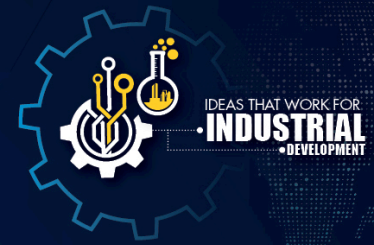


# The CSIR's role in mining

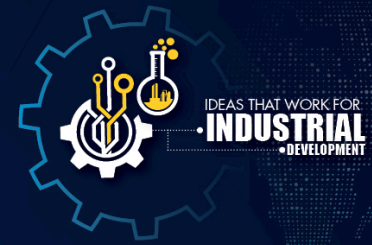
**Navin Singh**  
**CAM Mining and Mineral Resources**  
**CSIR**  
*5<sup>th</sup> October 2017*

# 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



**R286 billion**  
contribution to  
2015 GDP



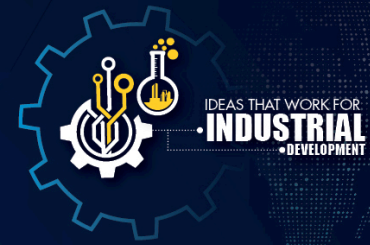
**R116.7 billion**  
employee earnings



**457 698**  
direct jobs created

Source: Chamber of Mines of South Africa

# Mining in South Africa - *in crisis*



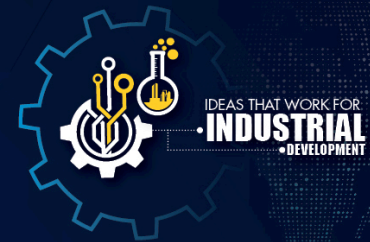
## Status quo



## “If we do nothing”



# 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

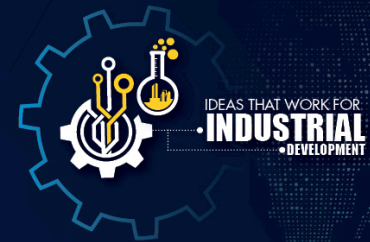


*....to keep the industry afloat during the commodity price slump*

*....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

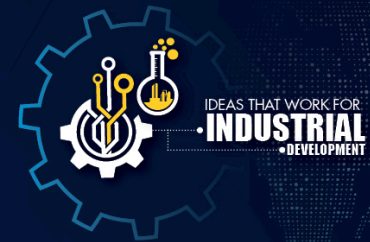
- Operational efficacy
  - Rebuild R&D capacity and capability
  - Collaborative R&D funding model
  - Institutional arrangement
- 
- Mechanised mining system solutions
  - Integration of transformed R&D capability and capacity across SA
  - Roll-out prototype solutions into production
- 
- Local R&D capability for narrow-reef mechanised mining solutions
  - Develop a hard rock cutting tool (>200 MPa)

## Mining Equipment Manufacturing Development programme

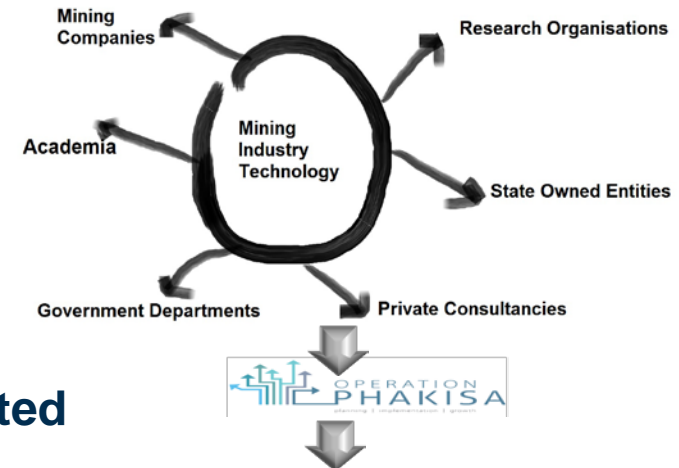
Providing locally manufactured equipment

- 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



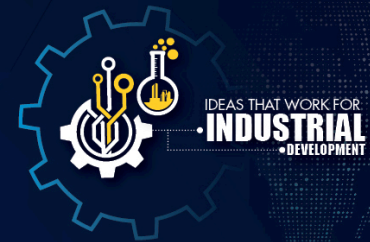
- Pre-Phakisa R&D in mining - there was no approved strategy – different foci and needs;
- Further fragmented due to competitive R&D funding environment;
- Post the Phakisa – SAMERDI strategy was adopted as the consolidated strategy for extraction;
  - **Focus on mines:**
    - Increase productivity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



