Disrupting the Productivity Challenge

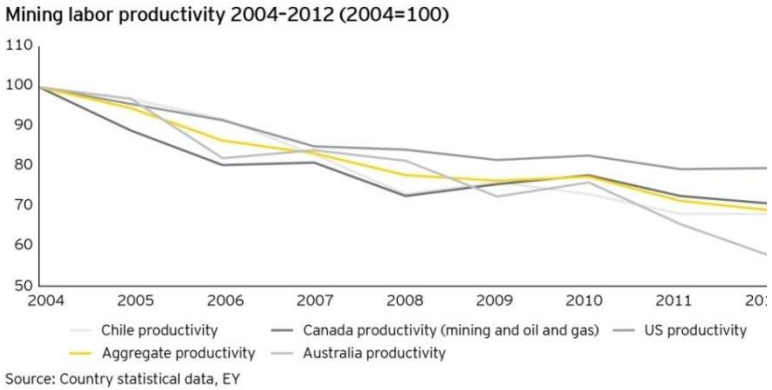
EY's view on Maximising Value from Productivity

March 2017

The better the question. The better the answer.
The better the world works.

EY
Building a better working world

Productivity fell dramatically through the super cycle



Source: Country statistical data, EY

Declining productivity trend

- Fading impact of 1980-1990 reforms
- Focus on volume rather than margin
- Right choice at the time
- Little focus on anything other than production – including innovation

"It now takes 40% more inputs to generate a single unit of mineral product"

Mark Cutifani, Anglo American

Why did Productivity decline?

Productivity has declined as a result of a relentless focus on volume, to the exception of all else

Labour productivity

- Inexperienced teams
- Lack of leadership training
- High turnover and ageing workforce
- Nobody focused on efficiency

Capital productivity

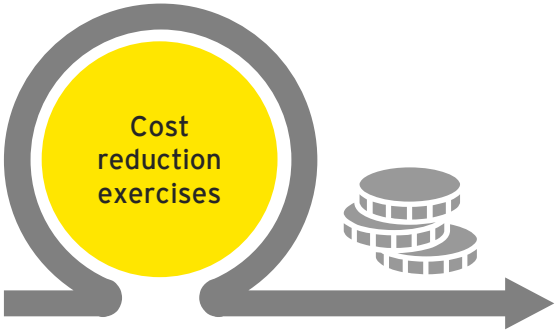
- Reduced expectations of capital productivity
- Cheap capital during the "super cycle"
- Poor capital efficiency

Diseconomies of scale

- As operations hit a certain size diseconomies kick in
- Hard to manage the complexity of a larger operation, particularly given the talent challenge
- Silo mentality exists

The "pursuit of tonnes" leads to silo behaviour, resulting in optimised elements of an operation, not the whole business

Industry progress to date has been substantial, but future gains will be driven by a manufacturing like approach to relentless loss elimination with digital enablement being the key advancement



"Higher volumes across most of the portfolio, with cash costs down 2% in real terms.

Anglo American

We have beaten our cost reduction targets, with $3.2 billion of sustainable operating cash cost improvements.

Rio Tinto

"We embedded productivity-led volume and cost efficiencies of US$2.9 billion, exceeding our target by 61%.

BHP Billiton

We have focused on increasing productivity and optimizing use of our equipment to ensure the highest level of efficiency.

Antofagasta

"Over the past two years, we've released $2.1 billion of working capital.

