



## Global discrete manufacturer reduces inventory costs and frees up working capital using C3 Inventory Optimization

A leading discrete manufacturer completed a trial of C3 Inventory Optimization™ and significantly reduced the inventory levels of their purchased parts by 25-35%. Since the manufacturer carries over \$4B in inventory, the ability to reduce inventory at scale drives significant financial benefit for the company.

The manufacturing company operates hundreds of factories globally and makes highly complex industrial equipment. The company allows customers to configure hundreds of individual options, leading to products that have thousands of permutations. The customized nature of the product drives significant complexity in managing inventory levels during the manufacturing process. Since the final configuration of a product is often not known until close to submission of the order for that product, factories often hold excess inventory to fulfill their orders on time.

Like other manufacturers in the industry, the company had deployed Material Requirements Planning (MRP) software to support production planning and inventory management. Prior to engaging with C3 IoT, the manufacturer had also experimented with different commercial inventory optimization software offerings. However, the existing software solutions were unable to dynamically optimize inventory levels of individual parts at scale while managing uncertainty and learning continually from data. Key sources of uncertainty include variability in demand, supplier delivery times, quality issues with items delivered by suppliers, and production line disruptions.



### About the Global Manufacturer

- **Manufacturing locations in 6 continents**
- **\$4+ billion** in inventory
- **150+** product lines
- **50,000+** employees



### Project Highlights

- **Developed C3 Inventory Optimization in 10 weeks**
- **3 years of historical data** on production orders, bill of materials (BOM), reorder parameters and movement events of parts within factory
- **42 individual files** across **11 legacy source systems**
- **9 million rows** of data



