



# RETAIL INVENTORY OPTIMIZATION

Project Portfolio

Data-Driven Analysis to Efficiency Performance

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# Outline

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# Executive Summary

1. The overall analysis shows that inventory management performance is affected by several factors such as sales demand, stock levels, and supplier reliability.
2. Class A items dominate total value (80%) and many show reorder needs ( $ROP > stock$ ), driven by sales demand and long lead times.
3. EOQ optimization indicates potential cost savings of ~4.5%, suggesting that the current policy (ROQ) may be too frequent and not aligned with economic order principles.
4. Inventory turnover rates vary widely (2.48–19.03), reflecting a mix of fast- and slow-moving products.
  - a. Top 10 high turnover: Pomegranate, Bread Flour, Jasmine Rice, Arabica Coffee, Haddock, Plum, Cauliflower, White Sugar, Green Tea, Cucumber.
  - b. Top 10 low turnover: Lettuce, Vanilla Biscuit, Banana, Coconut Oil, Feta Cheese, All-Purpose Flour, Kale, Cottage Cheese, Raw Sugar, Cabbage.
5. Supplier lead time variation among suppliers (ranging from 1-340 days) directly influences ROP levels and inventory efficiency, showing the supplier reliability and ability to maintain stock sufficiency.
  - a. Top 10 high lead time supplier: Centizu, Feedfish, Vipe, Midel, Skippad, Zoombeat, Wikivu, Tagcat, Oyoba, Mymm.
  - b. Top 10 low lead time supplier: Zoonder, Divape, Eabox, Camimbo, Fadeo, Edgeify, Eazzy, Brainbox, Yakidoo, Realfire, Gabcube.

# Project Overview

## Project Description

This project explores the efficiency of groceries inventory performance through key metrics such as ABC analysis, EOQ, ROP, Inventory Turnover, and Supplier Performance. The objectives is to assess current inventory performance, identify improvement areas, and suggest the recommendation to enhance inventory service level.

## Problem Addressed

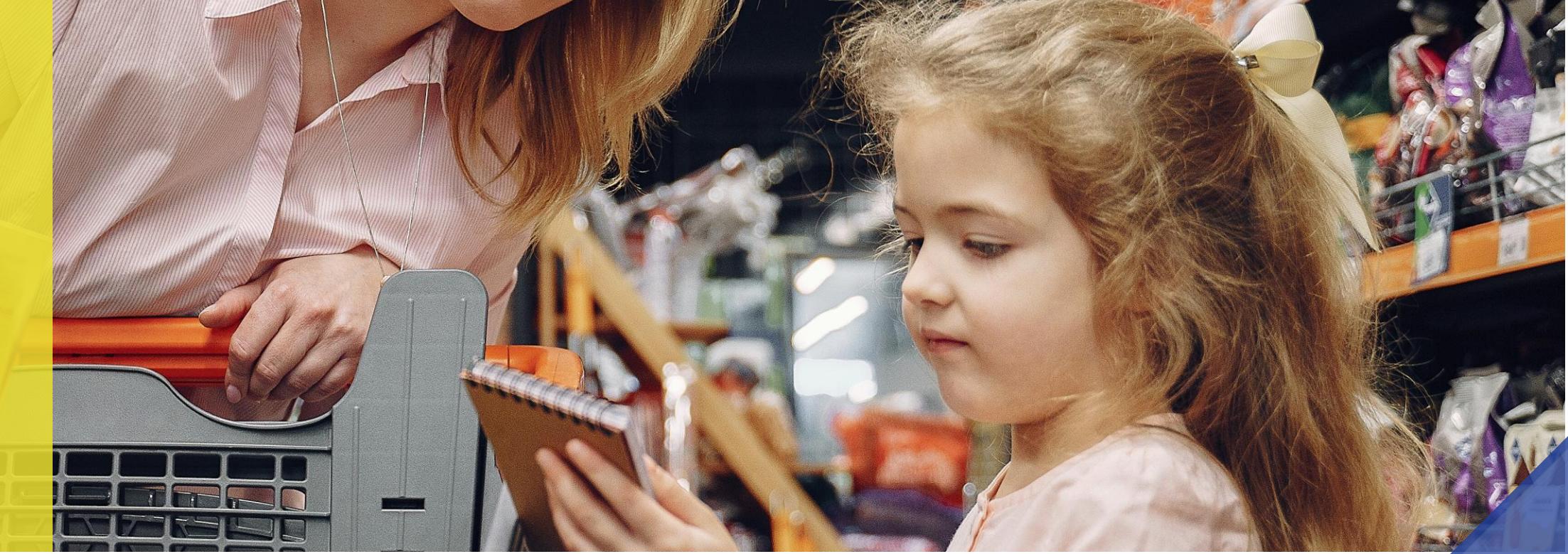
1. Perform key metrics analysis to understand inventory dynamics
2. Evaluate and suggest strategic recommendation to improve inventory efficiency

## Study Research

1. Which product categories contribute the most to the total inventory level?
2. What is the optimal order quantity that balances demand, ordering cost, and holding cost?
3. When should inventory replenishment occur to prevent stockouts?
4. How efficiently does inventory move within the supply chain, which products are overstocked or understocked?
5. Which suppliers demonstrate the high performance?