Rio Tinto

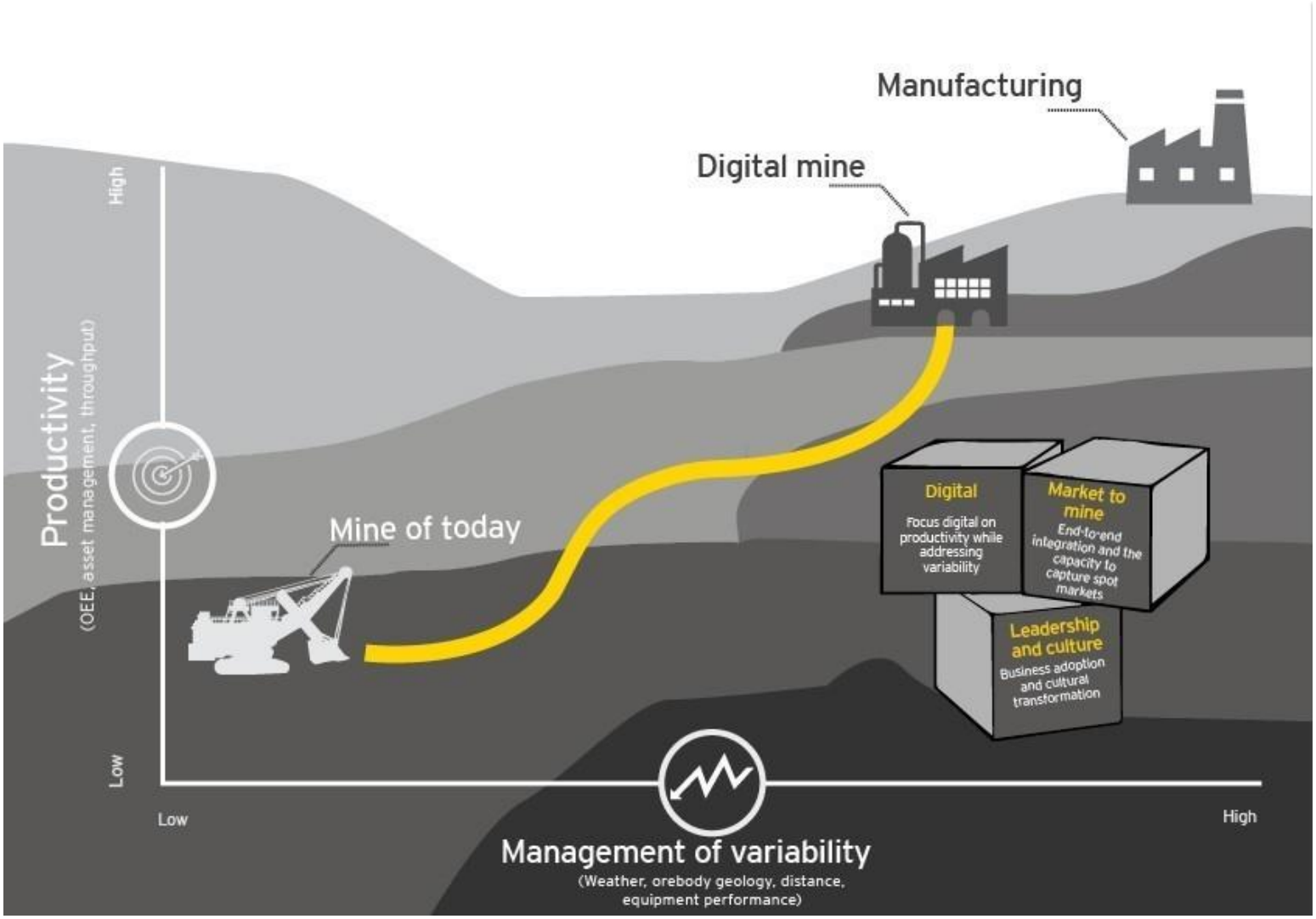
Alcoa has reduced average days working capital by 9 days since 2009.

Alcoa

We are freeing up working capital by reducing inventories.

Barrick Gold

Digital technologies and approaches will enable the leading miners to navigate from where they are today towards a "Manufacturing" level of productivity excellence



How can mining learn from manufacturing?

