ASSET PERFORMANCE MANAGEMENT FOR FIXED ASSETS IN MINING
Some of the biggest challenges facing metals and mining sites include increasing availability, enhancing performance and improving product quality.

Crucial to these challenges are fixed assets such as crushers, conveyors, SAG mills, motors, and pumps.

A digital APM solution for fixed assets can bring additional value through efficiency and sustainability improvements, reliability-centered maintenance, and higher equipment utilization.

Many factors go into running a successful mining operation. There are intangible ones like cybersecurity, cloud-based data and worker satisfaction. But there are also tangible, fixed assets such as crushers, conveyors, SAG mills, motors, and pumps to consider.

How do we make sure they are all performing to their fullest capacity? How do we monitor, track, analyze and optimize their output? Indeed – how do we even successfully capture all the data from these assets in the first place?

We do this by thinking of them not as siloed parts of the puzzle but rather one big ecosystem, working together to keep the mining operation efficient and safe. But before we can even think about optimization, we need to think about data.
This is where asset performance management (APM) systems come in. APM systems are all about efficient use of data, timely notifications, and clear next steps to sustain performance. This strategy allows organizations to reduce their operational risk as they have a continuous measure and visibility of their operations and can adjust and make changes earlier.

They also improve efficiencies in their operations as they can identify bad actors in a more streamlined manner and kick off earlier corrective actions. This leads to assets that can be taken to their technical limits of operations for extended periods of time without compromising their integrity. APM directly supports production goals by pairing with dynamic maintenance asset strategies that are more efficient at identifying and solving issues.

However, to be able to obtain all these benefits, selecting the right APM solution is key. It is important to consider that implementing APM and focusing on optimization is not a quick switch, but rather a journey. More importantly, the direction of this journey depends a lot on the current state of digitization efforts in the organization.

This is especially true when it comes to how the organization captures and deals with data. APM solutions should work as an aggregator of data to make it useful for making decisions. This data is not just data incoming from assets in the field, but also integration of data from surrounding enterprise systems like historians, CMMSs, and data from field operations.

The ultimate goal here is to use all of this data to have a complete view of operations produced by the highlights and insights from advanced analytics. In this holistic view companies will be able to:

- Measure their asset and process performance in real time.
- See how well they are doing regarding their specific KPIs or overall equipment effectiveness (OEE).
- Get notification when assets or processes start deviating from normal behavior or present an anomaly.
- Get sufficient information to identify the source of such deviations and a clear path of action to bring them back to optimal performance.

Achieving all of this builds a truly integrated autonomous operation, where all critical variables from process, assets, environment and financials will be controlled and updated online, in a reliable, safe and cyber-secure way - a way that is fully optimized with leading edge technology, while leveraging the best in applied AI and ML.

To reach the technical limits of operations, not only asset modeling/simulation are needed, but integrating that info to the optimization systems – where they can be incorporated into the automated process – is key. Only with this level of integration can we achieve an optimized autonomous operation.

This approach also considers incorporating key environmental and security/safety variables (for instance, water and emissions) which will provide a true sustainable operation - One that protects itself, its environment and its stakeholders.
THE VALUE OF APM

Asset performance management brings value through end-to-end solutions across all mobile and fixed critical assets.

So where, exactly, can APM strategies provide value?
The list of areas is lengthy, including:

- Mobile and fixed critical assets in the mineral beneficiation processes
- Mine Planning
- Mine Operations
- ROM Processing
- Ore Processing
- Concentrate Stockpile
- Concentrate Transportation
- Port Stockpile
- Port Logistics
- Refinery or Smelting Plant

Pre-built asset templates based on criticality and priority of assets aid in rapid implementation, and are provided through asset libraries, specific to mining operations. These pre-built model templates also include key environment, safety, and security variables important to the sustainability goals across the industry.
A JOINT SUCCESS

With Honeywell’s decades of mining experience, Codelco (a Chilean state-owned copper mining company) approached Honeywell for help with their automation program. As is the case for optimization, this project was a journey and not a one-and-done task.

Although improving an already-optimized operation is not an easy task, enlisting the right partner would allow Codelco to move forward, avoiding wasting time with technology fads.

Dubbed “Kairos Mining,” this joint venture required a deep understanding of process, integration, optimization, and AI/ML tools. Honeywell pushed the limits of AI and ML tools with initiatives like Quantum and is also integrating with ERP systems.

Companies also can ensure they realize quicker value from their APM investment by employing modular solutions and pre-built models.
MODULAR SOLUTIONS FOR INCREMENTAL SCALING

Businesses can take implementation a step at a time using what can be called a “crawl, walk, run” approach. By taking it a little at a time, engineers/managers can show progress quickly and then justify the next step. Modular solutions allow for incremental scaling; plants can implement capabilities as needed to customize their solution:

The first module to be implemented should be one that monitors asset health and performance – by aggregating data from assets & processes across the plant. This module should use rule-based diagnostics to provide near real-time information.

The next module would predict asset performance degradation in advance using machine-learning models: Use layered modeling to increase maintenance lead-time.

The next step would be to identify causes of performance losses and inefficiencies. This module would employ performance and energy calculations and increase overall equipment effectiveness (OEE) and operating margins.

The final step is to employ outcome-based optimization through analysis of failure modes and effects, identifying criticality, risk/costs, and maintenance actions. This will enable reducing O&M costs.

The solution should ensure each capability can integrate with each successive piece.

Companies can implement building blocks as more knowledge is gained, and asset-process links and considerations are understood.
LAYERED MODELING

A solution can employ robust analysis techniques and pre-built libraries to provide early warnings of impending issues, and actionable recommendations to apply corrective actions efficiently. After implementing an APM solution, layered models and pre-built content can provide quick visibility to faults and earlier lead times for asset maintenance and improvement.

One of the latest new approaches in APM is to layer a combination of three types of models. Each can be described by the type of data that is analyzed and the personas that usually rely on them. By combining modeling methods, the solution:

• Provides an in-depth view of overall asset performance,
• Reduces false alarms, and
• Provides higher fidelity analytics on reliability & efficiency:
  Insight into potential machinery downtime aids in planning and prioritization of asset maintenance and corrective actions.

Performance Model (Process Engineer):

Performance models use physics-based (thermodynamic) first principle equations for multiple performance measurements (for example, the pressure and flow generated by a pump or compressor.) They excel at measuring the work done by a machine. They quantify efficiency by relating the energy consumed vs. the work done.

Performance models are good at recognizing effects of changing process conditions, machine fouling, and process leaks.

Analytic Model (Maintenance Manager):

Analytic models are based on statistical calculation rather than thermodynamic formulas. Analytic models excel at early detection of variation in process conditions, as well as machine mechanical parameters such as bearing vibration.

Analytic models are adept at recognizing issues with sensors, including calibration drift and erratic measurements.

Health and Fault Models (Reliability Engineer):

Health models allow for traditional health monitoring relative to established alarm limits.

Health models monitor and record standard KPI’s such as uptime/downtime, machine availability, running status or status of needed maintenance.

Fault models provide a ready form of fault tree for identifying the location in a system that a fault or alarm is creating impact. It also assists in drilling down to the root cause of faults.
SUMMARY

A digital APM solution for fixed assets can bring value through greater efficiency and sustainability improvements, reliability-centered maintenance, and higher equipment utilization. As we have demonstrated, the APM models and deployment options are in place to bring together both fixed and mobile asset prediction and maintenance strategies. Leading technology can capture data, provide corrective action guidance, and enable insights on operational improvements that can bring about truly optimized and sustainable operations.
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