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CASE STUDY

Transforming Vaccine Supply Chain with Accurate Demand Forecasting

A leading global biopharma company provides vaccines and medicines that improve the lives of billions of people. The firm aspires to be a leader in innovation, enabling humanity to get ahead of disease.

Supply chain management in biopharma is complex with many layers of healthcare supply, various distribution channels and stringent compliance standards. To transform its supply chain and make it more efficient and resilient, the company started by focusing on improving its demand forecasts.

Forecasting vaccine and medication demand is extremely challenging because they have complex underlying demand profiles. It is even more challenging to forecast "sell-in" demand (including from wholesalers) that obfuscates demand with many layers of supply and distribution channels. Forecasting at a longer time horizon to meaningfully production and logistics is also incredibly challenging due to macroeconomic factors involved. Without accurate forecasts, the company saw increased costs from inefficient supply planning, resource misallocation, and higher inventory holdings. It also hindered their ability to serve patients effectively and on time.

Before engaging with C3 AI, demand planners generated statistical forecasts using only historical data. Then, they leveraged their expertise to manually adjust them. Each market had its own forecasting process, causing inconsistent forecasting process and low accuracy.

The firm partnered with C3 AI to deploy C3 AI Demand Forecasting, starting with the top three biggest markets. This included 450+ SKUs covering ~50% of their vaccine revenue. In the first 6 months, C3 AI configured the application to provide accurate forecasts at SKU-market-distribution channel level, leveraging internal data (that are fully virtualized from company's internal data lake) and external data sources.

With C3 AI Demand Forecasting, the firm improved its forecast accuracy by 20% compared to the baseline statistical forecasts. The AI forecast accuracy was also 4% higher than the adjusted forecasts performed by dozens of subject matter experts (SME). This accuracy uplift directly translates to $20 million potential inventory reduction annually for the three markets.

The company plans to deploy C3 AI Demand Forecasting for all products across 20+ markets within 6 months. They also plan to deploy other C3 AI Supply Chain applications, such as C3 AI Inventory Optimization, to continue their supply chain transformation journey.

Project Objectives

- Improve forecast accuracy to reduce inventory cost and vaccine write-offs due to expiration
- Drastically reduce time required by demand planners to manually adjust statistical forecasts
- Configure the C3 AI Demand Forecasting application with AI explainability for demand planners and modelers to increase their trust in AI forecasts

Results

20%

increase in forecast accuracy versus baseline statistical forecast

$20M

annual inventory reduction potential

4%

increase in forecast accuracy versus internal adjusted forecasts performed by SMEs

Challenges

Given the intricate nature of vaccine supply chains, an accurate demand forecast is imperative for efficiently planning complex production, inventory, and logistics processes. However, the firm's statistical forecasting approach fell short of this requirement. The firm had to manually adjust its statistical forecasts in a time-consuming manner, with teams of demand planners modifying the forecasts using their expertise. Forecasting process is also differently performed across markets. Despite the complicated and inconsistent process, the accuracy increases from manually adjusted forecasting were not sufficient and scalable across 16 product groups, 20 markets, and various global distributors.

Suboptimal demand forecasts resulted in higher inventory holding costs, misalignment in resource allocation and millions of vaccine doses written off annually. It also hindered the company's ability to effectively and timely serve its patients.

The company struggled to uplift its demand forecast accuracy due to multiple reasons:

- Complex underlying demand profiles (seasonal, erratic, etc.) of vaccine products for different types of diseases.
- Obfuscated demand from multiple layers of supply and distribution channels, making it difficult to forecast "sell-in" demand.
- Current forecasting approach relying only on historical data, not external data such as wholesaler inventory and sales or market insights.
- Inability to perform forecasts at SKU-market-distribution channel level to factor in different market/distributor-specific demand behaviors.
- Vaccines and medicines are at different stages of the product lifecycle (introduction, growth, etc.), further complicating the forecasting process.

About the Company

- $45 billion annual revenue in 2023
- 80,000+ employees globally
- 2 billion packs of medicines and vaccine doses delivered in 5 years

Project Highlights

- 26 weeks from kick-off to production-ready application
- 10+ internal and external data sources ingested
- Best-fit AI models configured and tested for 13+ segments across 450+ SKU-market-distribution channels
- Accurate forecasting for up to 12-month time horizon
- Configured the C3 AI Demand Forecasting application user interface

Approach

The firm partnered with C3 AI to configure and deploy C3 AI Demand Forecasting in 6 months to improve forecast accuracy for its vaccine business.

The team started by ingesting, cleansing, and unifying 10+ data sources into one image based on the C3 AI Supply Chain Digital Twin. These data sources include internal data, such as sales orders, daily finished inventory, and customer records; and external data, such as wholesaler inventory and sales and market insights. All data sources were fully virtualized from the firm's internal data lake.

