Optimizing Supply Chain Efficiency and Product Portfolio for an agricultural and retail business

A Mid-term report for the BDM capstone Project

Submitted by

Name: Govindula Acharya Abhisht

Roll number: 23F2001578

IITM Online BS Degree Program,

Indian Institute of Technology, Madras, Chennai

Tamil Nadu, India, 600036

Table of Contents

Declaration Statement

I am working on a Project Title “Optimizing Supply Chain Efficiency and Product Portfolio for an agricultural and retail business unit”. I extend my appreciation to **Pure O Natural**, for providing the necessary resources that enabled me to conduct my project.

I hereby assert that the data presented and assessed in this project report is genuine and precise to the utmost extent of my knowledge and capabilities. The data has been gathered through primary sources and carefully analyzed to assure its reliability.

Additionally, I affirm that all procedures employed for the purpose of data collection and analysis have been duly explained in this report. The outcomes and inferences derived from the data are an accurate depiction of the findings acquired through thorough analytical procedures.

I am dedicated to adhering to the information of academic honesty and integrity, and I am receptive to any additional examination or validation of the data contained in this project report.

I understand that the execution of this project is intended for individual completion and is not to be undertaken collectively. I thus affirm that I am not engaged in any form of collaboration with other individuals, and that all the work undertaken has been solely conducted by me. If plagiarism is detected in the report at any stage of the project's completion, I am fully aware and prepared to accept disciplinary measures imposed by the relevant authority.

I agree that all the recommendations are business-specific and limited to this project exclusively and cannot be utilized for any other purpose with an IIT Madras tag. I understand that IIT Madras does not endorse this.

Signature of Candidate: (**Digital Signature**)

Name: Govindula Acharya Abhisht

Date :08/07/2025

1 Executive Summary

Pure O Naturals is a retail company that sells organic fruits, vegetables, and dairy products sourced directly from local farmers and sells them to customers chemical free. Despite its ethical sourcing model and loyal customer base, the company faces supply chain inefficiencies primarily overstocking of slow-moving items and stockouts of fast-selling products.

To address these issues, stock data from December 2024 to February 2025, comprising 15,406 sales transactions and 5,587 stock entries across 5,000+ SKUs are analyzed. Descriptive statistics show imbalance the average quantity received per SKU is 7.16 units, while only 3.13 units are sold, with an average sell-through rate of 28.6%. This indicates large volumes of unsold stock and inefficient inventory turnover.

Applying descriptive statistics, time-series trends, sell-through rate evaluation, and SKU classification helped to identify patterns of overstock (e.g., Ladies Finger, Drumstick) and stockouts (e.g., Cow Milk, A2 Buffalo Milk). Daily sales data revealed fluctuating demand, highlighting the need for pre planning of the stock. Even top-selling items like Kiran Melon and Sweet Corn show excess stock, suggesting over-purchasing despite high demand.

This approach tries to uncover the specific SKUs contributing to stock inefficiency and demand supply mismatch. The insights gathered point toward practical and effective solutions such as optimizing procurement volumes, better organizing shelf space, and introducing timely alerts. By aligning stock intake more closely with actual sales patterns, Pure O Naturals can reduce waste, minimize stockouts, and enhance overall supply chain efficiency and profitability.

2 Proof of Originality of Data

(Please copy paste the links in the browser if click does not work)

Video of interaction with the business managers: **Video interaction with store manager.** https://drive.google.com/file/d/15hSerb2rIPz6zKzMLqD2AifvLKmfwRCD/view

Transcript Link: Transcript

https://drive.google.com/file/d/1jSHkojqbSTb7ULzcILtgeFq83-htOWV8/view?usp=sharing

Pictures of the firm:

Photos Link: **Photos**

https://drive.google.com/drive/folders/1Et0sogF-UP-yixe0Vxlc1sxkjdUWJB_d?usp=sharing

Letter from the firm in letterhead with stamp and sign:

Pure O Natural

FRESH FRUITS, VEGETABLES & JUICE

Date: 06-04-2025

TO WHOMSOEVER IT MAY CONCERN

This is to certify that the data provided to Govindula Acharya Abhisht, a student of the BS Degree Program in Data Science and Applications at the Indian Institute of Technology Madras, is authentic. We have no objection to his using this data for his BDM Capstone Project.

During his time with us, he has demonstrated sincerity, dedication, and a strong work ethic. We extend our best wishes for his future endeavors.

