Sustainable cost reduction in the mining sector

Driving value creation for shareholders

www.pwc.com/ca/mining
As the mining industry emerges from the Global Financial Crisis, many companies are already outlining plans for moderate to aggressive growth over the short to medium term. While production volumes will need to grow to meet an expected upswing in commodities demand, one of the largest opportunities for shareholder value creation is operating and capital cost reduction. This paper highlights leading practices to achieve sustainable cost reductions in mining operations. It also describes an effective approach to improve capital productivity, which focuses on rigorously challenging project economics and detailed design solutions during the early stages of a mining project.

Contents

| The case for cost reduction | 1 |
| Achieving sustainable cost reductions in mining operations | 2 |
| Reducing the capital cost of mining projects | 8 |
| Conclusion | 13 |

Introduction

As the mining industry emerges from the Global Financial Crisis, many companies are already outlining plans for moderate to aggressive growth over the short to medium term.

While production volumes will need to grow to meet an expected upswing in commodities demand, one of the largest opportunities for shareholder value creation is operating and capital cost reduction.

This paper highlights leading practices to achieve sustainable cost reductions in mining operations. It also describes an effective approach to improve capital productivity, which focuses on rigorously challenging project economics and detailed design solutions during the early stages of a mining project.

The case for cost reduction

The operating cost structures of mining operations globally have increased significantly over the past five years

For the five years leading up to the beginning of the Global Financial Crisis (GFC) in mid-2008 mining companies across the globe placed a primary emphasis on growth in production volumes to take full advantage of the soaring commodity prices on offer. This strategy reaped significant rewards, with net profits of the world’s 40 largest mining companies increasing from $12bn in 2003 to $80bn in 2007. As profits ballooned, so did operating costs. Energy, maintenance, consumables and labour costs all increased at rates significantly above their historical averages. But in the quest for booming production volumes, one of the fundamental success factors of world-class mining organizations had been compromised: cost efficient operations. Unbeknownst to the industry, in a few short months commodity prices would plunge and the focus would shift from aggressive growth to cash preservation. Despite investing approximately $200bn in capital expenditure between 2007 and 2009, global production has remained flat across most commodities.

Mining companies responded swiftly to this change in climate by immediately cutting discretionary spend on items such as exploration, contractors and head office costs. For mining executives the frustration was that many valuable cost reduction opportunities could not be achieved in such a short time frame, the primary of which being a reduction in the inflated cost structures of existing production assets. No other short-term cost reduction options were available but to cut production, place higher unit cost operations on care and maintenance, and in the process announce the planned redundancy of over 40,000 workers globally.

As the economy stabilizes, production volumes will grow to meet an increased demand for commodities. In the coming years, mining companies will have a valuable opportunity to focus on the cost efficiency of their existing production assets to drive growth in shareholder value.

Capital expenditure has also increased materially, but the effectiveness of these investments has been sporadic

According to PwC’s Mine publications, capital expenditure boomed between 2003 and 2008 with the world’s 40 largest mining companies’ investing cash outflows increasing from $20bn to $126bn. While this increased investment translated into increased production, by 2007, the mining industry was facing significant cost escalation pressures leading to some widely-publicized budget overruns and diminished returns on capital invested. Furthermore, despite investing approximately $200bn in capital expenditure between 2007 and 2009, global production has remained flat across most commodities.

Emerging from the GFC, mining companies are already outlining plans for moderate to aggressive growth over the short- to medium-term. These announcements have not been without caution however, as mining executives indicate a strong desire to reduce the capital intensity of new investments, to maintain flexibility in light of a still uncertain future.

This paper highlights leading practices to achieve sustainable cost reductions in mining operations. It also describes an effective approach to improving capital productivity, which focuses on rigorously and systematically challenging project economics and detailed design solutions during the early stages of a mining project.
Achieving sustainable cost reductions in mining operations

The majority of the cost reduction strategies initiated during the GFC were reactionary and did not address the root cause: the inflated cost structures of existing production assets.

Cost reduction and operational efficiency are key issues for mining industry leaders

A recent survey of mining executives by Newport Consulting identified cost control and cost management as clear focus areas for 2010 and 2011, with more than 50% of interviewed mining executives stating they are focusing on reducing or closely managing their organization’s cost base. Furthermore, 44% of survey respondents indicated they would be placing a central focus on operational efficiency, an objective that is typically pursued in parallel with cost reduction initiatives without compromising safety, environmental and corporate social responsibility performance.

