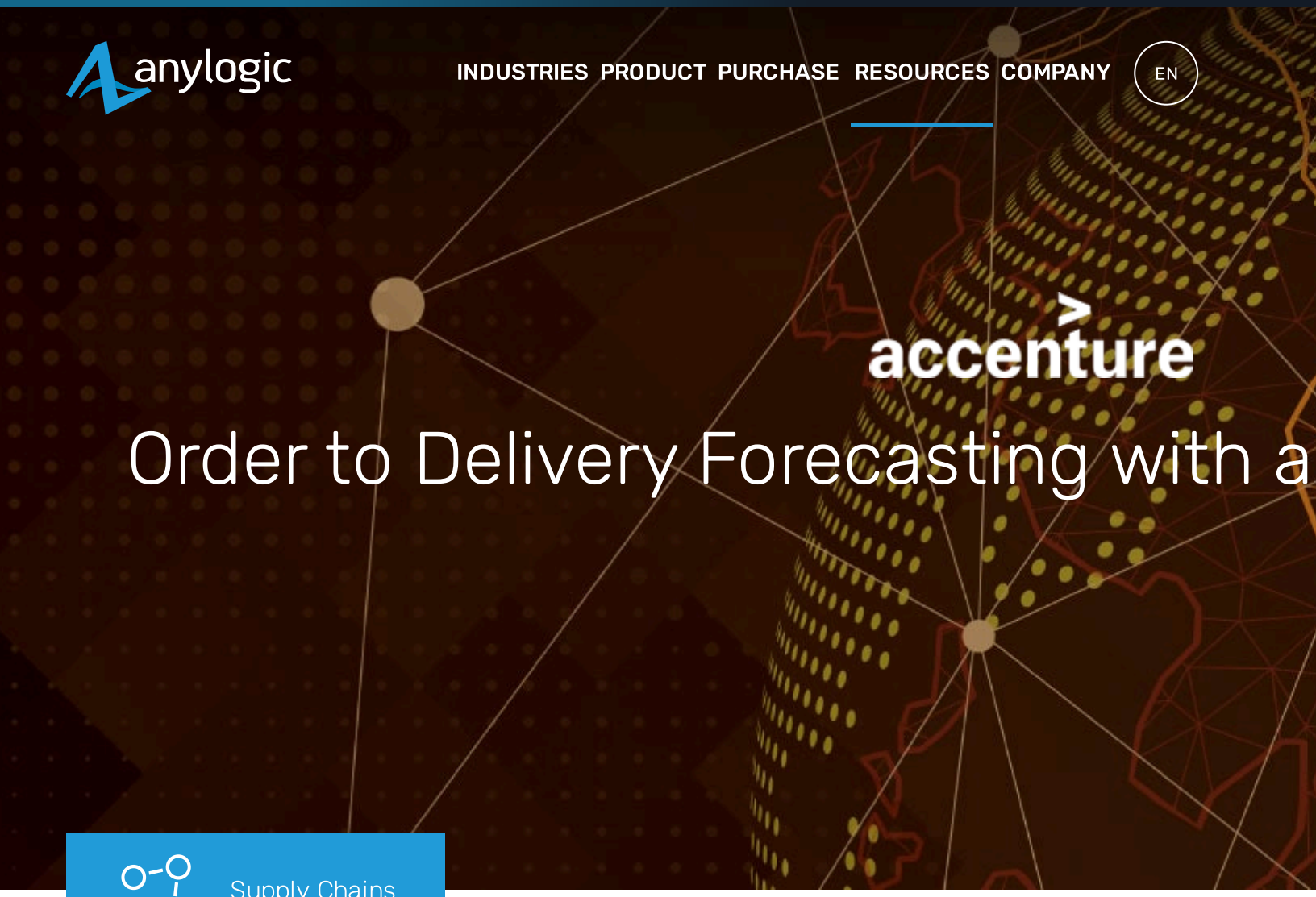


Order to Delivery Forecasting with a

Supply Chains

Accenture's Applied Intelligence HSA team delivered an Order to Delivery (OTD) forecasting system for a US-based exercise equipment brand that was affected by COVID-19 related supply chain disruptions. The forecasting system, based on a supply chain digital twin, increased OTD forecasting accuracy by 57% and reduced costs by 20%.

The OTD forecasting system, its results, other improvements, and development plans are detailed in

automation under a bold strategic vision to transform business across every function and every process, at scale.