# Methodology



## Data Collection

1. The dataset was obtained through Kaggle provided by Willian Oliveira (licensed under CC0: Public Domain). The final dataset contained 990 rows and 17 columns
2. Key features: Product Name, Supplier Name, Date Received, Last Order Date, Stock Quantity, Unit Price, Sales Volume.

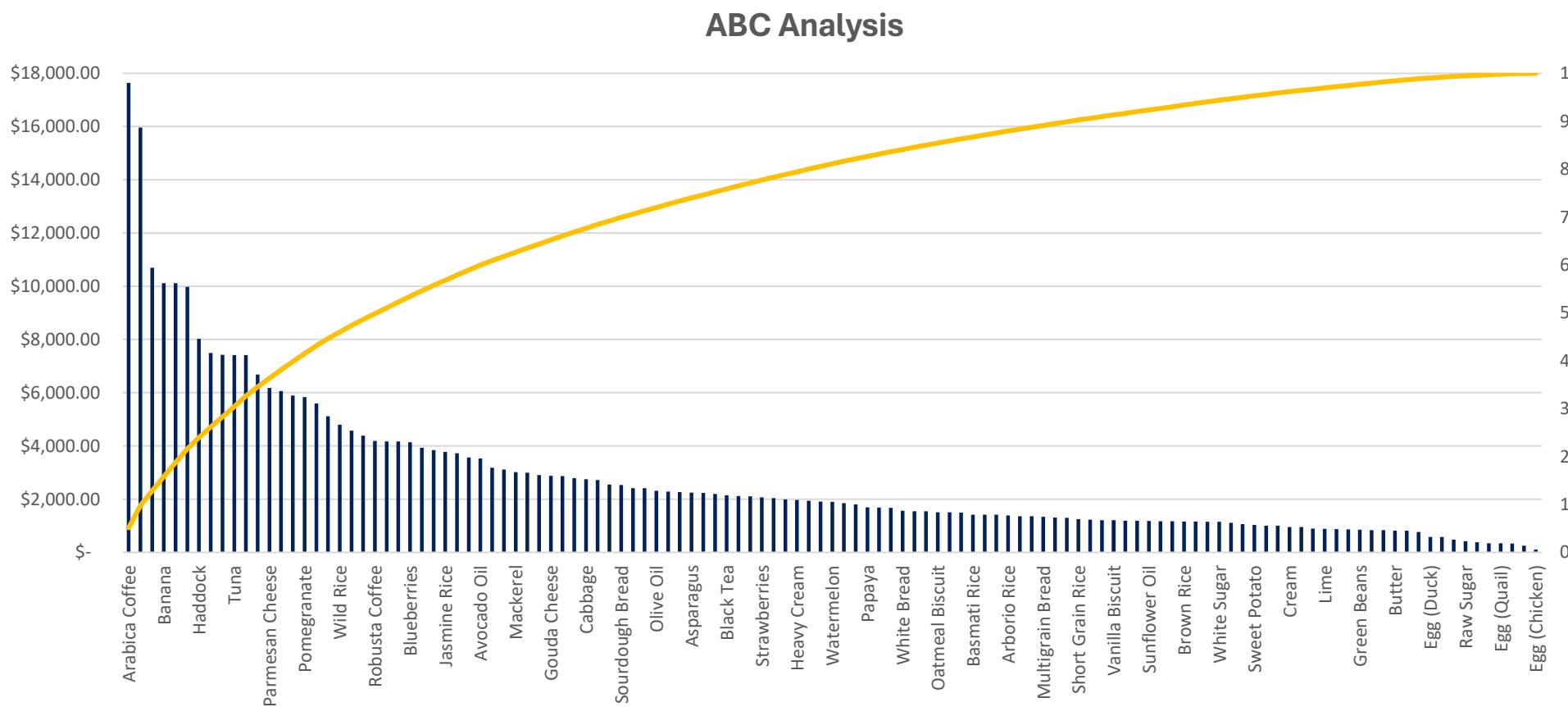
## Data Wrangling

1. Data formatting (converted date column into datetime type, standardize column names and formats for consistency)
2. Handle missing values : 0 missing values
3. Duplicates values : 0 duplicate records found