While all mining companies pursued cost reduction initiatives during the GFC, it is generally recognized that the majority of these strategies were reactionary and did not address the root cause: the inflated cost structures of existing production assets. Higher unit cost operations that were placed under care and maintenance during the GFC will recommence production, but with a pressing need to reduce unit costs to guarantee the longevity of these operations. Over the coming year and beyond, reducing operating costs, improving utilization and reducing waste at the operational level will undoubtedly be a top priority for mining industry executives.

Many cost reduction initiatives fail to achieve their desired benefits

Our discussions with executives of mining companies and those involved with other capital-intensive industries indicate that over 80% of cost reduction and operational improvement initiatives fail to achieve their targeted benefits; of those that do, many of the benefits tend to be short-lived. The underpinning driver in many of these failures is that such initiatives are put into practice without appropriate planning that fully considers the sustainability of proposed operational improvements. Specifically, we have found that most mining sector cost reduction attempts fail as a result of:

- A lack of a strong foundation. Companies lacking financial discipline, stable cost management practices, and an in-depth understanding of their cost baseline will have difficulty identifying and tracking cost reduction opportunities.
- Continually dipping into the same well. Companies tend to repeatedly focus on low-hanging fruit and back-office activities. They often fail to appropriately address operating costs at their mining operations and third-party spending where significant opportunities usually exist.

To be successful, cost reduction and operational improvement efforts must focus on waste and outcomes rather than inputs. The mantra of “eliminate bad costs and support or increase a good cost” is critical to ensure that cost reduction initiatives create long-term positive impacts. The table below highlights three common cost reduction methods applied in the mining sector and the reasons that they typically unravel over time.

<table>
<thead>
<tr>
<th>Common approach</th>
<th>Common reasons for failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top down</td>
<td>• Little consideration for the management decisions driving cost</td>
</tr>
<tr>
<td></td>
<td>• Organization focus and betting on a “silver-bullet” (e.g., shared services and off-shoring)</td>
</tr>
<tr>
<td></td>
<td>• Complexities of reducing costs and existing business are not changed</td>
</tr>
<tr>
<td>Slash and burn</td>
<td>• Reactive and focused on short-term cost cutting and focus on one-off savings (e.g., travel)</td>
</tr>
<tr>
<td></td>
<td>• Based on arbitrary targets</td>
</tr>
<tr>
<td></td>
<td>• Savings difficult to manage and track</td>
</tr>
<tr>
<td></td>
<td>• Negative impact on morale and culture</td>
</tr>
<tr>
<td>Boil the ocean</td>
<td>• Timidity constraint and lack of urgency</td>
</tr>
<tr>
<td></td>
<td>• Greater investment required</td>
</tr>
<tr>
<td></td>
<td>• Typically loses momentum and focus</td>
</tr>
<tr>
<td></td>
<td>• Negative impact on morale and culture</td>
</tr>
<tr>
<td></td>
<td>• Processes often only produce lists</td>
</tr>
<tr>
<td></td>
<td>• Departments become personally invested in their own budgets and barely find waste</td>
</tr>
</tbody>
</table>

Sustainable cost management is a process that identifies and implements lasting reductions to a company’s cost structure. It avoids the pitfalls of commonly adopted approaches by developing a strong and sustainable foundation built on effective planning. Management and staff must understand the value drivers of their mining operation and the direct impact that day-to-day decisions have on operating costs. Sustainable cost management focuses on instilling a well-controlled spend culture where cost baselines are clearly understood and the ownership for cost outcomes is assigned to management and staff who have the power to affect lasting change. Central to achieving sustainable improvements are the systematic quantification, tracking and monitoring of the benefits realized by initiatives and feedback mechanisms to continually improve cost management practices.
In effect, mine site “cost reduction” is really mine site “margin improvement”. Achieving a state of sustainable cost management is a journey that typically takes several years to fully embed. In the case of mining companies, sustainable cost reduction initiatives typically focus on minimizing the cost per unit of output at the operational level, while seeking to reduce total cost at the corporate level.