Problem: Avoiding long order to delivery times

The client wanted to predict supply chain behavior and enable intelligent execution for its exercise bike supply chain in the United States of America.

During the COVID-19 pandemic, demand for exercise bikes grew significantly and caused order to delivery (OTD) times to increase from five days to sixty days. The challenge was to reduce the OTD time and improve planning.

Five main questions needed answering and they fell into two categories:

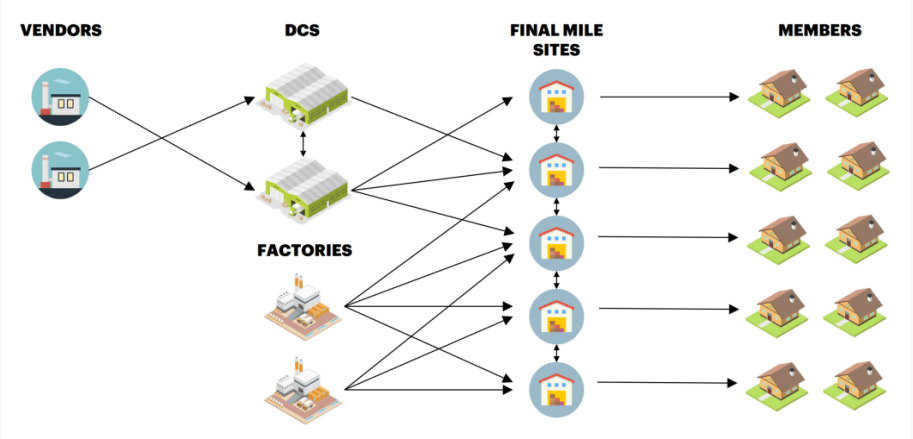
1. Planning
    - What is the expected OTD time for any given new order within the planning horizon?
    - What throughput should we expect through any given location within a 12-month planning horizon?
    - What is the expected inventory at any location?

2. Execution
    - What inventory levels should be fulfilled and from where?
    - Should inventory arriving soon at a port be rerouted to different DCs given the latest delay status?

this approach created extra challenges and meant working closely with the client to ensure buy-in.

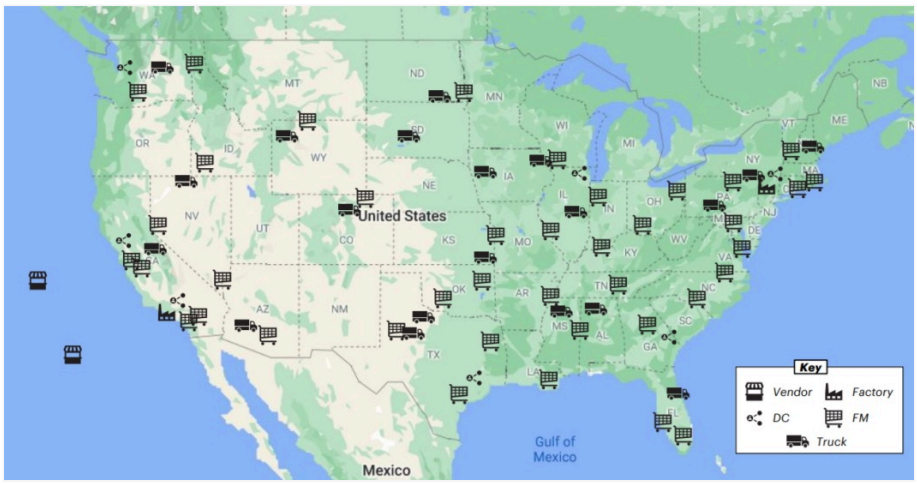
The supply chain solution focused on predicting OTD times, to help reduce them, and providing a basis for a smart inventory-allocation solution, to improve planning. By creating a digital twin as the solution, it is possible to understand why something is happening and ask what-if questions. A digital twin is a dynamic model of a system based on real-world data that can be inspected and observed in operation — the reason for results and behavior can be seen and explained.

The team chose to use AnyLogic simulation modeling software for constructing the digital twin because of its flexibility and machine learning integrations, which they planned to use later. In AnyLogic, the team replicated the entire supply chain from vendors, through distribution centers (DC), to final-mile sites using discrete event modeling.



The entire supply chain structure: from vendors, through distribution centers (DC), to final-mile sites (click to enlarge)

1. **Orders:** order creation date, product, node, order delivery date.
2. **Nodes:** location, type (vendor, DC, final-mile), inventory, processing time.
3. **Trucks:** capacity, leadtime.