**“SOUTH AFRICAN MINING EXTRACTION RESEARCH, DEVELOPMENT & INNOVATION STRATEGY” (SAMERDI)**



# Advancing the cluster - SAMERDI strategy

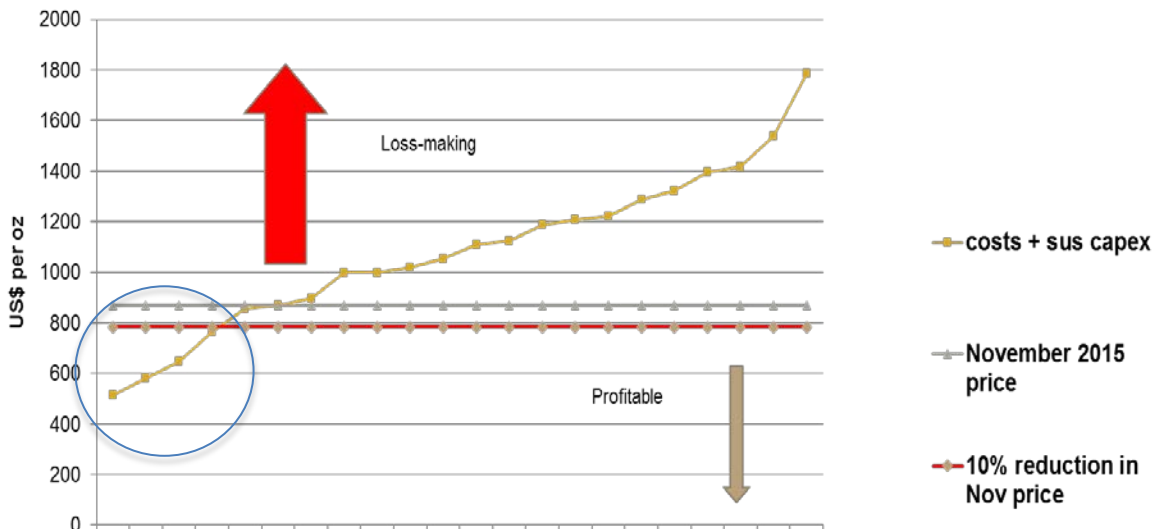


## Current Mines

*Mining is in crisis,*

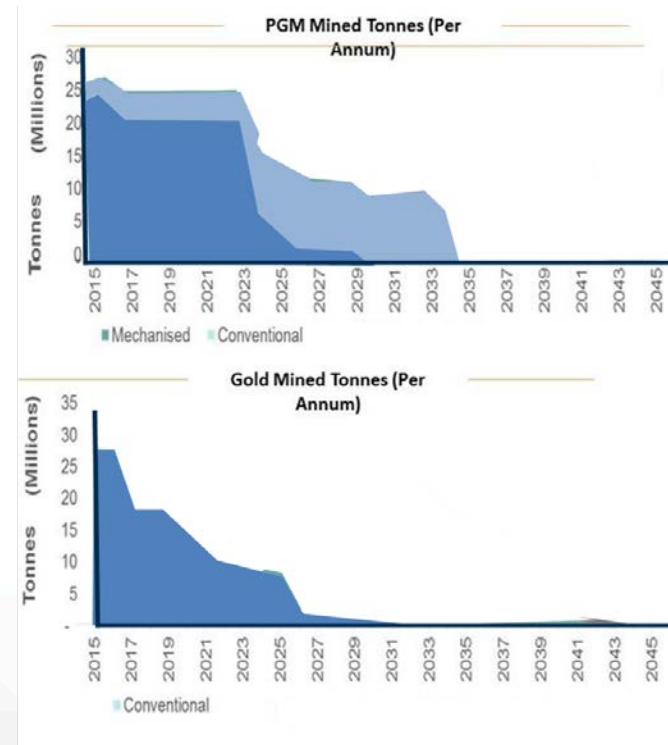
- *safer,*
- *reduce costs,*
- *increase efficiencies*