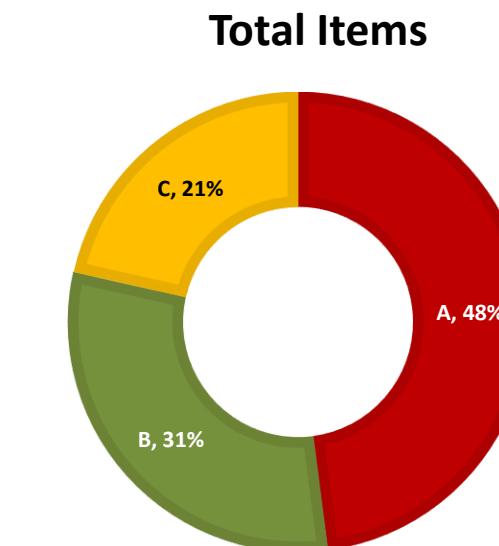
## Data Analysis

1. Performed product segmentation values ( $\text{sales volume} \times \text{unit price}$ ) to identify items contributing most to total values
2. Calculating optimal order quantity using :  $EOQ = \sqrt{\frac{2DS}{H}}$
3. Estimated reorder point using average daily demand and lead time using :  $(\text{avg. daily unit sales} \times \text{avg. daily lead time}) + ss$
4. Inventory turnover using : COGS (cost of goods sold)/average inventory value
5. Supplier performance analysis using average and variability (stdev) lead time performance

# ABC Analysis



ABC Classification	% of Relevance	Total Items	Total Value
Product A	80%	58	\$ 273,524.32
Product B	15%	37	\$ 52,495.05
Product C	5%	26	\$ 18,249.97
<b>Total</b>	<b>100%</b>	<b>121</b>	<b>\$ 344,269.34</b>



## Finding:

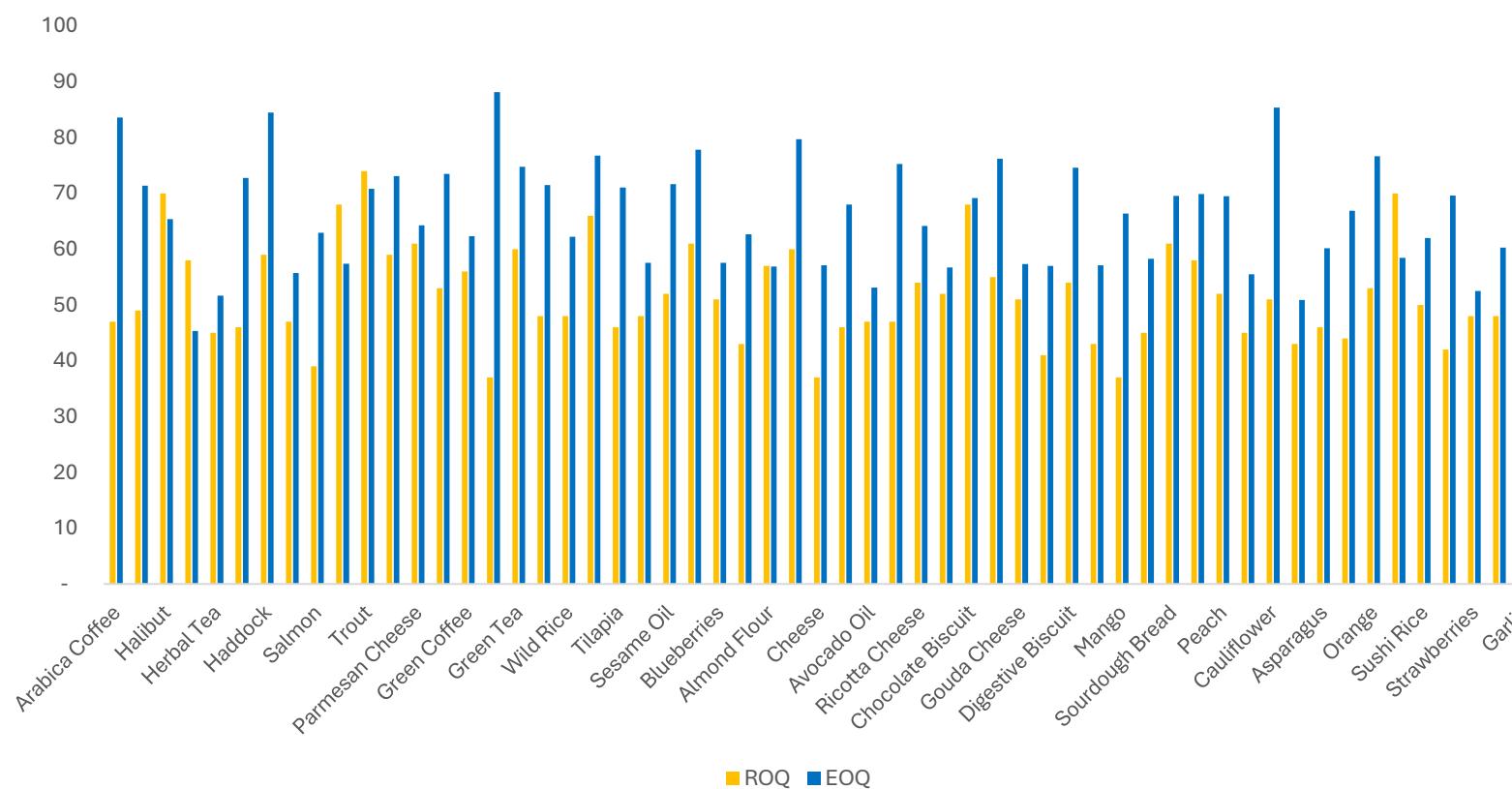
- Class A accounts for 48% of total items but contributes to 80% of inventory value, indicating critical products/SKUs that required tight monitoring.
- Class B, 31% of total items contributes 15% of total value, suitable for periodic reviews.
- Class C, 21% contributes 5% of total value, can be managed through bulk purchasing.