Yours sincerely,

Naveen

Manager

Pure O Natural

A.S.Rao Nagar

Figure1: Letterhead

3 Meta Data and Descriptive Statistics

The metadata for each of the datasets used in this preliminary analysis:

Sales Data (cleaned_sales_data.csv)

- Source: sales details from dec24 to feb25.xls
- Time Period: December 2024 - February 2025
- Number of Records: 15406
- Columns:
    - Date: Date of the sales transaction.
        - Data Type: Datetime
        - Example Value: 2024-12-23
    - SKU Description: Description of the product sold.
        - Data Type: Object (String)
        - Example Value: FILTER COFFEE 150ML NEW BOLD ID FRESH
    - Qty Sold: Quantity of the product sold in that transaction.
        - Data Type: Float
        - Units: Pieces/Units
        - Example Value: 1.0, 2.0

Stock Received Data (cleaned_stock_received_data.csv)

- Source: stock received project.xls
- Time Period: December 2024 - February 2025
- Number of Records: 5587
- Columns:
    - SKU Description: Description of the product received.
        - Data Type: Object (String)
        - Example Value: KARPURAVALLI BANANA, BEET ROOT
    - Qty Received: Total quantity of the product received over the three-month period.
        - Data Type: Float
        - Units: Pieces/Units (implied)
        - Example Value: 5.0, 20.0

Combined Stock-Sales Summary Data (combined_stock_sales_summary.csv)

- This dataset combines the total quantities of each SKU received and sold over the December 2024 - February 2025 period.
- Columns:
    - SKU Description: Description of the product.
        - Data Type: Object (String)
        - Qty Received: Total quantity of the product received over the three-month period.
        - Data Type: Float
    - Total Qty Sold (Dec24-Feb25): Total quantity of the product sold over the three-month period.
        - Data Type: Float
        - Sell-Through Rate (Dec24-Feb25): Ratio of Total Qty Sold to Total Qty Received for the period.
        - Total Qty Sold
        - Data Type: Float

Descriptive Statistics:

Dataset	Metric	Value
Sales Data (cleaned_sales_data.csv)	Total Sales Transactions	15,406
	Mean Qty Sold	2.88 units
	Std. Dev. Qty Sold	7.29 units
Stock Received Data (cleaned_stock_received_data.csv)	Total Stock Entries	5,587
	Mean Qty Received	7.16 units
	Std. Dev. Qty Received	10.16 units
Combined Summary (combined_stock_sales_summary.csv)	Avg. Qty Received per SKU	7.16 units
	Avg. Qty Sold per SKU	3.13 units
	Avg. Sell-Through Rate	28.6%
	Std. Dev. Sell-Through	0.47

Table 1: Descriptive statistics

4 Detailed Explanation of Analysis Process/Method

4.1 Data Cleaning and Pre-processing

The raw sales and stock data were initially disorganized due to formatting inconsistencies and metadata rows. In the sales file, headers appeared at row 3, while in the stock file, headers were found at row 6. These non-transactional rows are removed to retain only valid data.

Column names were standardized for consistency ‘Description’ was renamed to ‘SKU Description’, and spaces in fields like ‘Qty Sold ’ are cleaned. Date columns were reformatted using Google Sheets functions like DATEVALUE() to ensure accurate time-series analysis.

4.2 Analysis Process/Method

1. Descriptive Statistics:

Descriptive statistics such as total transactions, average quantity sold/received, and standard deviation were calculated using AVERAGE(), STDEV.S(), and COUNTA() functions. These metrics helped assess variability in demand, stock inflow patterns, and overall inventory performance across SKUs.

2. Aggregation and Merging:

Sales and stock data were aligned using VLOOKUP() or INDEX(MATCH()) based on SKU names. Aggregated totals per product were computed using SUMIF() or QUERY() functions, enabling unified SKU-wise analysis.

3 Classification and Gap Analysis:

To assess inventory efficiency, the Sell-Through Rate was calculated as: =IFERROR(Total Qty Sold / Qty Received, 0)

SKU-level inventory was classified using: =IF(AND(Qty Received > 0, Sell-Through Rate < 0.25), "Overstocked",

IF(Sell-Through Rate > 1, "Understocked", "Other"))

This classification helped in identifying products that were either moving too slowly or frequently running out of stock. Additional stock status calculations included:

Overstock: =MAX(0, Qty Received - Qty Sold)

Understock:

=Qty Sold - Qty Received

4 Time-Series and Trend Analysis

Sales trends were analyzed using QUERY() functions to group and sum data by date: =QUERY(Sales!A:C, "SELECT A, SUM(C) GROUP BY A LABEL SUM(C) 'Daily Sales'") This allowed the identification of demand fluctuations, seasonal patterns, and periods of high or low customer activity

Justification for Its Usage:

These google sheet functions helped to understand the nature of the data and the business challenges faced by Pure O Naturals. Descriptive and comparative methods provided a foundation for evaluating SKU-level efficiency, detecting overstock or stockouts, and understanding demand patterns.