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

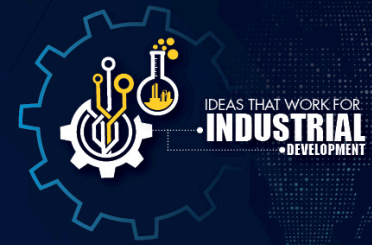


## PGM Operations in South Africa

Source Chamber of Mines Phakisa 2015



# Advancing the cluster - *SAMERDI* strategy



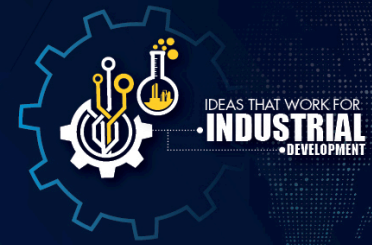
## Current Mines – Longevity

*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



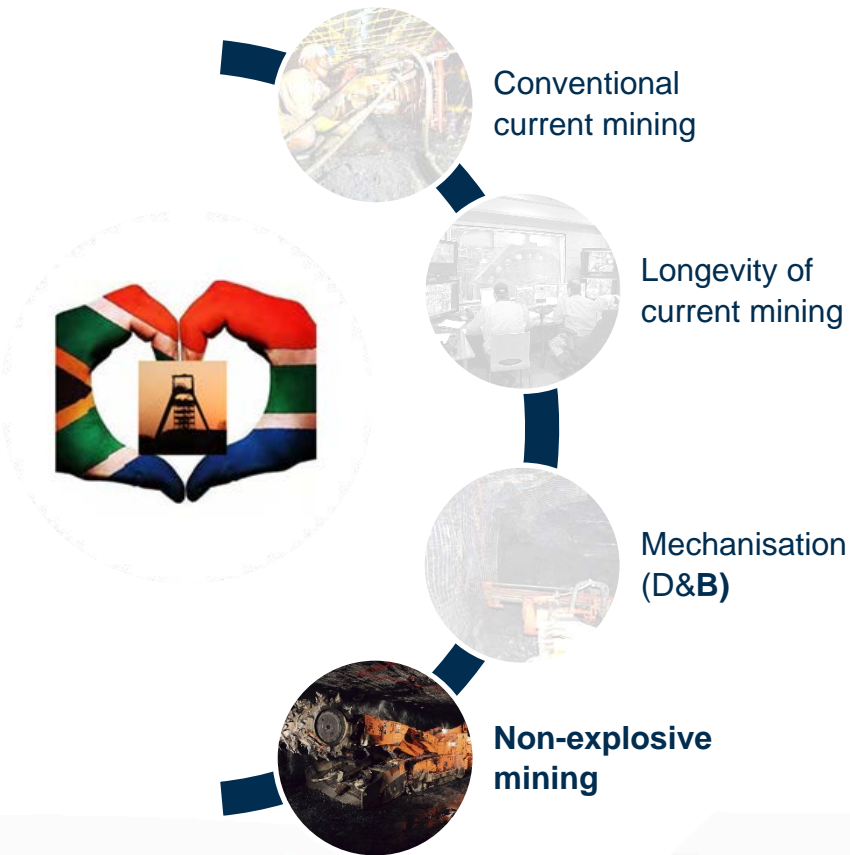
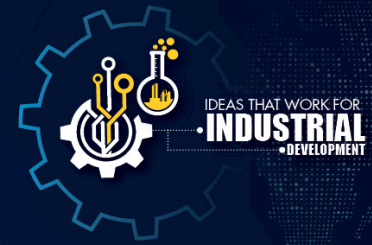
## **Mechanisation - Drill & Blast**

*Mechanisation across the process*

- Zero Harm
- Significant productivity increase
- Specialised equipment for Au & PGM separately



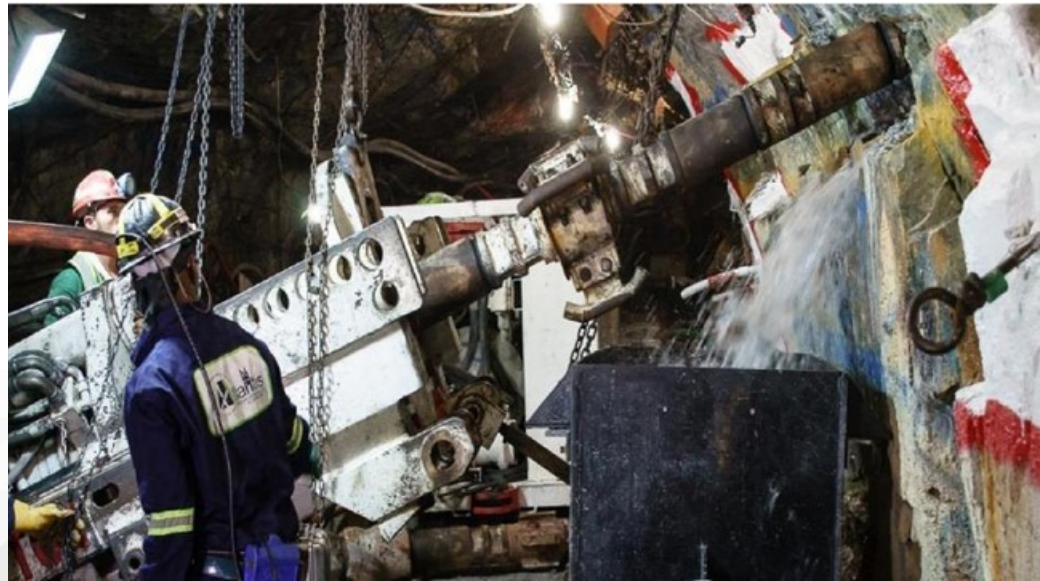
# Advancing the cluster - *SAMERDI* strategy



