Operations Performance Management

A Digital Mine solution
External environments have significantly changed the way mines are operated, and data silos and a lack of standards are preventing plant operators from optimizing efficiency and margin.

Increase revenue and margin by optimizing the performance and throughput of your plants, sites, and portfolio.

If you’re like most mining companies, you need to improve your processes, fleet efficiency, margin, and production output to optimize throughput and recovery. You also need to minimize your energy costs, and do so in a sustainable, compliant manner. But how do you prioritize all these goals? How do you drive analysis and decisions to mitigate risks and achieve the operating improvements you need?

You’ve already invested in data for better decision making.

Yet, problems still persist. Your current systems don’t provide the insight you need to leverage the data in the right ways to obtain maximum performance. You’re not getting the right information, to the right people, at the right time. This analysis gap can consume your people and mine operations. Processes are being operated sub-optimally, and you are not fully optimizing the assets within your plant. Throughput, recovery, and availability are suffering, constraining your operational and financial performance.
Operations Performance Management
Maximize production while balancing costs

Increase revenue and productivity with a complete control-to-cloud optimization solution. Consolidate and track operational and business key performance indicators (KPIs) and optimize process performance in real time to increase throughput, recovery, and efficiency.

Understand your operations from pit to port

GE’s Digital Mine solutions support operational decision making to rapidly respond to changing mining conditions. They provide accurate, clear, and complete situational awareness to help mining professionals maximize outcomes.

Operations Performance Management (OPM) leverages the power of GE’s Predix platform for the Industrial Internet to provide real-time operational intelligence on control, site, fleet, and enterprise levels. It’s an all-in-one, real-time, 24/7 solution that closes your analysis gap by helping you make timely and accurate decisions that balance process performance while optimizing your mine site.

Differentiating features

• Instant access to operations, financial, and regulatory data
• Data-driven mapping to dramatically reduce implementation timeline and cost
• Adaptive cybersecurity solutions to protect data
• Broad and extensive advanced analytics catalog
• Single unified architecture from the sensor to the boardroom

Optimized outcomes

• Increased productivity, efficiency, and recovery
• Better decision making via instant access to your information
• Improved performance and reliability and safer mining practices

The solution provides:

Operational visibility and intelligence—to help you get the most out of your available resources and meet production targets safely and within compliance standards.

Forecasting and What If analysis—to ensure confidence to execute best business outcomes within your mining facility.

Performance optimization—to improve operating results through better process performance, utilization, and planning.

As an example, take a milling circuit. OPM calculates the optimal set points to stabilize and optimize the circuit. The solution monitors the sump pump, electric motor, and gearbox, and maximizes the lining lifetime. The solution can improve throughput from 1 to 10%, within grind quality constraints, while also minimizing specific energy consumption (kWh/t).
## Operations Performance Management offering

### Core capabilities

- Connectivity
- Data management
- Process workbench
- Configurable dashboards
- Process monitoring
- Control loop monitoring
- Quality tracking

### Processes

<table>
<thead>
<tr>
<th>Grinding and Floatation</th>
<th>Leaching</th>
<th>Control Loop</th>
<th>Other processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>(~$0.7 – $1.6M savings circuits/yr)</td>
<td>(~$0.7 – $0.9M savings circuits/yr)</td>
<td>(~$1.5 – $1.8M savings circuits/yr)</td>
<td>(~$0.7 – $1.6M savings circuits/yr)</td>
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<td>- Ore sorting</td>
<td>- Heap leaching</td>
<td>- Proportional-Integral-Derivative (PID) tuning</td>
<td>- Underground productivity</td>
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<td>- Crushing</td>
<td>- Vessel leaching</td>
<td>- Control strategy</td>
<td>- Dryer</td>
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<td>- Thickening</td>
<td>- In-situ leaching</td>
<td>- Sensor maintenance</td>
<td>- Roaster</td>
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<td>- Filtration</td>
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<td>- Actuator maintenance</td>
<td>- Gas treatment plant</td>
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How does Operations Performance Management improve process performance?

OPM is a proven technology that reduces process variability and inefficiency, improves product consistency, increases throughput by allowing operations to push constraints to the limits, and achieves higher return on investment (ROI).

The capabilities within the OPM solution are used for identifying and visualizing abnormal process variations, visualizing causes for process variation in real time, and identifying and visualizing poorly performing control assets. The applications can be configured and customized for optimal use. Customized applications include real-time displays and the use of a unique combination of advanced analytical techniques to properly account for the complexity of any process.

OPM gives you a single, secure way to gather data from your plant and systems, creating a comprehensive and validated data repository. OPM applications provide you a unified, complete, and accurate view of your operations. Once your plant is connected, OPM applications go to work monitoring your operations and alerting you about behavioral anomalies. OPM predicts manufacturing problems before they happen so you can focus resources where they are needed. And when issues do arise, OPM provides comprehensive case and knowledge management to ensure that your best practices are captured and available for future use. The ultimate goal of the OPM solution is to identify strategies to maximize production and minimize $/ton. OPM takes optimization to an entirely new level, providing you the quantitative foundation to implement a comprehensive, financially optimized operations strategy.
Benefits of Operations Performance Management

- Accelerate time to value through a KPI catalog giving complex performance and financial KPI calculations including revenue, process efficiency, and process performance
- Enable analysis of a loss event (production loss or generation availability) and capture the impact, root cause, and remediation
- Provide financial projections for plant and fleet
- Leverage output projection and price curves to project cost, revenue, and margin
- Enable VPs and plant managers to ensure targets are met
- Allow management of all the activities and resources around the outage including workforce, inventory, etc.

