proximus ada

Minimizing stock costs for Proximus shops

Vlerick Business School
Group 7

April 2024

Meet the Team

Jean-Louis Swart

Yohanes Nuwara

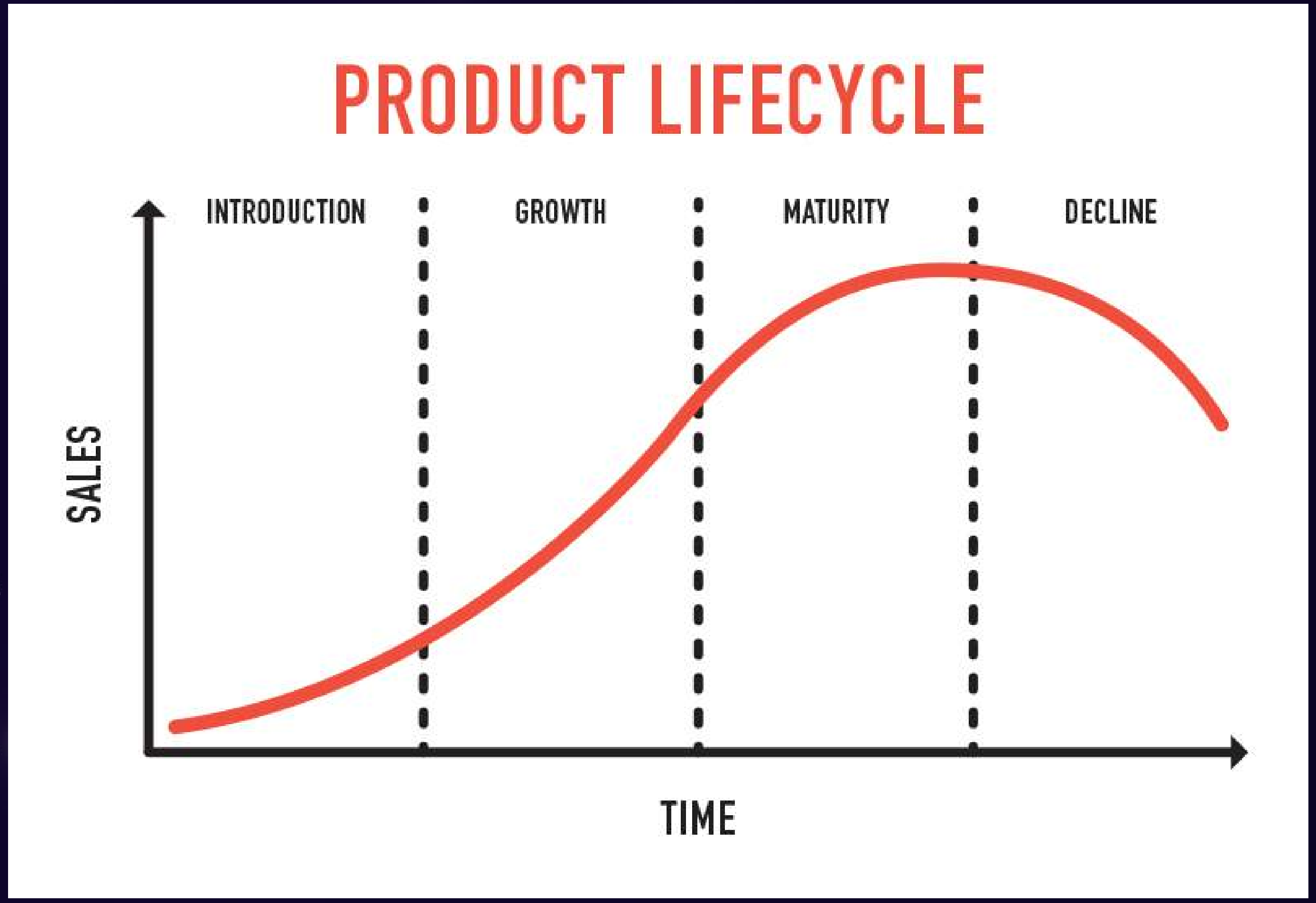
Aizaz Ali Khan

proximus ada

Challenge:
Optimizing Proximus' product distribution across stores.

- High Stakes: Short product lifecycles and limited data make it difficult to ensure the right products are in the right stores at the right time.

- Impact: Lost sales, frustrated customers, and inefficient inventory management



Sample data = 9 products with 80+ shops

Our Solution

Improved demand forecast accuracy by 52%
using new forecast model

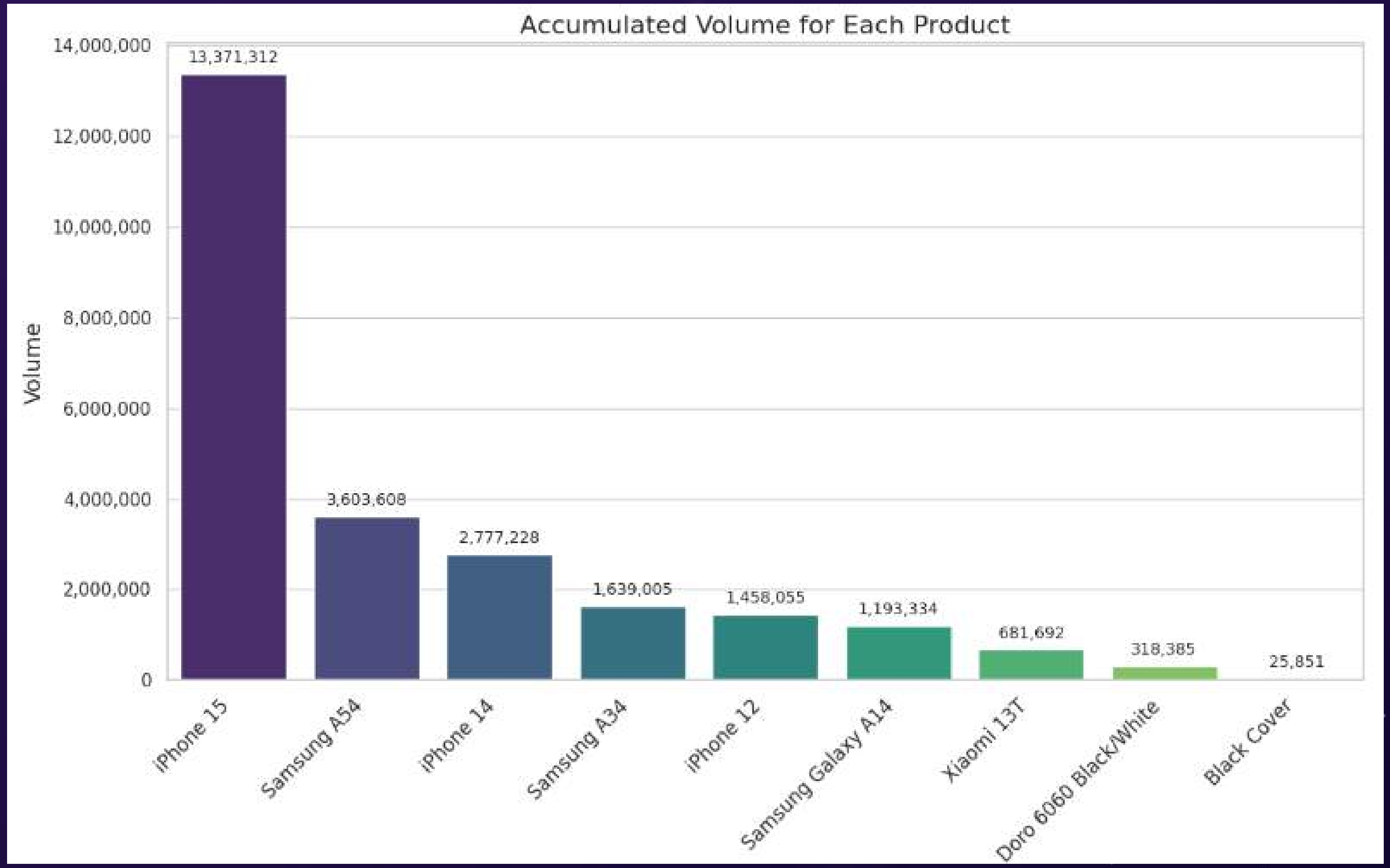
Optimized total cost by 56%
using our new policy optimization