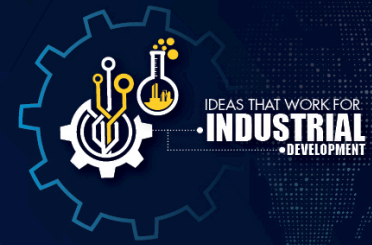
## Non-Explosive Mining

*Full 24/7 operations*

- Revolutionary change to mining
- Remove dependency on explosives
- Extraction of only channel width – no waste



# Advancing the cluster - *SAMERDI* strategy



Initiative	Rationale	Benefit
Advance Orebody	Ability to “see” ahead of the rock	<ul style="list-style-type: none"> <li>• Increase safety</li> <li>• Increase efficiency by knowing where the reef is</li> </ul>



Conventional current mining



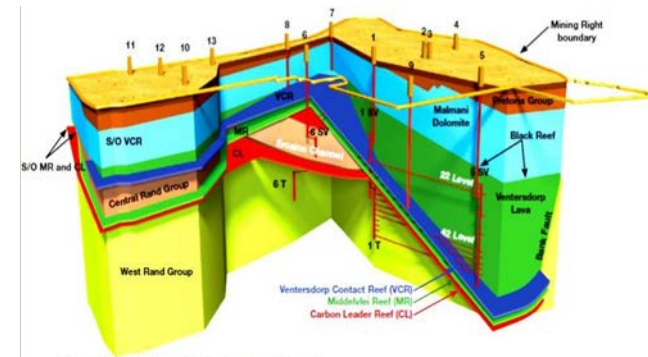
Longevity of current mining



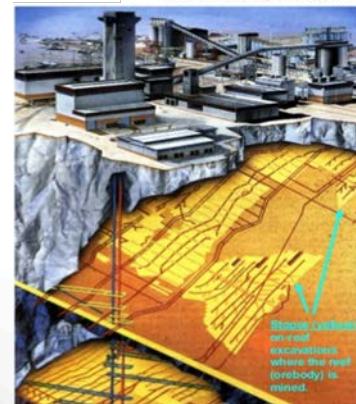
Mechanisation (D&B)



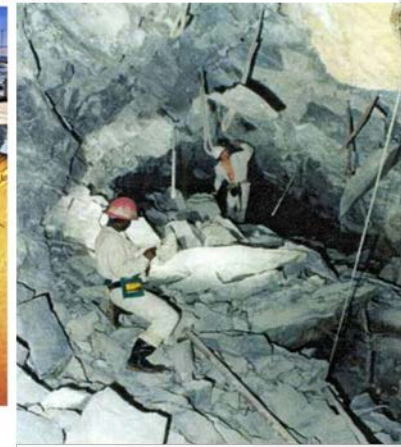
Continuous mining



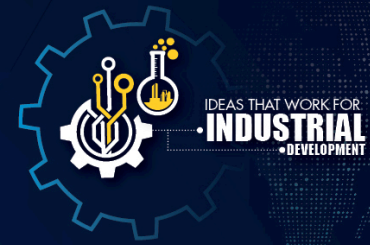
Schematic 3D section through the Driefontein ore body looking north



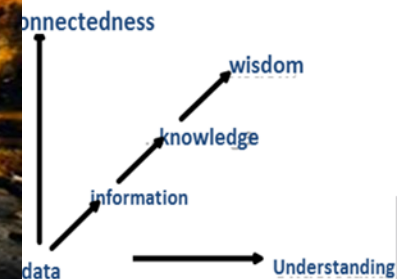
<http://www.bolidon.org.za/MiningEducation/Images/Images/CrossSectionMine.jpg>



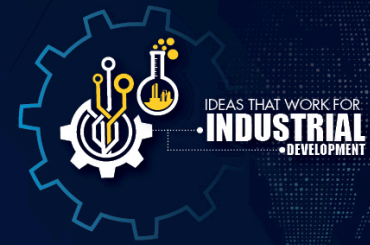
# Advancing the cluster - *SAMERDI* strategy



