

# Enterprise AI for Biotechnology



## Improve Uptime and Asset Reliability in Biopharma Production

A Fortune 500 biotechnology company, with a wide portfolio of medicines and diagnostics for chronic and life-threatening conditions, set a strategic priority to leverage AI / machine learning solutions to improve manufacturing asset reliability and optimize maintenance costs.

Prior to engaging C3 AI®, production sites relied on conventional systems to monitor a critical biomanufacturing asset, centrifuges. However, site operators were inundated with alarms that captured only a small percentage of failures and provided only minutes of lead time prior to a failure event. As a result of unanticipated centrifuge failures, millions of dollars were lost due to interrupted operations and discarded products. The company searched for an AI-enabled solution

that can predict impending centrifuge failures with more accuracy and more lead time to reduce unplanned downtime and maintenance costs.

In 12 weeks, the C3 AI team partnered with subject matter experts from the biotechnology company to configure the C3 AI Reliability application to monitor and predict impending failures of 3 centrifuges across 2 manufacturing plants.

With C3 AI Reliability, the biotechnology company can predict 93% of impending failures, take preventative action with 48x more lead time, and reduce false alarms by 80%, improving production margins with reduced downtime.

### Project Objectives

- Integrate and unify over 6 years of historical data from 6 disparate data sources
- Apply machine learning to predict centrifuge failures in advance
- Configure C3 AI Reliability user interface to surface AI insights and unified analytics for end users

### Results

**\$60M**

Annual impact potential at scale

**93%**

Shutdowns predicted in advance

**80%**

Reduction in false system alerts

**2+ days**

Actionable lead time

# Challenges

Centrifuges are critical assets in the upstream stage of the biomanufacturing process. As centrifuges harvest the proteins necessary for downstream purification, unplanned centrifuge failures can halt operations and cause plants to miss a production slot entirely, reducing run rates and the number of batches produced. Unanticipated failures can also result in product being discarded from centrifuges, resulting in millions in lost revenue.

In addition to not being able to predict centrifuge failures, site operators at the biotechnology company were inundated with false and inadequate alerts. The existing rules-based monitoring systems produced upward of 60 alerts a month. However, the alerts achieved only recall of 13% and precision of 29%, meaning that 87% of actual failures were not captured and that 71% of alerts were false alarms. Moreover, the current system provided an average of only 45 minutes of lead time before a shutdown, leaving operators with a narrow window for preventative actions.

The existing rules-based system cannot flexibly incorporate new data sources or adjust preset sensor thresholds to improve the accuracy or comprehensiveness of alerts. An AI-led approach would be able to integrate all relevant data sources and apply advanced ML techniques on top of unified data to improve the recall and precision of failure predictions.

To address these challenges and implement an AI-driven approach to centrifuge monitoring, the biotechnology company chose C3 AI Reliability.

# Approach

Over 12 weeks, the C3 AI team worked with subject matter experts at the biotechnology company to configure the C3 AI Reliability application to surface predictive and prescriptive insights for 3 centrifuges.

The team began by ingesting and unifying over 6 years of historical data from 6 disparate systems, including batch reports, work orders, system alerts, sensor data, and deviation reports, to create a unified data model.

The team applied advanced machine learning techniques to the unified data model, experimenting with many proven and state-of-the-art ML approaches and testing over 500 ML model configurations to identify the optimal models for predicting centrifuge failures.

## About the Global Biotechnology Company

- \$60B+ annual revenue
- 15M+ patients worldwide
- 10+ manufacturing sites

## Project Highlights

- 12 weeks from kickoff to pre-production application
- Integrated over 6 years of historical data from 6 enterprise IT systems
- Developed over 300 reusable analytics
- Tested over 500 machine learning model permutations
- Configured C3 AI Reliability application user interface

Finally, the C3 AI Reliability user interface was configured to surface AI-based alerts and prescriptive insights. User-friendly dashboards provide high-level site and asset KPIs, prioritized AI alerts, and details for risk investigation and mitigation.