The C3 AI team then grouped the 450+ SKU-market-distribution channel combinations into 13 segments with distinct demand profiles. The C3 AI team tested the C3 AI library of 50+ ready-to-use ML models to tailor them for each segment. They ran over 100 experiments to automatically identify the best-performing odel for each segment.

Incorporating all available data, auto-segmentation, and automatic identification of best-performing models helped the customer factor in industry/market-specific insights into demand patterns, product

lifecycles, and seasonality at a granular level to significantly improve forecast accuracy.

To increase trust and user adoption of the C3 AI Demand Forecasting application by the demand planners and data scientists, C3 AI configured detailed evidence packages that provide feature contributions and explains key drivers behind each AI forecast. Users can review, overwrite, and accept AI forecasts via an intuitive user interface. The accepted or overwritten forecasts are written back to the company's existing ERPs and planning systems using bilateral connectors. This process ensures a seamless user experience.

Solution Architecture

C3 AI Demand Forecasting

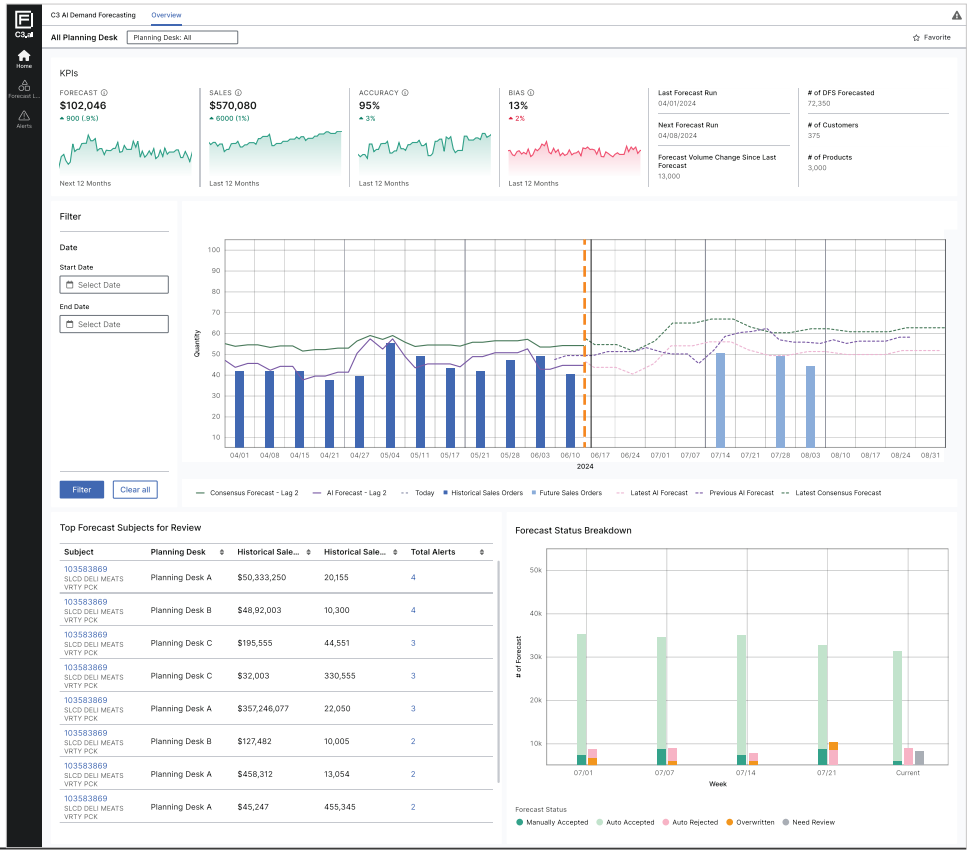
Enterprise Data

Internal Data

- Demand Forecasts
- Sale Orders
- Invoiced Sales
- Shipping Documents
- Daily Finished Inventory
- Customer Data

External Data

- Wholesaler Inventory
- Wholesaler Sell-out
- Market Insights



Benefits

By using the C3 AI Demand Forecasting application, the company can:

Increase

forecast accuracy by 20% versus the baseline statistical forecast and 4% versus the manually adjusted forecast by demand planners.

Reduce

inventory holding costs by $20 million annually.

Save

time for top demand planners from manually reviewing and adjusting forecasts to focus on other high value activities.

Unify

the data from 10+ disparate systems that are fully virtualized from the company's internal data lake and external data.

Scale

AI applications quickly across products and markets (20+ markets in 6 months).

Expand

quickly to other C3 AI Supply Chain applications leveraging C3 AI Supply Chain Digital Twin.

Proven Results in Weeks

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