Value creation through modernisation of South Africa’s mining industry

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SVP: SHE and Safe technology

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Agenda

• Recap of 2015 mining performance
• Mining: still a substantial value add
• Reversing the decline through modernisation
• Mechanisation as a driver for change
• Unlocking and preserving Reserves
• Extending Life of Mine
• The modernised mine: Sibanye’s view
• Safe technology developments
• Conclusion: Superior value creation for all
2015 Recap

A contributing industry in turmoil
2015 Recap SA mining’s industry performance

• Cash flow down despite 4% increase in revenue due to 14% increase in operating cost
• Nett loss of R47.5 billion after tax and dividends, only loss-making sector in economy
• Market capitalisation of top 35 SA resources companies down from R 675 billion (June 2014) to R 304 billion (September 2015) – 55% reduction

Mining: Still a substantial value add

- Direct National GDP contribution of 7.7% (approximately 9.3% indirect, 17% in total)\(^1\)
- Contributed 60% of total exports\(^2\)
- Generated R 391 billion in revenue\(^2\)
- Direct employment of over 1 million people\(^1\)
- Largest contributor by value to black empowerment\(^2\)
- Largest producer of chrome, platinum group metals, manganese, vanadium and vermiculite\(^2\)
- Estimated mineral resource worth R 38.75 trillion\(^2\)

Source 1: Chamber of Mines Facts and Figures
Reversing the decline, driving change, maximising value
Reversing the decline through modernisation

• Significant intervention required to reverse the ongoing decline
• Systems capable of efficient extraction will improve South Africa’s ability to exploit its reserves
  – Despite being one of the global front runners in gold reserves, South Africa is currently ranked 7th in production
• Reversing the production decline requires the introduction of continuous mining methods that cannot be performed safely or healthily using conventional methods
• Mechanisation of core production operations, with miners removed from risk zones, is the key enabler
Mechanisation as a driver for change

- A critical factor is the establishment of local, upstream supply industries to support mechanisation and create employment.
- Develop supporting manufacturing industry with strong potential for sectoral transfer – sustainable with future independence.
- Manufacturing industry jobs tend to be higher skilled and therefore higher paid, in a safer environment - increasing spending power - economic multiplier.
- Potential to substantially impact on socio-economic stability of local communities by extending lives of operations.
Improving safety

A business imperative
and moral responsibility
Next generation mining for Zero-Harm

• 2015 MineSafe Awards – Best in class performance
  – Gold: 1st prize mechanised mine; no narrow-reef, hard-rock mine is mechanised
  – Platinum: 3 of the top 4 were mechanised mines
  – Coal: All of the top 4 were mechanised mines (Winner: last injury 8/2013)
  – Diamonds: All of the top were mechanised mines

• Health
  – People removed from dust, noise, vibration and other sources
### Proven safety benefit of mechanisation

<table>
<thead>
<tr>
<th>Key Indicators</th>
<th>Conventional*</th>
<th>Combination**</th>
<th>Mechanised***</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIFR****</td>
<td>0.06</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LTIFR****</td>
<td>6.74</td>
<td>2.52</td>
<td>0.26</td>
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</tbody>
</table>

* Sibanye Gold Division – Predominantly Conventional, Minimal Mechanised Operations
** Sibanye Platinum Division 2015 – Predominantly mechanised with conventional
*** Mimosa Joint Venture (Implats and Sibanye) – Mechanised, trackless
**** Frequency rate per million man hours worked

- Mechanised underground mining operations boast significantly better key lagging safety indicators
  - Operators/employees removed from danger areas – reduced risk exposure
- Mechanisation of conventional operations will have similar effect
Unlocking Reserves

Better, faster for longer
Unlocking Reserves

- Modernisation and mechanisation will enable mining companies to increase Resource to Reserve conversion by enabling mining operations in previously sterilised areas.
- Low grade areas extractable through increased accuracy, better control of stoping widths and decreased dilution.
- Resources at depths that preclude extraction using conventional methods due to ventilation and other restrictions.
- Stability pillars.
Reserve preservation, extension

**Gold**

- Ultra deep 24/7 mechanised: 106 Mt
- Pillars and remnants: Remote mechanisation: 20 Mt
- Bulk mining 24/7 mechanisation: 8 Mt
- Portion to be converted to 24/7 mechanisation: 71 Mt
- Non-convertible: will be mined out conventionally: 96 Mt
- Low grade reefs mineable using 24/7 mechanized: 71 Mt
- Current conventional, that can be converted to mechanisation: 220 Mt

**Platinum Group Metals**

- Convert to 24/7 mechanisation: 284 Mt
- Convert to Mechanised: 176 Mt
- Remains conventional: 303 Mt (older shafts)

Source: Phakisa Innovation Work Group – Inclusive of all SA gold and Platinum assets

Mechanisation to unlock reserves not currently safe, healthy or economic to mine
• Production profile extension from 2033 to 2045+

• Total employees costed (TEC) remains robust despite mechanisation due to increased production

• TEC excludes potential upstream job creation in manufacturing

Source: Phakisa Innovation Work Group – Inclusive of all SA gold assets
Extending Life of Mine

Platinum

• Production profile extension from 2035 (partially mechanised) to 2042+

• Total employees costed (TEC) remains robust despite mechanisation due to increased production

Source: Phakisa Innovation Work Group – Inclusive of all SA platinum assets
## Summary of economic benefits

### Difference between Baseline and Baseline with Mechanisation

<table>
<thead>
<tr>
<th>Metric</th>
<th>Average 2016 – 2020</th>
<th>Average 2021 - 2025</th>
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</thead>
<tbody>
<tr>
<td>Export Revenue (R Billions)</td>
<td>1.4</td>
<td>28.4</td>
</tr>
<tr>
<td>Tax (R Billions)</td>
<td>1.6</td>
<td>5.8</td>
</tr>
<tr>
<td>Value Add (R Billions)</td>
<td>2.1</td>
<td>20.9</td>
</tr>
<tr>
<td>Production (Index)</td>
<td>0.6</td>
<td>10.5</td>
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</tbody>
</table>

Substantial economic benefit to be realised through Mechanisation
The modernised mine

Sibanye’s view
What is a modernised mine?

