C3.ai

Cement and Mining Equipment Manufacturer Reduces Unplanned Downtime with AI Insights

A global manufacturer is a leading supplier of cement and mining equipment such as pumps, crushers, mills, high-pressure grinding rolls (HPGR), and other industrial equipment, with customers in over 150 countries. As a top priority for the company is to ensure customers maximize value from their installed assets, the company provides monitoring and advisory services for in-service assets to help customers improve their operational efficiency and avoid equipment downtime.

Assets such as pumps can cause frequent unplanned shutdowns due to variation in climate, process materials, and operator knowledge. The company historically relied on static dashboards to provide its monitoring and advisory services, using univariate key performance indicators. This approach was manual, difficult to scale, and lacked predictive insights on machine behavior and operational usage.

To enhance the monitoring and advisory services offered to their customers using the industrial equipment, the company

partnered with C3 AI and deployed C3 AI Reliability to predict asset failures, focusing on pumps, crushers, and HPGRs. The application used high precision, AI-based alerts to improve asset performance, increase asset lifetime, and avoid costly unplanned downtime.

C3 AI Reliability enabled predictive maintenance on industrial assets for the company. The machine learning models were proven to be less noisy than univariate sensor monitoring, with significant reduction in false alarms. The application also made asset onboarding 75% faster, allowing the company to quickly scale predictive maintenance to new assets – with customer data scientists able to onboard a new asset, configure, validate, and deploy the predictive model in less than 1 day. With C3 AI Reliability, the company and its end customers can now realize significant economic benefit through improved monitoring and advisory services, and improvement in overall equipment availability.

Project Objectives

- Enable predictive maintenance to accurately predict failures across 4 asset types: pumps, mills, HPGRs, and crushers.

- Integrate and unify data from 62 machines and 2,600 sensors to unlock machine learning insights for customers.

- Enhance monitoring and advisory services to increase asset performance and availability.

- Configure the C3 AI Reliability application to surface AI insights in an intuitive interface.

Results

$25 million+
annual economic benefit through increased adoption of advisory services by customers

87%
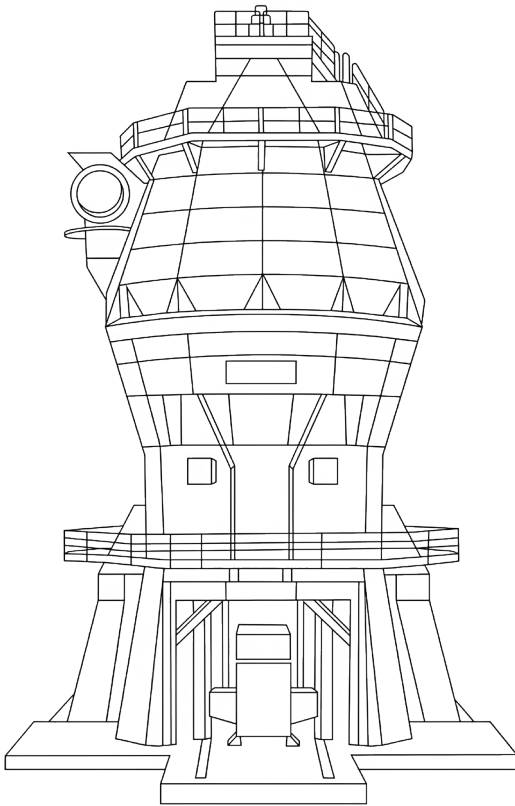precision of true positive alerts from ML model insights

75%+
faster onboarding of assets and deployment of ML models, from 4 days to less than 1 day

Challenges

The manufacturer has customers in over 150 countries, providing thousands of pumps, crushers, mills, and other assets for industrial manufacturing operations. As a value-added service, the manufacturer also tracks machine sensor data to offer technical advisory and monitoring solutions. The company's monitoring teams and subject matter experts provide these services, delivering operational advice and machine condition reports to customers.

However, the existing advising and condition report solutions had several limitations:

- Historical sensor and KPI dashboards had little predictive capability

- Data science and engineering teams required 4 days to onboard and deploy ML models for new assets

- Data science teams had limited ability to add value through additional machine learning experiments, given the time required for asset onboarding and the solution's lack of predictive power

