during the commodity price slump
...putting in place initiatives to place the mining cluster on a firm foundation
...to grow, transform & contribute to the economy
Advancing the cluster

Extend the life of platinum and gold mines in South Africa beyond 2025 & establish global leadership in narrow-reef, hard rock mining systems

Mining R&D programme
The establishment of focussed R&D solutions

- Operational efficacy
- Rebuild R&D capacity and capability
- Collaborative R&D funding model
- Institutional arrangement

- Mechanised mining system solutions
- Integration of transformed R&D capability and capacity across SA
- Roll-out prototype solutions into production

- Local R&D capability for narrow-reef mechanised mining solutions
- Develop a hard rock cutting tool (>200 MPa)

Mining Equipment Manufacturing Development programme
Providing locally manufactured equipment

- Establish mining manufacturing equipment cluster
- Increase local content in current procurement
- Partnering with global OEMs
- MMEC incentive model to ensure local manufacturing

- Strengthen SA manufacturing capability
- Incentivise global OEMs for local assembly
- Develop Tier 2 & Tier 3 suppliers

- Local OEMs exporting narrow-reef hard rock mining systems
Advancing the cluster - SAMERDI strategy

- Pre-Phakisa R&D in mining - there was no approved strategy – different foci and needs;
- Further fragmented due to competitive R&D funding environment;
- Post the Phakisa – SAMERDI strategy was adopted as the consolidated strategy for extraction;
  - Focus on mines:
    - Increase productivity and safety
    - Optimised use of input resources
    - Cost efficiencies
    - Increased LoM
  - Rebuilding R&D capability
    - Long-term programmes
    - Capacity building
    - Skills enhancement
Advancing the cluster - SAMERDI strategy

Current Mines
Mining is in crisis,
• safer,
• reduce costs,
• increase efficiencies

Platinum cost curve (cash costs plus stay in production capex) FY2015

PGM Operations in South Africa
Source Chamber of Mines Phakisa 2015
Advancing the cluster - SAMERDI strategy

Current Mines – Longevity
*More from the same with the same.*
- Focus on mines with limited LoM
- Tweaks and optimisation without necessarily introducing large CAPEX requirements
Advancing the cluster - SAMERDI strategy

Mechanisation - Drill & Blast

Mechanisation across the process
- Zero Harm
- Significant productivity increase
- Specialised equipment for Au & PGM separately
Advancing the cluster - SAMERDI strategy

Non-Explosive Mining

*Full 24/7 operations*
- Revolutionary change to mining
- Remove dependency on explosives
- Extraction of only channel width – no waste

Conventional current mining

Longevity of current mining

Mechanisation (D&B)

Non-explosive mining
Advancing the cluster - SAMERDI strategy

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<th>Benefit</th>
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Conventional current mining

Longevity of current mining

Mechanisation (D&B)

Continuous mining
Initiative | Rationale | Benefit
--- | --- | ---
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• Increase efficiency by knowing where the reef is

Real-time Information Management Systems | Converting information to knowledge and wisdom | • Information is immediately available to decision makers
• Information is collected, processed and managed to allow for proactive and predictive decision
Advancing the cluster - SAMERDI strategy

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<td>Successful Applications of Technology</td>
<td>understanding why technologies either work or fail</td>
<td>• Understanding the pitfalls when technology is implemented</td>
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<td>• Change management</td>
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- Conventional current mining
- Longevity of current mining
- Mechanisation (D&B)
- Continuous mining

- Stakeholder engagement
- Impact assessment
- Leadership
- Change Management
- New Mining skills
- Wellness, health and safety
- Utilising current skills
- Economic diversification
- Skills for other industries

- Localisation
- Social protection
The CSIR’s role in mining
<table>
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<tr>
<th>Activity</th>
<th>Mine Initiation activities</th>
<th>Mineral extraction</th>
<th>Mineral beneficiation</th>
<th>Mine Closure</th>
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<tr>
<td>MINING VALUE CHAIN</td>
<td></td>
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<td>Rehabilitation and mine closure</td>
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<td>Exploration</td>
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<tr>
<td>Mine development</td>
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<td>Primary mining activities</td>
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<tr>
<td>Milling &amp; concentrating</td>
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<td>Smelting &amp; refining</td>
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<td>Product development &amp; manufacturing</td>
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<td>Post Mining Landscape - Closure &amp; Rehabilitation</td>
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• CSIR contracted by DST to lead the implementation of SAMERDI strategy.

• Central player and driver of the SAMERDI Strategy.

• Mining industry has been identified as a pillar in Project Synapse on Industrialisation.

• Has multi, inter and transdisciplinary capabilities to provide diverse technological solutions.

Mining coordination currently under the Industry Research Impact Area (RIA).
CSIR role in mining

Examples of Mining R&D

1. OHS for MHSC’s on Blasting vibrations and Statutory Equipment Monitoring;
2. Geotechnical offerings to Sasol, Impala;
3. Addressing post-mining projects in Limpopo with Anglo American;
4. Geophysics projects for various mines
5. Coaltech - Coal processing & Environmental studies
6. International Collaboration - China and EU
Mining matters!

“If it’s not grown, it’s mined”

**Keeps you connected**
- Copper (16 grams) \(^1\)
- Silver (0.35 grams) \(^1\)
- Gold (0.034 grams) \(^1\)
- Palladium (0.015 grams) \(^1\)
- Platinum (0.00034 grams) \(^1\)
- Ceramic magnetic switches containing rare earths \(^2\)
- Indium \(^2\)
- Titanium dioxide \(^2\)
- Indium tin oxide \(^2\)

**New energy sources**
- 335 tons of steel
- 4.7 tons of copper
- 13 tons of fibre-glass
- 3 tons of aluminium
- 1,200 tons of reinforced concrete

**Global infrastructure**

**Beauty and healthcare**
- Talc
- Mica
- Kaolin
- Calcite
- Titanium dioxide
- Zinc oxide

\(^1\) Source: USGS [link]
\(^2\) Source: NRC critical minerals report

Source: Chamber of Mines of South Africa
## Mining matters - CSIR’s role

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<th>Sector Needs</th>
<th>CSIR response</th>
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<td>Industry and Government has recognised Mining R&amp;D is core.</td>
<td>• CSIR is rebuilding is mining capabilities for direct mining application.</td>
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<td>Modernisation of mining requires a range of solutions from tweaks to “game changing” approaches</td>
<td>• Has multi, inter and transdisciplinary capabilities to provide diverse technological solutions.</td>
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<td>• Central player and driver of the SAMERDI Strategy, funding over next three years (R 27 m, R 100 mil, &gt;R 60 mil)</td>
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<td>• <a href="#">Mining Precinct@Carlow Road</a> established</td>
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<td>• Mining Hub for R&amp;D with DST, CoM, dti and CSIR in Public Private Cooperation.</td>
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Mining matters - CSIR’s role

Fulfilling the CSIR mandate

- Industrial and scientific development:
  - Improved quality of life of the people of the Republic:

RD&I outcomes

- Scientific and technological support to strategic and national initiatives and to industry:
  - Scientific and technological capabilities, e.g. materials science, photonics, robotics, modelling, ICT:

RD&I outputs

- Publications:
- Reports:
- Patents:
- Technologies:

RD & I activities

- Research:
- Partnering
- RD&I management
- Technology transfer

Inputs

- Human capital
- Research facilities
- Financial resources
- Governance
Thank you