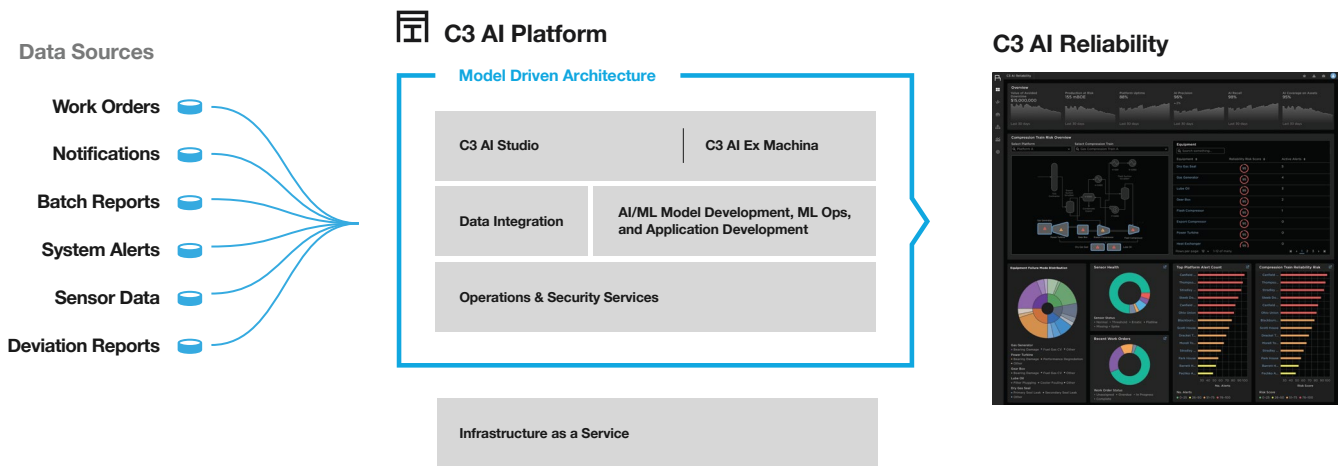
C3 AI Reliability reduced the number of alarms generated by 80%, from 60 to 10 alerts per month; improved the number of impending failures predicted by 80%, from 13% to 93%; and increased lead time by 48x, from 45 minutes to more than 2 days.

# Benefits

With the C3 AI Reliability application, the biotechnology company can:

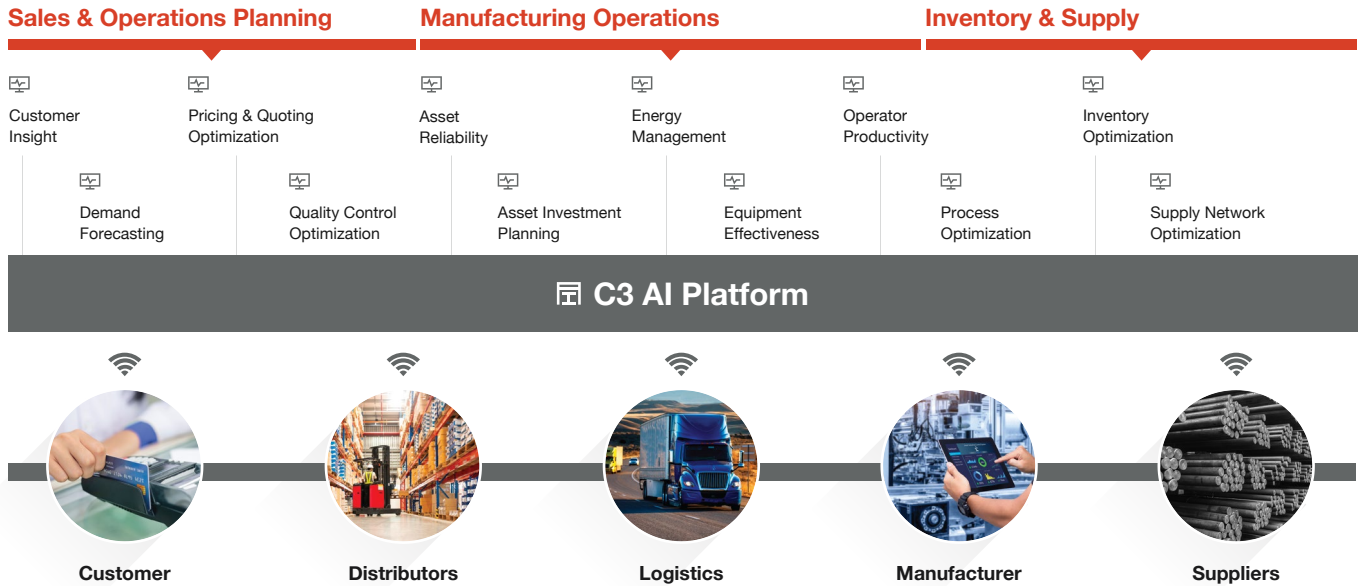
- Reduce unplanned downtime with failure predictions and evidence package for targeted root cause analysis
- Reduce alert noise and improve alert precision with AI-based insights
- Optimize maintenance costs by leveraging prescriptive insights during planned downtime
- Reduce high-risk emergency repairs and improve safety with increased lead time
- Leverage a consolidated view of critical assets by unifying disparate data sources into a single interface