- The monitoring support team lacked tools to deploy and manage live production models at scale or to provide access to end customers who want to use the tools to monitor their machines
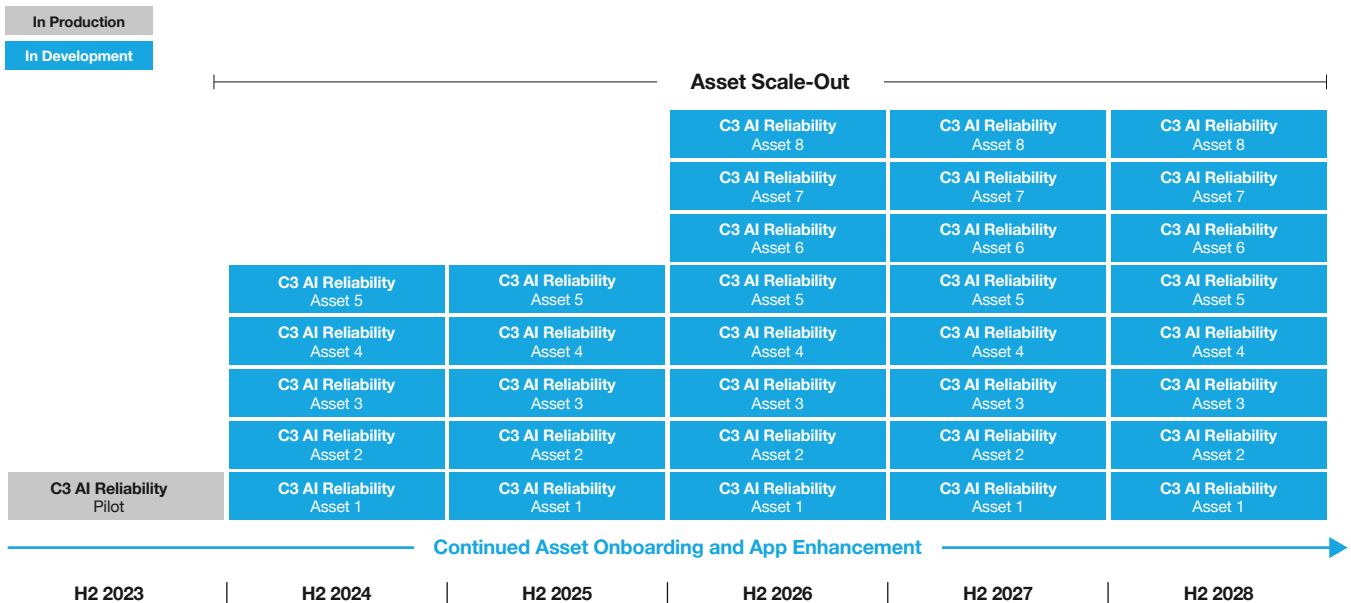
Approach

Over 24 weeks, C3 AI partnered with the manufacturer to configure C3 AI Reliability and enable predictive maintenance across customer operations. The team began by ingesting, cleansing, and unifying two years of historical time series data across four asset classes and 2,600+ sensors. The company uses a Snowflake data lake for sensor data, so the team configured C3 AI Reliability to integrate directly with Snowflake for model training and inferences, as well as plotting and querying data.

After integrating data from the 62 in-scope machines, the joint team performed exploratory data analysis and identified high variability in sensor data. Since the manufacturer does not directly operate the machines it produces, it did not have access to downtime and maintenance data. To address these challenges, the C3 AI team designed a modeling approach based entirely on sensor data. The team applied unsupervised anomaly detection algorithms and validated results with SMEs during development using the application's model feedback user workflows. Over the 24-week project, the data scientists and SMEs collaborated to tailor each ML model based on observed and known characteristics of each machine.

The application enabled the manufacturer to provide early warning of critical failure modes, such as seal failure, improper lubrication, cavitation, and high vibration. Furthermore, C3 AI Reliability provided prescriptive corrective actions and detailed data-driven evidence packages to accelerate engineering troubleshooting and risk management. ML models on pumps and other asset classes demonstrated precision of 87%, defined as the proportion of useful alerts to total alerts.

Finally, the team configured the rich, full workflow-enabled application user interface to visualize AI-based insights, failure risk scores, and time series analytics. Additional custom screens to visualize pump curve plots and further define KPIs and metrics helped the customer to analyze and explore machine performance and efficiency.

The scale out plan for the assets is depicted below, with more assets as well as new categories of assets (such as cones and screens) to be onboarded rapidly over the post Pilot deployment phase.

