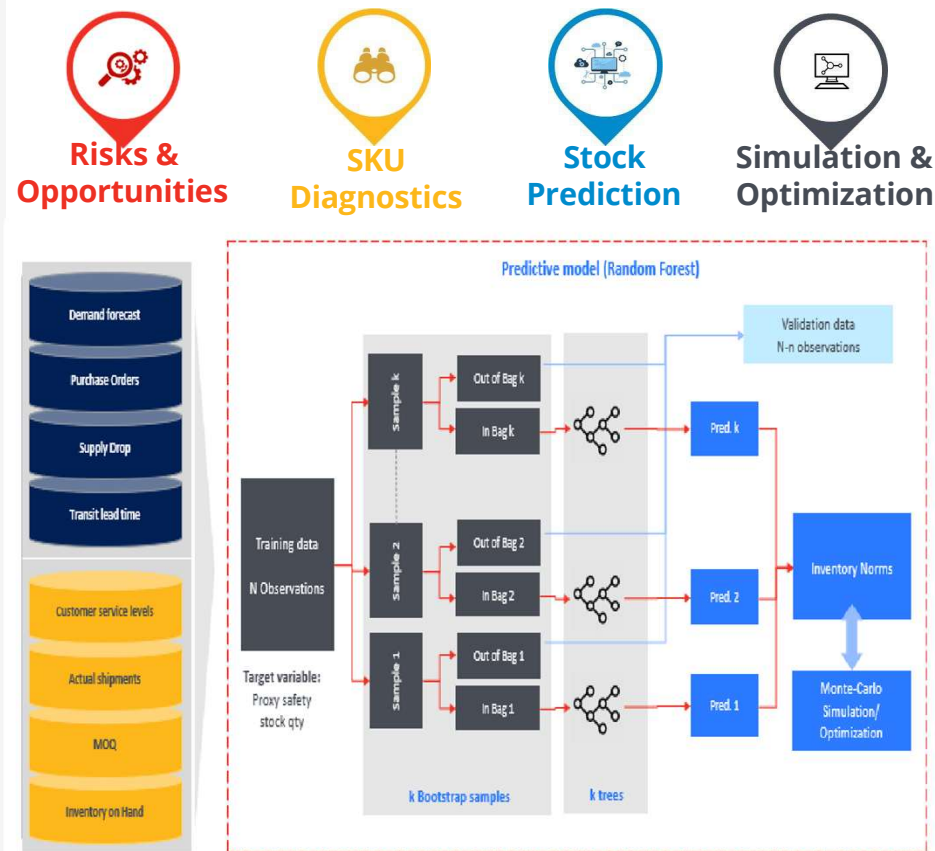fractal

SafeStock - Inventory Optimization Solution

Our SafeStock solution approach for inventory optimization

Business problem

- High Inventory : High Carrying Costs, Increased Risk of ageing , scraps.

- Inaccurate safety stock : No Protection against stock-out situation , Unable to handle demand volatility

- Liability of blocked working capital, Low customer satisfaction scores and lost opportunity.

- Traditional statistical approaches only focus on achieving target service level , not flexible to accommodate more supply chain variables.
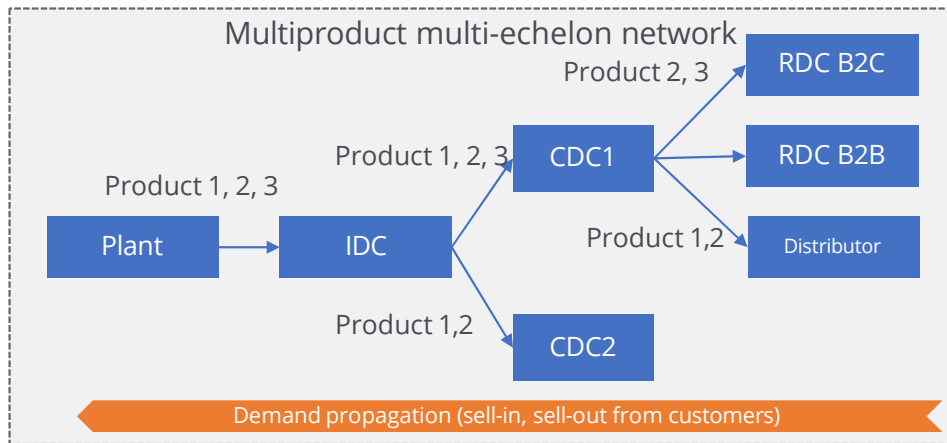
Solution Construct

Risks & Opportunities   **SKU Diagnostics**   **Stock Prediction**   **Simulation & Optimization**

