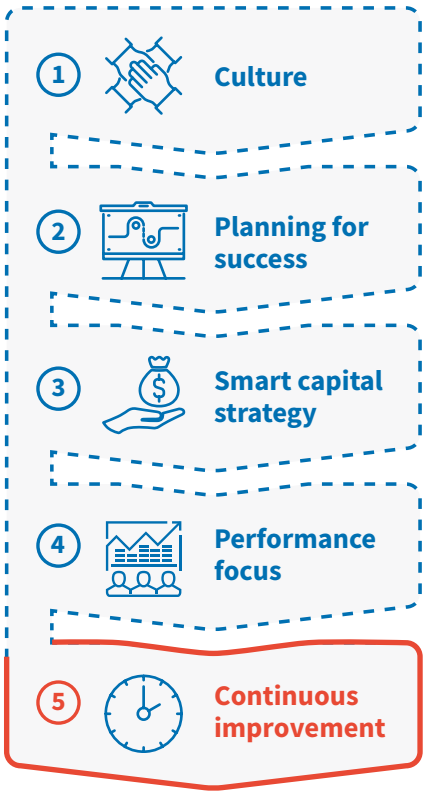
ARTICLE

Precious mettle

The value of high-grade mining CFOs – Part 5: Continuous improvement

Our five-part blog series, *Precious mettle – The value of high-grade mining CFOs*, looks at the qualities proactive mining CFOs deploy to drive greater business returns. This series shares observations from more than 75 years' combined experience in senior mining finance roles, across multiple commodities, by Andrew Bantock, Steven Michael and Martin Nicholson of FTI Consulting's Australian Mining Advisory Practice.



The Macraes gold mine in New Zealand is a great example of continuous business improvement. Developed in 1990 on the site of century-old historic gold workings, the Macraes operation struggled at first, mining a relatively low-grade (around 1.5 grams of gold per tonne), high-strip ratio (around 8 tonnes of waste for every tonne of ore) and metallurgically difficult (around 70 per cent gold recoveries) orebody. Add in the low gold prices of the mid to late 1990-early 2000s, and the management team faced a serious challenge just keeping the doors open.

Through hard work, innovative thinking, a relentless focus on costs and astute capital investment, the mine was kept in business over its first decade and even began to make money. Investment in new ore processing technologies and a move from outsourced to in-house mining progressively improved gold recoveries and reduced the cost base, while ongoing step-out drilling added years to the mine life. These improvements have seen Macraes continue on to produce more than 5 million ounces of gold over its 30 year operating life, including more than 140,000 ounces in 2020.

Not all mines have the orebody endowment of Macraes. However, this example highlights how mine leaders who adopt a continuous business improvement ("CBI") mindset can add significant value to their business.

In this final instalment of our *Precious mettle* series, we look at how experienced mining CFOs can support their operations colleagues to deliver CBI, and explore the planning and performance measurement tools that support it.

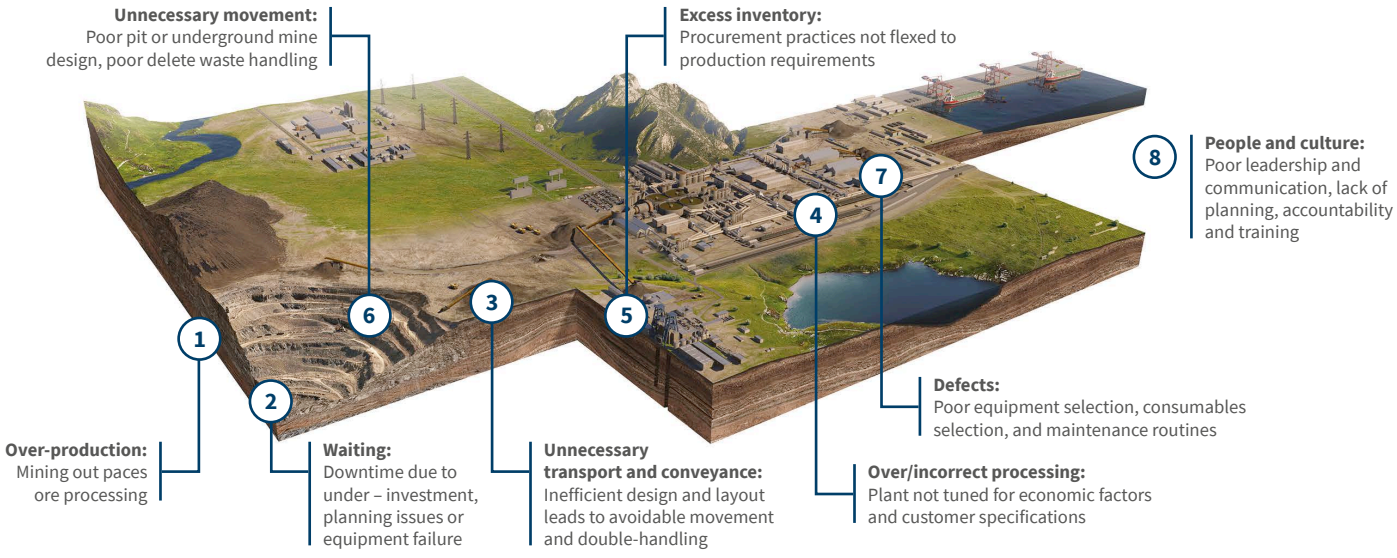
CBI – A SYSTEMIC "WAR ON WASTE"

The concept of CBI sounds simple but finding a sustainable and systematic way of achieving it has proven elusive for many. At its heart, CBI in mining is the practice of eliminating waste and improving production margins. Critically, it is supported by measurement and reporting practices that provide accurate, timely information to inform decision-making across the mine management structure.

