



LEAN MINING: BRINGING SUSTAINABLE EFFICIENCIES TO THE MINING INDUSTRY

THE MINING INDUSTRY IS KNOWN FOR FACING CONTINUAL UNCERTAINTY AND VOLATILITY, MAKING IT IMPERATIVE FOR MINING COMPANIES TO IDENTIFY AND IMPLEMENT STRATEGIES FOR SUSTAINABLE COST REDUCTION AND OPERATIONAL EFFICIENCY IN ORDER TO MAINTAIN HEALTHY PROFITABILITY AND REDUCE RISK. AS SUCH, IT'S NO SURPRISE THAT THE PRINCIPLES OF LEAN MANAGEMENT ARE BEING INCREASINGLY ADOPTED BY COMPANIES THROUGHOUT THE INDUSTRY.

'To gain competitive positioning and increase responsiveness in a complex, dynamic market, mining organizations need to be streamlined, flexible and efficient—strengths that Lean thinking is uniquely positioned to impart,' says James Ryan, Principal at Four Principles. 'Lean management brings a relentless focus on improvement through the elimination of waste and maximizing of value for the customer. These principles are particularly relevant today, as many companies in the mining sector are dealing with the legacy of a strong 'boom' period during which high costs and low efficiency were sometimes overlooked and now must be remedied.'

Here we'll examine how Lean management principles can lay the foundation for sustainable, long-term success in the mining industry.

KEY OPPORTUNITIES TO HARNESS THE POWER OF LEAN THINKING IN MINING

The mining industry faces a unique collection of challenges. As sellers of commodities, mining companies must contend with volatile market prices, fluctuating demand and cyclical forces. Drilling deeper into the operations of a mining company, we see that things aren't any easier: To be successful, mining entities must achieve and maintain high overall equipment effectiveness (OEE) and constantly target minimum wasted product. Taken together, these challenges indicate that any operation that isn't able to exercise optimally efficient use of capital and resources will surely struggle to compete—and ultimately fail to deliver solid margins and overall results as a business.

Fortunately, Lean practices are designed to deliver sustainable efficiencies in such an inherently difficult industry. As pressures on the bottom line of mines are ever-increasing, more firms are seeking to reap the benefits offered by Lean, including enhanced production efficiency, the ability to adapt to technology and improvements in safety and environmental programs, as described below.

Improvements in process efficiency – Much like the automotive industry, which was the birthplace of Lean thinking, the mining industry relies heavily on efficient industrial processes, value stream efficiency and a strict focus on safety—all areas in which Lean has demonstrated success in the auto industry.

'If I had to name one thing I have transitioned from what the automotive industry taught me across to what Rio [Tinto]'s mining operations are doing today, it would be an intense, laser-like focus on value and efficiency. Many of us are familiar with the systems that fall under the banner of 'Lean Six Sigma.' Pioneered by companies like Toyota and General Electric, they are far from confined to any particular industry or process. At base level it represents a concentrated intent to eliminate variation or waste at every stage of production.' Sam Walsh AO, former executive at Rio Tinto.

Consider this example of Lean principles in action at Tüprag, the Turkish subsidiary of Eldorado Gold. In 2011, the price of gold reached nearly USD1,900 per ounce as the global economy continued to deal with the effects of the financial crisis, creating a favorable environment for Tüprag to commission a new gold mine. The efforts to start production at the new site as quickly as possible, however, led to dwindling production performance and increasing safety risks.

In 2013, the price of gold sank to around USD1,300 per ounce, which applied serious pressure on the company's mining investments and budgets around the world. It was in this moment that Tüprag chose to initiate a Lean transformation.

'Our goal quickly became clear: because no mining company is immune to the fluctuations in the price of gold, the only way for us to achieve continuous profitability would be to deploy precise, planned and disciplined cost control. Knowing this is a matter of life or death in our business, we decided to become a more robust mining enterprise by basing our culture and processes on the idea of continuous improvement.' Selçuk Turan, Process Superintendent at Tüprag

After six months, pilot projects began to yield results. For example, the application of 5S, a methodology to reduce waste and optimize productivity through maintaining an orderly workplace, generated a better-organized, safer and more efficient underground work area.

As the Lean initiative gained traction, the mine was able to achieve other significant operational improvements, including:

- Reduction in time to complete one cycle. By creating a value stream map, a key Lean concept which details products' movements through the process and the resources utilized at each step, the company realized its biggest loss was created by sending materials needed for production to each area separately. As a remedy, standardized material areas were created and refilled each hour, eliminating waiting and material waste. The changes enabled the mine to gain one extra ore face cycle per day and a 5% cost reduction per meter excavated.
- Transformation in equipment management and maintenance. The equipment used by Tüprag for underground mining is roughly three times more expensive than machines deployed on the surface, with much higher maintenance costs. As such, it was critical for the mine to have reliable equipment operating at a high OEE. Initially, the approach was to have many spare parts available at all times and dispatch trouble-shooting crews on demand. With the implementation of Lean, the firm introduced autonomous maintenance and empowered teams to perform root-cause analysis to eliminate problems at their core. As a result, the planned maintenance rate increased and a backlog of 850 failures was cleared within three months. Equally important, the average gold recovery in OEE for the plant grew by 1% to reach 94%. Lastly, the improvements in equipment maintenance processes meant the company purchased fewer units of expensive extra equipment.