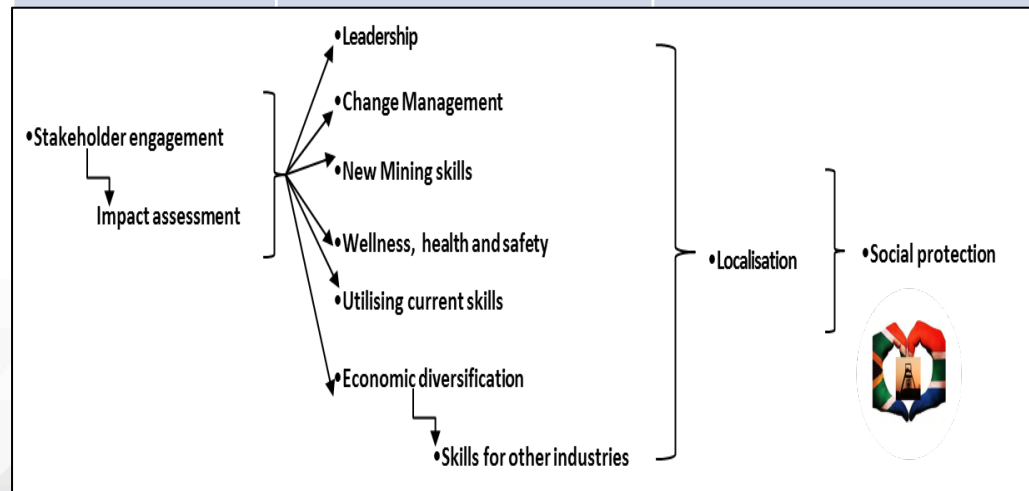
Initiative	Rationale	Benefit
Advance Orebody	Ability to “see” ahead of the rock	<ul style="list-style-type: none"> <li>• Increase safety</li> <li>• Increase efficiency by knowing where the reef is</li> </ul>
Real-time Information Management Systems	Converting information to knowledge and wisdom	<ul style="list-style-type: none"> <li>• Information is immediately available to decision makers</li> <li>• Information is collected, processed and managed to allow for proactive and predictive decision</li> </ul>