Formulas such as SUMIF(), QUERY(), IFERROR(), and INDEX(MATCH()) allowed for clear understanding by business stakeholders and revealed key inefficiencies in stock management. While more advanced tools like predictive analytics will be explored , this analysis helped in uncovering key problem areas and supporting clear, practical decisions around inventory management.

5 Results and Findings

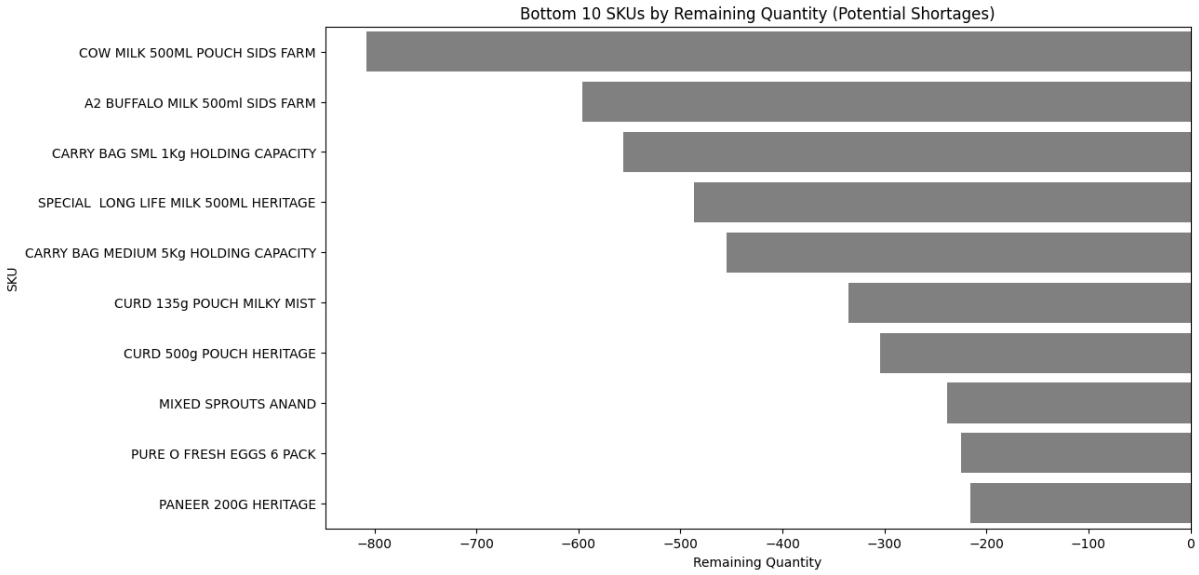

Figure 2: Bottom 10 SKUs by Remaining Quantity (Potential Shortages)

This bar chart highlights the SKUs with the lowest remaining quantities after accounting for sales, indicating possible stockout scenarios. Products such as "COW MILK 500ML POUCH SIDS FARM" and "A2 BUFFALO MILK 500ML" exhibit the most significant negative balances, signaling urgent replenishment needs. These shortages directly threaten service levels, risking both customer dissatisfaction and revenue loss.

Observation: SKUs with negative stock levels suggest that demand far outpaced supply during the observed period. These items should be prioritized for procurement or stocking adjustments.