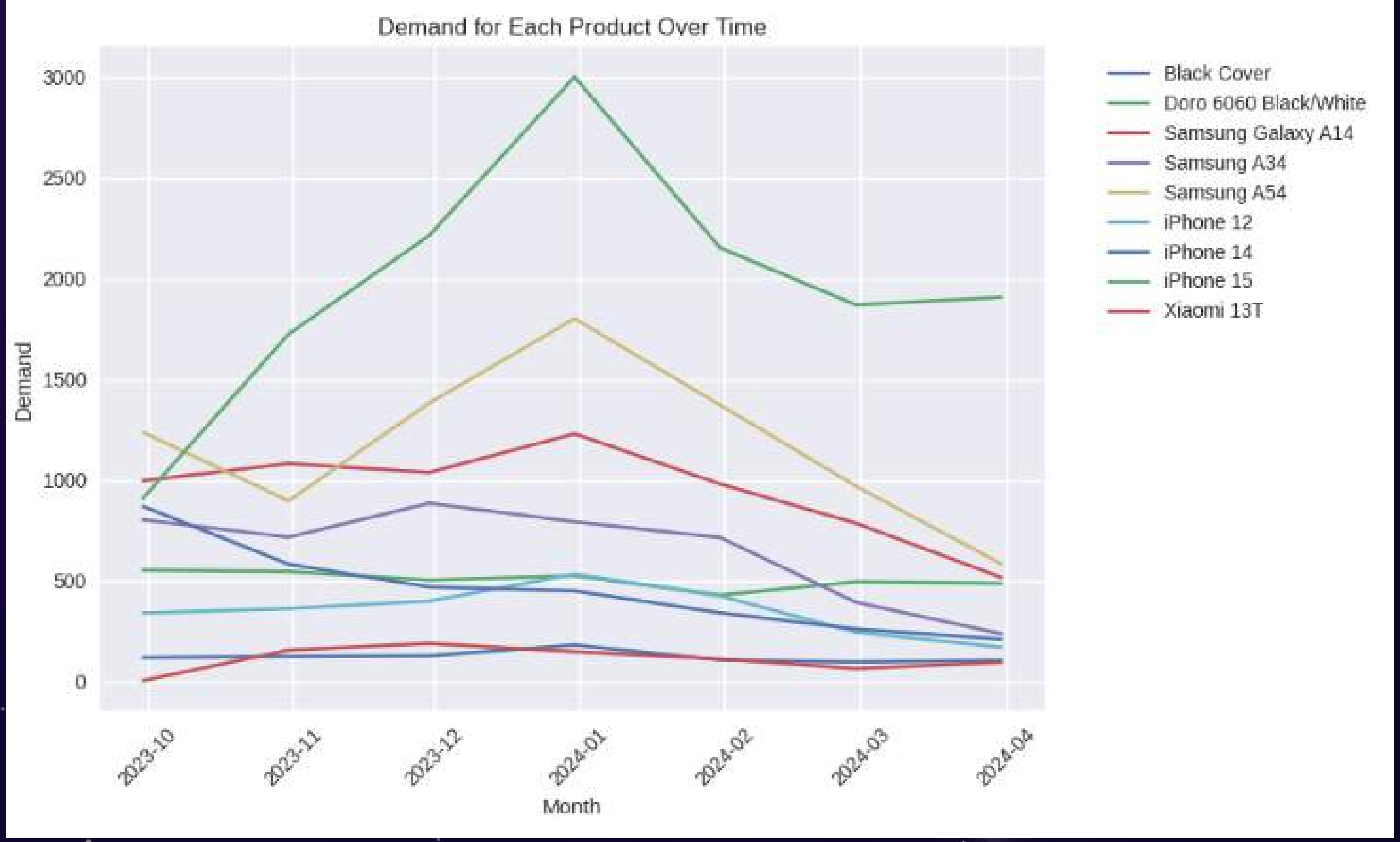
Scalable to all products and plants

proximus ada

Data Exploration

Product level Demand

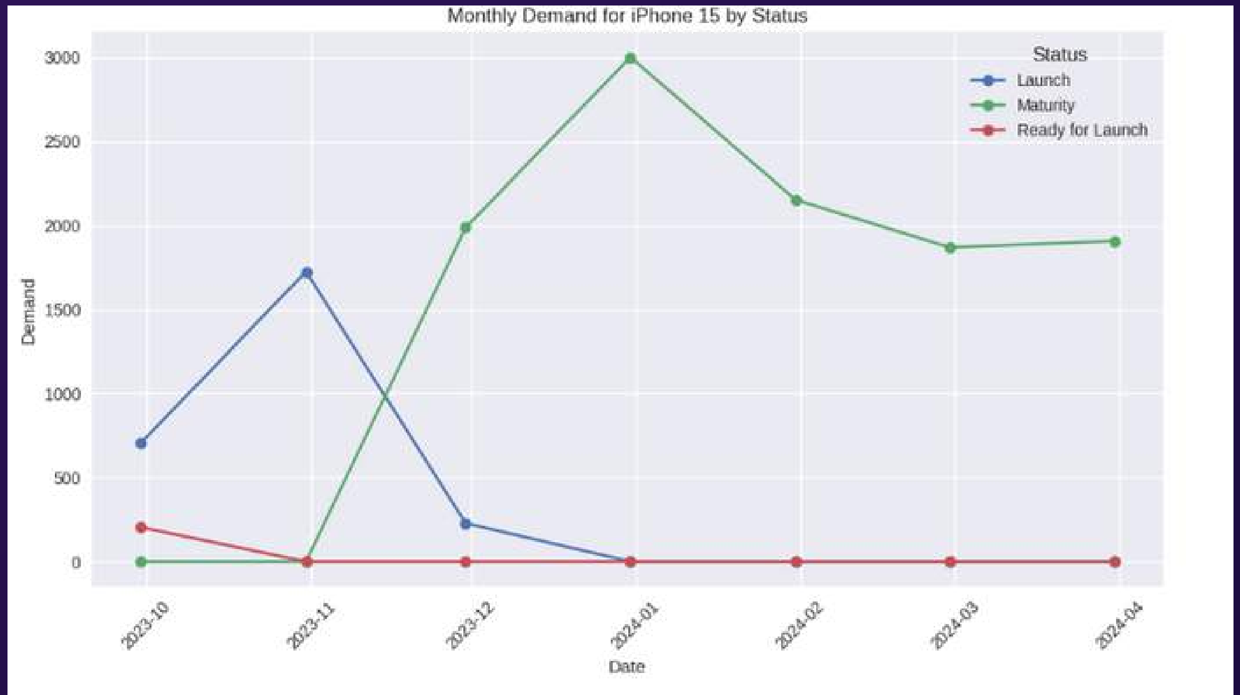


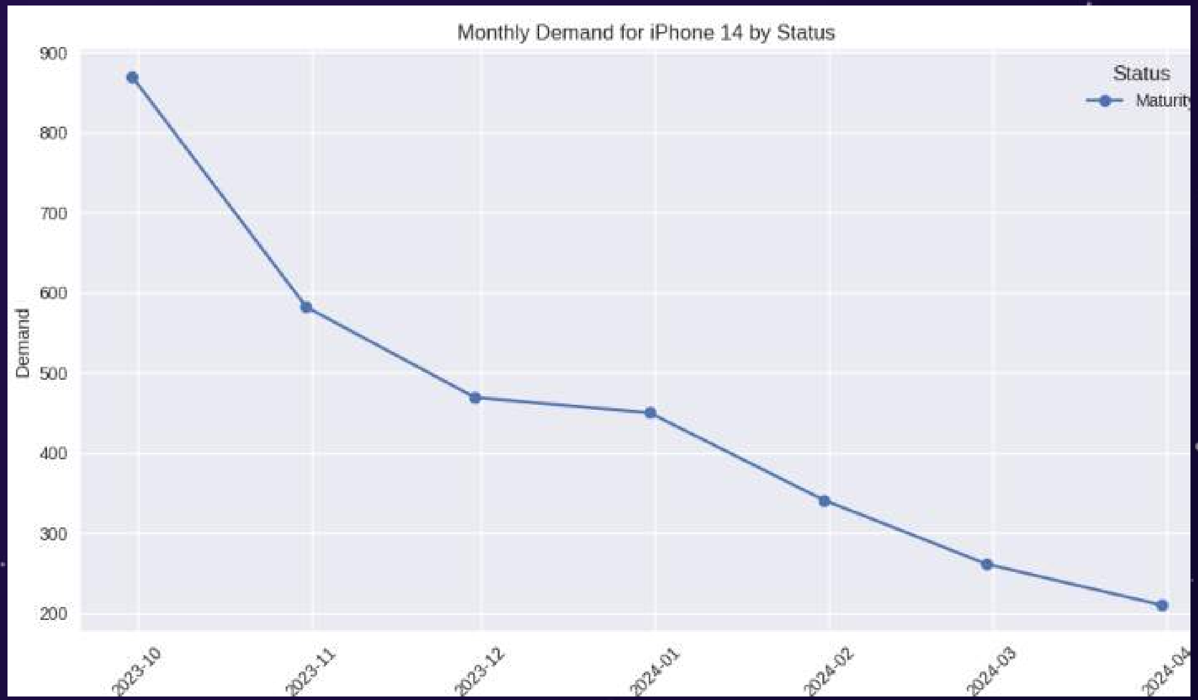


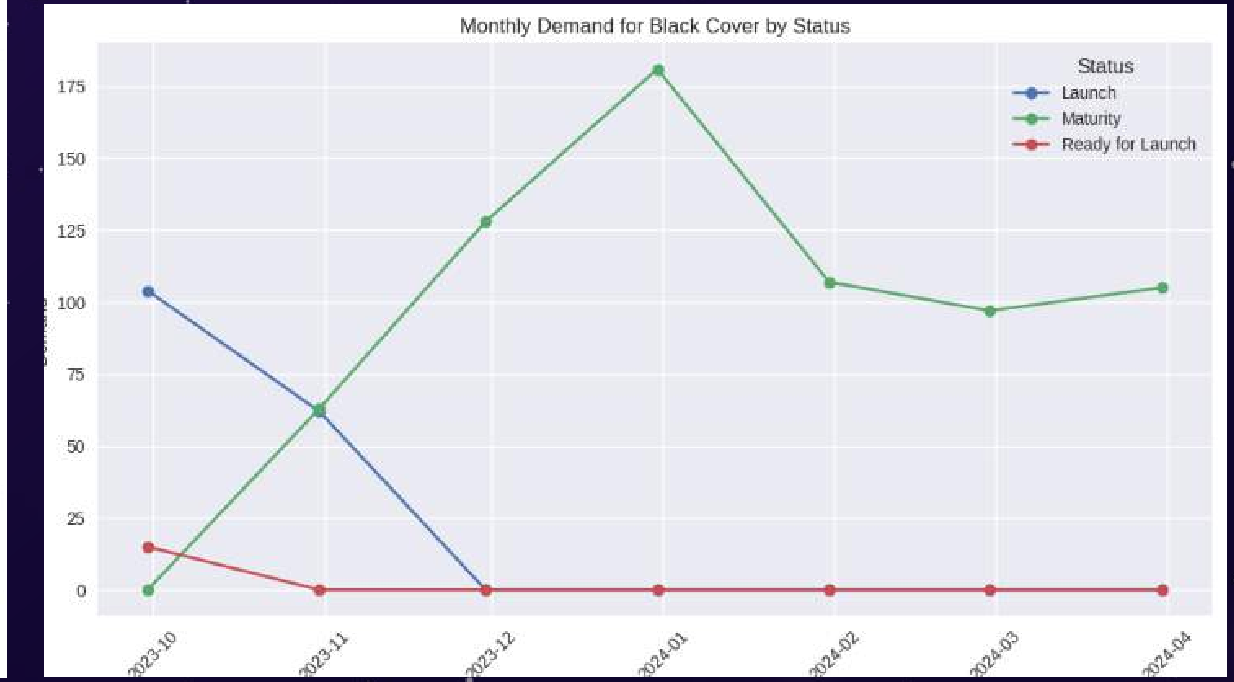
iPhone 15 is the highest value product (price * volume) followed by Samsung A54 and iPhone 14.
Peak in demand in the month of January for almost all products.