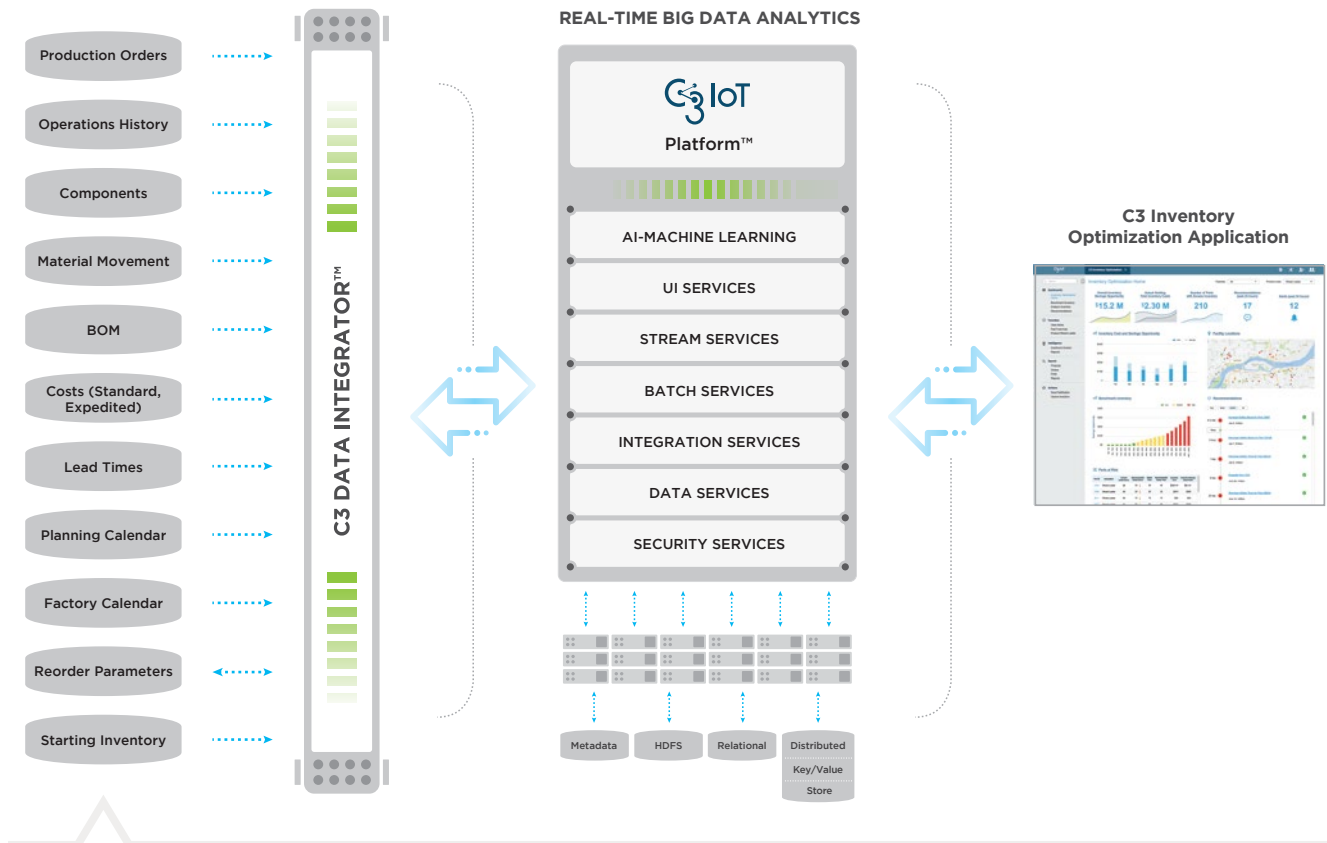
### Results

C3 Inventory Optimization was able to identify **25-35% savings** in inventory holding costs for the manufacturer

In order to manage these uncertainties, analysts at the company consistently maintained excess inventory levels. Their decisions were driven primarily by historical challenges with shortages and unclear expectations regarding service levels. The analysts' behaviors resulted from a lack of tools to help them make informed decisions about inventory levels.

In order to provide the right tool to the analysts, the customer selected C3 IoT for a twelve-week trial of C3 Inventory Optimization to dynamically optimize inventory levels for each part, given uncertainty in demand and supply. The focus of the trial was on one product line at one factory, with the understanding that if C3 IoT optimizes inventory levels for one product line, then the solution would readily scale for other product lines and factories.

## C3 Inventory Optimization Leveraging the C3 IoT Platform



### Data Integration and Processing Effort

- Processed 42 individual files from 11 different source systems
- Loaded 9 million rows of data, including 32 part movement files
- Represented 3.2 million movement events within the manufacturer's facilities

C3 Inventory Optimization was developed on the C3 IoT Platform since the latter provides a number of benefits while developing, deploying, and operating big data machine learning applications.

- All data and compute are managed through a metadata-based object model representation – the C3 Type System, providing a unified federated image
- The C3 Type System enables the C3 IoT team to rapidly load data, identify data issues and resolve those issues through quick iterations.
- The C3 IoT Platform also has native support for time series data, allowing the team to load data with different time intervals – but then group them and analyze them in a consistent way without having to write any code

Over the course of the trial, the C3 IoT team accomplished the following:

- Received, loaded, and processed data corresponding to production orders (actuals and planned), product configurations, bill of materials, part movement events (e.g., arrival of parts from suppliers, consumption in a production line, intra- and inter- facility shipments), historical settings of reorder parameters, lead time and shipping costs from suppliers
- Developed fifteen canonical transforms using the C3 Type System to map fields from the input data sources into a unified data image
- Created a unified object model using the proprietary C3 Type System to represent all the inventory data
- Recreated historical inventory levels of individual parts by processing the various movement of parts from the point of arrival from suppliers to the production line at the factory
- Developed an algorithm to compute part-level demand forecasts based on production orders and assemblies, and by traversing multi-level, time-varying BOM files
- Iterated several times with the customer to address data issues
- Developed a stochastic optimization algorithm to dynamically optimize inventory levels
- Configured the application user interface to provide actionable insights to users to help them reduce inventory holding costs

