Digitalization in Mining

Danya Liu

BloombergNEF
BNEF coverage

Strategies for a cleaner, more competitive future

Commodities
- Gas & LNG
- Power
- Oil
- Carbon
- Coal
- Metals
- Chemicals
- Agriculture

Sector transitions
- Clean power
  - Solar
  - Wind
  - Storage
  - Decentralized energy
  - Power systems & networks
- Advanced transport
  - Electrified transport
  - Mobility services
  - Connected & autonomous vehicles
  - Next-gen aviation
  - Next-gen shipping
- Buildings & industry
  - Low-carbon heat & cooling
  - 3D printing & green manufacturing
  - Circular economy
  - Composites & bioplastics
  - Energy efficiency
- Agriculture / land
  - Agri-chemicals & biotechnology
  - Land & water management
  - Alternative proteins & food demand
  - Food waste management
  - Agricultural technology & supply chain

Cross-cutting technologies
- Industrial digitalization
- Hydrogen
- Bioenergy
- Carbon, capture, utilization & storage (CCUS)

Strategy & forecasts
Policy
Finance & economics
Sustainability
Consumers
## Digital Industry

<table>
<thead>
<tr>
<th></th>
<th>IoT platforms &amp; connectivity</th>
<th>Optimizing asset performance</th>
<th>Predictive analytics &amp; AI</th>
<th>Drones &amp; computer vision</th>
<th>Blockchain</th>
<th>Edge computing</th>
<th>Digital twins</th>
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</thead>
<tbody>
<tr>
<td>Power</td>
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<td>Oil &amp; gas</td>
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<td>Manufacturing</td>
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<td>Supply chain, logistics</td>
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<td>Mining</td>
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### Competitive landscape and strategies
- Digital technology startups
- VC/PE, M&A flows
- Hardware to software business transformation
- Company and country rankings
- IoT platform differentiation
- Industrial business strategy & transformation
- ‘As a service’ business models
- Regulation & policy
- Data-centric business models
- National technology strategies
- Incubators, accelerators and strategic investor strategies
Why do digital?

1. Reduce uncertainty and minimize losses
2. Automate regulatory requirements
3. Generate new value and outpace competitors
4. Shift the business model

Source: BloombergNEF
Tracking efficiency improvements

Sensors on drill bits reduce mapping time from *months to weeks.* Autonomous drills 10-20% more productive than manned, can work 11.5 hours of a 12-hour shift vs 8.5.

Source: BloombergNEF, company reports
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End-to-end process:
- Exploration
- Mining
- Haulage
- Crushing & sorting
- Refining
- Final product
- Waste management

Source: BloombergNEF, company reports
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All-electric underground mines cut GHG emissions by **70%**. Reduces ventilation system capex by 50%.

Fully autonomous underground mining reduces operating costs **15%**.

Source: BloombergNEF, company reports
## Digital strategy in mining

### Digital adoption

<table>
<thead>
<tr>
<th>Cloud computing</th>
<th>Deployed</th>
<th>Pilot</th>
<th>Inactive/unknown</th>
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<tbody>
<tr>
<td>IloT platform &amp; analytics</td>
<td></td>
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<tr>
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<td>Autonomous trucks</td>
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Source: BloombergNEF, company presentations, research calls, company websites.
## Corporate case studies

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<thead>
<tr>
<th>Company</th>
<th>Technology</th>
<th>Impact</th>
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</thead>
<tbody>
<tr>
<td>RioTinto</td>
<td>Autonomous technology</td>
<td>Autonomous trucks operate 700 hours longer, with 15% lower costs. Trains deliver 20% faster. Drills reduce downtime by 10%.</td>
</tr>
<tr>
<td>BARRICK</td>
<td>Predictive maintenance</td>
<td>Cortez vehicle fleet costs $60M per year to maintain. Most PdM systems estimate 10% O&amp;M reductions, suggesting $6M in savings per year for one site.</td>
</tr>
<tr>
<td>BHP</td>
<td>Connected worker</td>
<td>Smartcaps resulted in a reduction of safety incidents.</td>
</tr>
<tr>
<td>Anglo American</td>
<td>Robotics</td>
<td>Rock cutting robots bring 20-30% increases in productivity, reduces employee exposure to potential risks.</td>
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Elements of Digital Strategy

Motivation: the forces behind digitalization push and the ultimate goals

- What is the primary motivation for digitalization?
- Are they using technology for own sake, or considering selling it to peers?
- Is the company developing proprietary technology or sourcing externally?

Integration: the structure of technology decision-making

- Are technology decisions made mine by mine or top down across the whole company?
- Does the company run separate pilots at each mine or have one testbed for everything?
- How do digital, innovation, operations teams interact with each other?

Technology scope: the volume and mode of technology development

- What’s the breadth of digital technologies they are considering? Has there been significant investment?
- What is the role of the VC? Strategic investments or lead company into new areas?
Digital strategy in mining

Which sites to digitalize

Source: BloombergNEF, company sites. Volume is relative to average industry mine for that metal.
## Which sites to digitalize

### Factors to consider when evaluating order of digitalization

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<td><strong>Internal</strong></td>
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<tr>
<td>Mine Characteristics</td>
<td>• Underground or open-pit</td>
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<td></td>
<td>• Relation to rest of portfolio</td>
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<td></td>
<td>• Percent ownership</td>
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<tr>
<td>Technology Considerations</td>
<td>• Ore complexity</td>
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<tr>
<td></td>
<td>• Scattered or expansive site?</td>
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<tr>
<td></td>
<td>• Production bottleneck</td>
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<tr>
<td><strong>External</strong></td>
<td></td>
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<tr>
<td>State of the Market</td>
<td>• Cost of labor</td>
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<td>• Cost of externalities</td>
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<td>• Phase in commodity cycle</td>
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*Source: BloombergNEF*
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What next?

Technology flow

Mining companies

Past

Future

Equipment & service providers

Decision-making

Decentralized

Centralized
What next?

Carbon neutral by: 2050

- Investment
- Tied to executive pay
- Scope 3 emissions

50% reduction
Speaker

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• Analyst
• BloombergNEF
• dliu294@bloomberg.net
Questions?

Please wait for the microphone

State your name & company

Save the Date...

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