Predictive model (Random Forest)

Demand forecast · Purchase Orders · Supply Drop · Transit lead time

Customer service levels · Actual shipments · MOQ · Inventory on Hand

Training data — N Observations

Target variable: Proxy safety stock qty

Out of Bag k · In Bag k · Pred. k · Sample k
Out of Bag 2 · In Bag 2 · Pred. 2 · Sample 2
Out of Bag 1 · In Bag 1 · Pred. 1 · Sample 1

Validation data — N-n observations

Inventory Norms

Monte-Carlo Simulation/ Optimization

k Bootstrap samples · k trees

Features/ Capabilities

- Flexible & Customized : The model can be tuned to maximize service level or minimize inventory as req.

- Learns from historical data for accurate predictions

- Explore hidden patterns from the data to identify pain points and opportunity areas for the business to deep dive for SKU diagnostics.

- Simulating Capabilities: Flexibility to simulate multiple business scenarios with ease , user-friendly tool.

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SafeStock solution for multi-echelon inventory optimization & stock deployment

Multiproduct multi-echelon network

Product 1, 2, 3 → Plant → IDC

Product 1, 2, 3 → CDC1
- Product 2, 3 → RDC B2C
- → RDC B2B
- Product 1,2 → Distributor

Product 1,2 → CDC2

Demand propagation (sell-in, sell-out from customers)

Break down the entire network into Product DC multi-echelon network

Define target stock levels at each node

IDC
- Product 1 → CDC1 → Product 1 → Distributor
- Product 1 → CDC2

Balance Inventory OH in each node to avoid shortage/excess
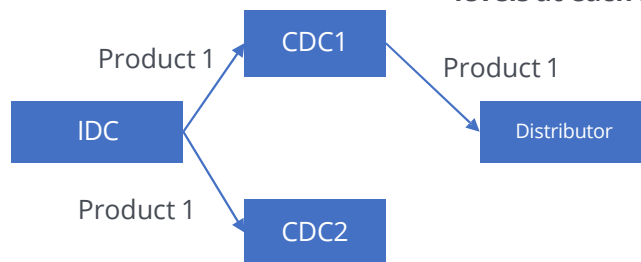
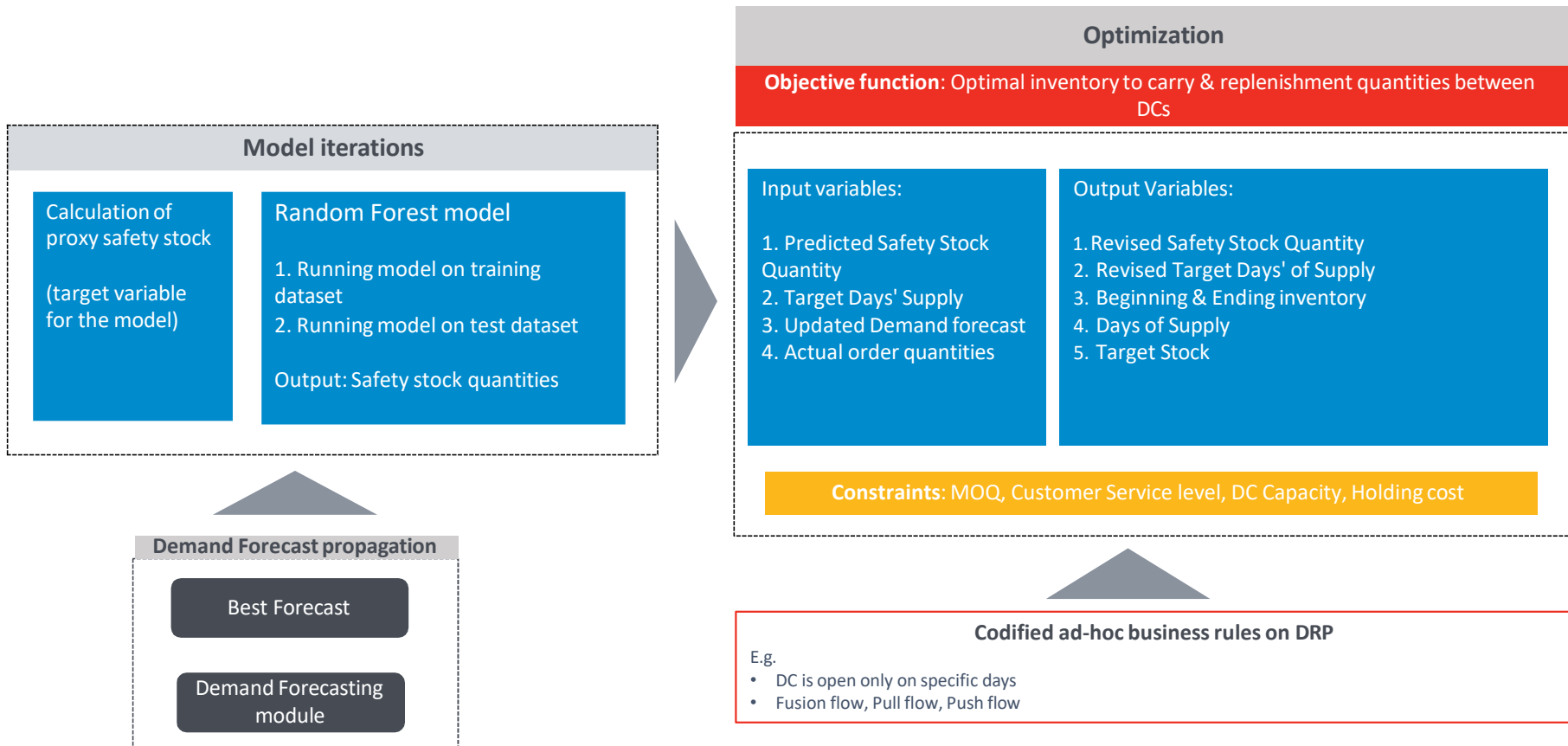**Arriving at the right inventory at right position**
- Identify product level multi-echelon network e.g.
  - Product 1: IDC ➔ (CDC1, CDC2) ➔ RDC B2B
  - Product 2: IDC ➔ (CDC1, CDC2) ➔ (RDC B2C, Distributor)