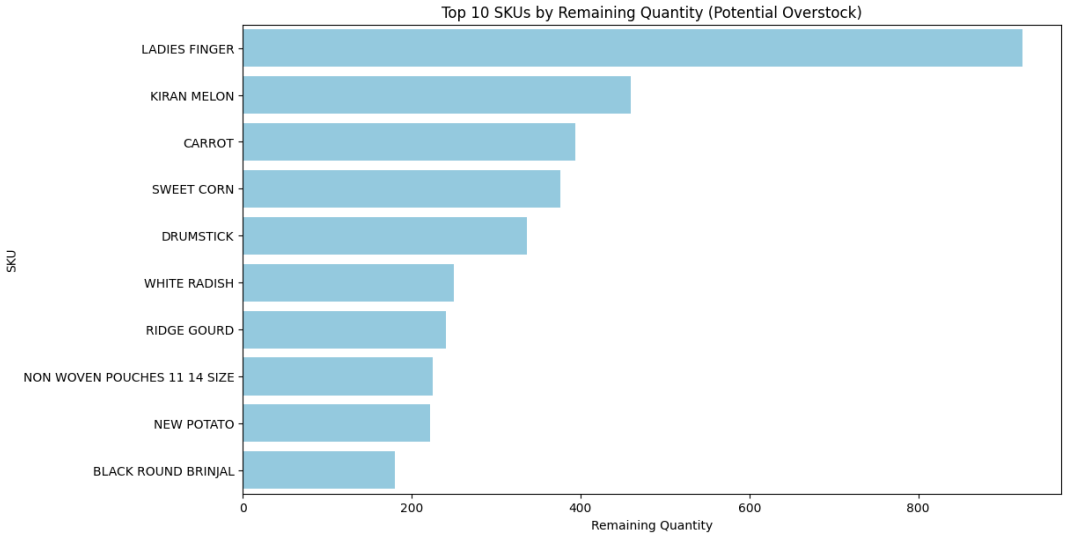

Figure 3: Top 10 SKUs by Remaining Quantity (Potential Overstock)

This chart displays the top 10 SKUs with the highest remaining stock levels after the sales period. SKUs like "LADIES FINGER" and "KIRAN MELON" are overstocked, with excess quantities indicating slower movement or over-procurement.

Observation: Though “KIRAN MELON” was also among top items sold over the period , overstocking ties up capital and increases the risk of spoilage. Items shown in this chart should be reviewed for excess purchasing.

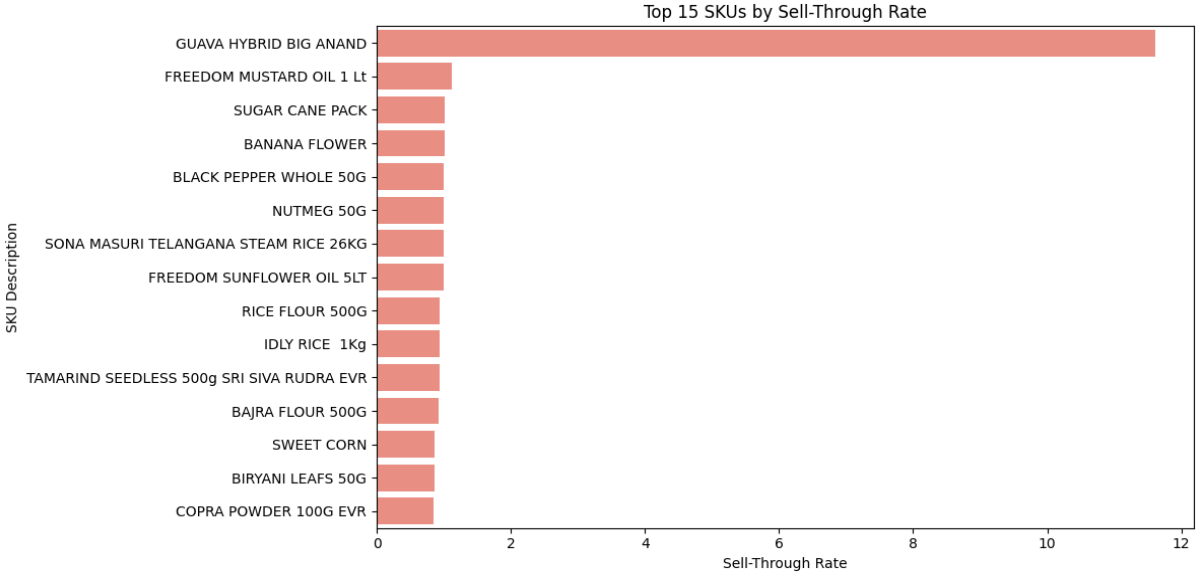

Figure 4: Top 15 SKUs by Sell-Through Rate

This chart highlights the SKUs that achieved the highest sell-through rates—calculated as the ratio of quantity sold to quantity received. Products like "GUAVA HYBRID BIG ANAND" exhibit extremely high turnover, indicating strong demand and efficient stock rotation.

Observation: High sell-through rates signify strong alignment between procurement and demand. These products can be prioritized for promotion or featured as best sellers.