Cost reduction initiatives at a mine site should not only focus on reducing total cost, but should place a high level of importance on improving operational effectiveness, asset utilization and production volumes. The most successful sustainable cost reduction initiatives in the mining sector have also had a significant impact on top-line revenues. In effect, mine site “cost reduction” is really mine site “margin improvement”.

The driver tree below highlights the key drivers of unit costs within a mining operation.

Achieving a state of sustainable cost management is a journey that typically takes several years to fully embed. Key steps along this journey always include:

- **Reducing non-essential spending.** Discretionary spend is typically the first area to get scrutinized—and rightly so, since it’s not essential to business operations. Annoying and challenging this type of spend centrally will help reduce any resentment about cutting these expenses.

- **Clarifying business cost drivers and improving accountability.** Managing a cost centre as one big bucket makes it very difficult to understand what actually drives cost. Defining operating cost drivers through a bottom-up analysis and linking financial plans to operating plans will provide transparency, improve accountability, and enable the measurement of cost reduction activities.

- **Taking control of third-party spend.** Ensuring that sound agreements and decisions are being made with third parties can reduce spend and improve supply chain leverage.

- **Tackling the company’s cost culture and behaviours.** Cost reduction gains can be sustained only in a culture that encourages individual responsibility for managing and controlling spend.

**Targeted cost reduction projects are an important subset of a company’s sustainable cost management initiative.** Targeted cost reduction programs typically form an important sub-set of a sustainable cost management initiative. From our experience cost reduction projects can be of particularly high value to mining companies exhibiting any of the following symptoms:

1. Setting reactive and arbitrary cost targets
2. Lack of transparency of key cost and value drivers
3. Building financial plans on a “last year plus” basis
4. Waiting too much time on analyzing perceived “best possible solutions”
5. Operating managers receiving weak cost information from financial analysts

<table>
<thead>
<tr>
<th>Objective</th>
<th>Key drivers</th>
<th>Influencers</th>
</tr>
</thead>
</table>
| Operational | Operational effectiveness | Business
| Capital expenditure cutting | Financial
| Production and plant maintenance | Strategic
| Planned corrective maintenance | Value
| Unplanned corrective maintenance | Technology
| Breakdowns | Organizational
| Strategic sourcing | Reporting
| Organization | Training
| Technology | Planning and scheduling
| Effective preventive/Predictive maintenance | Knowledge of cause and effect
| Effective preventive/Predictive maintenance | Knowledge of cause and effect
| Materials management | Capacity planning and execution
| Process improvement | Process improvement
| Commodity strategies | Knowledge of cause and effect
| Reporting | Knowledge of cause and effect
| Efficient transaction processing | Knowledge of cause and effect
| Data capture at source | Knowledge of cause and effect
| Savings from previous initiatives are not being realized | Knowledge of cause and effect
| Difficulty to Implement | Difficulty to Implement

<table>
<thead>
<tr>
<th>Value drivers of cost effectiveness</th>
<th>Key drivers</th>
<th>Influencers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Key drivers</td>
<td>Influencers</td>
</tr>
</tbody>
</table>
| Operational | Operational effectiveness | Business
| Capital expenditure cutting | Financial
| Production and plant maintenance | Strategic
| Planned corrective maintenance | Value
| Unplanned corrective maintenance | Technology
| Breakdowns | Organizational
| Strategic sourcing | Reporting
| Organization | Training
| Technology | Planning and scheduling
| Effective preventive/Predictive maintenance | Knowledge of cause and effect
| Effective preventive/Predictive maintenance | Knowledge of cause and effect
| Materials management | Capacity planning and execution
| Process improvement | Process improvement
| Commodity strategies | Knowledge of cause and effect
| Reporting | Knowledge of cause and effect
| Efficient transaction processing | Knowledge of cause and effect
| Data capture at source | Knowledge of cause and effect
| Savings from previous initiatives are not being realized | Knowledge of cause and effect
| Difficulty to Implement | Difficulty to Implement