- Identify parameters for each product -DC combination e.g.
  - **Days of coverage over the network**
  - Net Lead time (Lead time N + Wait time between node N – Lead time N-1)
  - **Service Levels for customer**
  - **Demand forecast (sell-in/out)**
  - Replenishment / Supply drops

- Arrive at safety stock quantities using decision tree model for the network

- Apply DRP rules and business rules on open orders to arrive at replenishment frequencies & quantities

EWS & Alerts
- Alerts on possible stock-outs to planners
- Excess stocks./replenishments
- EWS on days of supply going below target days
- Manual overrides and adjustments on any exceptions

* Any addition or deletion of nodes/products in the multi-echelon network will be part of change in master data, and it will get reflected in the solution workstream.

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Optimization of inventory to carry & replenishment quantities between DCs

Model iterations

Calculation of proxy safety stock

(target variable for the model)

Random Forest model

1. Running model on training dataset
2. Running model on test dataset

Output: Safety stock quantities

Demand Forecast propagation

Best Forecast

Demand Forecasting module

Optimization

Objective function: Optimal inventory to carry & replenishment quantities between DCs

Input variables:

1. Predicted Safety Stock Quantity
2. Target Days' Supply
3. Updated Demand forecast
4. Actual order quantities

Output Variables:

1. Revised Safety Stock Quantity
2. Revised Target Days' of Supply
3. Beginning & Ending inventory
4. Days of Supply
5. Target Stock

Constraints: MOQ, Customer Service level, DC Capacity, Holding cost

Codified ad-hoc business rules on DRP

E.g.
- DC is open only on specific days
- Fusion flow, Pull flow, Push flow

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Evaluating safety stock by simulating inventory policies

Inputs

Demand forecast

Actual Order quantities

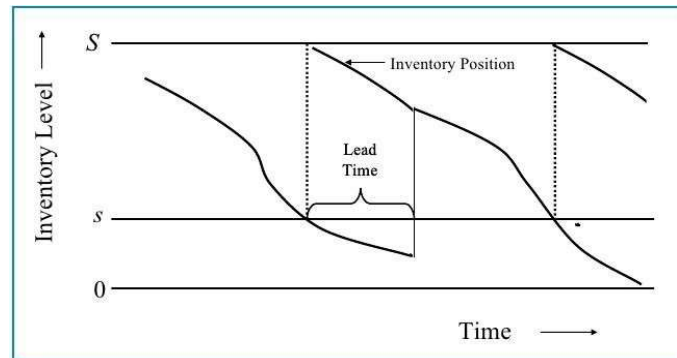Predicted Target days of supply

Predicted Safety Stock

Constraints

Service level

DC Capacity

MOQ

**Tool simulates inventory consumption over 13 weeks considering policies:**

❶ (s, S) Inventory Policy

- S (Max Stock) = Rolling average N weeks demand forecast + Predicted safety stock