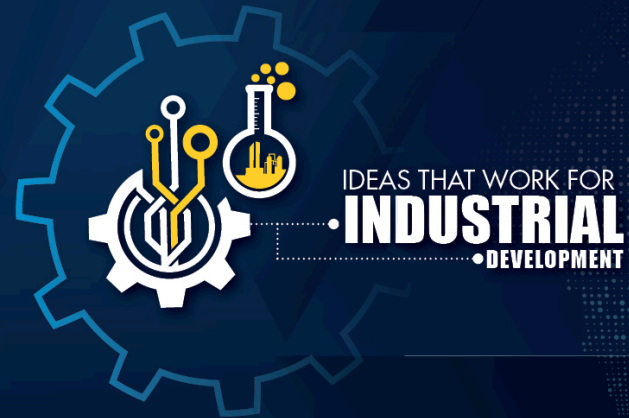


# Advancing the cluster - *SAMERDI* strategy



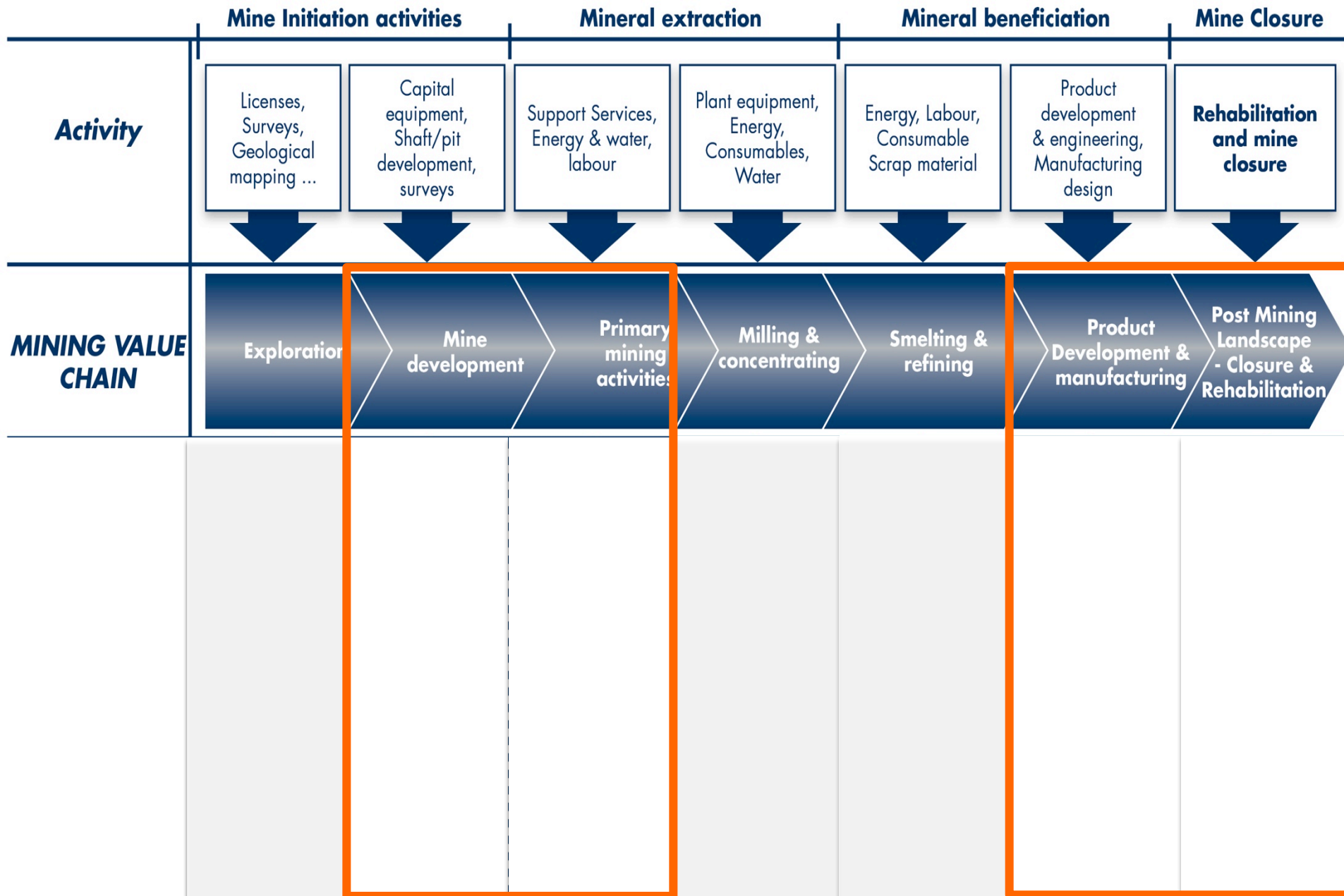
Initiative	Rationale	Benefit
Advance Orebody	Ability to “see” ahead of the rock	<ul style="list-style-type: none"> <li>• Increase safety</li> <li>• Increase efficiency by knowing where the reef is</li> </ul>
Real-time Information Management Systems	Converting information to knowledge and wisdom	<ul style="list-style-type: none"> <li>• Information is immediately available to decision makers</li> <li>• Information is collected, processed and managed to allow for proactive and predictive decision</li> </ul>
Successful Applications of Technology	understanding why technologies either work or fail	<ul style="list-style-type: none"> <li>• Understanding the pitfalls when technology is implemented</li> <li>• Change management</li> </ul>