proximus ada

Demand View by Status





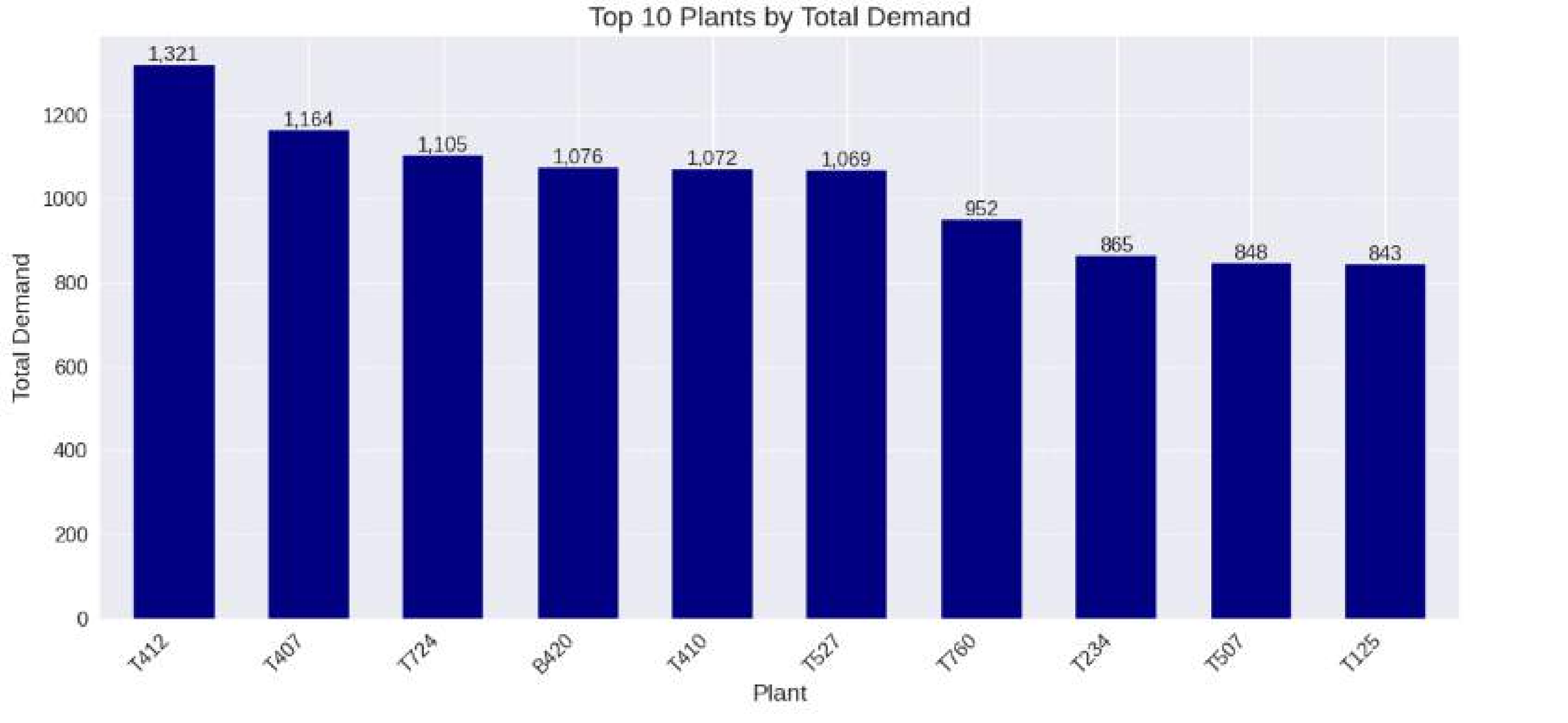


Multiple products have different ‘Status‘ at any given time - Varied Product life cycle stage simultaneously

Most products are in maturity stage and naturally Demand in ‘maturity’ stage is higher than in other stages.

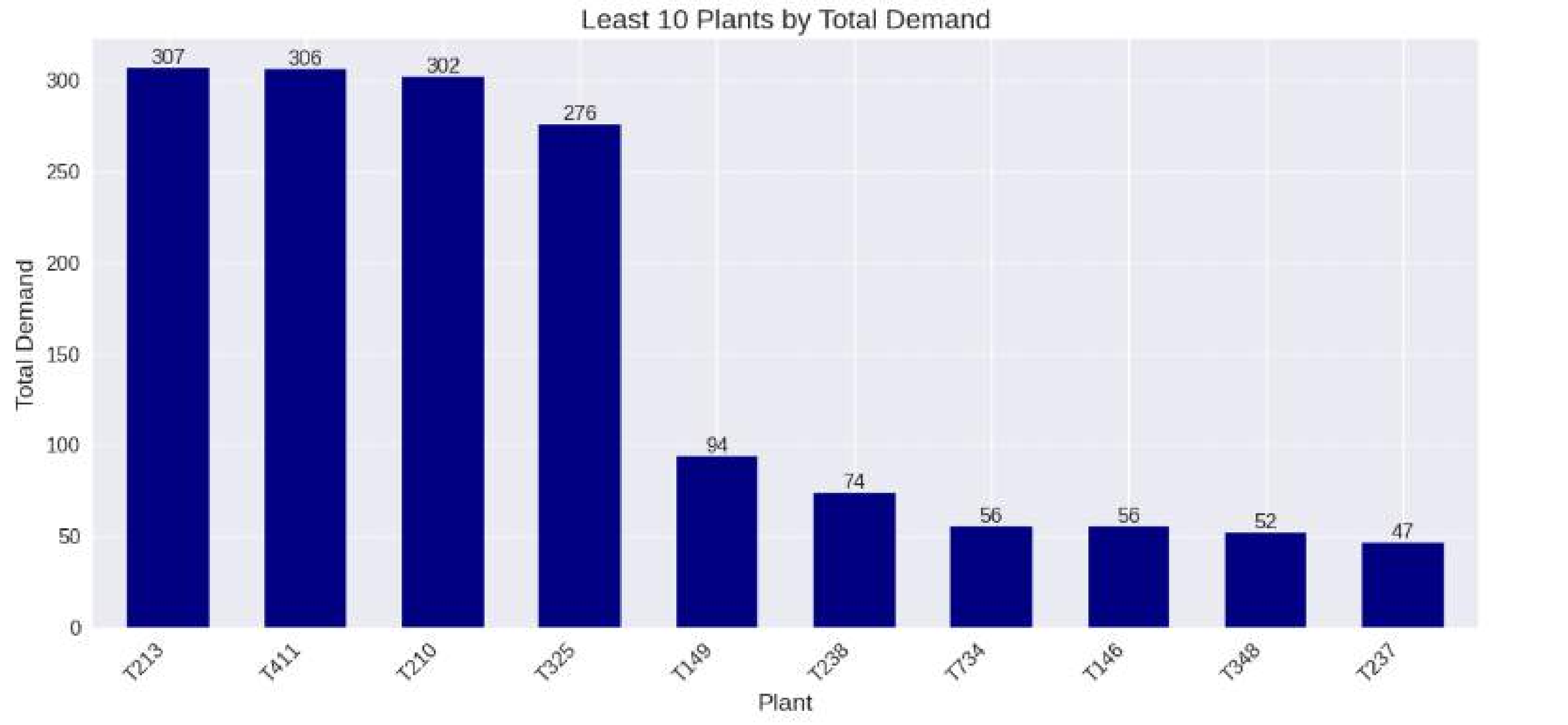
Demand sees a big drop after the peak in January irrespective of the Status/Stage

Shop Level View



Shop T412 has the highest demand followed by T407 & T724

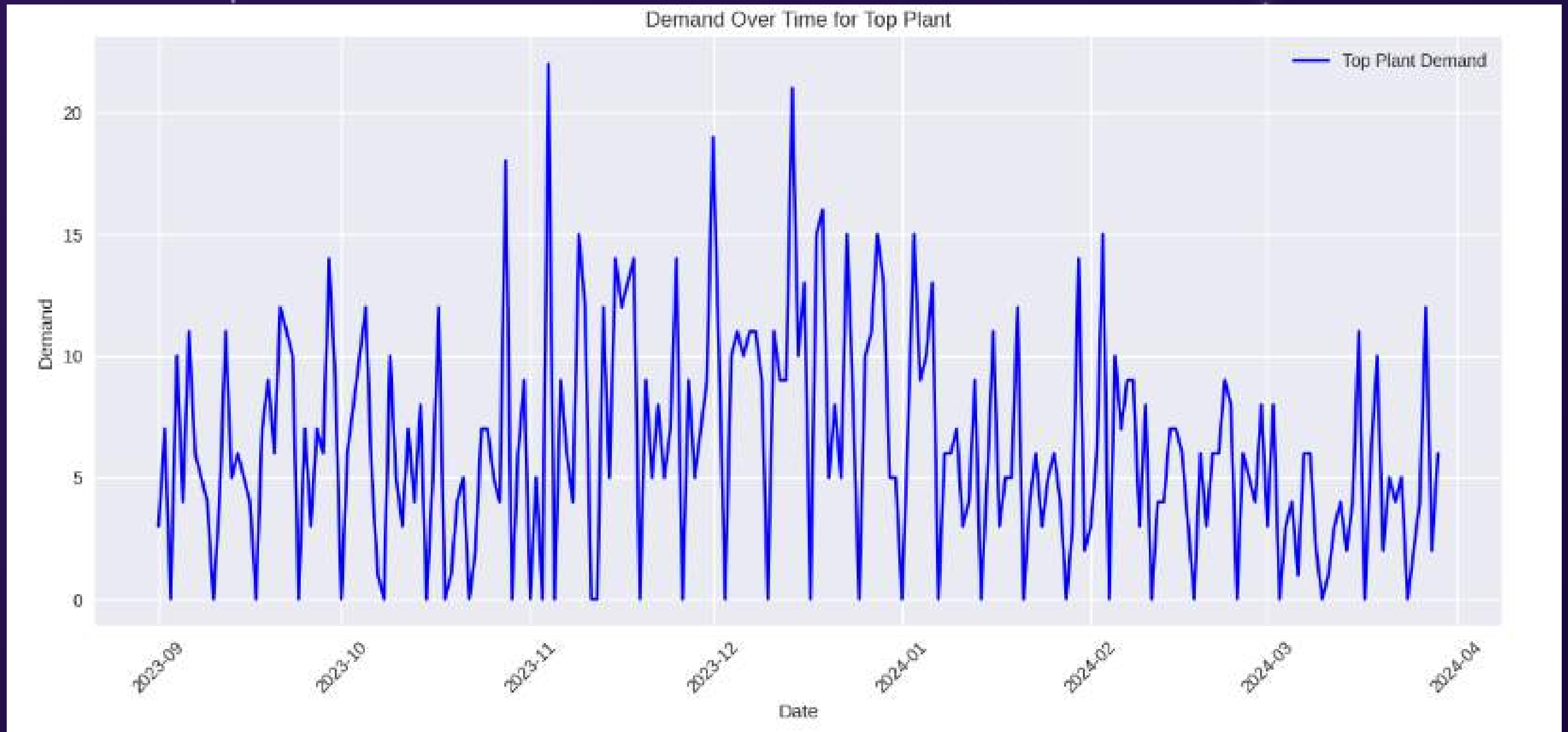
- Contribute to ~ 23% of the total demand
- T412 has the highest demand with 1,321 units