## Solution Architecture



# Enterprise AI for Manufacturing

The C3 AI Platform provides the necessary comprehensive capabilities to build enterprise-scale AI applications 25x faster than alternative approaches. The C3 AI Platform enables manufacturers to rapidly integrate petabyte-scale data from all enterprise and operational systems, sensor networks, and external sources to power machine learning models that generate predictive insights to solve previously unsolvable problems. Many global manufacturers are already using the C3 AI Platform to drive digital transformation efforts, generating hundreds of millions of dollars in economic value annually.



C3 AI manufacturing applications are built on the C3 AI Platform and use AI at scale to provide ever-smarter actionable insights for business-critical challenges. These applications include:

## C3 AI Reliability

Increase operations and equipment uptime by anticipating equipment risks using a system of systems approach. Unsupervised deep-learning algorithms leverage the unified data to identify anomalies and recommend prescriptive actions. Actionable insights increase production, reduce unplanned downtime, and improve safety in operations.

## C3 AI Inventory Optimization

Reduce inventory holding costs, improve cash flow and supply chain visibility, and increase the productivity of inventory analysts. C3 AI Inventory Optimization uses advanced machine learning to analyze variability in demand, supplier delivery times, quality issues, and product line disruptions to build real-time recommendations for users to optimize operations by confidence level and receive real-time notifications and root cause analysis.

## C3 AI Production Schedule Optimization

Optimize planning and scheduling across manufacturing and distribution operations using advanced AI and machine learning. C3 AI Production Schedule Optimization generates dynamic manufacturing and distribution plans and optimal industrial schedules using a holistic view of customer demand, supply chain, manufacturing, and distribution.

## C3 AI CRM for Manufacturing

Grow revenues, maximize customer lifetime value, prevent customer churn, and increase customer satisfaction. C3 AI CRM for Manufacturing unifies all available enterprise and extraprise data and uses advanced machine learning algorithms to prioritize leads, recommend new product offers, detect clients at risk of churn, and drive more accurate revenue and product forecasts.

## C3 AI Process Optimization

Improve throughput and product quality by applying advanced machine learning to complex discrete, batch, or process manufacturing data in order to pinpoint process opportunities to identify defects early on and improve production yield.

## C3 AI Energy Management

Reduce energy costs through real-time tracking, analytics, and optimization. C3 AI Energy Management uses machine learning techniques to enable accurate forecasting, benchmarking, demand response, and anomaly detection to lower costs, improve operations, and meet energy efficiency and sustainability goals.

Proven Results in 8-12 Weeks

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