- s (Safety stock) = Predicted safety stock qty

- Replenishment qty = (S – Ending inventory) in multiples of MOQ

❷ (r, Q) Inventory Policy

- Q (Order Qty) = MOQ or in multiples of MOQ

- r (replenishment point) = Predicted target days of supply

- Replenishment qty = (r + Q – Ending inventory)
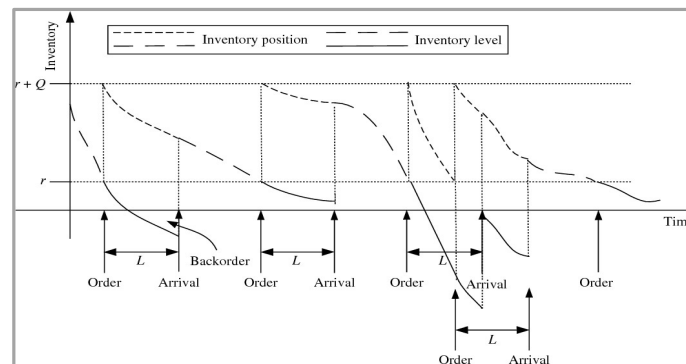
Simulation & Optimization

Output

- Revised Safety Stock Quantity

- Revised Target Days' of Supply

- Beginning & Ending inventory

- Days of Supply

- Target Stock

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Reduced ~ 40% of Safety stocks by enabling visibility at optimized service levels – P&G/Mars

Business Case

- Poor service levels despite high inventory levels
- Static Inventory targets & thresholds
- Optimize safety stocks at DC level

Solution approach:

Explore

Inventory control tower to explore hidden patterns from the data to identify **pain points and opportunity areas** for the business to work on

Predict

A model **predicting safety stock quantity** based on historical demand error, shipments, order quantities, service levels, replenishment quantities

Simulate

Gauging the **impact & efficacy of predicted safety stock quantities** on the service levels and **recommending min & max inventory norms**

Decision tree-based model for prediction of safety stock quantity, Monte Carlo simulation technique to run multiple scenarios & Early warnings & decision cockpits for insights & deep dives
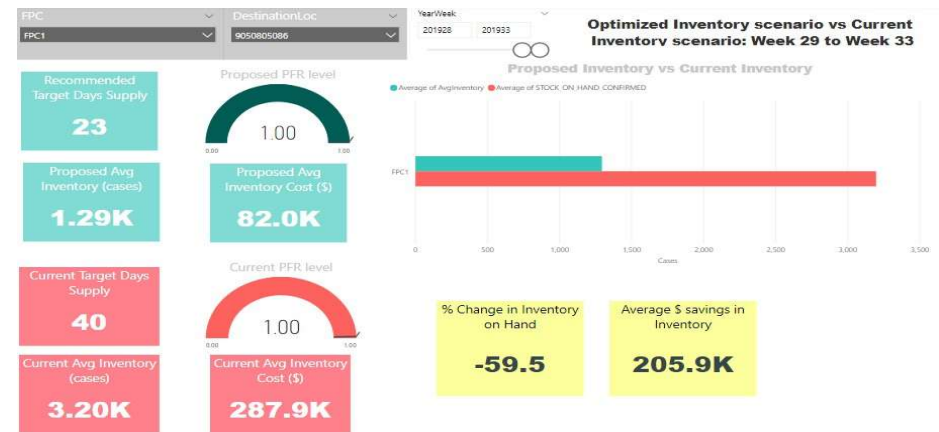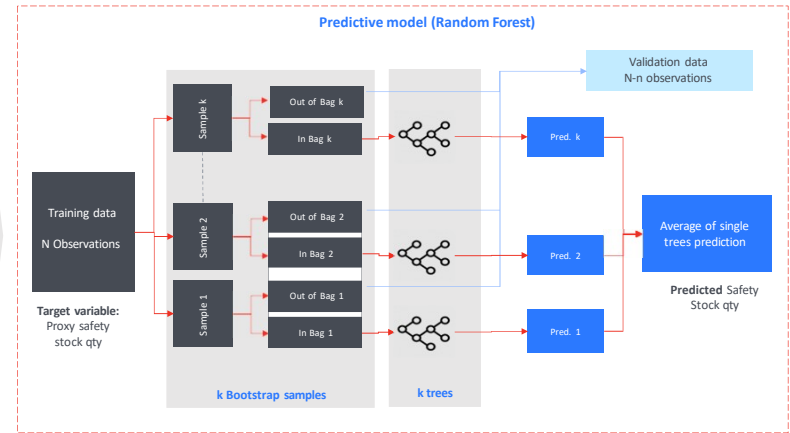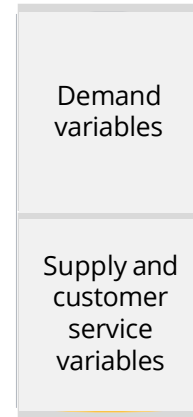
A Glimpse of Our SafeStock – Target Recommender Product