Shop T237, T348 & T146 have the least demand

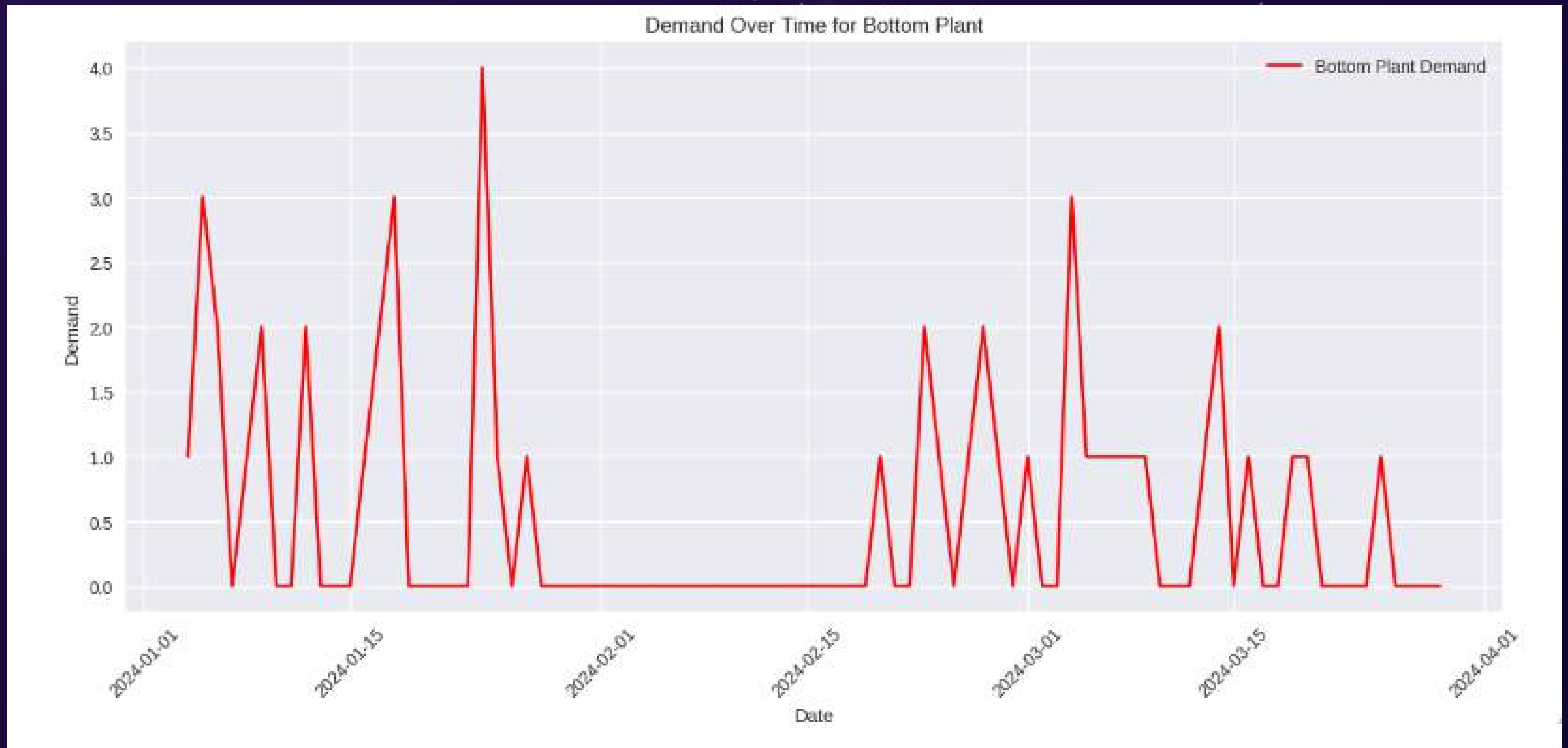
- Contribute to ~3.5% of the total demand
- T237 has the lowest demand with 47 units

Shop Level - Demand over Time



The demand for the top shop remained mostly within the range of 5-15 units

Though there are some outliers in the month of November & December 2023.



A lot more inconsistent demand with frequent spikes for the bottom shop

Demand peaked at 4 but also remained zero quite often

proximus ada

Product and Shop level View

iPhone 15 records the highest demand across all products

IPhone 15 sales in Shops T412, T407, T527 are important

Finding a Policy

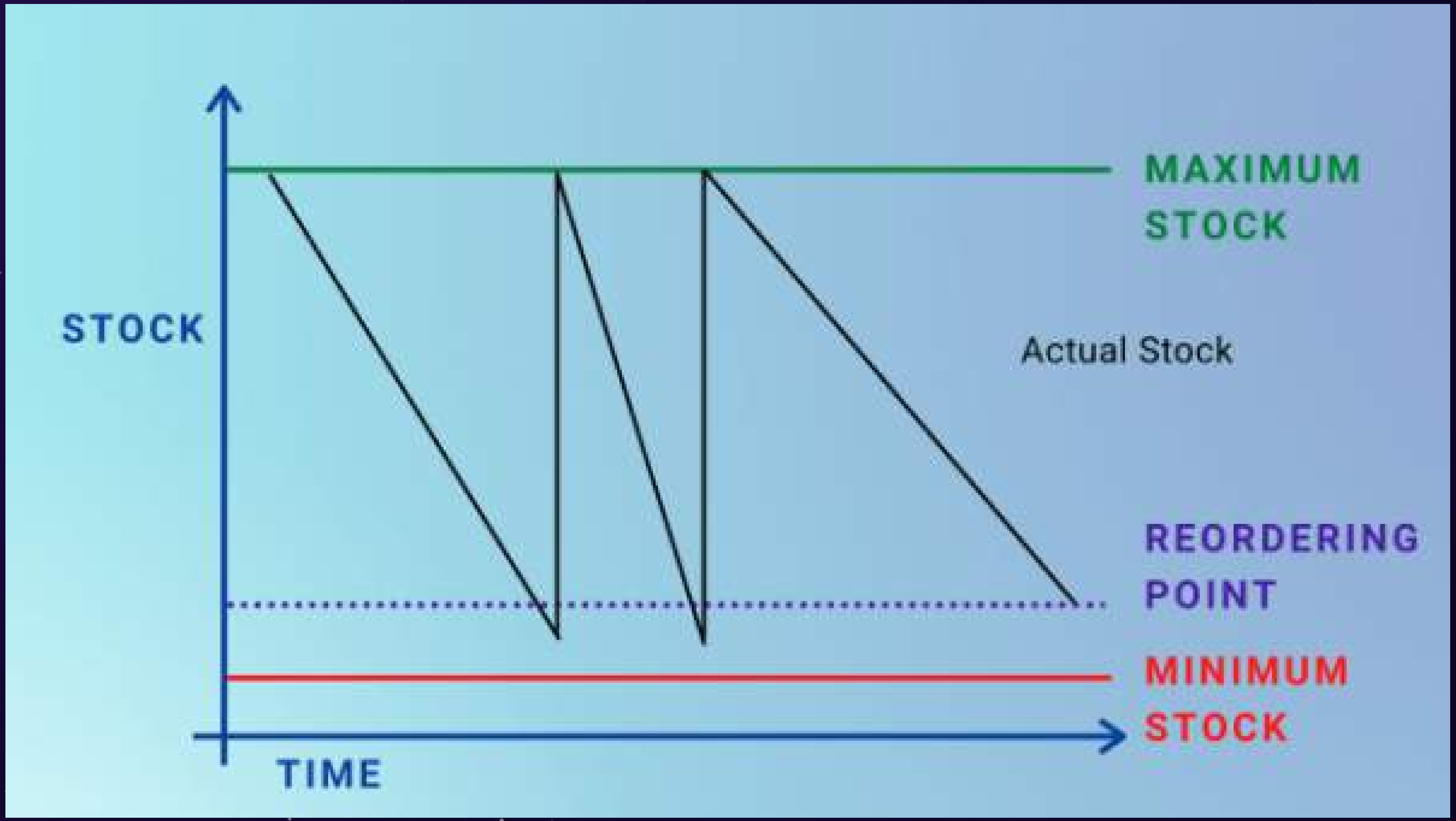
Baseline Dummy

When stock reaches a certain ordering point:

- Order up to a defined stock level for all plants

For the iPhone 14 across all 88 plants September to March:
ROP = 0, level = 1: $226 856

Afte making it more anticipatory and optimizing:
ROP = 1, level = 2: $197 517



*Benchmark to beat

https://www.edi2xml.com/wp-content/uploads/2020/04/EDI-reordering-with-INVRPT-message-e1587999265253.png

Why order up to a certain level if you can anticipate demand?
Leverage our forecasting figures to determine how much to order

proximus ada

Demand Anticipating Policy

Cost of shortage is 5000X more than an overstock

- Therefore, aim to have a buffer inventory.

