Future Mining Conference

The Gold Mining Company of the Future

Nick Holland  CEO of Gold Fields
120th Anniversary Wits Mining School - 23 March 2017

Presentation at www.goldfields.com
Gold Fields founded 1887, 130 years old (same age as Johannesburg)

1929
- Interests in 25 countries around the world

1931
- Gold Fields discovers WestWits gold deposits – Kloof and Driefontein follow

1998
- GFSA merged with Gengold – modern Gold Fields started

2006
- South Deep acquisition

2013
- Unbundling of Sibanye Gold
Long-standing relationship between Wits Mining School and Gold Fields

2010: R18m three-year sponsorship. Benefits continue to date:

- Gold Fields Engineering Library
- Rock Engineering Lab
- Paskalia Neingo – was a Gold Fields associate lecturer, now full-time lecturer

Before Sibanye-split:

- >150 bursaries
- >350 technical sponsorships
- >40 post-graduate assignments

- Continues to date – smaller scale, but focus on mechanised mining
- Contribution to Mining Education and Training Fund
- Gold Fields’ annual skills development and education spend: >R33m
Gold Fields today
Things that keep me up at night

Gold Fields today

The industry is still relevant
Geological inflation is driving **double-digit cost inflation**

Today it takes an **average of 18 years from discovery to first production** versus 10 years a decade ago

The average grade of gold mined has fallen **3% p.a. since 2000**

Clashes with local communities rose on average by **20% p.a. between 2002 and 2015**

**Governments want greater benefits** from mining operations

**The gold price has declined by about 30% since its peak in 2011**
The industry is still relevant

2014 data
- US$284M invested in socio-economic development
- Significant infrastructure spend on education, road, power and water facilities
- Focus on healthcare (e.g. HIV/AIDS, TB, malaria)

2014 WGC
- About 4M People employed (1M directly)
- 90% Local employees
- 3-10 Dependency ratio for each direct employee (Ghana, SA, Peru)

2014 WGC
- Total GDP contribution, (half direct, half indirect)
- 77% - 90% of expenditure remains in host countries
- 60% of top gold producers are lower-middle income countries
Still an industry worth investing in

Supply and demand fundamentals

Supply
- Exploration spending down
- Average reserve life has declined
- Cost reductions mostly implemented
- Mining inflation stabilised
- Secondary supplies set to rise

Demand
- Growth of Chinese and Indian middle classes
- New Chinese investment platforms
- Investment diversification
- Protection against risk
- Central banks purchases to continue

Source: McKinsey, SNL, CPM
The mine of the FUTURE

Operating practices and technology
Talent focus and leadership
Partnerships
Responsibility and transparency
The operating challenges facing gold mines

- Embracing digital mining
- Mining on demand
- Converting from conventional mining to mechanisation & automation
- Improving economics of low-grade and residual ore bodies
- Embracing energy and water efficiencies to reduce impact on the environment
What we are doing
Our Technology and Innovation Strategy

Gold Fields' Technology and Innovation Strategy

- Delivering future mine (>seven years)
- Transformational Phase (five – seven years)
- Foundational Phase (one – two years)

Mine of the Future

- Grow Mineral Reserve Life – Halve mineral discovery cost and cycle time from discovery to development handover

Sustain and Grow Cash Margin – Improve operational efficiencies through the use of mechanisation, automation, information, integration and innovation

- Improve Safety and Health – Distance people away from active mining areas
- Maintain Social License – Halve mining waste, tailings and emissions by 2026
Partnering with OEMs

Partnerships with Original Equipment Manufacturers will become increasingly critical to:

- Harness best-of-class technologies
- Gain access to products with various levels of automation
- Access to autonomous solutions for support equipment
- Pursue contractor mining, where this is feasible

Partnering with IT firms

Partnerships with IT firms is becoming increasingly critical to implement technology advances with multiple applications
Drones at St Ives, Australia

Fleet of drones equipped with cameras and sensors

Enables:
- Using drones as **front-end of exploration**
- Drone sensors pick up **different magnetic fields that define ore bodies** (previously took month of geologist scouting the tenements)
- Drones can also **scan difficult terrains** (e.g. 4km up in the Andes)
- Drones have **replaced satellites** in providing photographs of our mines and TSFs (Cost savings)
3D Visualisation at South Deep