The manufacturing industry

Manufacturing has built capabilities in several key areas to achieve:

- Low variability
- Narrow product differentiation
- Asset productivity focus
- Zero loss culture
- World class OEE

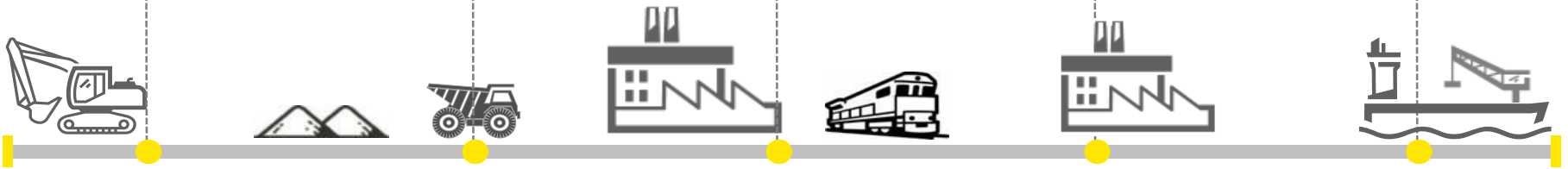
The challenge for miners

The mining industry is challenged by cultural and environmental variables, including:

- Naturally variable environment (weather, orebody, geology)
- Broad range of product variations
- Throughput focus
- Culture of passive acceptance of losses
- Performance to plan versus performance to potential

Digital will enable new ways to drive productivity and manage the variability challenges of the mining sector

How will knowing more about the ore body and broken ore improve productivity?	How will advanced modelling enable us to understand real capacity, losses, and bottlenecks in the value chain spread of 1000's of kilometres?	How can we better manage variability like weather?	How will digital facilitate better asset management?	Customer buying variations /variability?
Improved ore characterisation through fully digitised ore bodies, will allow for close to real time management of recovery and process plant optimisation through forecasting feed types accurately	End to end understanding of bottlenecks and downstream trade offs, supported by digital tools. Improved visibility and real time identification of Digital 'twins' of assets can allow for real time simulation and response	Predictive weather tools, close to real time information, advanced simulations/strategies for new conditions	Predictive analytics to extend maintenance windows and automated planning and scheduling to reduce labour needs	Anticipating customer trends (e.g. China coking coal) through examining buyer behaviours can give a lead time on mine plan regarding alignment to more profitable product ranges



Service and Support Functions (HR, Projects, Finance, Supply etc)

How can digital improve back-office productivity?	How can I deliver greater value from my project portfolio?	How can we better manage risks?
Robotic Process Automation (RPA) can help standardise processes to reduce variability and eliminate labour through automation	The ability to generate multiple views of portfolios on a variety of criteria, and supporting decision tools to trade-off risk, timing, geographical and technical issues	Implementation of real-time Continuous Control Monitoring (CCM) and live updates to risks

Digital enhances Productivity
Operating Strategies, Tactics and Plans

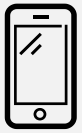
Digital presents the opportunity to optimise plans and productivity rates across any operation and to manage variability in any conditions

Benefits include...

Optimal strategies for production execution for every face/seam in detail across each mine to ensure maximum throughput for a set of asset configurations

Ability to rapidly reset tactics to respond to natural variations for events such as equipment changes, wet weather, temperature extremes, etc.

Enabled by...



Digital will enable this through combining detailed ore body data with equipment operational and maintenance data in a real time environment to produce alternative operating plans for review by management and the ability to refine these for plans for variability

Solution...

A mobile app for the daily operations/maintenance management which provides current plans, schedules and standard activities for the shift along with scope to modify in real time and feed implications through to affected departments/areas.

Digital enhances Productivity Availability and Reliability

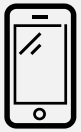
Digital presents the opportunity to move to a predictive maintenance approach

Benefits include...

This capability will allow for extension of maintenance windows and improve planned maintenance performance to minimise costly breakdown maintenance events

Automation of maintenance planning and scheduling activities ensures strategies are reflected in plans and schedules and reduces the cost of the maintenance function

Enabled by...



Digital will enable this by capturing the equipment data and analysing through cognitive/machine learning to form predictive outcomes, these will then be linked through to the planning and scheduling function to set the maintenance strategy and tactics for the asset

Solution ...

Asset Performance Management powered by Predix

Predictive Asset Analytics: analyses OEM data, history, and benchmark data to make predictions about asset failure – allowing both asset planning and proactive maintenance.