Aim to achieve a specified inventory level after the lead time.

Takes orders in the pipeline and forecasted demand into account during the lead time.

Objective: minimize stockouts

	Day 1	Day 2	Day 3	Day 4
Inventory	6	2	0	3
Pipeline	0	3	x	x
Demand	4	2	0	1

Lead Time

3 - 1 = buffer inventory

Demand Anticipating Policy

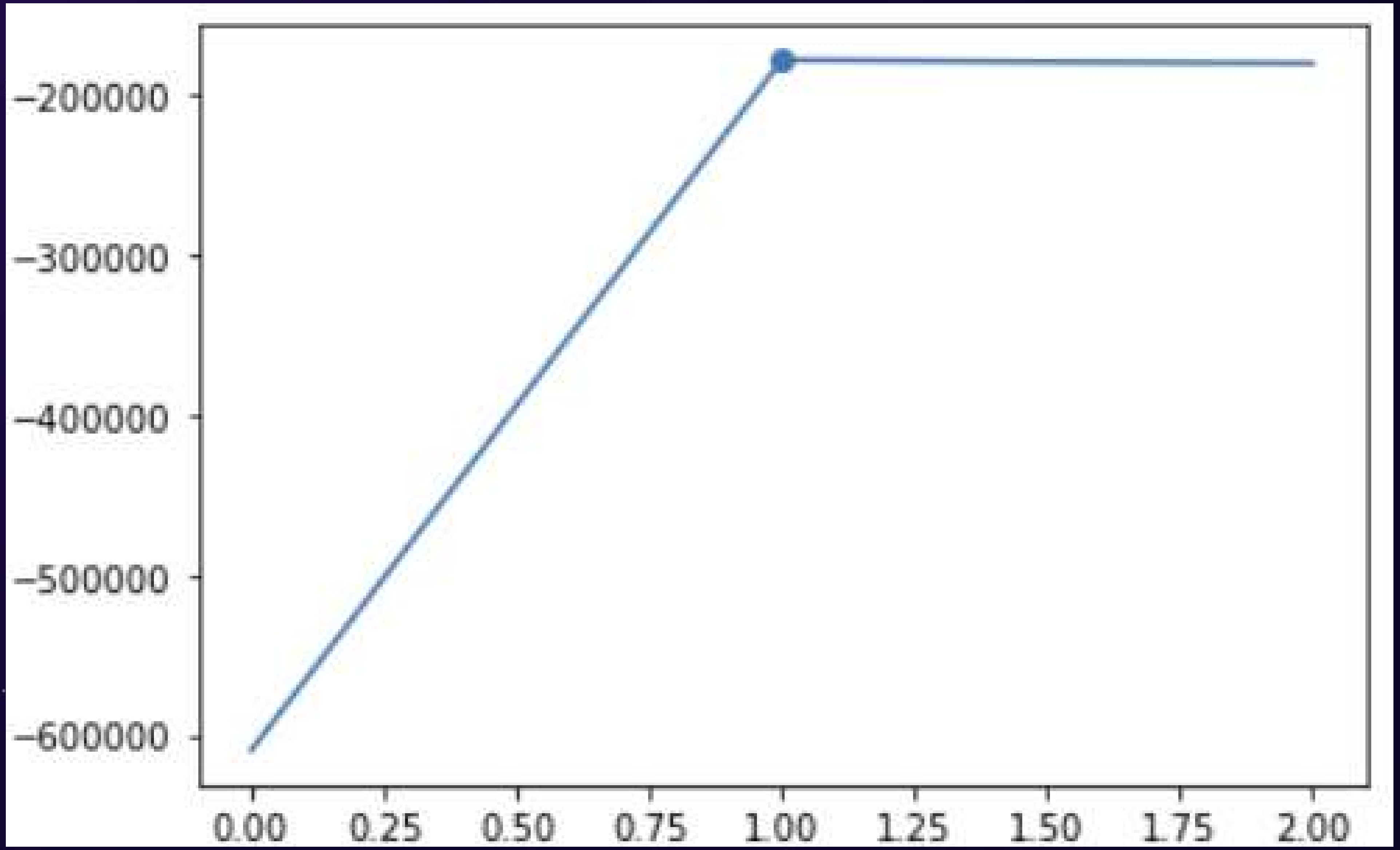
Optimize for the target level stock:
Safety Stock level = 1
Cost = $178 372

10% improvement in costs!

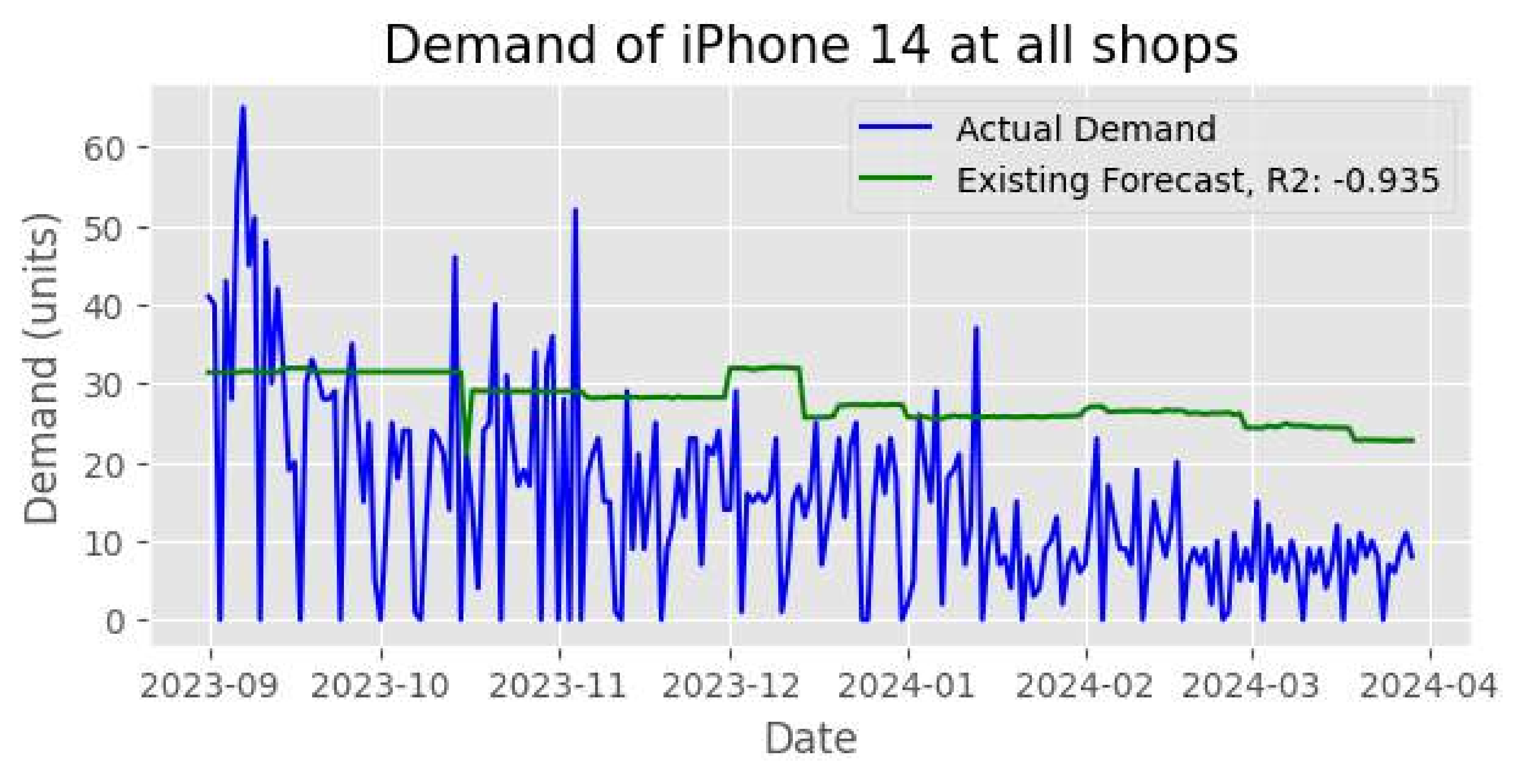
How to improve?

- Can start adding heuristics based on the data to better anticipate demand (from EDA)

- OR improve forecast



Current Forecast Accuracy



proximus ada

Improving the forecast

Step 1:

- Segment products based on features
- Cluster products within segments based on sales patterns (product lifecycles)

Step 2:

- Fit Bass model to estimate the product adoption curves and use for product clusters

Step 3:

- Arma model to capture more fine grained demand & seasonality (Sundays)

Int. J. Production Economics 239 (2021) 108206

Contents lists available at ScienceDirect

International Journal of Production Economics

journal homepage: www.elsevier.com/locate/ijpe

ELSEVIER

Lifecycle forecast for consumer technology products with limited sales data

Xishu Li *, Ying Yin, David Vergara Manrique, Thomas Bäck

Institute of Advanced Computer Science, Leiden University, The Netherlands, Snellius Gebouw, Niels Bohrweg 1, 2333 CA, Leiden, the Netherlands

