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ITC INFOTECH

Inventory Management and Optimiz
Manufacturing Comp

Supply Chains

Manufacturing

Warehouse Operations

ITC Infotech is an international provider of technology services and solutions across a variety of industries, including banking, healthcare, manufacturing, FMCG, supply chains. Using simulation and optimization techniques, as well as advanced analytics, they develop solutions for such problems as network design and planning, inventory planning, scheduling, and

Problem: Inventory management and optimization in FMCG

Fast-moving consumer goods (FMCG), also called consumer-packaged goods (CPG), refer to products that sell quickly at a relatively low cost. Some FMCGs, like beverages and food, do not stay on shelves for long because they are in high demand, perishable, or both. To mitigate this quick turnover challenge, companies are constantly searching for new inventory management solutions.

A global manufacturing leader was interested in optimizing its food product inventory management process with regards to the complexity of its multi-echelon distribution network.

The problem the company faced was high deterioration of product quality and a less-than-expected fill rate. It could have manufactured more to increase the fill rate, but that would lead to higher deterioration. Alternatively, it could have manufactured less, to keep deterioration low, but that would also lower the fill rate. To solve this challenge, they approached ITC Infotech to find an optimal production quantity and frequency, as well as an optimal replenishment policy.

Solution: Building a simulation model to optimize the production quantity

To plan production and calculate how many days a manufacturer can keep the product in its inventory before shipping it to the retailer, ITC used a **shelf-life factor**. This factor is a ratio of the number of days a manufacturer can keep a product in its inventory to the period for which a product should be delivered to the retailer. For example, at a factor of 0.6, the producer will have 42 days (0.6 of 70 days) to store the product before shipping to the retailer.

ITC specialists aimed at calculating this shelf-life factor for every stock-keeping unit (SKU), as well as optimal production quantity to avoid product quality deterioration. Also, their goal was to determine replenishment and production frequency while maintaining maximum fill rate. For that, they decided to build a simulation-based optimization model in AnyLogic and test different scenarios.

Brief overview of the simulation-based inventory optimization model

A multi-echelon distribution network typically consists of a factory, a warehouse, and several distribution centers.

In this inventory simulation model, the specialists considered two agent populations: a **factory** and a **distribution center**. They also defined several agent types, including **shipment** (shipping goods from the factory to distribution center), **demand**, and **batches** (a certain number of identical products).

A **distribution center agent** responds to demand and calculates a **fill rate** based on how much demand has been satisfied. This in turn helps determine the **service**

The distribution center agent receives batches from the factory agent, processes them, and then stores them in inventory. Food products in the inventory that are not sold, because there was no demand for them, deteriorate. The model considered this information when calculating **product quality deterioration** for the distribution centers as well.

iteration num	sku id	shelf-life factor	deterioration	fill rate
1	10614000	0.5	0	99.55
2	10614000	0.6	10720.82	99.57
3	10614000	0.7	17132.76	99.57
4	10614000	0.8	23107.56	99. 78
5	10614000	0.9	33777.45	99. 86

Output data: shelf-life factor and fill rate (service level) interdependency.

Result: Benefits of the simulation-based inventory optimization model

After executing multiple simulation model runs with different shelf-life factors, ITC specialists found the optimal shelf-life factor for each replenishment policy. They also determined a production frequency that

Using the simulation results, ITC plotted a curve that represents the interdependency between the fill rate and product quality deterioration.
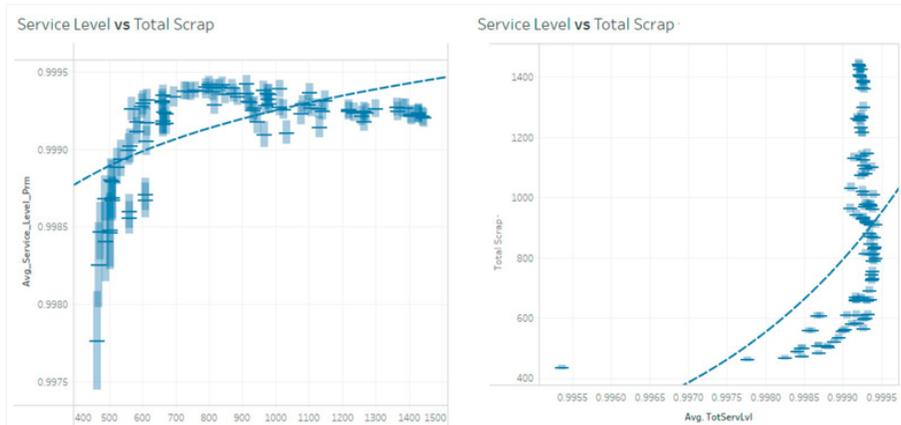

