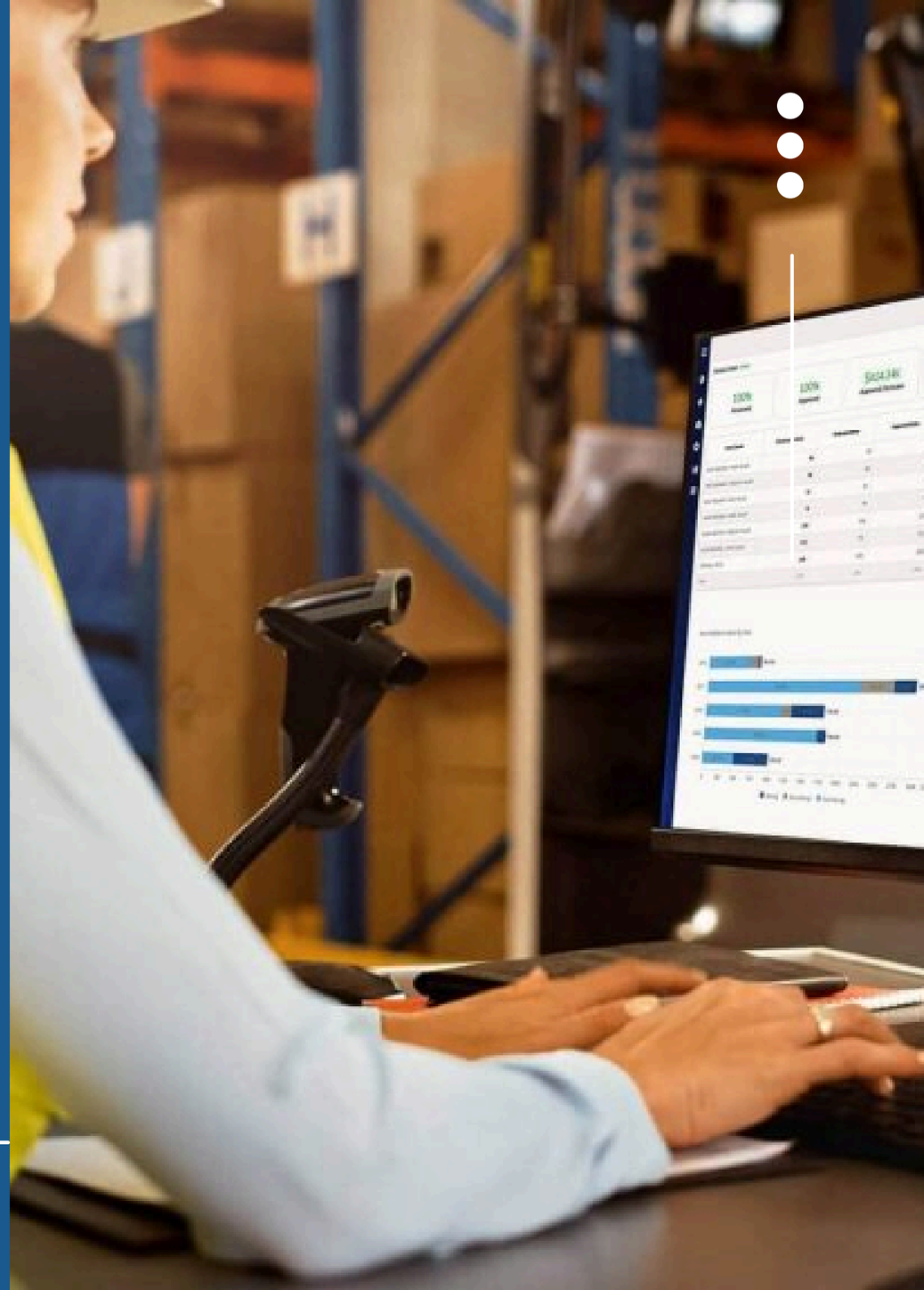
Optimizing Inventory Management for Curd SKUs: A Data-Driven Approach



Business Context

A leading dairy company faces challenges in curd inventory management due to:

1. Lead time of 5 days between production and market distribution.
2. Uneven contribution of SKUs to overall sales, making forecasting for all SKUs inefficient.
3. Optimizing inventory and production is crucial for reducing wastage and improving service levels.