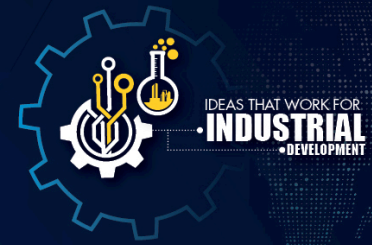


# The CSIR's role in mining

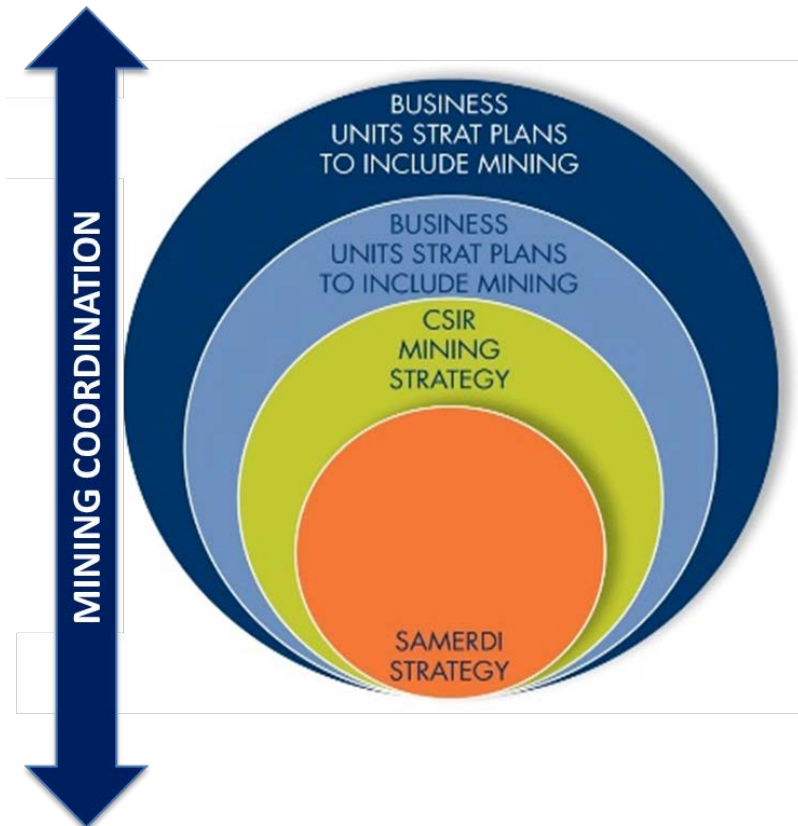
# Generic Mining Value Chain



# CSIR role in mining

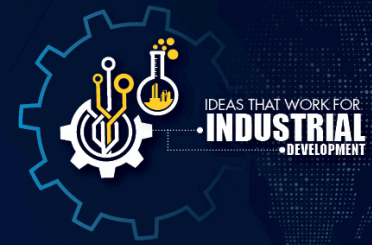


- CSIR contracted by DST to lead the implementation of SAMERDI strategy.
- Central player and driver of the SAMERDI Strategy.
- Mining industry has been identified as a pillar in *Project Synapse* on Industrialisation.
- Has multi, inter and transdisciplinary capabilities to provide diverse technological solutions.



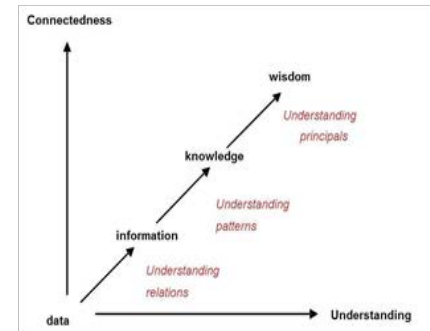
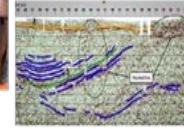
Mining coordination currently under the Industry Research Impact Area (RIA).

# CSIR role in mining

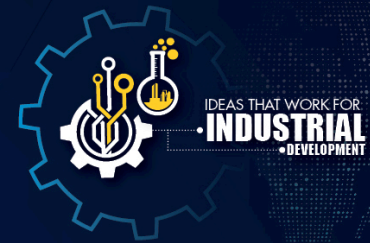


## Examples of Mining R&D

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!



## Keeps you connected

- Copper (16 grams)<sup>1</sup>
- Silver (0.35 grams)<sup>1</sup>
- Gold (0.034 grams)<sup>1</sup>
- Palladium (0.015 grams)<sup>1</sup>
- Platinum (0.00034 grams)<sup>1</sup>
- Ceramic magnetic switches containing rare earths<sup>2</sup>
- Indium<sup>2</sup>
- Titanium dioxide<sup>2</sup>
- Indium tin oxide<sup>2</sup>



<sup>1</sup> source – USGS <http://pubs.usgs.gov/ta/2004/3097/>

<sup>2</sup> source – NRC critical minerals report

## 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

“If it’s not  
grown,  
it’s mined”