A curve representing the interdependency between the fill rate and deterioration (click to enlarge).

ITC also provided the spread of the value obtained over the 100 model runs for each of the shelf-life factors, as can be seen on the right side of the below diagram. It helped the business to decide on the optimum shelf-life factor.
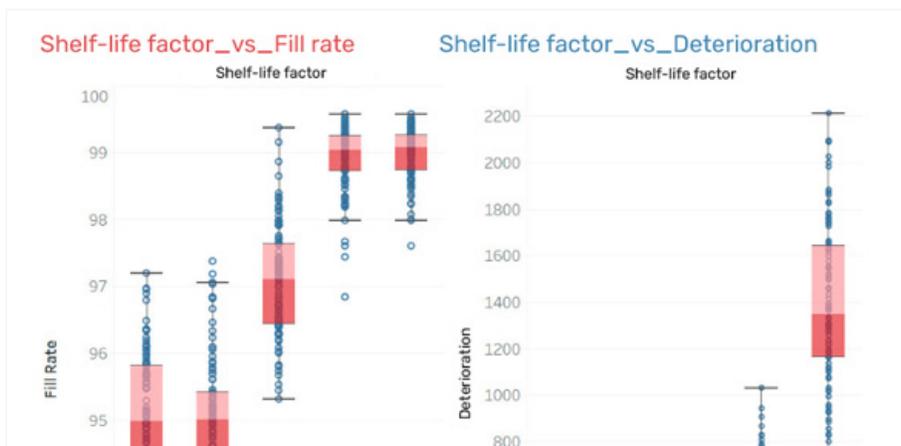
model runs for each of the shelf-life factors (click to enlarge)

ITC Infotech presented the project at the AnyLogic Conference 2021:
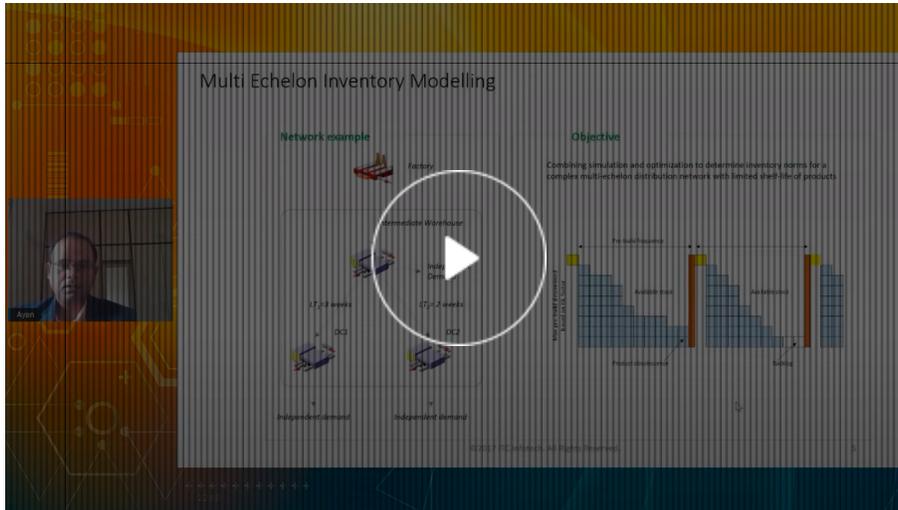
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