- Provide monitoring, recording, reporting, and analysis of the work activities that were executed
- Utilize emissions constraints to ensure that recommended optimized operations do not violate the emissions limits.
- Define financial goals (revenue, profit) to drive the optimization calculations
- Ensure plant operations achieve financial goals

GE software has been deployed hundreds of times. We’re currently monitoring various critical rotary, reciprocal, and fixed assets around the world, across industries, and we can provide references for process optimization in the mining industry. Our depth of experience in large industrial-equipment monitoring and predictive analytics encompasses hundreds of millions of machine hours.
Operational outcomes

1.5% Increase in recovery at a concentrator plant

3.5% Production increase at a roaster

15% Increase in availability of mobile assets

30% Increase in processing capacity of crystallization

2% Decrease in specific energy consumption

$2MM USD savings in maintenance costs

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**DECREASE IN PROCESS VARIATION**

Impala Platinum

40% improvement in pH stability

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**INCREASE IN THROUGHPUT**

Mining company

Increase in average throughput by more than 5.5%

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**INCREASE IN THROUGHPUT**

Lonmin

10% increase in smelter throughput

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**INCREASE IN THROUGHPUT**

Mining company

Increase in energy efficiency

Decrease in specific power consumption by almost 2%

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Check out our Digital Mine video
Customer corner

A mining customer decreases flow variability through flotation circuit by **50%**

**Challenges**
- Inconsistent flow
- Need for manual intervention
- Need to stabilize flow for downstream flotation levels

**Results**
- Decreased flow variability by 50%
- Increased throughput by 5%
- Increased recovery optimization calculations
- Ensured plant operations achieved financial goals

A mining customer increases throughput in milling circuit by **9.75%**

**Challenges**
- Sub-optimal throughput
- Circuit instability and poor grind quality
- Sub-optimal energy consumption

**Results**
- Increased throughput by 9.75%
- Stabilized circuit and consistent grind quality
- Decreased specific energy
Operations Performance Management solution includes Operational Intelligence, Forecasting and What-If Analysis, and Process & Performance Optimization

<table>
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<tr>
<th>Operational Intelligence</th>
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<tr>
<td>Increase efficiency by proactively responding to business KPIs and enabling centralized benchmarking</td>
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<tr>
<td>• Performance &amp; financial KPIs</td>
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<tr>
<td>• System availability</td>
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<tr>
<td>• Benchmarking</td>
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<tr>
<td>• Event calendar</td>
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<tr>
<td>• Audit logs</td>
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<tr>
<td>• Situational awareness</td>
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<table>
<thead>
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<th>Forecasting and What-If Analysis</th>
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<tbody>
<tr>
<td>Scenario analysis and planning to ensure confidence to execute best business outcome</td>
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<tr>
<td>• Financial projections</td>
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<tr>
<td>• Outage planning</td>
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<tr>
<td>• What-if analysis</td>
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<tr>
<td>• Forecasting</td>
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<tr>
<td>• Performance modeling</td>
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<td>• Process troubleshooter</td>
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<th>Process &amp; Performance Optimization</th>
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<tbody>
<tr>
<td>Optimize processes and people balancing revenue, costs, and emissions for your sites and fleet</td>
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<tr>
<td>• Emissions optimization</td>
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<td>• Financial optimization</td>
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<td>• Schedule optimization</td>
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<tr>
<td>• Run-time execution</td>
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<td>• Performance optimization</td>
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<th>Machine &amp; Equipment Health</th>
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<td>Anytime, anywhere, unified view of your assets’ current state and health.</td>
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<tr>
<td>• Connectivity</td>
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<tr>
<td>• Data management</td>
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<tr>
<td>• EAM integration</td>
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</table>

| - Condition monitoring |
| - Data analysis and visualization |
| - Criticality analysis |
| - Event management |
| - Recommendation management |
| - Benchmarking |
Get started today

GE’s Digital Mine leverages decades of experience, cutting-edge data science and analytics technology, and the scale of $1 trillion in managed assets to offer a full suite of solutions powered by Predix, the platform for the Industrial Internet.

Are you ready to increase revenue and margin by optimizing the performance and throughput of your mining plants, sites, and portfolio?
About GE

GE (NYSE: GE) is the world’s Digital Industrial Company, transforming industry with software-defined machines and solutions that are connected, responsive, and predictive. GE is organized around a global exchange of knowledge, the “GE Store,” through which each business shares and accesses the same technology, markets, structure, and intellect. Each invention further fuels innovation and application across our industrial sectors. With people, services, technology and scale, GE delivers better outcomes for customers by speaking the language of industry.

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