Source: Chamber of Mines of  
South Africa<sup>3</sup>

## Global infrastructure



## Beauty and healthcare

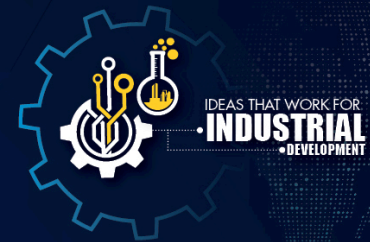


- Talc
- Mica
- Kaolin
- Calcite
- Titanium dioxide
- Zinc oxide



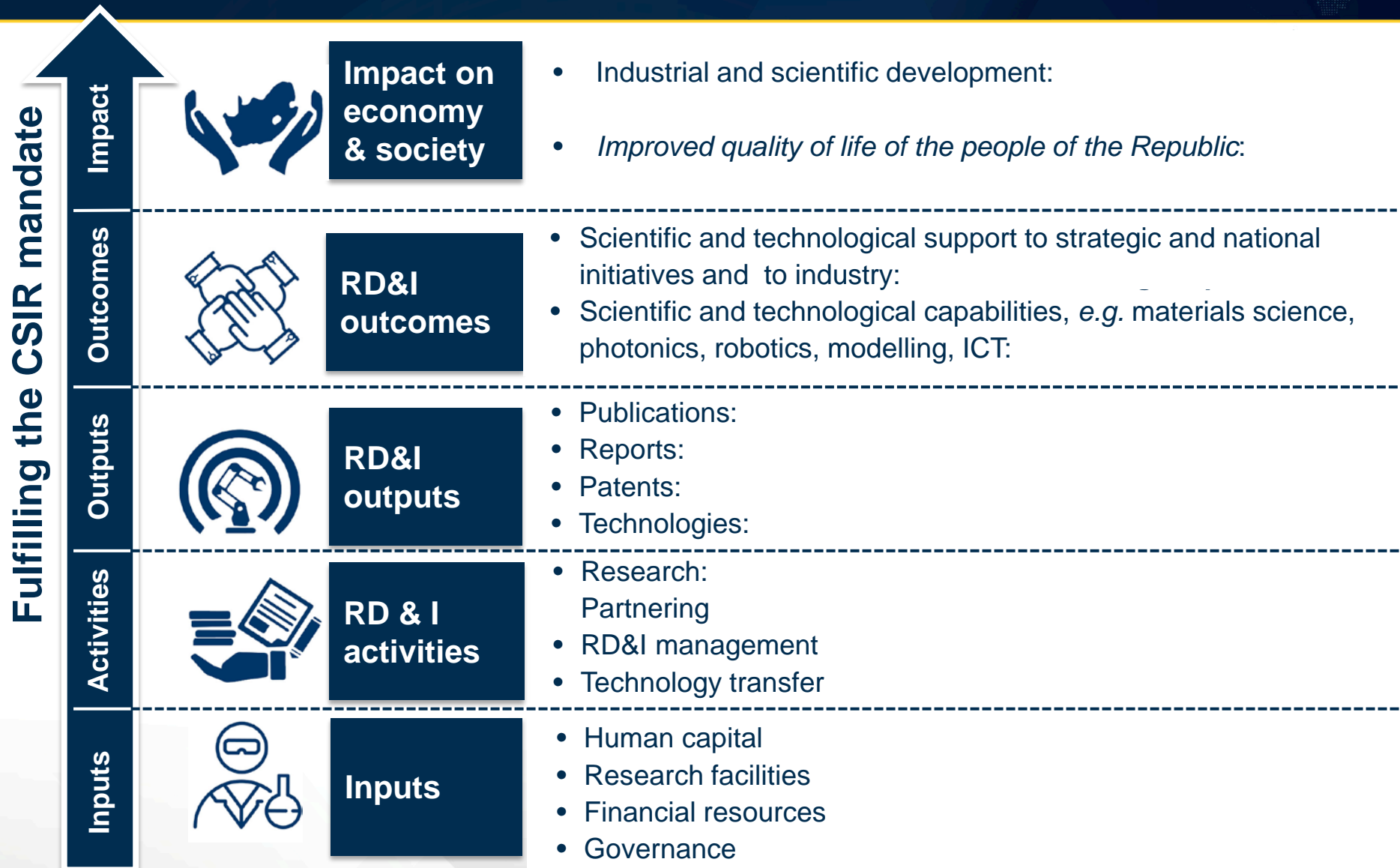
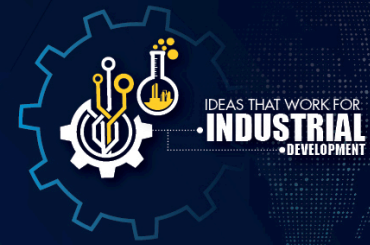
- Silica
- Limestone
- Aluminium
- Fluoride
- Titanium
- Petroleum

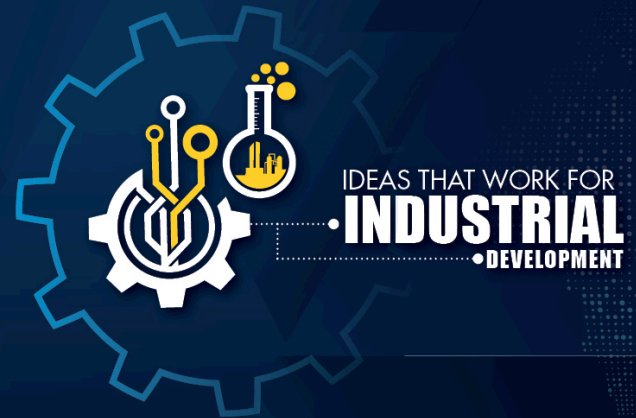
# Mining matters - CSIR's role



<u>Sector Needs</u>	<u>CSIR response</u>
Industry and Government has recognised Mining R&D is core.	<ul style="list-style-type: none"><li>• CSIR is rebuilding is mining capabilities for direct mining application.</li></ul>
Modernisation of mining requires a range of solutions from tweaks to “ <i>game changing</i> ” approaches	<ul style="list-style-type: none"><li>• Has multi, inter and transdisciplinary capabilities to provide diverse technological solutions.</li><li>• Central player and driver of the SAMERDI Strategy, funding over next three years (R 27 m, R 100 mil, &gt;R 60 mil)</li><li>• <u>Mining Precinct@Carlow Road</u> established</li><li>• Mining Hub for R&amp;D with DST, CoM, dti and CSIR in Public Private Cooperation.</li></ul>

# Mining matters - CSIR's role





**Thank you**

**CSIR**  
*our future through science*