Productivity in mining operations: Reversing the downward trend

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A new methodology for measuring productivity in mining operations reveals more effective ways to improve it

With the end of the demand supercycle and the ensuing collapse in profitability, mining companies are shifting their focus from volume growth to productivity. McKinsey’s new MineLens Productivity Index (MPI), which adjusts for declining ore grades and mine cost inflation, shows that they have a lot of ground to make up. Worldwide mining operations are as much as 28 percent less productive today than a decade ago. Importantly, our research also shows that some mining companies are already turning around productivity performance, suggesting room for improvement throughout the industry.

In the scramble to meet rocketing demand during the first decade of the 21st century, mining companies worldwide largely lost sight of productivity goals that had been key to operating discipline in the lean years of the 1980s and 1990s, when parts of the industry had set a healthy record in productivity improvement. As the supercycle gathered pace, cost increases related to expanding production got badly out of control.

Today, there is intense interest across the industry in reversing the excesses of the 2000s. But it is hard to improve something you can’t properly measure. Efforts to boost productivity are hampered by the challenge of decoupling the factors managers can influence from those over which they have no control. Conventional measures of mine productivity don’t do this, because they tend to compare operating costs with the value of final product output, and so are influenced by commodity price volatility and by changes in ore grades or other geological conditions. Similarly, such measures can’t separate the effect of rising input prices—like fuel and explosives—from unnecessary consumption caused by process inefficiencies.

We have developed the MineLens Productivity Index (MPI)—that enables mining managers to measure the aspects of productivity that are within their control, namely capital, labor, and non-labor operating expenditure.
These three elements are adjusted to account for mine cost inflation and linked with a measure of physical mine output that, critically, is not affected by changes in the ore grade, stripping ratio, or the price of the commodity.

Data on each of these four elements from individual mines reveals how their productivity has changed over time. And we have collated data from an extensive line-up of mines, covering all major mining geographies, commodities, and types of player, to create a picture of performance across the sector.

Our data shows that mining productivity has declined 3.5 percent per year over the last decade, meaning that mining companies are 28 percent less efficient at digging and moving a ton of total material today than they were ten years ago (Exhibit 1). The pronounced decline in productivity is evident across most commodities, including iron ore, copper, coal, and platinum group metals. It is also in evidence across most mining players, and most geographies—from North and South America to Australia and Africa.

More encouragingly, however, the MPI data suggests that, over the 2009 to 2013 period, the industry has more or less stabilized its downward trend in productivity, with MPI running on average at minus 0.4 percent a year. Productivity in a number of commodities actually rebounded in 2012 and 2013.
Addressing the industry’s productivity challenge
To address the challenge of productivity improvement, miners will need to make moves on two levels: first to achieve short-term gains, and second to set their operations on the right course for higher long-run productivity performance.

On the first level, the way forward is clear. Our research shows that capital expenditures and non-labor operating expenditures have been the main drivers of the productivity decline. In the mines we studied, capital expenditure increased at a compound annual growth rate (CAGR) of 37 percent and operating expenditure at a CAGR of 18 percent from 2004 to 2013, while output has grown at a CAGR of 15 percent. By contrast, the number of workers has also risen, but at a slower rate, with a CAGR of 7 percent from 2004 to 2013.

Many companies are already reining in capital expenditures and making moves to obtain more value-adding output from their assets. Work also needs to continue on lowering non-labor operating expenditures, notably by improving procurement performance. The reward for these efforts can already been seen in the MPI data, with an upturn in productivity performance in some regions where capital expenditures have been reduced dramatically, and where a number of large assets have come online that have boosted output, while major efforts have been undertaken to drive costs out of operations.

Moving to the second level of actions, we see three important areas of focus to address the root causes of productivity decline.

1. Embed effective management operating systems at mines. Doing this will create greater transparency on operations performance. Mines should also free up people and resources to prioritize productivity and operational excellence, and support effective performance management. This will help them avoid the common trap of emphasizing one or two variables, like cost, capital intensity or throughput, rather than maintaining a holistic focus on all the drivers of productivity.

2. Prioritize operational excellence and the development of capabilities.
   - The best operations work to continually reduce costs, boost throughput and improve their ability to respond flexibly to changing conditions.
   - They do this by eliminating waste wherever they can, reducing variability and improving the productivity of assets through advanced reliability and maintenance approaches.
   - All these activities require skilled people, and addressing shortages in those skills must be a priority.
Many mining companies still consider operational productivity improvement to be the domain of a “continuous improvement” department or a handful of lean experts or Six Sigma black belts, but do not yet regard it as a core competence.

3. Focus on innovation.

The mining industry can be slow to adopt new ideas, with managers often preferring to stick with what they know rather than risk an interruption in output. For example, the potential to implement advanced dispatching processes in underground mining operations is clear, but it has still not been adopted at scale. In many cases, new capital projects are executed without integrating new technologies into the mine design.

To ensure they benefit from breakthrough technologies, mining company management should encourage openness to trying new approaches and to adopting new technologies. Partnering between mining companies and equipment and technology providers should also increase, and companies must be willing to look beyond the boundaries of the mining industry to seek inspiration from other sectors.

Mining companies can also make better use of advanced analytics to harness the potential of the vast amounts of data generated in typical modern mining operations in order to boost productivity improvement initiatives. Doing this will require a broadening of the responsibilities of operations leaders, and tighter integration with other corporate functions.

Mining commodity prices are volatile and investors are currently unenthusiastic about the industry’s prospects. But the long-term supply and demand fundamentals of many important mining commodities suggest that companies that can cost-effectively raise their output will be rewarded. Those that succeed in the race to achieve higher productivity will be among the biggest winners. The initiatives described above are important enablers of those productivity improvements. Combined with a commitment to monitor productivity performance, they will be an important factor in that race.

Evaluating individual mine performance

Exhibit 2 shows how individual mine performance can be tracked using MPI. The four quadrants represent the evolution of performance (from a base in 2008) in terms of unit costs and output, with the lower right quadrant representing the most desirable outcome—lower unit costs and higher output per employee. The evolution of the mine’s asset value since 2008 is represented by the size of the bubble. A bigger bubble than the dark gray 2008 base bubble indicates an increase in asset value (corresponding to
increased capital spend). A smaller bubble indicates lower capital spend.

A mine that has improved in all four elements of productivity will move from its starting position, as shown by the dark gray bubble, into the lower right quadrant, and the bubble size will be the same size or smaller than in 2008. Such a mine will have reduced unit costs and raised output per employee without increasing its capital expenditures. This has represented a difficult challenge for mines since 2008: none of the mines in the sample studied have succeeded in moving into this quadrant.
An examination of individual mine data using MPI can deliver useful insights about the path towards higher productivity. A South American copper mine made significant capital expenditures to boost its production, and saw output rise 3.9 percent per annum (Exhibit 3). However, while productivity has started to increase in the past four years helped by the higher output, the increased outlays on labor and, in particular, on
operating costs across the full 2005 to 2013 period resulted in productivity declining 1.9 percent per annum on average over the period.
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