**Stabilization – Transparency and accountability**

- Savings from previous initiatives are not being realized
- Difficulty to Implement
- Clarity of spending and operational plans
- Controllable costs are increasing as a percentage of fixed costs over the medium-term
- Discretionary spend is typically the first area to get scrutinized—and rightly so, since it’s not essential to business operations. Annoying and challenging this type of spend centrally will help reduce any resentment about cutting these expenses.
- Targeted cost reduction programs typically form an important sub-set of a sustainable cost management initiative.
- From our experience cost reduction projects can be of particularly high value to mining companies exhibiting any of the following symptoms:

**Cost reduction “value killers” and “value builders”**

1. Setting reactive and arbitrary cost targets
2. Lack of transparency of key cost and value drivers
3. Building financial plans on a “last year plus” basis
4. Waiting too much time on analyzing perceived “best possible solutions”
5. Operating managers receiving weak cost information from financial analysts

**Cost reduction “value builders”**

1. Setting reactive and arbitrary cost targets
2. Lack of transparency of key cost and value drivers
3. Building financial plans on a “last year plus” basis
4. Waiting too much time on analyzing perceived “best possible solutions”
5. Operating managers receiving weak cost information from financial analysts

**Total cost management**

- Contracts and third-party spend management
- Cost management and control processes
- Lean and waste elimination
- Sustainability

**Driving value creation for shareholders**

**PricewaterhouseCoopers LLP**
A cyclical approach to cost reduction leads to far more sustainable results than the traditional top-down, slash and burn approach. Key design principles of successful cyclical cost reduction programs include:

1. **Each cycle is time bound.** No longer than 12 to 14 weeks is typically required to size the prize, identify and validate opportunities and develop business cases for implementation.

2. **A comprehensive focus on the drivers of cost.** The approach engages middle-management and key stakeholders in multidisciplinary teams to identify realistic and achievable ideas and opportunities for improvement.

3. **Clear delineation and tracking of benefits.** Benefits realization is a critical focus in each phase of the cycle. This includes the clear definition of the in-scope cost base and reduction targets, monitoring the benefits realization run-rate and results monitoring reviews up to two years after initiatives are implemented.

4. **Criticality of continuous improvement.** Feedback on the performance of new process/systems and appropriate employee reward mechanisms to foster a continuous improvement culture is essential to sustaining incremental improvements.

**Targeted cost reduction projects typically yield savings in the range of 10 to 15%, however depending on the circumstances and the severity of cost escalation pressures, this number may be higher. Revenue enhancement from production increases and improvements in the reliability of production and asset utilization are other core benefits yielded by successful cost reduction projects.** We have observed that this approach also delivers a number of secondary benefits to mining companies, both at the corporate and mine site levels. In particular, it creates an improved understanding of the value added by key processes and activities and develops a deep knowledge of the key drivers of cost and value. It also helps to build the skills and necessary culture for achieving ongoing and sustainable continuous improvements.

**Figure 5: The three phases of sustainable cost reduction projects**

**Figure 5: The three phases of sustainable cost reduction projects**

**Phase 1**
- **Find the money**
  - Assess the state of the cost base
  - Identify operational and systemic waste
  - Establish an in-scope cost base
  - Develop and publish robust business cases
  - Develop and execute implementation plans

**Phase 2**
- **Save the money**
  - Select quick wins for fast savings
  - Identify and validate opportunities
  - Implement initiatives
  - Establish a framework for continuous improvement and tracking of benefits
  - Incorporate a revenue enhancement strategy

**Phase 3**
- **Keep the money**
  - Validate savings as benefits are realized
  - Implement continuous improvement and performance management
  - Establish a framework for continuous improvement and tracking of benefits

**Mining executives have a number of immediate opportunities to drive their companies towards sustainable cost management**

Achieving sustainable cost management within a mining company is not a goal that can be achieved within a 12-month time horizon. The virtuous cycle of sustainable cost reduction is a process that typically takes several years to embed and requires the day-to-day mentality of all staff to be firmly focused on continuous improvement and cost consciousness. While targeted cost reduction projects can yield substantial results, mining executives need to take immediate actions to move their companies towards the goal of cost-efficient operations as the industry re-emerges from the economic downturn:

- **Establish an environment for cost reduction.** Confirm cost reduction targets for each operation, agree on the in-scope cost base, and complete a preliminary reduction analysis.

