Supply chain planning and inventory management | Retail | Inventory management / control | Constrained / Unconstrained

Ship-pack replenishment optimization in a two-echelon distribution system

BUSINESS PROBLEM

As a retailer leverages a two-echelon distribution system to forward-deploy inventory, an important consideration that is often overlooked is the elevated processing costs related to sending single units instead of units packed in full cases to the forward deployed node. For seasonal retailers, there are also large obsolescence costs associated with products that reach the end of their life-cycle and have not yet been sold. The goal of this work is to develop a cost-optimal replenishment strategy with high inventory productivity that takes into consideration all end-to-end supply chain costs associated with forward deployed inventory.

DATA SOURCES

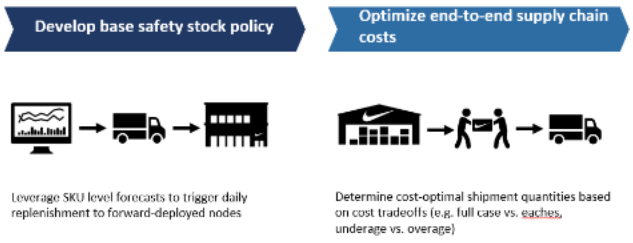
The majority of data was queried using SQL within Nike's database environment. Data includes: - Daily demand data at the individual consumer and SKU level - Daily on-hand inventory data at each Nike distribution center - Full case quantities by SKU Additional cost data was gathered from key stakeholders across the supply chain organization in the form of Excel and powerpoint files,

Data Types and Format

Time series data, static cost estimates

APPROACH

A simulation model was developed to determine the impact of a new replenishment model that leverages the mechanics of a base safety-stock policy. Once the simulation model confirmed improved supply chain performance, the policy was implemented in Nike's North America supply chain. Lastly, a cost optimization model was built to minimize end-to-end supply chain costs.



IMPACT

The new replenishment policy significantly improves inventory productivity and relieves supply chain capacity constraints in the overall network. The cost optimization model finds that an optimal replenishment policy can lead to between 2.7% - 4.1% savings relative to a baseline replenishment policy that replenishes eaches. A sensitivity analysis is also conducted on cost inputs to show the impact of optimal replenishment decisions if the retailer's cost structure is impacted. The cost input change is formulated as an internal carbon tax that would significantly impact transportation costs. The sensitivity analysis concludes that the optimal replenishment policy consistently yields 0.7 - 1.8% savings as costs are varied.

DRIVERS

The dramatic growth in e-commerce sales and need for social distancing measures in distribution centers, driven by COVID-19, led to significant processing capacity constraints in distribution centers across the supply chain. Coupled with consumers' desire for faster delivery times, the supply chain needed to become more efficient to meet demand.

BARRIERS

Large number of stakeholders across many divisions of the organization, need for communication across technology, data science, and operations teams to implement solution, urgency due to constraints placed on the supply chain by COVID-19

ENABLERS

Knowledgeable data scientists to assist with data pulling and data field interpretation from disparate data sources. Dedicated data engineers to help with solution implementation within IT systems. Weekly cross-functional meetings that enabled collaboration across the organization.

ACTIONS

Built simulation model to understand potential impact of solution. Created interactive dashboard to visualize results and align on solutions with senior leadership. Worked side-by-side with data scientists and engineers on the team to transfer ownership of code and broader model architecture.

INNOVATION

The model developed an intuitive algorithm that could be easily explained to stakeholders and was understood by both technical and non-technical audiences. It also pulled together data from disparate databases within Nike's data platform and centralized the data in one location for ease of use.

IMPROVEMENT

Over 2x increase in inventory turns at regional DC, estimated 2 - 4% cost savings across Footwear and Apparel.

BEST PRACTICES

Socialize solution with all key stakeholders early and often, communicate results via intuitive dashboards, develop production level code that optimizes run-time.

OTHER APPLICATIONS

The solution can be applied to assess the optimal full case quantities that retailers should require from their suppliers to minimize end-to-end supply chain costs.