01

Identify all potential risks & opportunities to the demand planner at SKU level and Class level granularity

A Glimpse of Our SafeStock – Target Recommender Product

02

Diagnostics using Forecast error, Days of supply vs Product fill rate , Current target stock vs Order Quantity.
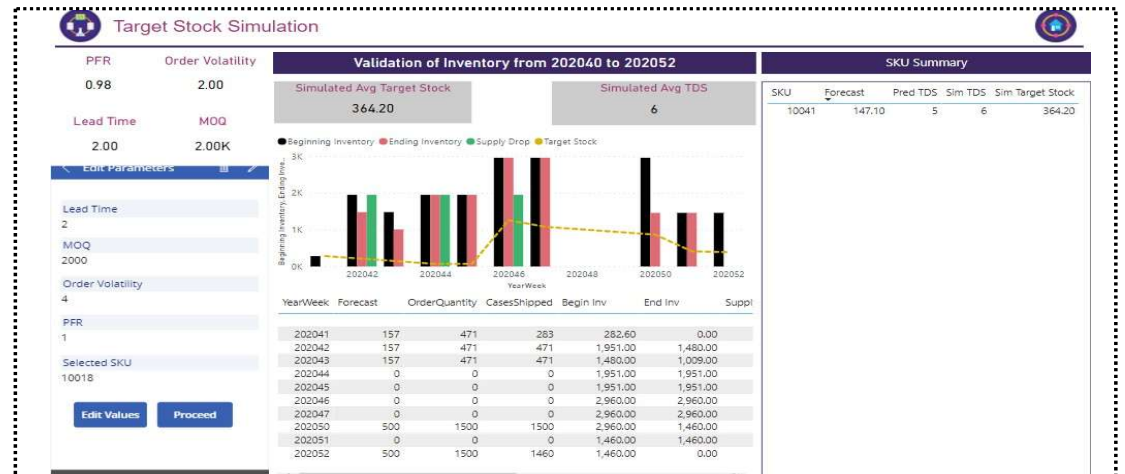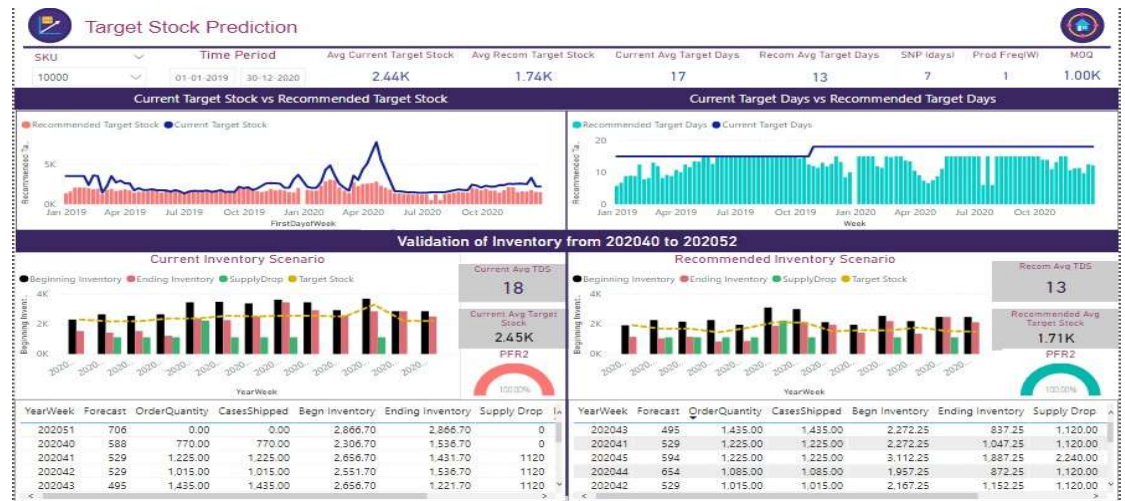
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A Glimpse of Our SafeStock – Target Recommender Product

03

Recommended Inventory Scenario with best possible service levels and optimized inventory.

Simulation of target stock using Lead time, Minimum Order Quantity, Order Volatility and Product fill rate to understand the effect of these parameters on your business.

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Thank You.

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A strategic partner to the most admired Fortune 500® companies globally, we help power every human decision in the enterprise by bringing advanced analytics & AI, engineering and design.