- **Agree on cost ownership.** Assign individual responsibilities at the mine site level. This will create accountability amongst those with the power to influence costs and will prevent any costs from falling through the cracks.

- **Challenge the financial plan.** Foster a culture where operations and finance staff work together to clarify cost drivers, challenge operating cost assumptions, and reduce discretionary spend.

- **Look for contract leakage.** A comprehensive review of supplier contracts will typically uncover recoverable claims, cost avoidance areas, and off-contract savings opportunities.

- **Gauge performance by measuring results.** Do so by monitoring activities, capturing related spend results, and producing robust reports for site-based and corporate office management.

- **Rigorously control spending.** Immediately establish a tighter span of control for spend approval to begin the “spend culture” transformation.

- **Stabilize cost controls.** Complete a gap analysis of critical cost management controls to identify immediate actions required to stop the bleeding and create a culture of cost awareness and ownership.
Reduction the capital costs of mining projects

Capital effectiveness is critical to drive value creation for the shareholders of mining companies

In the mining industry, spending capital effectively is a critical lever for improving shareholder returns. While mining projects have the potential to be enormously earnings accretive, the combination of long-term planning horizons, volatile commodity markets and significant up-front capital requirements make the risk of substantial shareholder value destruction a distinct possibility. As capital projects mature in their development life cycle, the degree of influence that mining companies have over project costs reduces dramatically, particularly after construction commences. For these reasons it is imperative that the business need and detailed design of mining projects be rigorously challenged early in the project development life cycle, particularly during the scoping, pre-feasibility and feasibility project phases.

Figure 6: Mining project lifecycle

It is imperative that the business need and detailed design of mining projects be rigorously challenged early in the project development life cycle.

Three primary levers exist for managing capital effectively

Asset intensive industries such as mining have three levers at their disposal to effectively manage their capital spend:

1. Manage the demand for capital
2. Reduce capital costs
3. Manage project execution

In-house development teams and engineering consultants are typically aware of each of these levers; however “project familiarity” and “big project excitement” often shifts the focus away from these business imperatives to detailed engineering design challenges. Further, in “just trying to get the project over the line” business needs and design solutions are often insufficiently challenged before moving to the next project phase.

From our experience there is almost always significant potential for improvement in the capital productivity of mining investment projects through the optimization of these levers. We have observed that this value is most likely to be realized when capital projects are comprehensively reviewed and challenged in a systematic manner by multi-disciplinary teams with fresh eyes, a sound commercial grounding and a strong belief that incremental value can be extracted from the proposed solution.

Lever to manage capital | Effective capital managers do the following:
--- | ---
Manage the demand for capital | • Ensure standardized, rigorous financial justifications for capital projects.  
• Avoid non-financial justifications of projects (e.g. “strategic considerations”).  
• Rigorously prove the need for the capital outlay:  
  • Is there sufficient capacity already within the system?  
  • Are there alternative options that do not require capital? 
Reduce capital costs | • Analyse the total cost of the project, rather than focusing on incremental components.  
• Analyse risk/reward and opex/capex tradeoffs.  
• Seek multiple design options and actively debate the merits of “out-of-the-box” alternatives.  
• Seek “fit for purpose” rather than gold-plated capital solutions to the business problem. 
Manage project execution | • Develop and nurture strong project management disciplines with rigorous controls around project costs and scope.  
• Mandate rigorous financial justifications for changes in scope.
An iterative idea generation and evaluation methodology is central to the success of each phase of a CPI program. During each project phase an independent core project team with strong commercial skills is responsible for breaking the business problem and design solution into manageable pieces and then facilitating multiple “group think” sessions with internal design teams and external experts to identify and quantify potential opportunities for improvement. Each idea is subjected to a detailed screening process by the core project team with the support of “idea champions” focused on evaluating net present value (NPV) impact, capital expenditure, operating expenditure and risk trade-offs and the probability of implementation success. Ideas that are determined to improve capital productivity are then prioritized and proposed to a CPI program steering group for inclusion in revised feasibility or detailed feasibility studies.