| In Production |
| In Development |

Asset Scale-Out

		C3 AI Reliability Asset 8	C3 AI Reliability Asset 8	C3 AI Reliability Asset 8
		C3 AI Reliability Asset 7	C3 AI Reliability Asset 7	C3 AI Reliability Asset 7
		C3 AI Reliability Asset 6	C3 AI Reliability Asset 6	C3 AI Reliability Asset 6
C3 AI Reliability Asset 5	C3 AI Reliability Asset 5	C3 AI Reliability Asset 5	C3 AI Reliability Asset 5	C3 AI Reliability Asset 5
C3 AI Reliability Asset 4	C3 AI Reliability Asset 4	C3 AI Reliability Asset 4	C3 AI Reliability Asset 4	C3 AI Reliability Asset 4
C3 AI Reliability Asset 3	C3 AI Reliability Asset 3	C3 AI Reliability Asset 3	C3 AI Reliability Asset 3	C3 AI Reliability Asset 3
C3 AI Reliability Asset 2	C3 AI Reliability Asset 2	C3 AI Reliability Asset 2	C3 AI Reliability Asset 2	C3 AI Reliability Asset 2
C3 AI Reliability Pilot / Asset 1	C3 AI Reliability Asset 1	C3 AI Reliability Asset 1	C3 AI Reliability Asset 1	C3 AI Reliability Asset 1

Continued Asset Onboarding and App Enhancement →

| H2 2023 | H2 2024 | H2 2025 | H2 2026 | H2 2027 | H2 2028 |

Solution Architecture
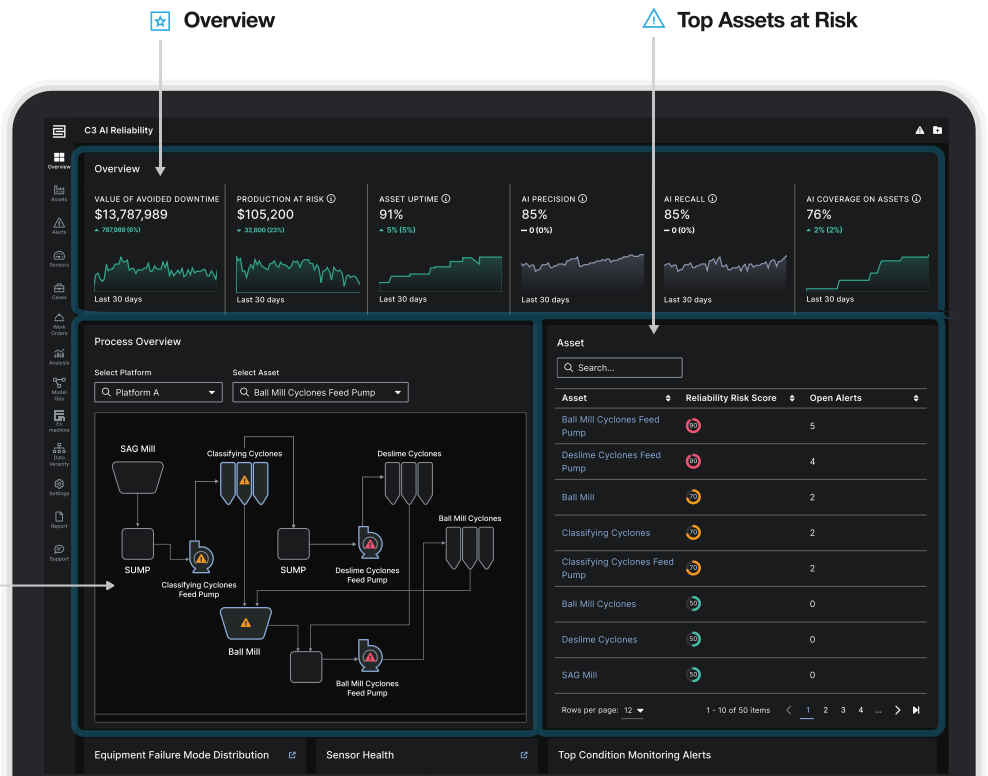

C3 AI Reliability — Solution architecture diagram showing Enterprise Data (Sensor Data, Failure Event History, Operational Instability History, Maintenance History, Asset Configuration, Asset Hierarchy) feeding into the C3 AI Reliability application dashboard with Overview, Top Assets at Risk, and Process Flow Diagram panels.

Benefits

With the C3 AI Reliability application, the global manufacturer can now:

Generate
$25 million in annual economic benefit with enhanced monitoring and advisory services

Onboard
assets 75% faster, in less than 1 day rather than 4 days

Ensure
87% of alerts are useful so operators can efficiently prioritize maintenance activities

Detect
usage anomalies in advance and proactively advise customers on optimal usage

Drive
additional asset and spare parts sales by offering forward looking predictions to pinpoint root cause of failure, including specific component issues

Leverage
AI-based risk scores to guide troubleshooting, reducing operator triage time from days to hours

Monitor
system health and performance in near real time across 8 asset types for customers in 150+ countries

Design
develop, and deploy new AI applications rapidly, including inventory optimization and generative AI to improve troubleshooting

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Proven Results in 8-12 Weeks

Visit C3.ai/get-started