ARTICLE INFO

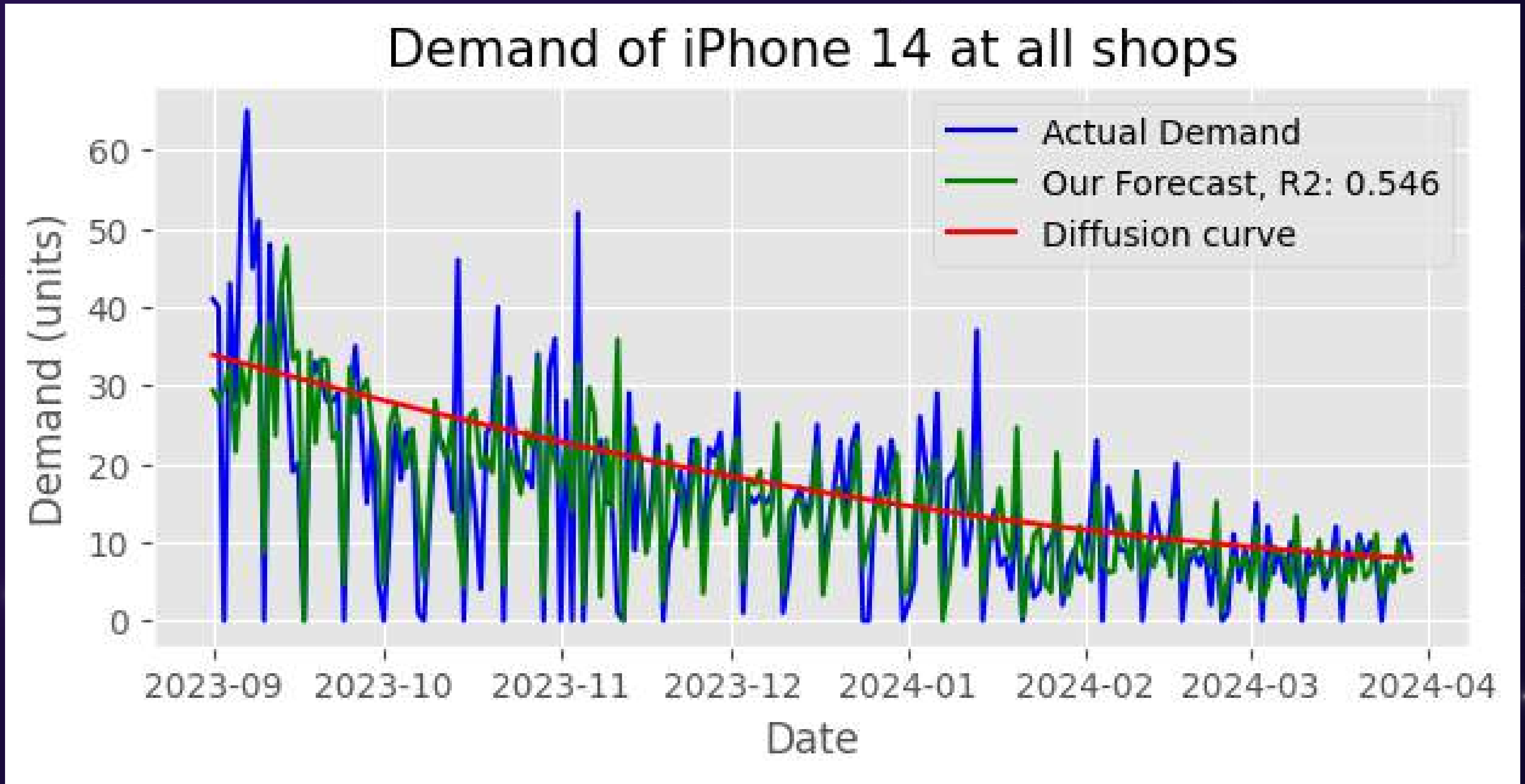
Keywords:
Consumer technology products
Product lifeclye forecast
Clustering-based data aggregation
Bass model

ABSTRACT

Early lifecycle demand forecast is critical to consumer technology products with a fast innovation speed, as firms which compete on these products focus on timely responding to market changes through new product development and efficient product diffusion, rather than sustaining product sales. The challenge for obtaining an accurate long-range forecast is that sales volumes at the early lifecycle stages are small, which limits the forecast accuracy. We propose a two-step lifecycle forecast approach for consumer technology products with limited sales data. First, we segment products based on market and clustering. Second, we apply the Bass model to aggregated products in a group using the average periodic sales of all products in the group and then use the forecast for related new products. We validate our approach using a dataset collected from Philips Netherlands, which contains consumer healthcare products sold in US and China over an 8-year timespan. The results suggest that for forecasting the lifecycle of a new product, models based on aggregated products generally perform better than models based on an individual product. It highlights the value of data aggregation in product lifecycle forecasts. Clustering is also useful for improving the forecast accuracy: when aggregation is done using sufficient product sales data, the aggregated model based on products with which the new product has the most sales pattern similarities could provide a more accurate forecast than other aggregated models. Based on our results, we provide a practical guideline to firms for obtaining an accurate early product lifecycle forecast.

Li, X., Yin, Y., Manrique, D.V. and Bäck, T. (2021). Lifecycle forecast for consumer technology products with limited sales data. International Journal of Production Economics, 239, p.108206. doi:https://doi.org/10.1016/j.ijpe.2021.108206.