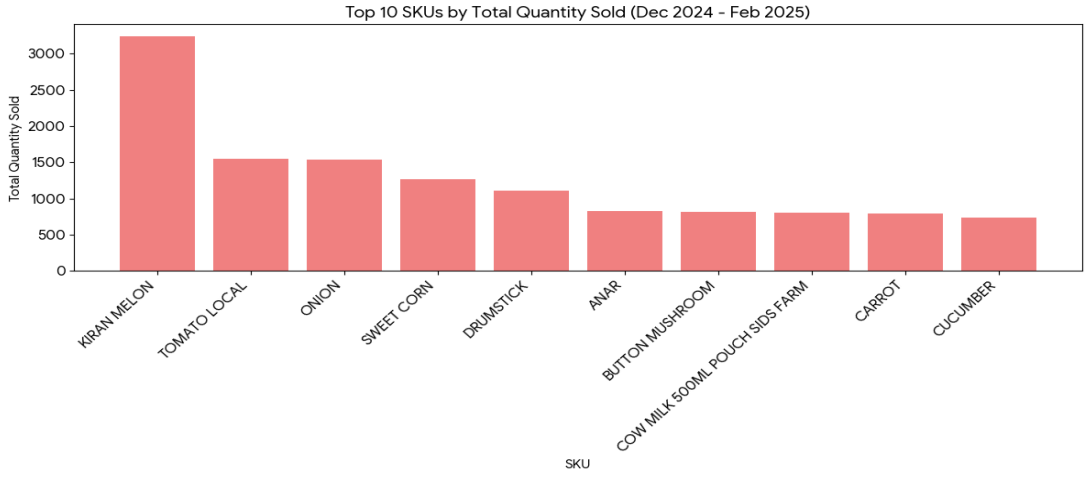

Figure 5: Top 10 SKUs by Total Quantity Sold (Dec 2024 – Feb 2025)

This bar chart ranks the top 10 products by total sales volume during the analysis period. "KIRAN MELON" leads with over 3,000 units sold, followed by "TOMATO LOCAL" and "ONION," highlighting customer preferences.

Observation: Identifying best-selling items helps in demand forecasting and supply prioritization. These products are essential for ensuring continuous availability and customer satisfaction and also needs to be cautious about not overstocking them.

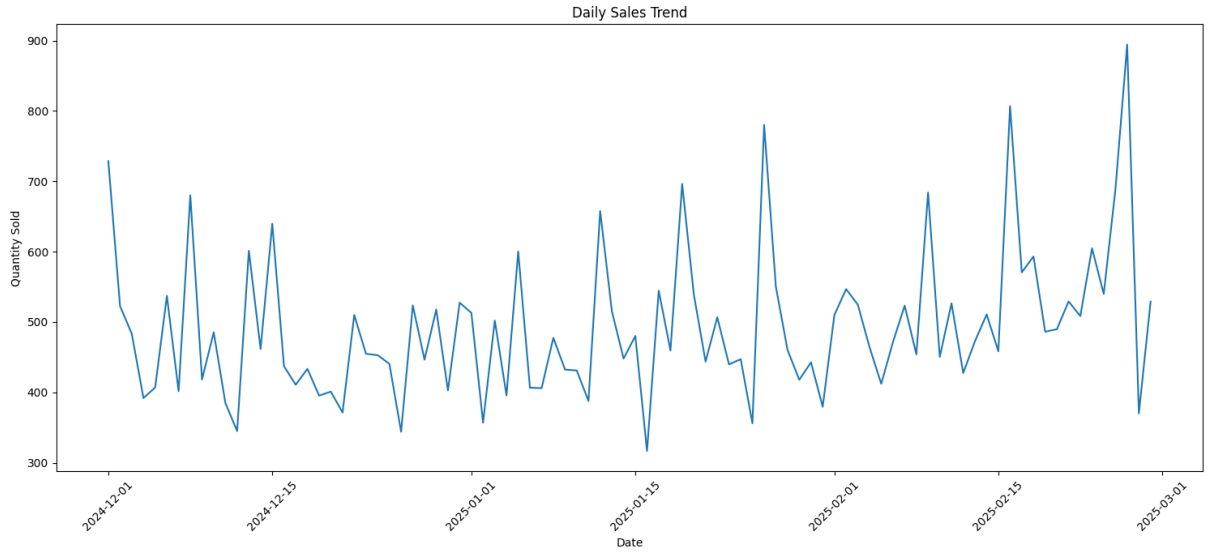

Figure6: Daily Sales Trend

Sales fluctuate between 300 to 900 units per day. A sharp peak is seen near end-February 2025, due to seasonal demand. The overall trend shows moderate recovery post mid-January, supporting the idea of seasonal variance. Understanding these peaks helps in planning procurement cycles and promotional timing.