"MotF"  
Mine Of the Future

Mechanised
- Mechanisation programme
- Pillar extraction programme
- Rapid Development programme

Automated
- Advanced maintenance programme
- 3D Spatial awareness
- Dynamic automation

Connected
- Personnel, Asset Tracking (PLS)
- Operational communication
- Digitisation “IoT”

Dynamic
- Predictive analytics
- Advanced Ore Body Knowledge
- Dispatching

Efficient
- Compressed Natural Gas programme
- Drive Train Of the Future (SG Loco)

Substantial economic benefit to be realised through Mechanisation
Sibanye Safe Technology strategy

Long
Developing future state mining methods
- 24-7 mining
- In-stope mechanisation
- Non-explosive mining
- Connected/Smart Mine

Medium
Safely enhancing current mining practices
- Incremental Improvement Projects
- Mechanised pillar extraction
- Advanced Ore Body Knowledge

Short
Capitalising on legacy mining
- Mechanised vamping
- Ultra-fine sweeping
- Mechanized Pillar Extraction

Short, medium and long term drive to “Mine of the Future”
Mining technology and manufacturing cluster
Sibanye at the fore in transformational activities
Technology focused outcomes of Mining Phakisa

• Significant progress has been made in developing the Mining Technology and Manufacturing cluster – “Innovation Hub”
  – “To promote investment in core mining activities and associated technologies whilst positioning mining as a key driver of industrial and agricultural development”
  – Multi-stakeholder, collaborative platform, mandated to create local, highly technologically dynamic and sustainable R&D and manufacturing capacity

• Hub facility has been established and resourced
• Multi-stakeholder engagements ongoing
• “Quick-Win” projects initiated/ongoing – not just a talk-shop
Technology focused outcomes of Mining Phakisa

- Local development and manufacture of primary mining tools will significantly improve Sibanye’s global competitiveness
  - Reduced cost exposure to volatile currency fluctuations
  - Lower cost of manufacture and zero import tax implications

- Innovation hub projects identified:
  - Advanced ore body knowledge (ongoing)
  - Gold and platinum mechanisation programme (ongoing)
  - Continuous mining using rock cutting (initiated)
  - Tramming and transport programmes (ongoing)
  - Mine digitisation programmes (initiated)
Safe technology developments

Progressive innovation
Mechanised pillar extraction

Project scope
- Investigate Down Dip Strike Pillar Extraction
- Pillar width – 35 m
- Pillar dip - 22°
- Hole diameter – 350 mm
- Grade potential – **275 g/ton**
- In operation margin - **85%**

Key Performance Indicators
- Hole on Reef – **Confirmed**
- Hole Depth Achieved – **Confirmed**
- Material Extracted – **Confirmed**
- Grade achieved – **Not Confirmed**
- Project Outcome - **Successful**

RD2000 in operation

Phase 2 considerations
- Water-Hydraulic flushing causes grade losses
- Cycle must be improved to reduce pay limits
- Reverse-Vacuum Ore Recovery to be employed
Stope Mechanisation programme

**MT1000**

- Ultra-low Profile mining machine capable of navigating steeply dipping mining environment
- Multi-Drill Attachment for **sub-90 minute** panel drilling
- Drill-and-break attachment for **24/7 Mining**

**MT100**

- Light weigh mining platform for sundry/peripheral support activities
- Dozer attachment for **alternative cleaning** operations
- Ultra-fine sweeping attachment for vamping operations
Rapid infrastructure development

**Project scope**

- Significantly improve rate of infrastructure development to provide for **rapid** resource/reserve conversion
- Develop support system for men/material handling as well as **support installation**

**Project progress**

- Site establishment **complete**
- Project resourcing **complete**
- Development initiation ongoing
- Expected drilling start date – end **November 2016**
Personnel Locator system

**Project scope**
- Low cost, scalable, wireless tagging and tracking solution
- Capable of specific regional/directional search and rescue functions – **Personnel Locator**
- Locally manufactured
- **Big Data** Initiation Point

**Project progress**
- Search and rescue functionality testing – **Complete**
- Small scale lamp room management pilot – **Complete**
- Full scale pilot system installation – **Ongoing**
Sibanye Hybrid locomotive

Project scope

- Develop a highly efficient, hybrid locomotive as suitable replacement for DC and Diesel Locomotives
- Proposed drive efficiency ~ 90% + Regenerative Braking
- Potential net-zero energy consumption in operation

Project progress

- Phase 1 prototype testing completed – Successful
- Phase 2 prototype manufacturing – 80% complete
- Initial Testing expected by end November 2016

Additional benefit

- Multitudinous safety improvements and redundancies
- Power delivery system can be used as modular power supply in remote areas
- Potential to apply tech to TMM
Creating superior value
Superior value creation for all

- Modernisation will reverse decline in mining performance
- Enable South African miners to meet, and exceed international safety benchmarks
- Facilitate the establishment of a sustainable dynamic secondary manufacturing industry that will outlast mining
- Create significant value for mining companies as well as local communities and the economy in general
- Will create higher skilled, higher paid jobs in line with the expectation of the countries youth
- Create a socially responsible industry for future generations
Questions

Thank you