GOAL

Identify high-priority SKUs for accurate forecasting and efficient inventory

Mining Objective

Objective 1

Perform Clustering to Categorize SKUs based on volume and predictabilty

Objective 2

Help the company to improve sales forecasting accuracy

Objective 3

Optimize the inventory based on demand forecasting

Machine Learning Models and Evaluation

Clustering Approach

Algorithm used:
K-Means clustering.

Evaluation Metrics

- Silhouette Score: Ensures effective cluster separation.

Cluster Insights

- High Volume, Low CV: Priority for forecasting.
- Low Volume, High CV: Monitored as potential outliers.

Implications

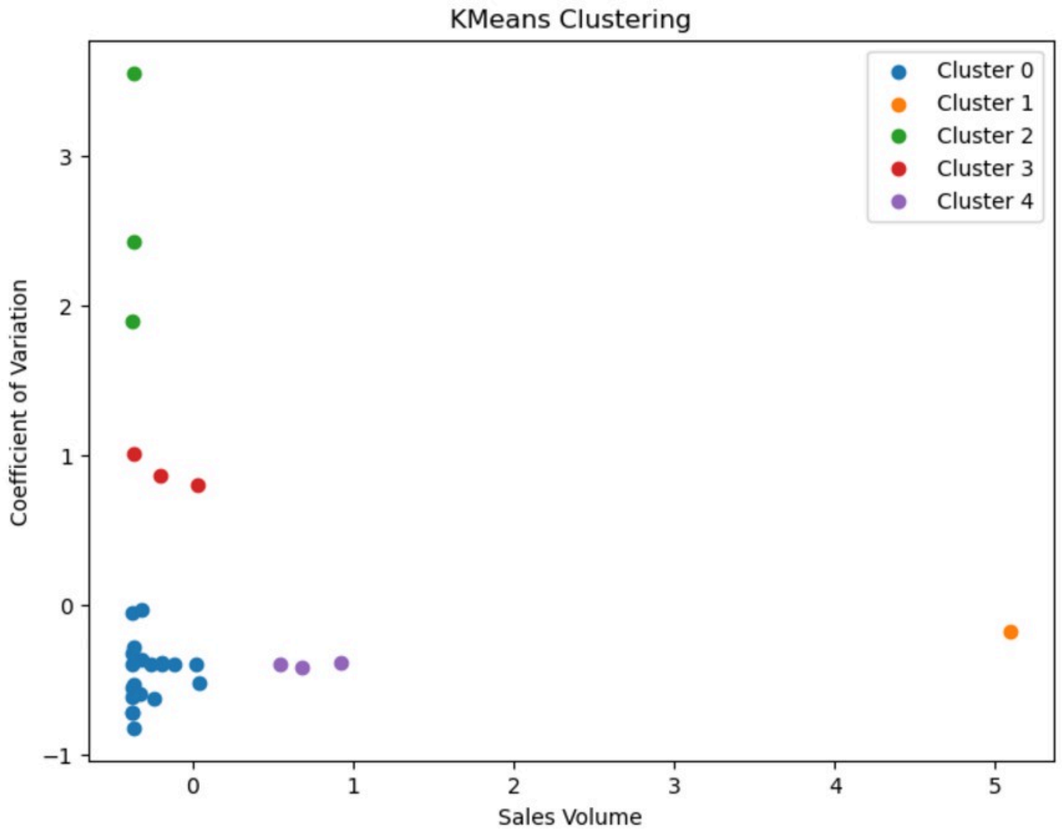
- **Clear identification of SKUs for targeted management strategies.**
- **Opportunity for resource reallocation based on SKU priority.**

