CASE STUDY

Analytics-driven smart sourcing and procurement of grinding media for a Semi-Autogenous Grinding (SAG) mill

Abstract

A global mining corporation with mining operations spread across the Americas had embarked on a mission 2020 that aimed to lower operational costs, and increase production and reserves. To realize this, the company partnered with Infosys BPM to optimize its procurement and manage spend. We introduced market intelligence (MI) service as part of our end-to-end sourcing & procurement (S&P) offering.

Our S&P MI teams are embedded in the sourcing team, enabling alignment to category goals and targets. This visibility, alignment to category objectives, and collaboration with the sourcing teams enabled them to proactively identify opportunities in line with the client's goals. The MI team helped the company make a business-critical decision on product and supplier through cost-benefit analysis and research, helping identify new supplier and material for a high spend category that resulted in 10% savings and improved production.

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Four major obstacles to realizing mission 2020

To realize its mission 2020, the company evaluated several potential projects but faced four major challenges:

- Its processes were localized
- It had low visibility on spend areas
- It had a fragmented supplier base
- It had a low bandwidth to identify and run strategic projects

The localized nature of their operations limited their engagement to a single specific supplier for each mine location. This resulted in little exposure to various new materials that could be used to save costs.

Project planning and execution

As part of its quarterly review, the company identified various high spend categories as savings opportunity. Our MI team analyzed these spend categories and proposed researching the grinding media category used in its SAG mill. Recent market developments rendered this category suitable for potential cost savings.

A SAG mill is predominantly used during the preliminary stage of grinding in the mining process. The machine grinds large chunks of material to small, useable pieces for processing. The material is then fed into a large cylindrical drum (known as feed head) where the grinding medium (generally, steel balls) is used to grind it by spinning the drum at high speed. The ground material is filtered out from the drum and discharged through the discharge head.

There are two key cost factors in a SAG mill:

- Power consumption
- Grinding media

Our MI team recommended identifying and evaluating low cost grinding media that could be used without impacting the mill's productivity and power consumption.

A two-phase solution approach

With the client's approval, the MI team worked alongside the sourcing team to develop a scalable total cost analysis tool that the sourcing teams could use for ongoing comparison of various grinding media materials in a two-phase approach.

Phase I: Identify industry trends and new suppliers for the grinding media category

Based on the market research, our team designed the supplier benchmarking criteria to identify and shortlist potential suppliers. The MI team focused on six key criteria for grinding media suppliers:

- Geographic presence in key mining locations across the globe
- Distribution and logistics capabilities (if in close proximity to client's mining sites)
- Experience in supplying to mining companies
- Specialization in grinding media
- Grinding media materials in the product portfolio
- Product pricing and company revenues

The team evaluated suppliers based on these criteria and shortlisted four suppliers who had a specific advantage over others – specialization in grinding media. The team then obtained product pricing details from the shortlisted suppliers to evaluate the respective savings potential. From the pricing details, the team narrowed down to one supplier with the capability to supply grinding media at 8-10% lower cost than the current price. The cost advantage was primarily due to the material used as the grinding media by the supplier.

While a potential supplier was identified, there was no available tool to further evaluate the cost benefits from switching the supplier. Further, the impact of the new grinding material on production, power consumption of the mill, feed, product size, etc. was not clear. To measure and evaluate the total savings, our team designed phase II of the project.

Phase II: Framework to measure and evaluate the savings

This phase focused on the developing a scalable tool / framework to capture and compare the total cost benefit of switching to an alternate product / supplier. This tool was used to evaluate the total cost and validate the claim of 10% savings.

The MI team performed extensive research on grinding media and conducted detailed discussions with subject matter experts to design the analytical framework. The team identified three major factors that impacted the total cost of ownership:

- Wear rate of the grinding balls
- Power requirements of the mill
- Income from scrap sales

Wear rate of the balls

To calculate the wear rate of the balls, the team first calculated the mill's filling of the grinding media. With this, the number of balls present inside the mill was deduced. This helped in comparing the quantity of the proposed material to the current material used.

Based on the number of balls used, the team calculated the before and after production wear rates for both grinding media materials (proposed and current).

Power consumption

To calculate the power consumption, MI team applied the principle of bond work index. Bond work index is an industry best practice to calculate power consumption for grinding process.

Bond work index:

Bond work index was originally developed and proposed by Fred C. Bond to calculate the power consumption during the crushing and grinding of ores.

It is calculated by using the formula:

$$E = 10 \times Wi \left(1/\sqrt{P80} - 1/\sqrt{F80}\right)$$

Here,

E is the specific energy consumption, KWh/ton

Wi is the work index, = 16.5 for gold ore

F80 is the 80% passing size of the feed, µm (micrometer)

P80 is the 80% passing size of the product, µm (micrometer)

Income from scrap

The volume of the grinding media scrap generated was deduced from the difference between the volume of grinding media ball before and after production.

Three key parameters are measured while keeping the SAG mill output, hours of production, feed size, and product size constant for both the test samples (old grinding media balls and the new proposed grinding media).

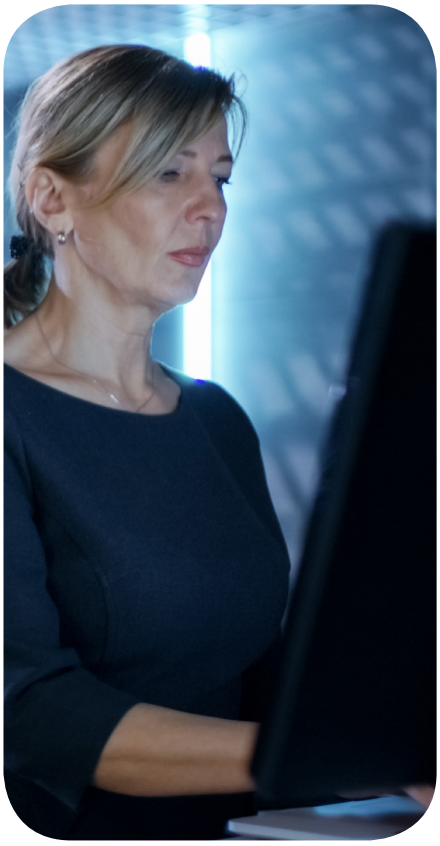
Our MI team worked together with the client's engineering team to measure the output through the new framework. This helped measure the grinding material consumption per day, thus help evaluating the potential savings, and eventually, select the best supplier. In addition, our team used other techniques such as bond work index for power calculation to make the framework scalable and flexible for future use.

Value delivered

Based on the analysis and recommendations from the market intelligence report, the client engaged with the supplier to evaluate samples and validate the potential savings using the evaluation tool developed.

The initial testing demonstrated that apart from a 10% savings, the new material could also potentially increase the overall production, further driving savings.

Optimizing the high spend category of grinding media helped the client achieve two out of its three key goals – improving operational costs and increasing productivity. This, in turn, helped them get closer to their overall organizational goals set in their mission 2020.



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