Figure 8: CPI program governance structure

Composition
- Representatives from mining company executive team and engineering management

Role and responsibilities
- Set targets
- Top-down communication
- Go/no-go decisions
- Barrier-busting

Composition
- Joint consultant/Client team:
  - 2 to 3 mining company staff
  - 3 to 4 consultant staff

Role and responsibilities
- Deliver project outcomes
- Provide commercial acumen
- Manage process
- Facilitate idea capture, analysis and prioritization
- Quality control
- Run tracking system
- Custodians of tools

Composition
- Engineers and other technicians responsible for project development and delivery
- Other engineers with content expertise not related to the targeted project

Role and responsibilities
- Provide technical expertise and analysis of current and potential solutions
- Generate and assist evaluation of improvement ideas

Composition
- 1 to 3 external engineers with relevant project experience (suggested by the mining company)

Role and responsibilities
- Challenge internal thinking; ask the tough questions
- Generate and assist evaluation of improvement ideas

CPI programs are typically delivered in three phases

Phase 1: Challenge the business case and investment proposal
CPI programs are typically launched during the pre-feasibility or feasibility phases of a mining project. They are labour-intensive, relying extensively on input from external engineering and commercial content experts, in-house project teams and engineering consultants. CPI programs focus on challenging existing project work from three perspectives:
1. The business case and investment proposal
2. The design of the process solution
3. The design and cost of the engineering solution

Phase 2: Challenge the design of the process solution
The next phase of the CPI program challenges the proposed process solution to the business problem and aims to identify ideas that together account for a 10% to 15% capital saving.

Phase 3: Challenge the process flows
This phase is focused on reviewing and rethinking detailed process flows to identify more cost-effective alternatives. Each major process is broken into its component parts and the key drivers of cost and commercial value are identified and reviewed in detail to pin-point inefficiencies, bottle-necks, latent capacity and unproductive capital. A significant focus is placed on reducing discontinuities between interfacing processes, with concepts being borrowed from methodologies such as Six Sigma and lean manufacturing to undertake this analysis.

“Thinking big picture”, challenging traditional operating paradigms and identifying innovative solutions are critical for achieving a step-change in capital cost reduction. Where possible non-core activities should be outsourced and design scope reduced to not account for every possible eventuality. Trade-offs between NPV, capital costs, operating costs, investment flexibility and timeline execution risks are forefront considerations of all analysis conducted during this phase.

Figure 8: CPI program governance structure
Phase 3: Challenge the design and cost of the engineered solution

The final phase of a CPI program is to challenge the design and cost of the engineered solution. This process aims to identify many ideas that together make growth projects easier to finance, grow mining companies’ market capitalization, and yield savings of 20% to 25% from a successful CPI program.

CPI programs have consistently yielded significant capital cost savings, particularly when a company is experiencing issues in their capital planning processes.

From our experience, CPI programs are likely to be of high value to a mining company exhibiting any of the following characteristics in their capital project planning processes:

- An urgency to complete project planning and approvals to meet stakeholder expectations or current market opportunities
- A high level of project complexity leading to difficulty in optimizing whole-of-life costs
- Design decisions determined by engineering rather than commercial considerations
- "Gold-plating" of assets rather than off-the-shelf solutions
- Adoption of a "no-risk" approach to design solutions
- Lack of clarity around the trade-offs between technical and commercial objectives
- The bundling of "nice to haves" with "must haves" during detailed planning

Across a wide range of commodities CPI programs have consistently yielded savings of 20% to 25% from previous capital cost forecasts without compromising business performance. These reduced capital requirements make growth projects easier to finance and deliver mining executives with increased financial flexibility, an imperative in the current economic climate. Life-of-mine operating cost reductions, enhancement of future revenues, reductions in investment risk and a compression of project time frames are other benefits typically yielded from a successful CPI program.

After a brief but challenging hiatus during the GFC, the future is looking bright again for the mining industry. Although significant short-term volatility remains from sources such as the Sovereign Debt Contagion situation in Europe, all evidence is pointing towards long-term demand fundamentals driving a strong upward cycle for commodities over the coming years.

The weakening of the US dollar against most mining currencies, coupled with stable labour costs and increasing energy prices, presents a real risk of further increases to the operating cost structures of existing assets. It is essential that lessons from the past are learned and that organizations focus on achieving sustainable cost reductions by addressing critical enablers such as effective planning and cost ownership, understanding key cost drivers and establishing a controlled spend culture.