# Economic Order Quantity (EOQ)

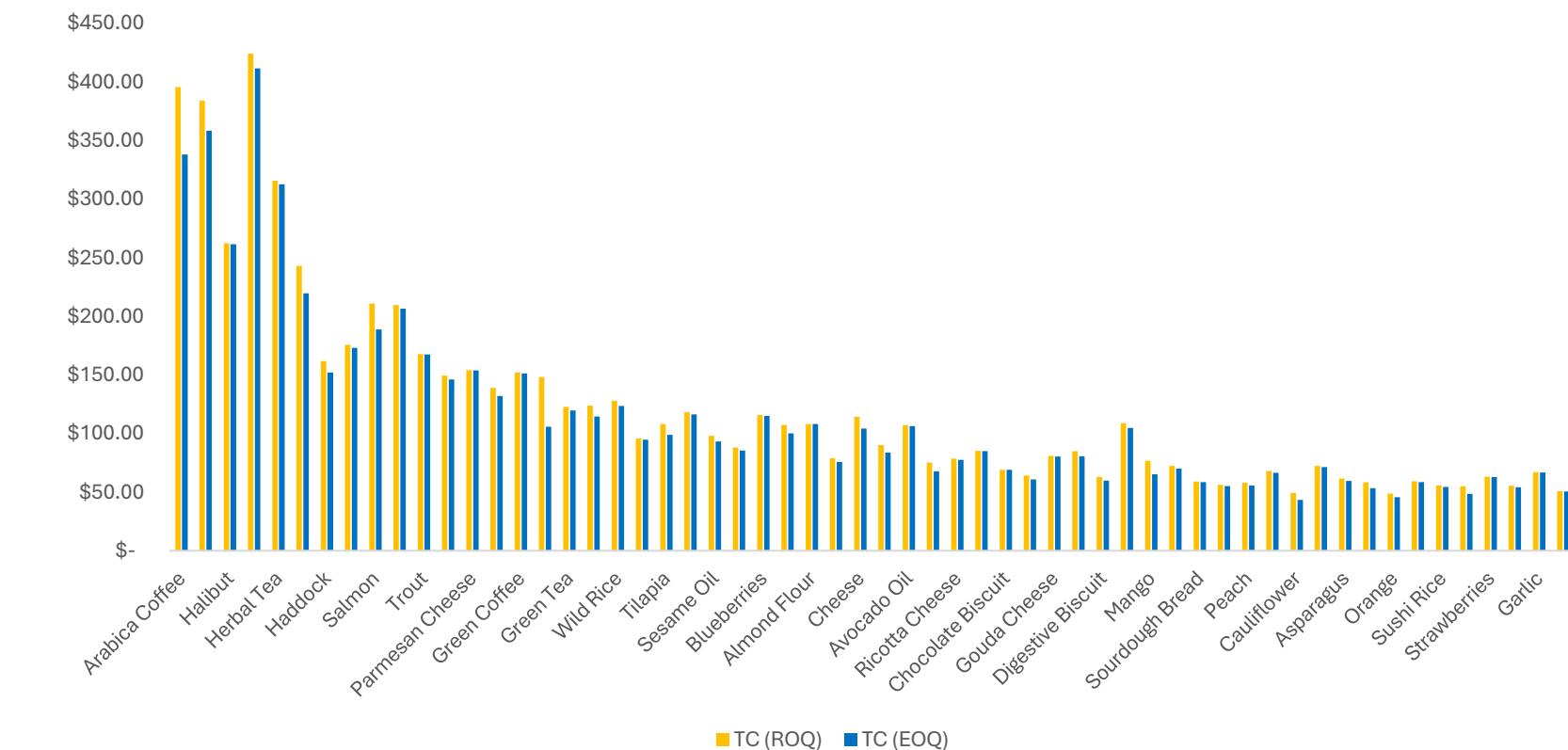
Class A Items



ROQ vs EOQ (Unit)



Cost Reduction using EOQ Analysis (\$)



## Findings:

1. EOQ per order is generally higher than the existing policy (ROQ), indicating that order frequency could be reduced while still fulfilling annual demand.
2. Increasing of EOQ results in a ~4.5% reduction in total cost (ordering + holding) for all products, demonstrating improved cost efficiency.
3. Note: total cost for existing policy is calculated using transaction frequency = (annual demand/ROQ) for a consistent comparison with EOQ. Actual transaction frequency may differ, which can affect real total cost and risk of stockouts (explained in the next slide).
4. Other class items are included in the appendix.