The loss of value through waste in mining can come in a range of forms. Examples grouped within eight broad categories include:

1. **Overproduction:** Mining capacity outpaces ore processing, leading to stockpile build-ups, as can occur where continuous production processes feature "push" systems;
2. **Waiting:** Underinvestment in open-pit pre-stripping or underground development lead to idle mobile equipment; inappropriate working conditions or environment (for example, inadequate ventilation to remove dust and gases), causing workforce downtime. Unplanned maintenance downtime;
3. **Unnecessary transport and conveyance:** Poor pit and haul road design; inefficient layout for transportation and logistics services; stockpile double handling; and inefficient movement of extracted ore before its final delivery;
4. **Overprocessing and incorrect processing:** Optimising the mine plan for ore grade only while ignoring processing economics factors such as reagent consumers and ore hardness. Processing ore to a higher final product specification than the customer is willing to pay for;
5. **Excess inventory:** Not managing (or "flexing") procurement practices in line with production volumes, resulting in a build-up of consumables and spare parts;
6. **Unnecessary movement:** Poor pit or underground mine design; inefficient waste dump design; pit backfill that could be replaced by in-pit tailings deposition; and failure to secure land access that could shorten ore or waste haulage paths;
7. **Defects:** Rework or repairs; substandard reagents and production consumables; lack of or failure of predictive or preventive equipment maintenance routines; plant and equipment not matched to ore handling and processing characteristics or mine longevity; and
8. **People and culture:** Poor leadership and communication; lack of accountability; lack of planning and awareness of profit drivers; inadequate training leading to the use of unskilled labour; inefficient shift schedules; absenteeism; and incorrect assignment of people to tasks.

Examples of waste in mining which is addressable through CBI



Experienced, commercially minded mining CFOs inherently understand and target these areas of waste, working closely with their operations colleagues to identify and address the root causes. Applying a triage mentality, they often start by focusing on significant bottlenecks in mining and processing systems, looking for the changes which will increase efficiency the most.

A PRACTICAL APPLICATION OF THE THEORY OF CONSTRAINTS

This value-driven war on waste in mining embodies key strategies championed in the theory of constraints ("TOC"), which has been successfully applied across many other industries.

This methodology asserts that prioritising the elimination of bottlenecks and efficiency constraints is the best way to improve an operation's profitability.

TOC requires structured analysis that focuses on:

- considering the entire system and determining what to change rather than how to change;
- increasing throughput and leveraging fixed costs rather than solely relying on cutting costs or minimising variability. According to TOC, the benefits of cost-cutting have a natural limit and when this is reached, further cuts may be counterproductive, reducing productivity and hence profits;
- implementing whichever change will make the most positive difference, rather than making lots of small changes;
- exhausting the least-expensive improvement options before considering more-expensive options such as those requiring significant capital investment; and
- using buffers to deal with uncertainty, rather than planning for perfection.

A constraint can relate to a physical capacity (for example, a particular piece of equipment) or a policy. For most mine operations that have not applied TOC, policy constraints are usually the most common issue.

A key symptom of a policy constraint is the so-called "wandering constraint". This is where it appears that a number of physical constraints exist but, in reality, the constraint simply draws together several limitations of policy and practice. Policy constraints and inefficient practices must be addressed before physical constraints.

Exploiting a constraint requires the whole team to focus on getting the most out of it. For example, the capacity of a piece of mobile equipment to move ore or waste might be a constraint in the mining process. The latent capacity of the equipment could be exploited by eliminating operator breaks through hot-seating, offloading ancillary operator duties not associated with the constraint, finding alternative process routes for some products or prioritising products with the highest margins (per equipment hour).

The mining team needs to focus everything on the constraint. To fully exploit it, they may need to reorient several other processes to ensure that no time is lost at the constraint. If the mobile fleet is operating for more time, the mining team may also need to increase production or improve the efficiency of upstream or downstream processes.

Only after all other options have been exhausted should additional capacity be added through capital investment. In the previous example, this would involve purchasing additional mobile equipment.

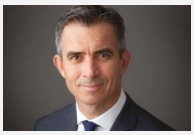
BUT ISN'T MINING DIFFERENT?

Although TOC-based methodologies such as Six Sigma and Lean were originally developed for use in the manufacturing and logistics or distribution industries, they can also be applied to the mining industry. A mining operation functions like a manufacturing and distribution system: raw materials (for example, ore) go through various stages (for example, develop, drill, blast, load, haul, crush, grind and leach) to produce a product that services a market (for example, delivered into customer offtake contracts).

In some respects, mining and processing are different: the composition of the raw materials can be highly variable due to the changeable nature of the underlying orebody, and the production horizon is finite. However, astute mining CFOs know the goal remains the same: to generate the most profit now and into the future. Therefore, the concepts and methods of TOC and the associated business improvement methodologies are almost directly transferable to mining situations.

HOW FTI CONSULTING CAN HELP

At FTI Consulting, we work alongside senior mining finance leaders at important times to boost their efficiency and assist their continuous business improvement efforts. We use our experience, insights and networks, providing surge resources and "bandwidth" to support clients through transformative events, with a clear appreciation of what drives success.



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