Partnership with Cyest

- Determining the mine’s full value chain capacity
- Assist in the development of improvement initiatives
- Develop an advanced 3D model of the mine

Solutions applied at South Deep:

- Discreet event simulation
- Carbon 14 - Modeling the interaction of different mining activities
- Value Driver Tree Modeling - linking financial value to mining processes
- Advanced visualisation
Remote rock breaking at South Deep

- After blasting rocks are transferred to the ore pass system
- A **hydraulic arm** is used to break the rock – **too dangerous to do it manually**
- The hydraulic arm is **controlled from surface**
Big Data - Telemetry UG at South Deep

- Telemetry nodes have a 100m radius – connects via WiFi to the fibre network at stope entrance
- Enables wireless connection to equipment and sensors

Transmit large amount of real time data from 3km UG to surface and enables:

- Sending signal to workers in case of emergency
- Checking status of equipment such as loaders, drills, etc (telemetry nodes are linked to engine management system)
- Monitoring air flow
St Ives Connected Mine

- Drones provide **real-time data** of truck movement
- Trucks are equipped with **specific IDs**
- Fleet management control from pit office
Granny Smith Remote Loading

- **Fibre-optic infrastructure** installed at all mines
- **Surface remote loading of stopes** – around blasting times
- **Increases production** output, worker safety and **reduce downtimes** between shifts
- **Future**: Independent guidance of loaders from stockpiles to stopes
- Control of **multiple loaders**
South Deep's mechanisation journey
Challenges
World's second largest gold ore body

Difficult geology with complex ore formations

Limited global experience of deep-level mechanised gold mining

Shortage of necessary skills in South Africa

Optimisation of machines and technology

Safety of current mining operations
What we are doing
- US$ 1Bn Investment in world-class infrastructure
- Skills training and recruitment
- Rebasing the mine for mechanised mining
- Investment in machinery and technology
- Leveraging of global expertise
- Large-scale destress mining
The outcome
Last mine standing in SA gold sector

Safer operations

Low-cost long life gold production

Skilled workforce

Engaged employees and communities

Technology leader in: Ultra-deep, mechanised gold mining
How our people will be working in the future

**Operators**
- Automated machinery requiring specialists
- Real-time, mine-wide information available for decision making
- Skills development for local community members

**Supervisors**
- Skilled technology and IT specialists
- Control room operators
- Remote monitoring and communication
- Individual skills development
CEO of the future
Mining company of the future

- Greater operational accountability devolved to mine site
- JVs with other mining companies
- Work with OEMs and tech companies

CEO of the future

- Collaborative decision maker
- Influencer and coach
- Integrated thinker and manager
- Intensive stakeholder focus
- Portfolio manager
# Upcoming meetings

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Partnerships
New partnership models

- Mining company
- Government
- Local communities
- Other mining company
- Employees
What we offer:

- Payment of taxes and royalties
- Contributing equity position
- Infrastructure PPP
- Job creation and skills development
What the partners provide:

- Competitive investment environment
- Regulatory consistency and stability
- Basic infrastructure and support (education, health, utilities)
Benefits of partnership:

- Diversification of technical risks and sharing of technical know-how
- Shared financial burden and risks
- Reduction of costs and overheads
- Creation of economies of scale
What we offer:

- Employment and skills development
- Greater shared value
- Local infrastructure PPP
What the partners provide:

- Social license to operate
- Stable local business environment
- Provision of procurement and services
Community engagement at South Deep

• Community investment around South Deep and labour-sending areas totalled R57m in 2016
• Includes spending by South Deep’s three community trusts
• Working in alliance with Sibanye Gold in Westonaria
• Establishing development roundtable with community NGOs and local government
• Two-thirds of spending is on education, training and skills development
• Additional focus on host community procurement and employment
Responsibility and transparency
On the Board's agenda
Commitment to transparency and accountability

- **Operational transparency**: Investors will require real-time data and transparent cost and earnings reports.
- **Corporate Governance**: More stringent standards and transparent payments to governments.
- **Integrated thinking**: Entrenching integrated thinking, management and reporting.
- **Transparent reporting**: Adherence to sustainability frameworks and global reporting standards.
Frameworks we adhere to:
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