# Reorder Point (ROP)

Class A Items



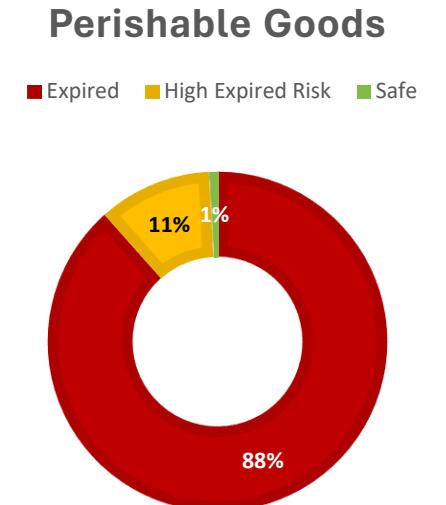
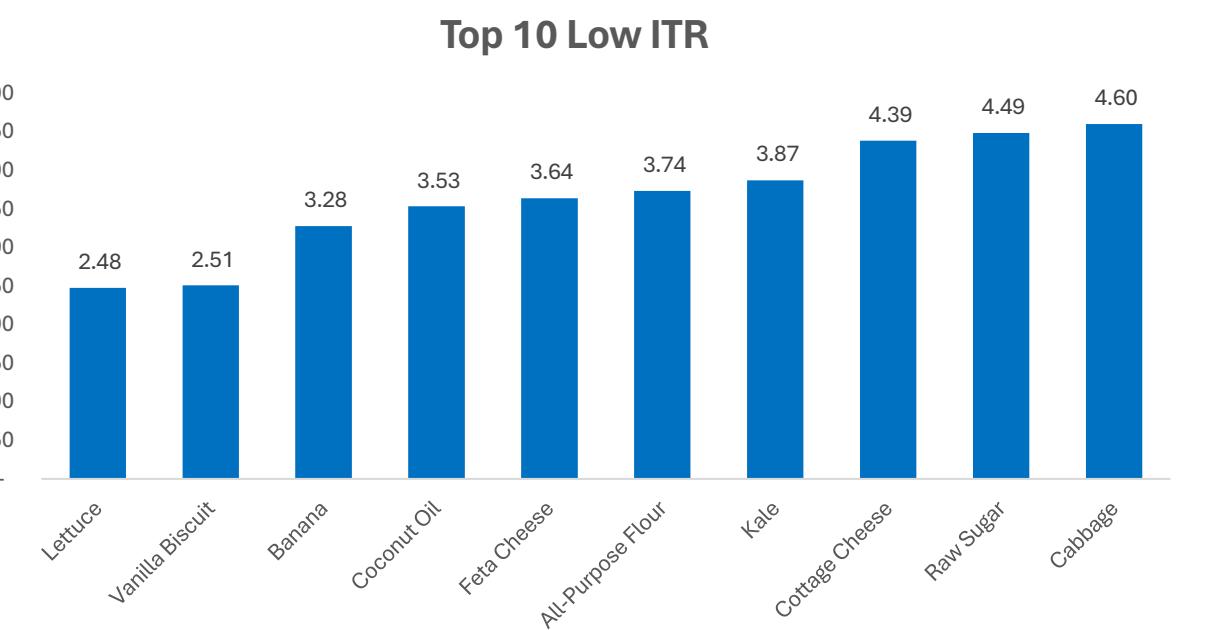
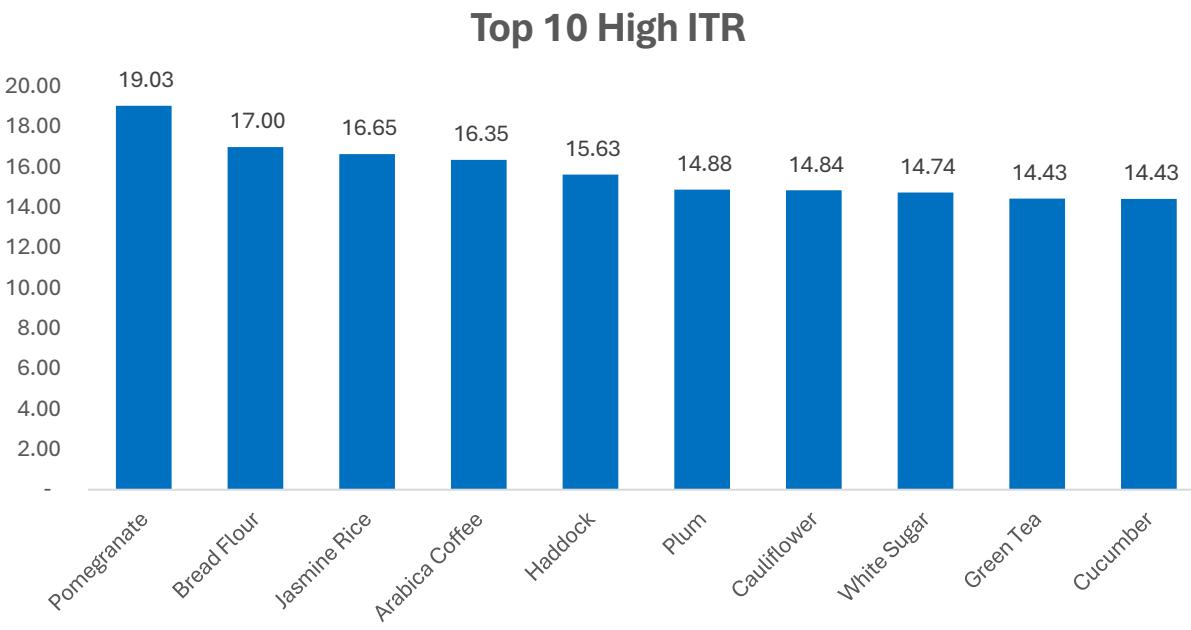
Products & Suppliers	LeadTime	Daily Sales	Safety Stock	ROP	Stock Qty	Stock Status	Supplier Status
<b>Arabica Coffee</b>					<b>704</b>		
Feedfire	209	1.00	124	333	98	Reorder	Active
Jayo	340	1.00	158	498	36	Reorder	Backordered
Jetpulse	60	2.00	66	186	13	Reorder	Backordered
Mynte	212	1.00	125	337	97	Reorder	Backordered
Rhycero	215	1.00	126	341	45	Reorder	Active
Rhyzio	67	2.00	70	204	74	Reorder	Backordered
Skivee	163	1.00	110	273	55	Reorder	Active
Voonyx	55	1.00	64	119	23	Reorder	Backordered
Yadel	262	4.00	139	1,187	74	Reorder	Active
Yotz	280	6.00	144	1,824	65	Reorder	Backordered
Youspan	289	1.00	146	435	46	Reorder	Backordered
Zoozzy	79	1.00	76	155	78	Reorder	Active
<b>Cheese</b>					<b>350</b>		
Eimbee	200	1.00	121	321	50	Reorder	Backordered
Mydeo	115	1.00	92	207	100	Reorder	Backordered
Oozz	2	30.00	12	72	78	Sufficient	Active
Shuffledrive	71	1.00	72	143	53	Reorder	Active
Twitterbeat	106	1.00	88	194	69	Reorder	Active
<b>Cod</b>					<b>166</b>		
Buzzshare	51	4.00	61	265	31	Reorder	Active
Buzzster	171	1.00	112	283	16	Reorder	Active
Devbug	201	9.00	122	1,931	23	Reorder	Backordered
Katz	13	2.00	31	57	96	Overstock	Active
<b>Apricot</b>					<b>260</b>		
Blognation	21	1.00	39	60	90	Sufficient	Backordered
Quinu	144	4.00	103	679	38	Reorder	Active
Skinix	60	2.00	66	186	42	Reorder	Backordered
Zoonder	3	12.00	15	51	90	Overstock	Active

