Mining Industry – Key Global Trends

**EXTERNAL DRIVERS**

**MARKET DYNAMICS**
- Price volatility
- Tax regimes
- Demand shift in “new” commodities
- Supply constraints as grades decline
- Increasing mine complexity

**SUPPLY CHAIN**
- Security of Supply and Pit-to-Port integrated supply chain

**SOCIAL / HSE IMPACT**
- Fatalities
- Water Usage & Environmental footprint
- Community Expectations

**OPERATIONS EFFICIENCY**
- Productivity & Cost Optimization
- Digital mining, IoT, Industry 4.0, AI,…

**INTERNAL DRIVERS**

**DIVERSITY, SKILLS & LEADERSHIP**
- Critical Skills Shortage and change
- Leadership of the Future
- Gender Diversity and inclusion
- Cultural shift

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DuPont Sustainable Solutions

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Operational Risk Management in Highly Hazardous Industries
A DSS perspective: Key Challenges

- 83% of Senior Leadership agree it is the hearts & minds of their employees that they need to influence…
- …but only 11% believe they do a good job in engaging employees.

**Misalignment within Roles** (source DSS 2018 ORM Research)

<table>
<thead>
<tr>
<th>Role</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Line Operators</td>
<td>25%</td>
</tr>
<tr>
<td>Front Line Supervisors</td>
<td>16%</td>
</tr>
<tr>
<td>Middle Management</td>
<td>12%</td>
</tr>
<tr>
<td>Senior Executives</td>
<td>11%</td>
</tr>
</tbody>
</table>

- Not sufficient emphasis on risks that can lead to Large-Scale incidents
- Gaps in risk management and governing processes, yet focus on adding more processes
- Disconnect and misalignment, in particular with regard to perception and management of risks and expectations
FOUR PRIORITIES
FOR SUSTAINED
RISK REDUCTION
AND PERFORMANCE IMPROVEMENT

1. Effective risk-based approach, with focus on fatal risks and large-scale incidents
2. Integrate risk into the operating rhythm across the organization
3. Strengthen leadership skills from top to front line
4. Leverage technology to de-risk mining operations and insights from data for better decision-making
Topic #1: The Current State of Safety in the Mining Industry

**Fatality Trend - South Africa**

- **Fatality Frequency Rate:** 0.10 (2012), 0.09 (2013), 0.08 (2014), 0.08 (2015), 0.08 (2016), 0.09 (2017), 0.08 (2018)

**Key Hazards**

- FALL OF GROUND: 38%
- GENERAL ACCIDENTS: 20%
- TRACKLESS MOBILE MACHINES (TMM): 16%
- TRANSPORTATION: 14%
- WINCHES
- MACHINERY
- EXPLOSIVE

*per 1 million hours worked


Total hours worked by country

Contribution to global fatalities
Across ICMM members, in 2017, South Africa accounts for nearly half of the mining fatalities, although constituting only 24% of the total work hours.
New technologies can effect step-change improvements at mining operations…

<table>
<thead>
<tr>
<th><strong>SAFETY &amp; RISK</strong></th>
<th><strong>PRODUCTIVITY &amp; COST</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor location, movement, health and environment</td>
<td>Optimized planning</td>
</tr>
<tr>
<td>Proximity detection and collision avoidance</td>
<td>Workforce allocation</td>
</tr>
<tr>
<td>Remote operation and inspection</td>
<td>Route optimization</td>
</tr>
<tr>
<td>Planning &amp; risk identification</td>
<td>Decision making</td>
</tr>
<tr>
<td>Augmented training &amp; maintenance</td>
<td>Process automation</td>
</tr>
<tr>
<td></td>
<td>Optimized maintenance</td>
</tr>
<tr>
<td></td>
<td>Stock level optimization</td>
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</tbody>
</table>
Deep mines, along with reliance on traditional labour-intensive mining methods make South African mines more hazardous than others

Deep mines and their associated hazards
- Most deep level underground mines in South Africa are aging with travel times to the face sometimes reaching an hour or more. Consequently, with increasing depth and distance from the shaft, actual drill time at the workface has contracted, accounting for greater health and safety challenges
- Deep South African mines are therefore prone to seismic events – making them some of the most dangerous in the world. Eight of the 10 deepest mines in the world are in South Africa

Labour intensive mining methods
- According to Fin24, a financial daily, South Africa has been mined commercially for over a century and many operators still rely on older, labor-intensive mining methods such as hand drilling

Safety vs production and profitability
- According to John Kane-Berman, former CEO of South African Institute of Race Relations - pressures to increase production had led to inadequate supervision and attention to safety in South African mines. He also mentioned that penalties for breaking safety rules are not as stringent in South Africa
- According to Daily Maverick, a South African daily - challenging profitability may encourage slips in safety standards, as mining companies in South Africa increasingly try to keep up in an industry that is inherently unsustainable