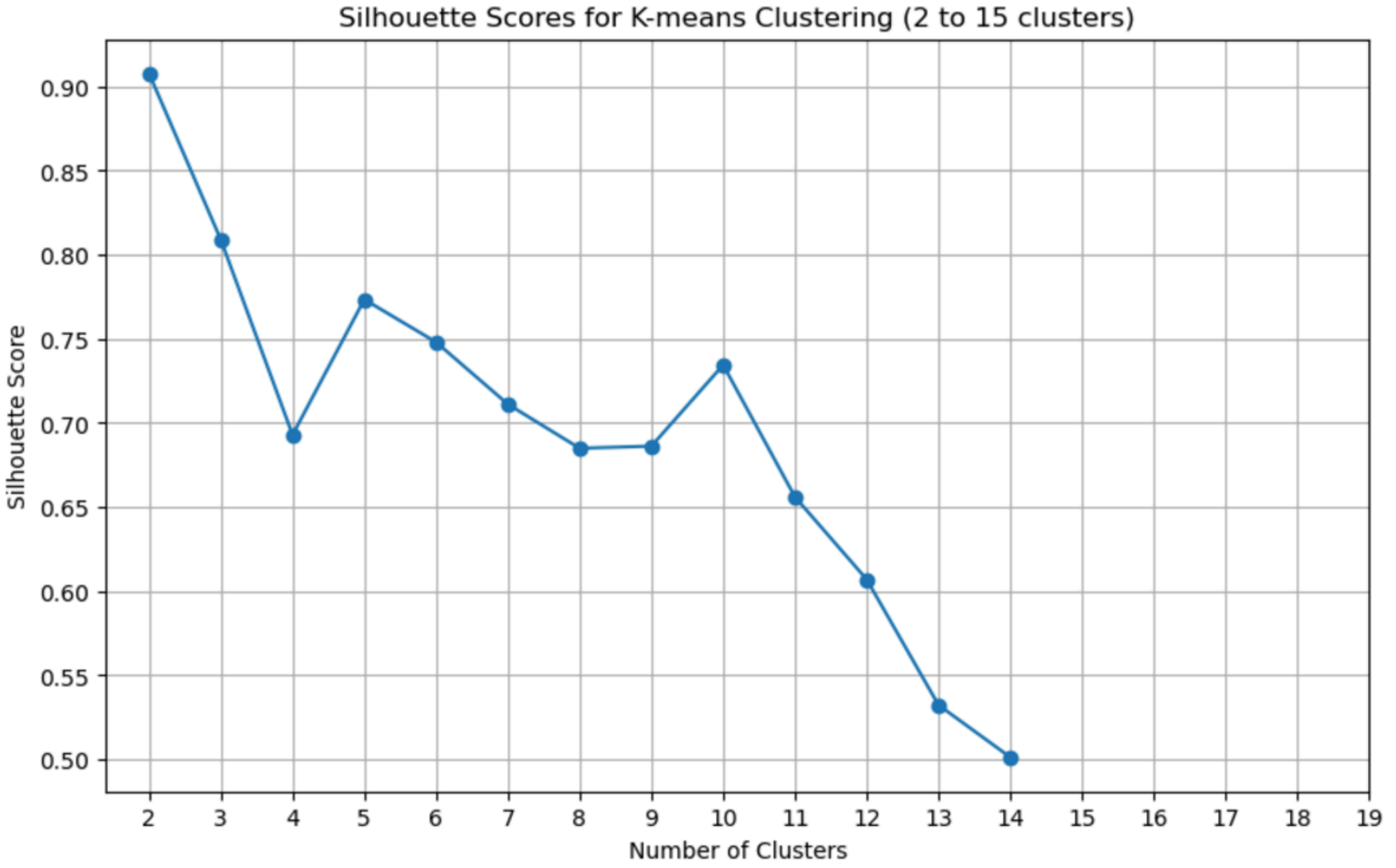
K-means Clustering

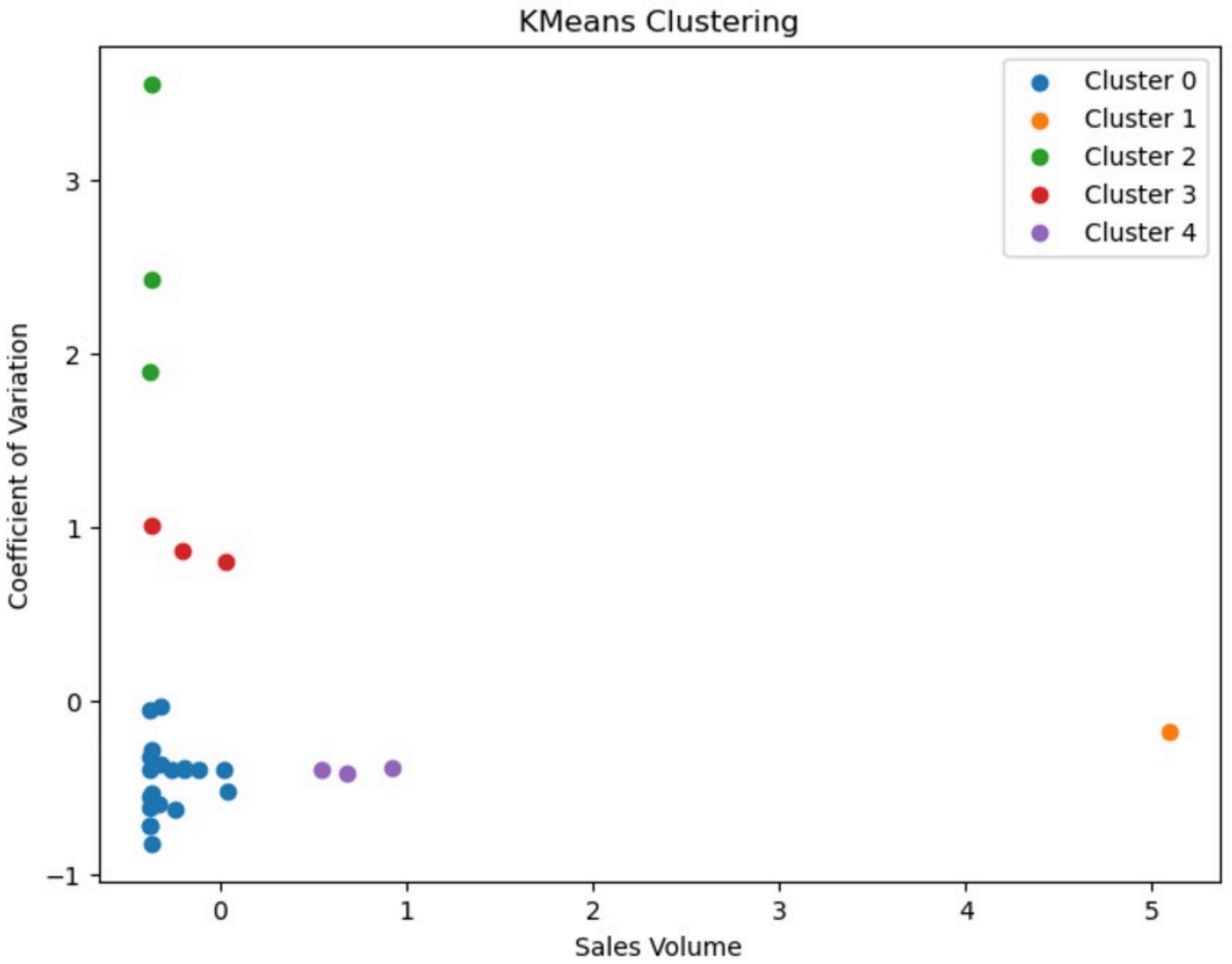
Variables used

- **Volume (Sales):**
  Contribution of SKUs to total sales.