Condition	Status
Stock Qty < ROP	Reorder
ROP ≤ Stock Qty < 1.5xROP	Sufficient
Stock Qty ≥ 1.5xROP	Overstock

## Findings:

- The table shows a sample from class A & B products, where mostly ROP > stock quantity, indicating a reorder requirement.
- Suppliers with “backordered” status (e.g. Jayo, Jetpulse, Mynte, etc) and high ROP (e.g. Yadel, Yotz, Chatterbridge, etc) represent potential supply risk as replenishment may extend actual ROP, therefore require periodic monitoring.
- “Active” suppliers and low ROP maintain sufficient safety stock, indicating stable fulfilment.
- ROP variation across suppliers for the same product (e.g Arabica Coffee) reflects different reliability or lead time performance among them.
- The remaining tables are included in the Appendix.

# Inventory Turnover Rate (ITR) & Perishable Goods Overview



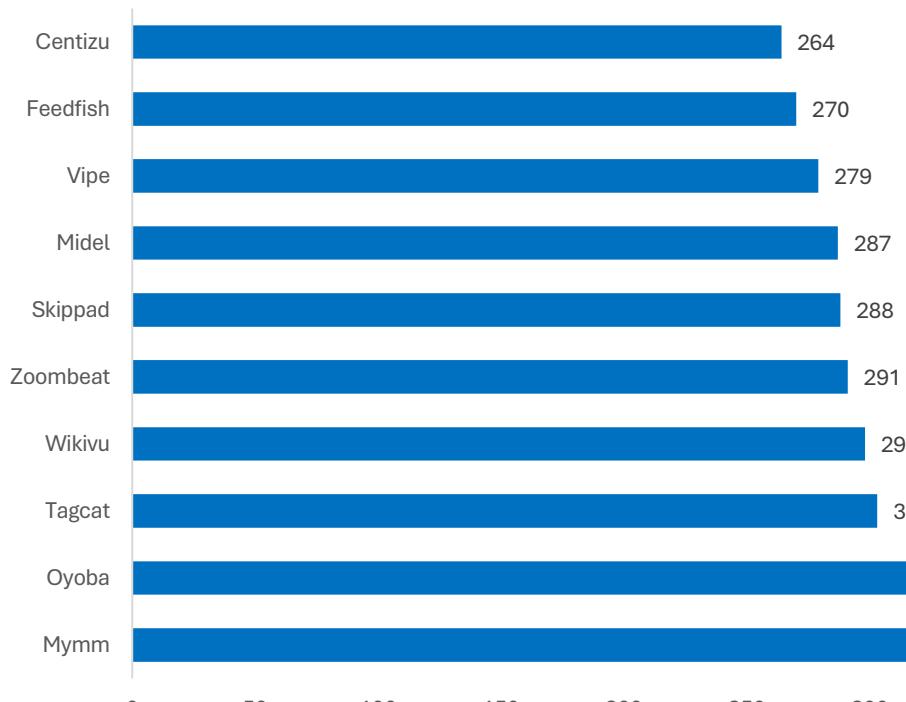
## Findings:

1. Inventory Turnover Rate (ITR) varies from 2.48 – 19.03, showing significant variation in products movement.
2. Pomegranate, Bread Flour, Jasmine Rice, Arabica Coffee, Haddock, Plum, Cauliflower, White Sugar, Green Tea, Cucumber, are the highest turnover, indicating fast-moving items that require periodic monitoring to ensure stock sufficiency.
3. Lettuce, Vanilla Biscuit, Banana, Coconut Oil, Feta Cheese, All-Purpose Flour, Kale, Cottage Cheese, Raw Sugar, Cabbage exhibit slow movement, indicating few factors such as low sales demand, overstocking, or demand seasonality.
4. Overall most products show a significant portion marked as expired (shelf life < 0). The preliminary shelf-life data may be affected by recording discrepancies between received and expired dates or by possible system input anomalies, requiring further data validation.