Optimised Planning and Scheduling: Based upon the predicted asset condition, predicted required service, commercial and production objectives and acceptable business risk, we can identify the optimal time (range) to conduct the next service/maintenance. This encourages proactive maintenance and reduces asset down time.

Digital enhances Productivity
True Market and Customer Agility

Digital presents the opportunity to increase agility and responsiveness to changes in market factors such as freight rates and customer buying behaviour trends

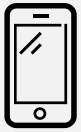
Benefits include...

Optimise shipping and scheduling to

reduce demurrage

With the ability to capture spot markets and price premiums via sales contracted at different points in the value chain e.g. 'on water'

Enabled by...



Digital will enable this through real time tracking of vessels to determine optimal loading dates/ports, using customer buying behaviour analysis to forecast trends in demand and subsequent prices

Solution...

Automated Decision Support

Optimisation engine (Combination of Mathematical Modelling, Robotics & Predictive analytics)

Multi dimensional and multiple objectives

Multiple timeframes (optimise short term and life)

Requires a near real time decision to maximise value uplift

End to end value chain impact

Digital enhances Productivity
End-to-End Simulation, Loss identification and Prioritisation

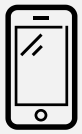
Digital presents the opportunity to understand end-to-end true capacities, system bottlenecks and characterise system losses aligned with a manufacturing mindset

Benefits include...

Real time visibility of the end to end system capacities and sources/characterisation of ALL system losses

Ability to identify, prioritise, monitor and solve dynamic bottlenecks as they travel through the system

Enabled by...

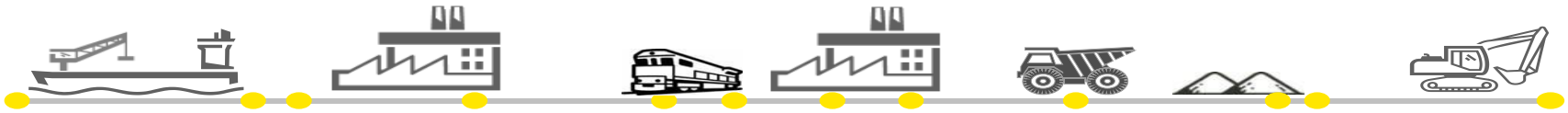


The construction of a 'digital twin' of the production system based on historical and forecast data on the throughput capacities under a range of various scenarios. Digital data processing will enable this to be done in real time conditions

Solution...

Digital twin of complete end to end mining process using fact based 'centre lining' of true capacities and not simple acceptance of 'nameplate' potentials

Market to Mine



Market Driven Insights

- Mine and product plans flexing as premiums and discounts adjust
- Customer buying behaviour patterns to forecast demand profiles
- "on sea' sales and/or blending optimisation

Integrated and systematic approach

- An integrated governance structure across the productivity initiatives
- Maintain an end-to-end value chain perspective
- Enabler of rapid and effective decision making
- Agile and iterative execution approach to quickly realise value
- Single source of truth for targets and reporting
- Top down bottom up approach

End to end asset view

- Whole of asset, whole of life
- Process and coordination
- Systems view

Leadership and culture

Leadership buy in and business engagement

- Visible, felt leadership (servant)
- Productivity improvement is the role of every employee from Operations to CEO, embodied by 'relentless pursuit of loss' - like zero harm, it can transform the business
- Exhausting focus on the 1%'s supported by an engaged workforce
- Investment in culture and capability is critical to reach the next level of productivity
- 100% employee engagement in productivity challenge

Embedded loss elimination culture and systems

- Transparency of loss translated in terms of OEE and margin
- Integrated loss analytics across the value-chain is critical, supported by predictive asset management and optimisation tools
- No sacred cows - all loss is actionable
- Sustainable loss elimination practices embedded through employee engagement and an integrated approach

Execution follow through and leadership support

- Clear expectation setting
- Stretch targets at the macro and opportunity level
- Hypothesis linked to operational metrics and value delivery actions
- Action, metrics, responsibility tracking and management