Consider another example: A leading diamond mining company set out to optimize cycle times through implementation of Lean principles. To begin, the diamond production process was represented by a current-state value stream map. The organization then used statistically significant variables to optimize cycle times and reduce the lead time to increase plant throughput.

Adapting to technology and digitization – Technology is poised to revolutionize the mining industry, creating huge potential benefits for mining companies. For example, mines of the future are expected to feature fully autonomous drills and trucks, rely heavily on drones and even employ virtual reality tools to allow employees to practice the management of hazardous situations involving explosives. In fact, some experts are predicting a day when there will be minimal human presence in mining production areas, with all processes being controlled remotely.

While these technologies are exciting, companies that don't adopt them within a carefully considered framework won't fully harness the benefits. In fact, these powerful technologies could become unforeseen sources of waste. As in other industries, Lean management is poised to help mining companies manage the task of infusing new technologies into their businesses without falling prey to wasteful, inefficient strategies.

'Mining companies can leverage Lean thinking to quickly and efficiently achieve substantial, sustainable impact through technology,' says Stefano Gaspari, Principal at Four Principles. 'By focusing specifically on one key criterion – the customer's perception of value – Lean brings much-needed clarity to the process of assessing and integrating new technologies into existing mining operations.'

Improving safety and environmental programs – Lean thinking is highly complementary to the safety and environmental programs already in place at mining companies. For example, Lean empowers every worker to identify problems, find the root cause and eliminate them each day – and this includes safety problems. In fact, some mining companies have seen improvements of more than 30% in their MTIFR (medically-treated injury frequency rate) thanks to implementation of Lean.

With regard to the environment, the benefits are clear: By improving work flow, operational footprints are often reduced, which can cut down on wasted energy and generated scrap, directly improving environmental outcomes.

AN IMPORTANT CHALLENGE WHEN IMPLEMENTING LEAN IN MINING: THE HUMAN FACTOR

Cultural changes in mining companies are foundational to achieving the continuous improvement (kaizen) that is central to successful implementation of Lean thinking. Ignoring the human factor is one of the primary reasons some Lean efforts struggle to deliver sustainable, long-term results for mining companies.

Consider the Chilean mining company SQM, which was facing rising costs and growing concern that prices for its primary products could fall. Past restructurings and cost-cutting campaigns had yielded temporary results but nothing sustainable, so the leadership team turned to Lean management principles and committed to making cultural changes starting at the top.

'Over time, I came to realize that the main challenge in a transformation is how to transform leaders. You may think that the problem is your workers. But in reality, it's probably you that have the problem.' Carlos Diaz, Vice President at SQM

At first, employees were hesitant, having experienced the failures of other cost-cutting initiatives, so the leaders made a concerted effort to communicate the breadth and depth of the cultural changes. For example, the company rolled out workshops and problem-solving sessions to involve everyone in the process, helping them recognize that the changes were being driven on all levels. The company also committed to having key change agents on site to personally oversee the transformation in each geographic location.

'To be honest, initially my goal was to just reduce costs some more. But during the process, I've become much more focused on people development. I can see what people can do and how that matters over the long term.' Carlos Diaz, Vice President at SQM

The company's close attention to the human factor has yielded impressive results. After approximately three years, metrics for cost, production and safety at the pilot plant have all improved – and the company is now targeting another plant for a Lean transformation.

MINING IN THE GCC AND SAUDI ARABIA

As countries in the GCC look to diversify their economies beyond oil and create jobs for their young, fast-growing populations, the mining industry is becoming increasingly important. In particular, Saudi Arabia has rolled out ambitious plans to increase the value of its mining operations to nearly USD70 billion by 2030. Major known minerals include gold, phosphates and bauxite, with additional opportunities expected to arise as the strategy continues to unfold. Significant recent changes in mining regulations are allowing greater access for foreign companies looking to invest in the Kingdom's blossoming mining sector.

The large domestic and neighboring regional markets for high grade, industrial raw materials are also fostering growth in Saudi Arabia's mining sector. Additionally, development of the mining industry is creating major infrastructure demands, including power, transport, communications and construction projects. In such a rapidly developing environment with a long runway for growth, opportunities for mining, resources and infrastructure companies are impressive; however, the path is not without obstacles and the application of Lean principles stands to be particularly powerful within this landscape.

For companies poised to embrace the next chapter within the mining industry, Four Principles is here to deliver tangible Lean Management expertise, not idle talk. We develop sustainable Lean solutions across various industries and in countries around the world. We implement. We are passionate about what we do. We are Lean experts. Learn more at <https://fourprinciples.com/>.



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