As demand side fundamentals take hold, it is expected that capital cost pressures will again become one of the key impediments to maximizing returns from growth projects. Further, unlike the previous upward cycle it is critical that mining companies better insulate themselves from potential market downturns by reducing the capital intensity of their proposed investments. A rigorous focus on business needs, project scope and detailed process and engineering designs during the early phases of these projects is the key to investment flexibility and improving the productivity of capital and shareholder returns.

This paper has highlighted the fundamental importance of effective sustainable cost reduction and capital productivity improvement initiatives. Over the short- to medium-term, we believe such initiatives will be of critical importance to fully extract the benefits of the market and to be prepared for inevitable future uncertainties.

References


Acknowledgements

This paper has been developed following insights gained by PricewaterhouseCoopers while working on operational improvement projects with Anglo American, BHP Billiton, Xstrata Coal and Sherritt International.

Our special thanks to the partners and staff of PricewaterhouseCoopers’ Consulting practices in Australia, Canada and the United States who have been kind enough to contribute their time and their deep knowledge in the areas of cost reduction and capital productivity improvement.
About the authors

**Arturo López**  
Americas’ Mining Centre of Excellence  
Consulting Leader  
Partner, Risk & Controls  
Toronto  
+ 1 416 941 8219  
arturo.j.lopez@ca.pwc.com

Arturo is the Consulting leader at the Mining Centre of Excellence for the Americas and the Systems and Process Assurance services leader at PwC Canada. He focuses on delivering value to clients in the mining industry. He has over 16 years experience in assessment, design and implementation of business applications and information technology procedures and controls. Arturo provides services in the areas of design, documentation and assessment of Business Process and Information Technology controls. He has responsibility for planning and executing our strategy for the delivery of Information Technology Audit services in support of certification of internal control for financial reporting under the Sarbanes-Oxley Act (SOX) and NI 52-109, and the audit of financial statements. Arturo is also experienced in assisting mining companies to deliver significant programs of work to transform how finance delivers value to their organizations.

Before joining PwC, Arturo worked for five years in Lima, Peru, for a large international audit and accounting firm. During this period he was responsible for conducting financial statement audits for large mining and oil and gas corporations.

Arturo is a CA and a Certified Information Systems Auditor.

**Aaron Carter**  
Manager  
Toronto  
+1 416 869 2443  
aaron.carter@ca.pwc.com

Aaron is a Manager in our Toronto Consulting practice with over five years of experience advising to mining companies on topics such as operational cost and value driver modelling, cost reduction, performance management and process improvement. Aaron has recently joined our practice from PwC Australia where he focused exclusively on the mining sector.

Aaron has consulted heavily to underground and open-pit coal miners, including Xstrata, Anglo American and BHP Billiton. He has also recently advised base and precious metals miners on their plans to implement cost reduction tactics and management reporting frameworks. Aaron has a solid understanding of the key drivers of successful mining operations, which he has gained from extensive experience working with both corporate and site level management.

Aaron is a Chartered Accountant and member of the Canadian Institute of Mining, Metallurgy and Petroleum. He also holds a Bachelor of Accounting and Bachelor of Business (Information Systems) from Central Queensland University where he was awarded the Business Faculty Medal on graduation.

**Canadian Resources Team**

**Mining Industry Leader**  
John Gravelle  
+1 416 869 8727  
john.p.gravelle@ca.pwc.com

**Toronto**  
Arturo Lopez  
+1 416 941 8219  
arturo.j.lopez@ca.pwc.com

**Vancouver**  
Mike Cinnamond  
+1 604 806 7029  
michael.cinnamond@ca.pwc.com

Brian Pawluck  
+1 604 806 7701  
brian.j.pawluck@ca.pwc.com

**Montréal**  
Nochane Rousseau  
+1 514 205 5199  
nochane.rousseau@ca.pwc.com

Richard Deslauriers  
+1 514 205 5045  
richard.deslauriers@ca.pwc.com

© 2015 PricewaterhouseCoopers LLP. All rights reserved. In this document, “PwC” refers to PricewaterhouseCoopers LLP, an Ontario limited liability partnership, which is a member firm of PricewaterhouseCoopers International Limited, each member firm of which is a separate legal entity. 0437-03a 0811