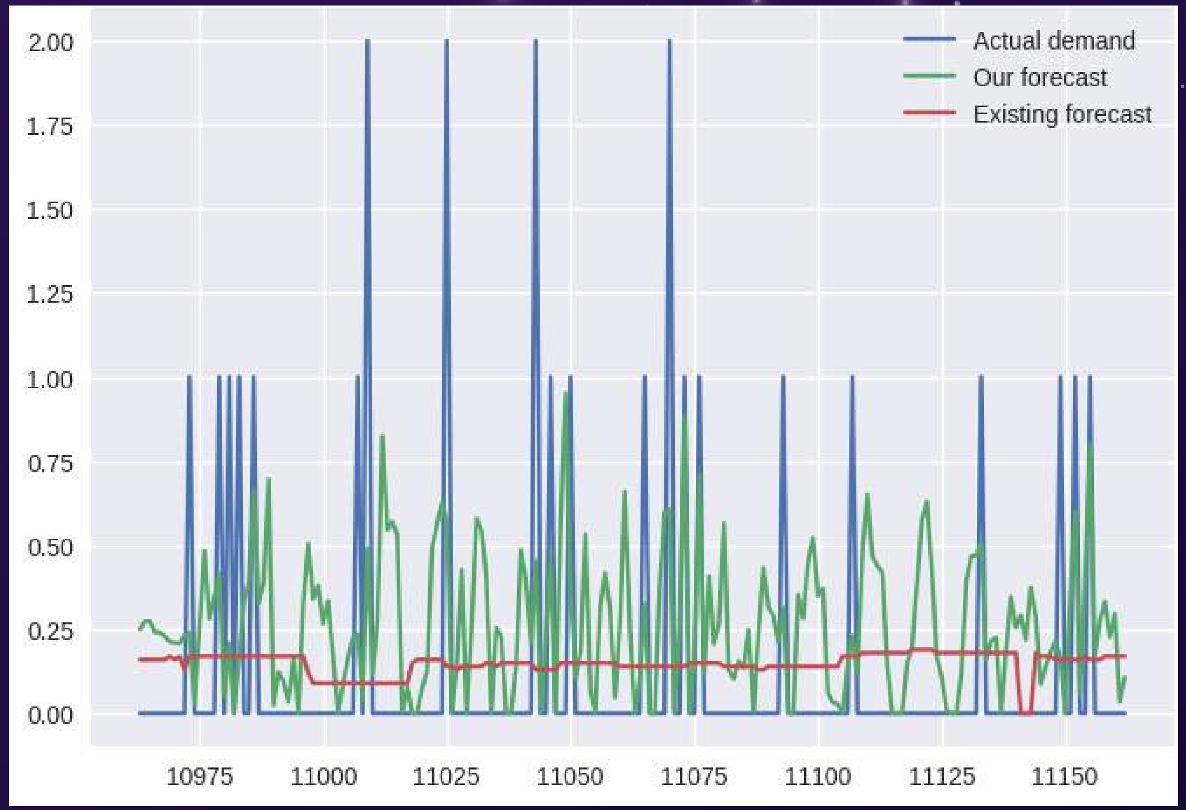
Forecast Improvement



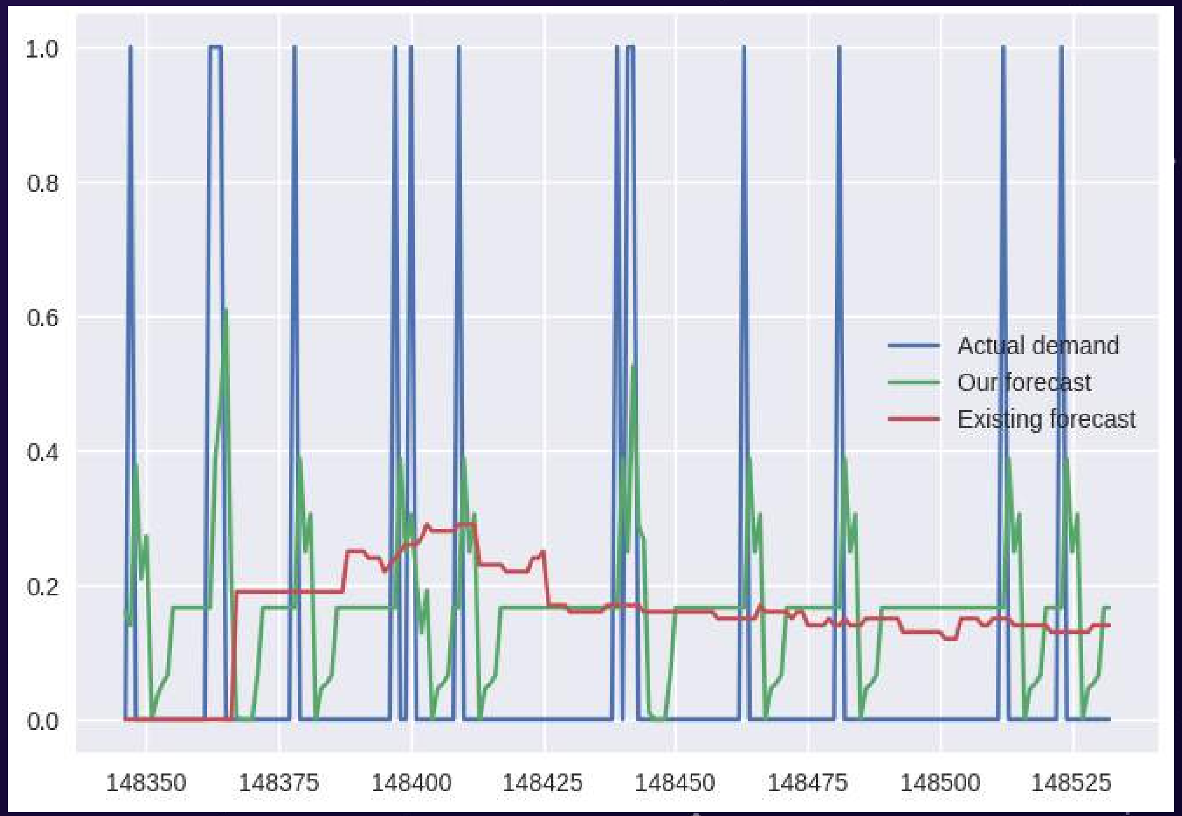
Forecasts at product level

*Distribute forecasts to shops based on historical sales contribution per shop

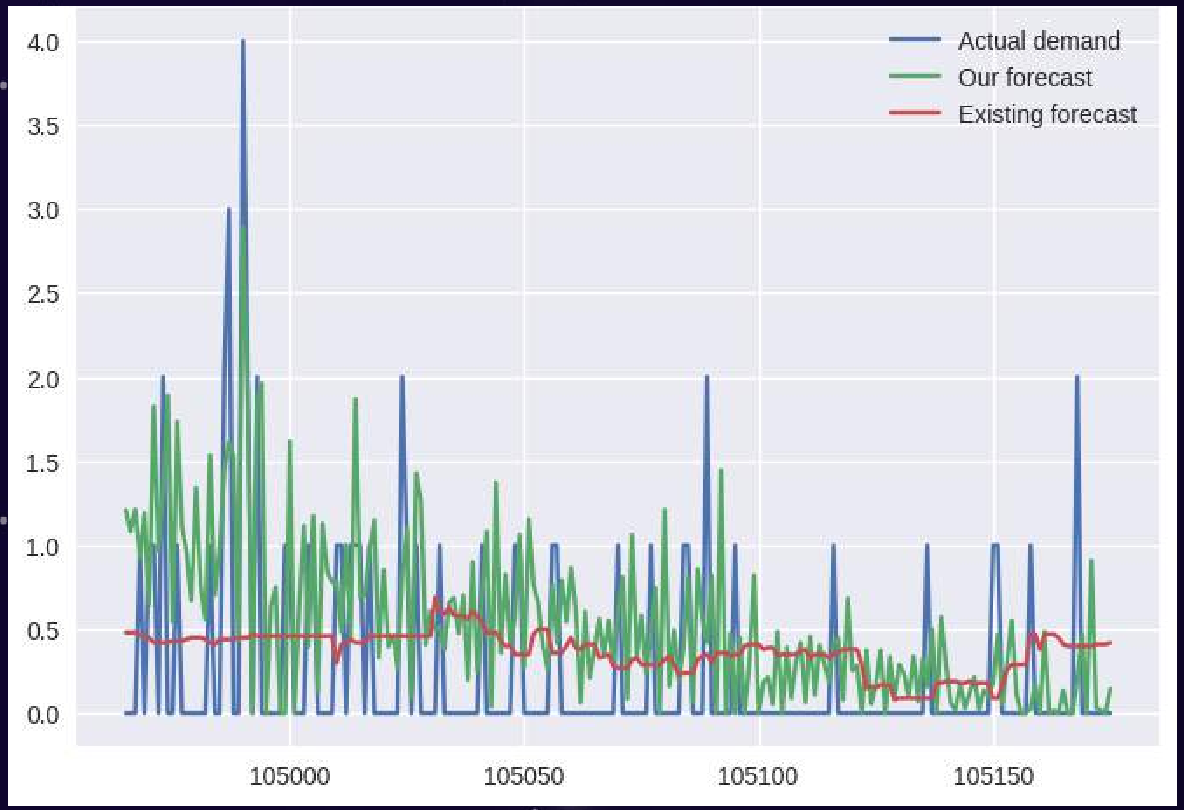
Forecasts included for all products at particular shop



Cover at shop T412



Xiaomi at shop B319



iPhone 15 at shop B412

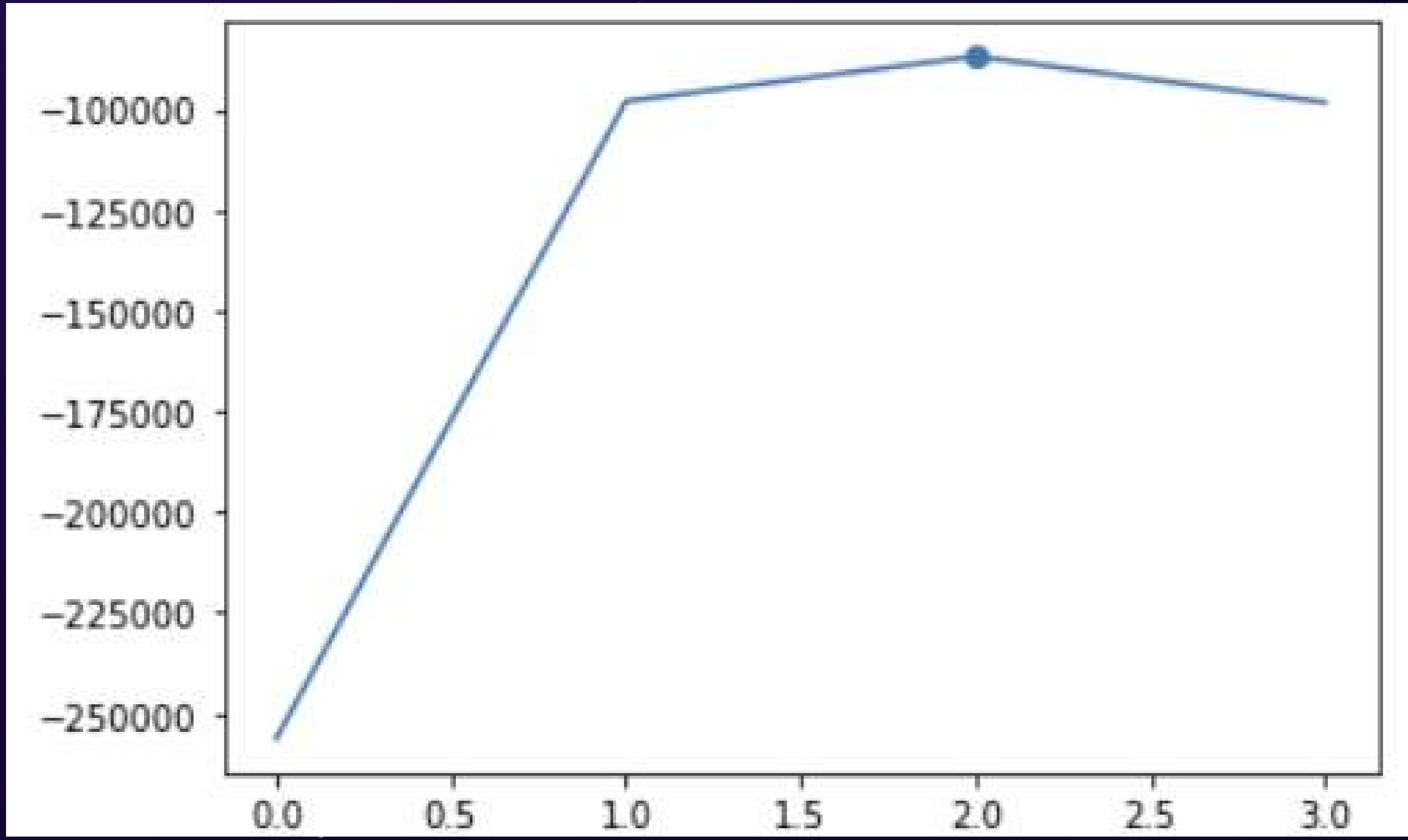
This technique allows us to optimize the safety stock level for all products

Demand Anticipating Policy: Improved

Optimize for the target level stock:
Safety Stock level = 2
Cost = $86 935

56% improvement in costs!

Heuristics can work but the forecasts will have the biggest improvements on costs



Overview of policies and costs

Forecast type	Policy	Cost
None	Dummy policy	$197,517
Existing forecast	Our policy with SS	$178,372
Improved forecast	Our policy with SS	$86,935

**For the iPhone 14*

Using this method for all products will drastically improve performance

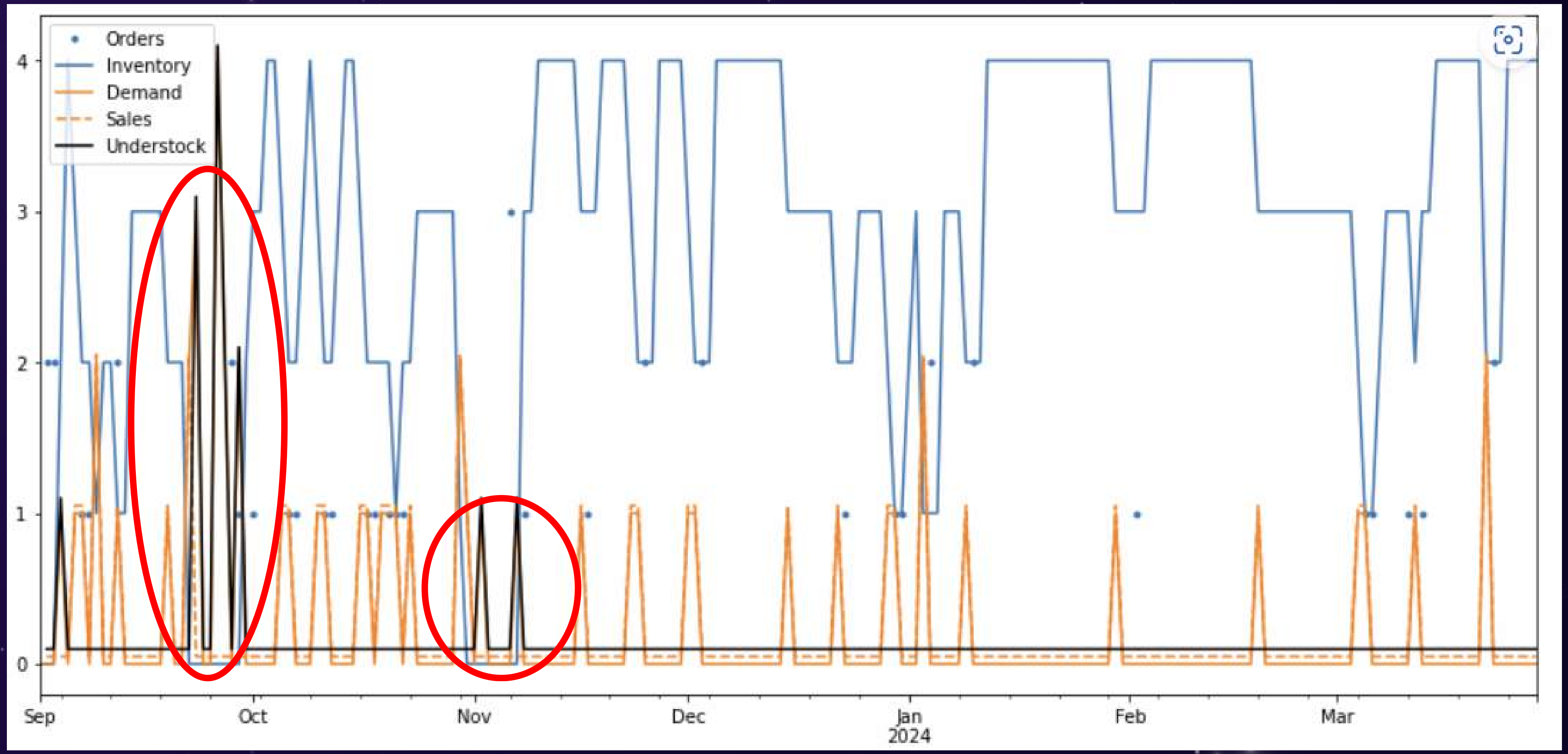
**Compute time limited company wide costs calculations*