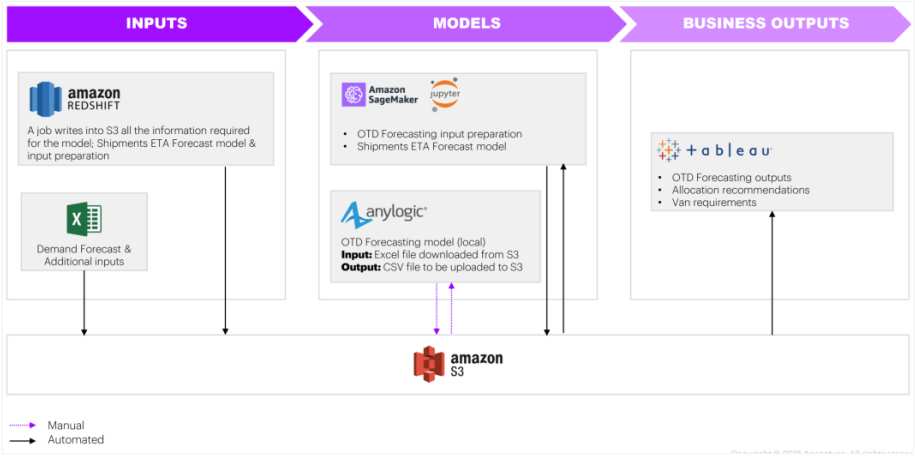


Map of nodes in the supply chain digital twin (click to enlarge)

The digital twin of the supply chain had a forecast range of one day to one year. Running Monte Carlo simulations on the model in the digital twin provided forecast ranges for OTD times. For each set of simulation runs the model required key inputs and provided key outputs:

Key inputs: location master, inbound/outbound location capacity, inventory position and backlog, target days-of-supply, lead times between nodes, demand forecast, production forecast

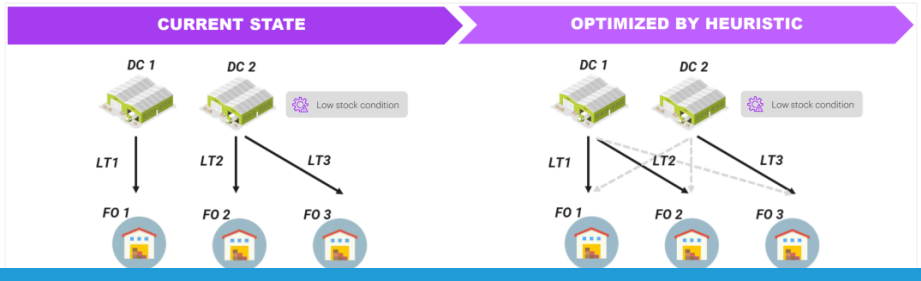
Key outputs: forecast OTD, final-mile order backlog, inventory position by network node, resource utilization (trucks)



Information flow diagram for the supply chain digital twin (click to enlarge)

The digital twin was configured with the supply chain's current state and verified. It showed the expected behavior and identified where improvements could be made.

After testing and analysis of the original state of the supply chain, the team used the supply chain model to heuristically optimize supply chain operations. Variables such as required inventory and safety stock were no longer fixed by network-wide rules. Also, parent replenishment DCs could be reassigned depending on the needs of final-mile sites.



supply chain digital twin

For the focus areas of OTD prediction and smart inventory allocation, the expected benefits of the supply chain digital twin initiative were significant. Respectively, an increase in accuracy of 57% for order to delivery forecasting and a 20% cost reduction for inventory allocation logistics costs.

Additionally, the expected accuracy of the estimated time of arrival for leads increased from 40% to 76%.

These results came from a thirty-minute simulation that only needs to be run once a week.

The project was not without challenges. There was resistance to using a digital twin from teams at the client. To overcome this resistance, it was necessary to work closely with the concerned parties. The visibility into the dynamic behavior of supply chain operations and the extra possibilities enabled by a digital twin helped gain support for the decision to use the approach.

Other challenges related to missing data and undefined logic. Because of the decision to use a digital twin approach, it was possible to overcome these challenges with assumptions.

Now, the digital twin will form the core of the supply chain, with the result that decision making can be holistic and more informed. Next steps include the integration of reinforcement learning to further help with optimization and planning for black-swan events. And, as the digital twin is built upon, it is envisioned that its capabilities will become applicable at all organizational levels: strategic, tactical, and execution.

page.

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