100+

**analytics applied**

60+

**analytics applied on daily input data**

40+

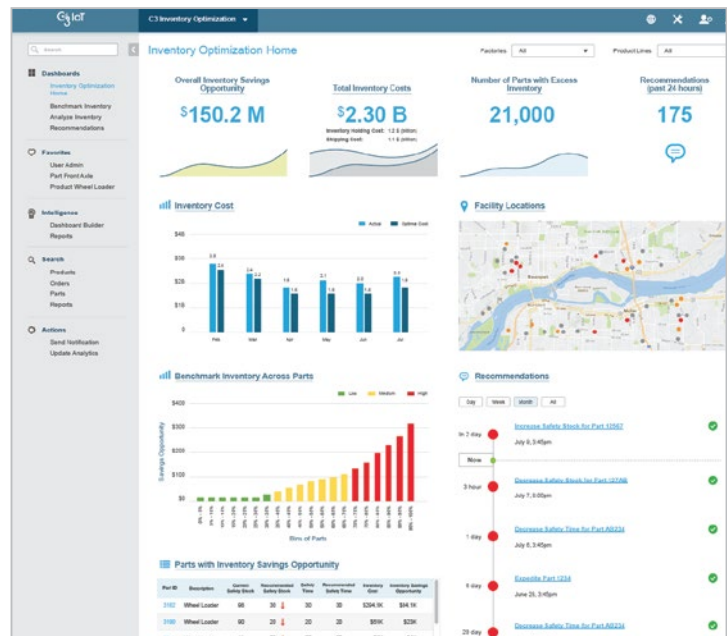
**analytics applied to optimization**

## Optimize Inventory by Dynamically Changing Reorder Parameters

C3 IoT developed an algorithm that is dynamically able to optimize reorder parameter levels (e.g., safety stock, safety time) and at the same time, avoid stock-out of parts at a specific confidence level.

C3 Inventory Optimization leverages machine learning and a stochastic optimization algorithm, and has the ability to:

- Learn several real-world uncertainties in input variables such as variability in demand, supplier delivery times, quality issues with parts delivered by suppliers, and production line disruptions
- Optimize reorder parameters dynamically and continually, and minimize inventory holding and shipping costs for each part
- Optimize inventory at different confidence levels that are based on service level agreements with customers



# Results

identified

25-35%

savings

savings of

\$100-200M

annually

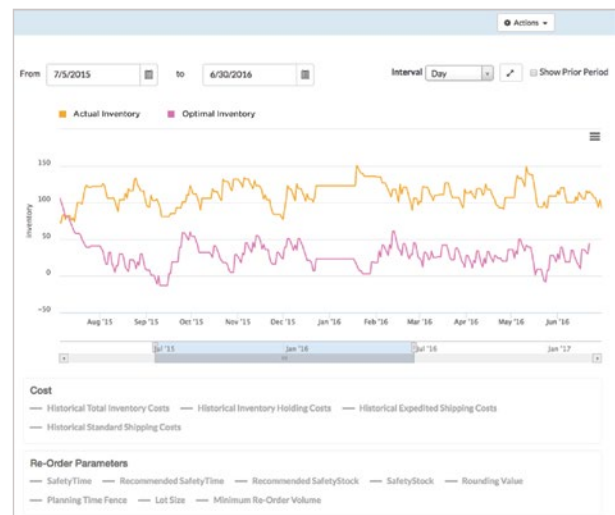
The results, in terms of savings from inventory holding costs, far exceeded the customer's expectations. Through the trial, C3 IoT was able to identify 25-35% savings in inventory holding costs. This represents savings<sup>1</sup> of \$100-200 million annually when scaled across the customer's locations.

Besides the savings in inventory holding costs, C3 Inventory Optimization provided several additional benefits to the customer:

- Improved visibility of inventory levels: C3 Inventory Optimization provided Supply Chain Managers and Executives comprehensive, consistent visibility into inventory metrics including actual and optimized inventory costs, total inventory savings opportunities, and a number of actionable recommendations by location. Supply management teams are better able to understand supplier performance, tradeoffs between reorder parameters, and their impact on suppliers.
- Alignment across organizational silos: C3 Inventory Optimization not only reduced inventory-related costs but also helped align organizational silos (e.g., materials management, supplier management, and logistics management) and provided a unified view of optimal reorder parameters and inventory levels for all departments within the supply chain and operations organizations. Such a unified view is very time-consuming and costly to generate using the customer's current systems.
- Productivity improvement: Due to reduced inventory in warehouses and staging areas, analysts needed to spend less time tracking and managing parts, leading to increased productivity by being able to focus on higher value-added activities.

- Identification of additional insights: The customer attests to C3 IoT uncovering key insights in their inventory data that they have suspected for years, but were never able to verify. Examples of such insights are:

- Understanding exactly how supplier "lock-in periods" during which orders cannot be changed adversely affect inventory levels
- Determining the extent to which various safety parameters compound to have a cascading impact on inventory levels
- Realizing the negative impact of unplanned miscellaneous material movement events (e.g., interdepartmental transfers, loss of materials due to quality issues) on inventory levels



<sup>1</sup> Savings calculation is based on the difference between actual and optimal daily inventory holding cost. Daily inventory holding cost is calculated by applying the company's weighted average cost of capital (wacc) on daily inventory levels.



## PROVEN RESULTS IN WEEKS, NOT YEARS

Complete a low-cost, low-risk production trial of the C3 IoT Platform in just 4-16 weeks. Validate the economic value and other benefits to your organization before expanding into full production use. For more details, visit [c3iot.com](http://c3iot.com).