- **Predictability (CV):**
  Coefficient of variation
  (sales variability).




Silhouette Scores for K-means Clustering (2 to 15 clusters)
Silhouette Score
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
Number of Clusters

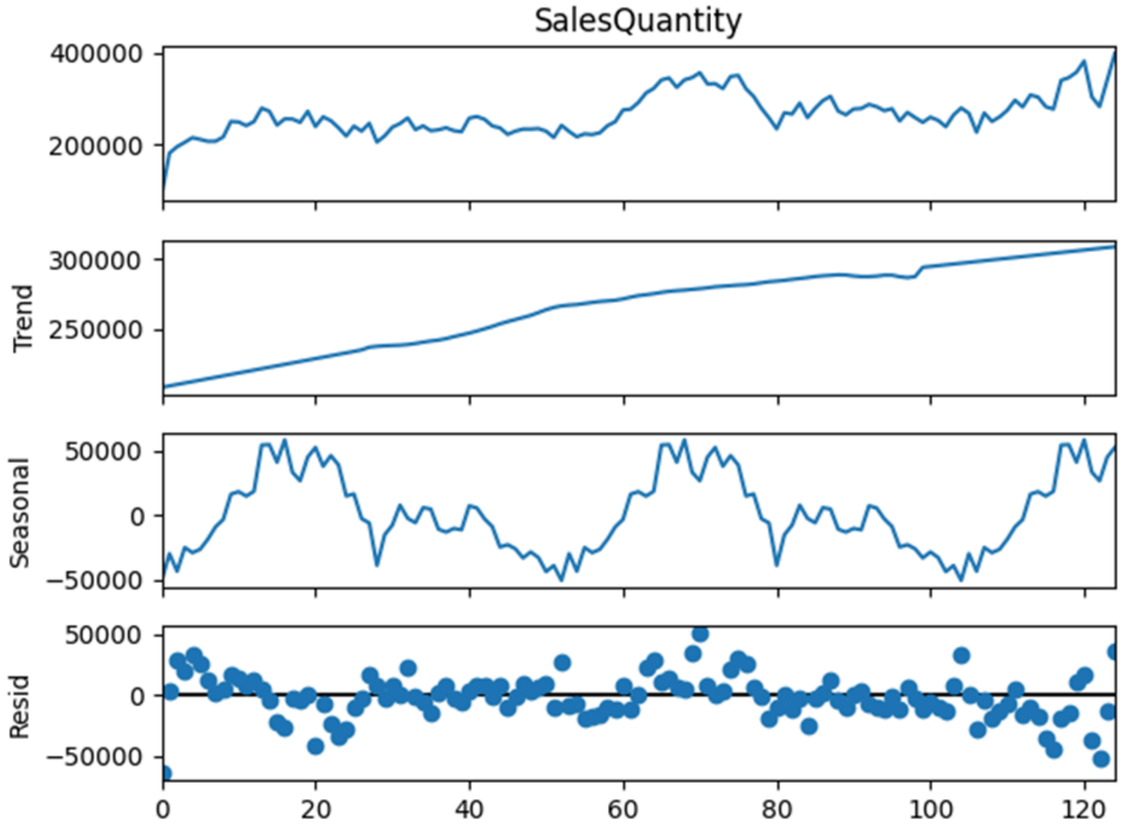

KMeans Clustering
Cluster 0
Cluster 1
Cluster 2
Cluster 3
Cluster 4
Coefficient of Variation
Sales Volume
3
2
1
0
−1
0
1
2
3
4
5

STL decomposition

for a SKU 10104

STL (Seasonal-Trend Decomposition using Loess) separates time series data into three components: seasonal, trend, and residual. The method handles non-linear trends and variable seasonality effectively.