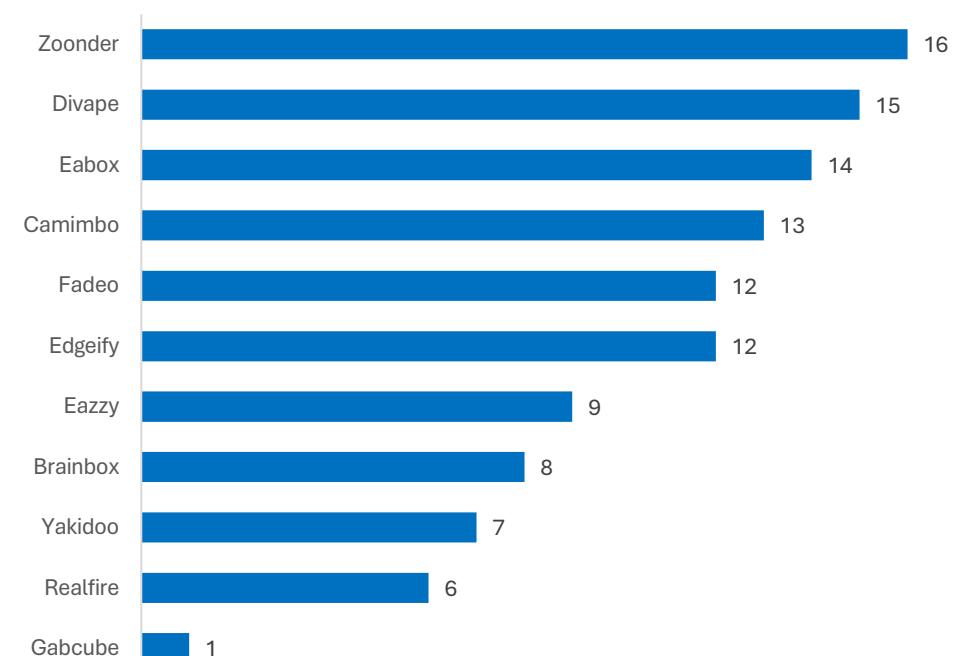
# Supplier Performance



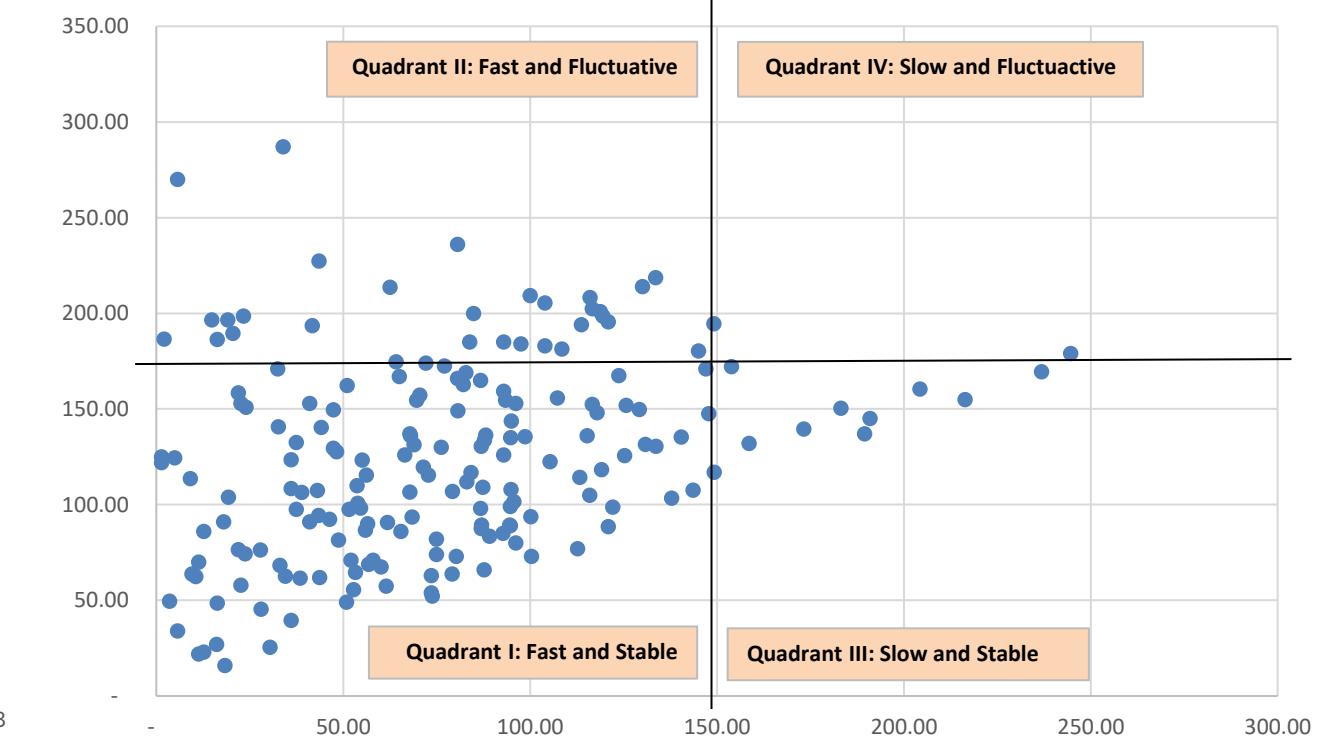
Top 10 High Lead Time by Supplier



Top 10 Low Lead Time by Supplier



Supplier Variation Distribution



## Findings:

- Lead times vary across suppliers, reflecting differences in delivery reliability. Based on lead time variability (calculated using standard deviation):
  - Quadrant I:** Majority of suppliers, fast and stable delivery.
  - Quadrant II:** Few suppliers, fast but slightly fluctuating delivery.
  - Quadrant III:** Some suppliers, slow but stable delivery.
  - Quadrant IV:** Only one supplier, slow and fluctuating delivery.
- Suppliers with longer or more variable lead times may increase the risk of stockouts, requiring periodic review and reevaluation.
- Conversely, faster and stable suppliers enhance responsiveness and ensure continuous service.



# Summary

1. The overall analysis shows that inventory management performance is affected by several factors such as sales demand, stock levels, and supplier reliability.
2. Class A items dominate total value (80%) and many show reorder needs ( $ROP > stock$ ), driven by sales demand and long lead times.
3. EOQ optimization indicates potential cost savings of ~4.5%, suggesting that the current policy (ROQ) may be too frequent and not aligned with economic order principles.
4. Inventory turnover rates vary widely (2.48–19.03), reflecting a mix of fast- and slow-moving products, while shelf-life evaluation reveals significant expiry risks, possibly due to late receipts or data recording issue, requiring data validation.
5. Supplier lead time variation among suppliers (ranging from 1–340 days) directly influences ROP levels and inventory efficiency, showing the supplier reliability and ability to maintain stock sufficiency.

# Recommendation

## Inventory Strategy

1. Prioritize Class A items for strict control using EOQ-based policy replenishment and periodic monitoring.
2. Apply differentiated inventory policies (e.g., bulk shipping) for Class B & C to balance cost and service levels.

## Supplier Management

1. Conduct supplier performance evaluation, through lead time, “backordered” status and high ROP, as they potentially risk to stockout items.
2. Establish collaborative partnership with critical suppliers to improve reliability.

## Process Improvement

1. Enhance inventory monitoring for fast moving items to prevent potential stockouts
2. Optimize stock policies for slow-moving products by considering special pricing/promo or adjust safety stock.
3. Implement further analysis to validate shelf-life data entries to ensure accuracy and consider applying FEFO (First Expired, First Out) for perishable goods.
4. Document and track ROP vs actual stock to refine inventory planning.





THANK  
YOU