SS = Safety Stock

Deep dive plant level - B319

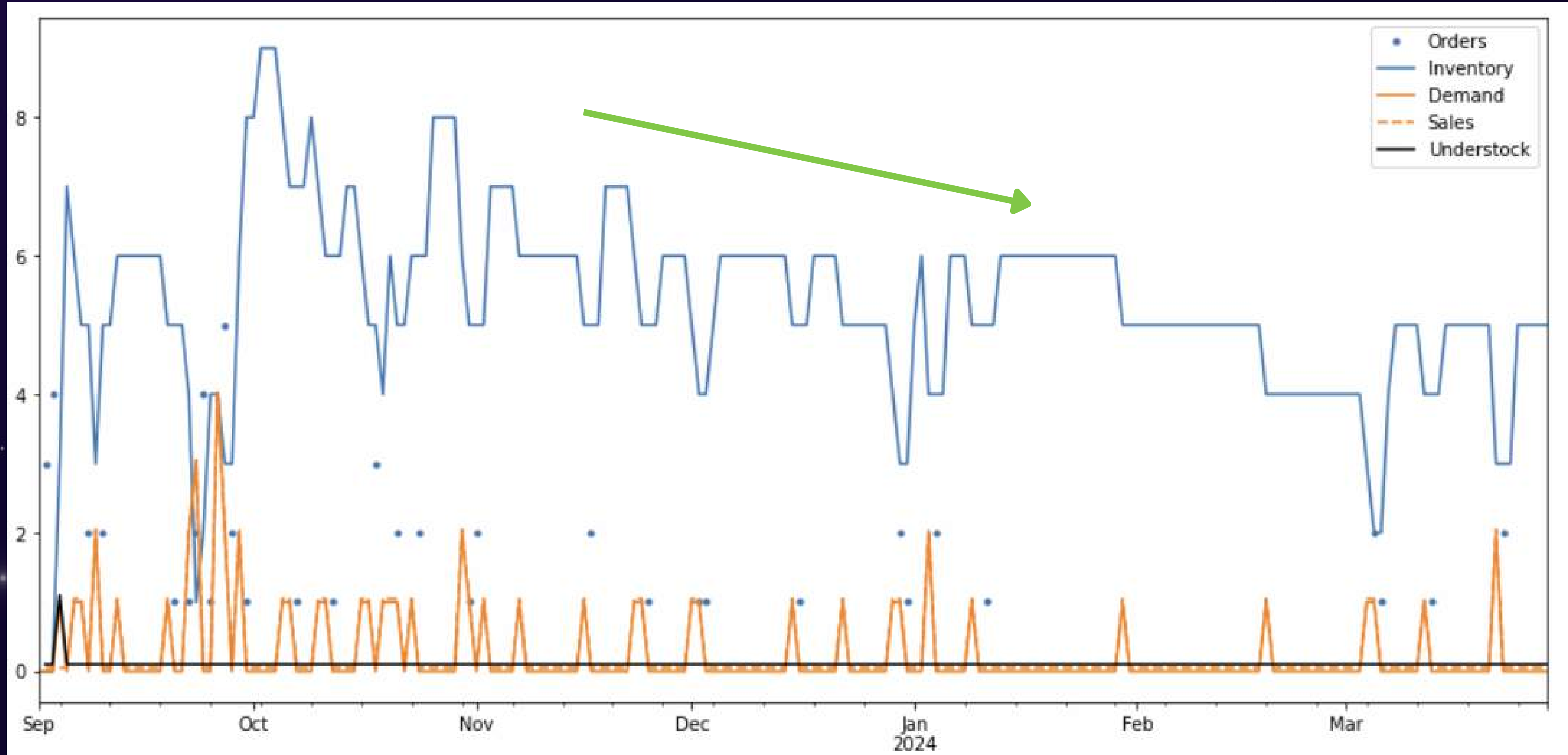
Original forecast:

- Bad forecast leads to no inclusion of trend and stockouts



Improved forecast:

- Forecast now takes adoption rate into account and less stockout



Insights and Takeaways

- Implementing policies based on heuristics (i.e. status and activity) is merely a reactive measure to compensate for inaccurate forecasts. It addresses the symptoms rather than the root cause.

- Maintain minimum inventory levels (2 units for iPhone 14): Ensure enough inventory is across all shops, while still using data to predict demand. Avoiding high understock costs

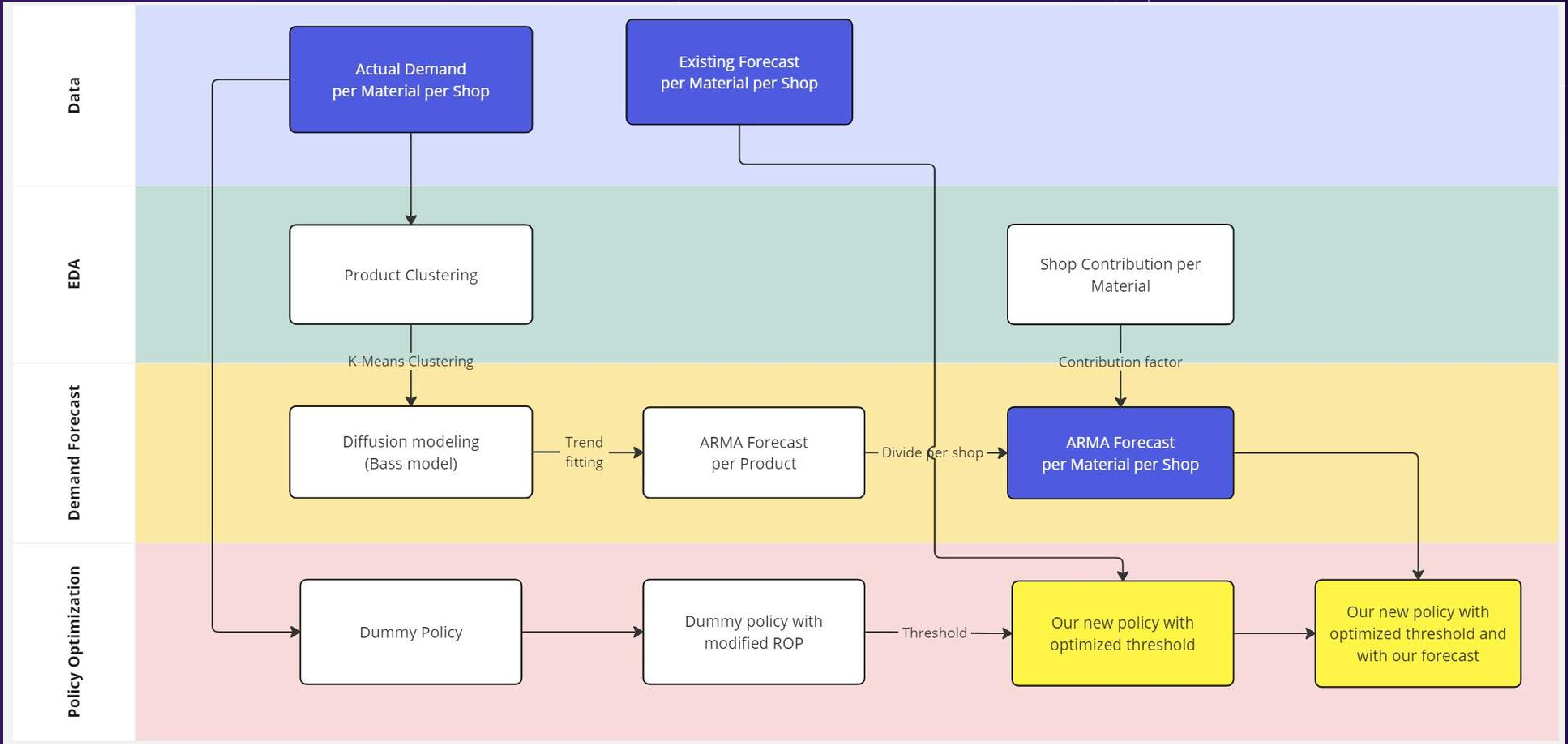
- Boost forecast accuracy:
  - Segment and cluster products (improves forecasting for new items)
  - Utilize Bass diffusion model (predicts product adoption curves)
  - Leverage ARMA models (accounts for variation and seasonality)

- Proactive approach benefits Proximus: While these improvements fall outside the direct scope, they can significantly benefit the Proximus.

proximus ada

Thank you!

Workflow Overview and Q&A



proximus ada