Application
STL helps at identifying recurring patterns (in our case, the demand for curd) and long-term trends in production, providing actionable insights for accurate prediction and capacity planning.



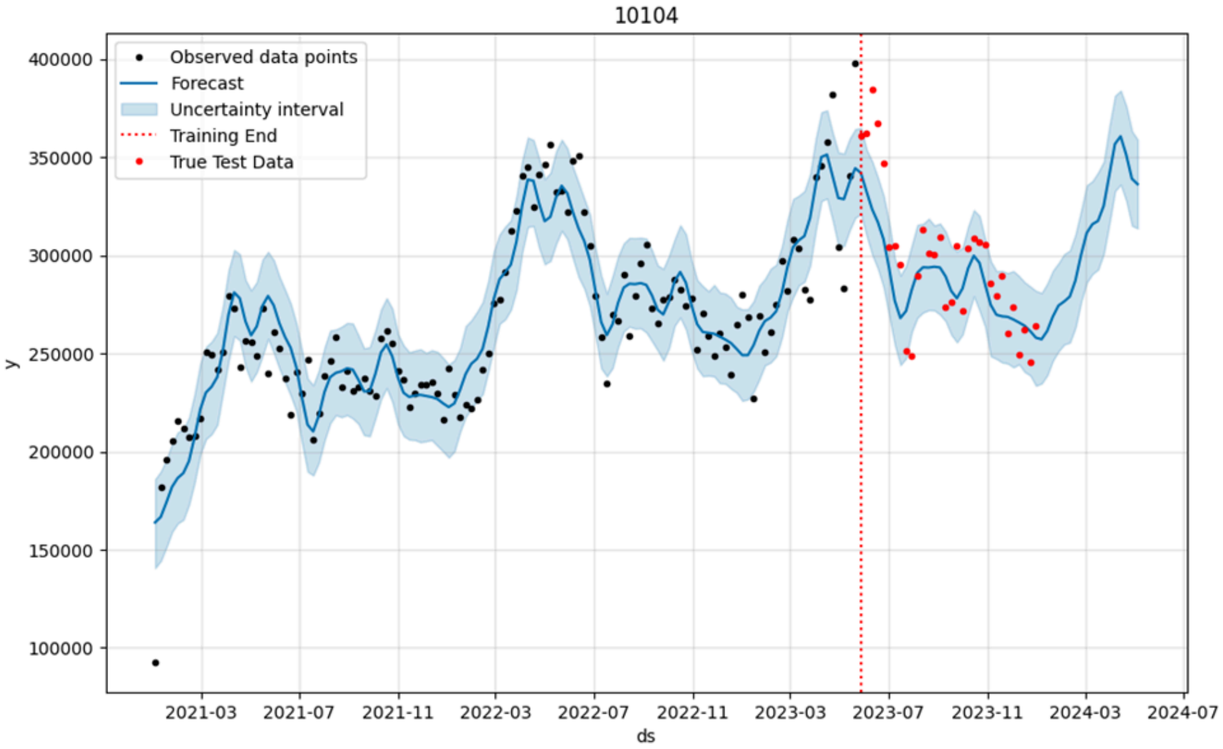
Forecasting using Prophet

for a SKU 10104

- Prophet is an open-source forecasting tool designed by Meta for time series data with strong seasonality and trend components.

- **Application**
  Prophet is suitable for automating production predictions due to its ease of use, robustness to irregularities, and ability to model complex, real-world seasonality patterns.

- From the plot it is visible that the forecast aligns well with the observed data during the training period, capturing seasonal trends and variability effectively.



Recommendations

Give highest priority to Cluster 1 followed by Cluster 4

Maintain safety stock for high-priority SKUs to mitigate demand fluctuations.

Reduce production buffer for low-priority SKUs to cut costs.

Align production schedules with forecasts for Cluster 1 SKUs.

Thank You