LEVERAGING DATA ANALYTICS FOR OPTIMISING INVENTORY LEVELS AND ENHANCING THE OVERALL SUSTAINABILITY PRACTICES

MID-TERM SUBMISSION FOR THE BDM CAPSTONE PROJECT

SUBMITTED BY:

MADHAVAN R MOHAN

22F3000983

IITM Online BS Degree Program,

Indian Institute of Technology, Madras, Chennai

Tamil Nadu, India – 600036.

CONTENTS

EXECUTIVE SUMMARY AND TITLE

As explained earlier in the proposal, Selvamani Store is a provision store located in Tirunelveli District, Tamilnadu. It is a B2C business which needs improvements in inventory management. Also, some improvements are needed in the sustainability practices in the store operations. So, the data pertaining to sales, purchases, inventory levels, customer demographics and preferences has been collected for about 31 days, and has been used for analysis. The tool used for the purpose of data collection was Google Forms. New forms were created and sent daily to the business owner for collecting the data on a daily basis. The proofs of originality of data have been included to establish the authenticity of the data which was collected. The metadata and descriptive statistics, under separate sub-sections have been included, which define, describe and give clear information and summary about the data collected. The detailed explanations of the analysis processes and methods have been discussed in this report, and the justifications have also been given for as to why be that the usage of those processes and methods is more appropriate. Further, based on the analysis done, the results and findings have been listed with the clear explanation of the trends and patterns observed. The main tool used for the purpose of cleaning, analysing and visualizing the data was Microsoft Excel.

PROOF OF ORIGINALITY OF DATA

The following is a list of supporting evidence for the validity of the data that is presented in the report. The Link to the Excel Work Book which has all the Primary Data is given below: (https://docs.google.com/spreadsheets/d/1x9FR7TlgFQOot7Eaela2kSqiLgM1dnRc/edit?usp=sharing&ouid=100862469586693168896&rtpof=true&sd=true).

1. *Survey Links:* Details of the Google Forms which were sent to the business owner. (https://drive.google.com/file/d/1XLysN_4vQk_APcEKLgni_PmMMT_K2bwB/view?usp=drive_link)
2. *Letter from the Organisation:* A No Objection Certificate with the signature of the business owner. (https://drive.google.com/file/d/1_mmbnIJkxrZaZxLvu9vl8ggUheqXb8Bd/view?usp=drive_link)
3. *Relevant Pictures:* Photos of the shop, customer bill details and Google Street View. (https://drive.google.com/drive/folders/1GgOtByQlHvpL3tNn4XfQSzGEqKHq7p_2?usp=sharing)
4. *Interaction Video:* A small discussion session was done on Google Meet and was recorded. (https://drive.google.com/file/d/1hC2zIVeOqgxMLDqrc6ytih_K0ctmyi4y/view?usp=sharing)

METADATA

The business owner provided me with the following data:

1. *Sales Data from 25 June 2024 to 25 July 2024:* This contains details of product names, quantity sold, product selling prices and total revenue generated per product.

2. *Purchase Data from 25 June 2024 to 25 July 2024:* This contains details of product names, quantity purchased, product purchase prices and total expenditure incurred per product.

3. *Inventory Data from 25 June 2024 to 25 July 2024:* This contains details of product names, daily inventory available, daily total inventory and average daily total inventory.

4. *Customer Data of 30 customers:* This contains details of customer's age, household size, gender (15 Male Customers and 15 Female Customers), preferred products, feedback and rating.

Metadata is data that provides information about other data. It can include descriptive information about the content and context of the data, as well as structural information about its physical structure. Metadata is important because it helps users find, understand, and reuse data, and can also help with data governance and quality.

SALES DATA METADATA:

Sl. No.	**Key**	**Description**
1	Name of the Product	Specific Name of the Product in the shop which was sold to customers
2	Quantity Sold	Specific Quantity of the Product sold to customers
3	Selling Price	Specific Price of the Product sold to customers
4	Revenue	Total Revenue generated from the sales (Quantity x Selling Price)

PURCHASE DATA METADATA:

Sl. No.	Key	Description
1	Name of the Product	Specific Name of the Product in the shop which was purchased from suppliers
2	Quantity Purchased	Specific Quantity of the Product purchased from suppliers
3	Purchase Price (Cost Price)	Specific Price of the Product purchased from suppliers
4	Expenditure	Total Expenditure incurred on the purchases (Quantity x Purchase Price)

INVENTORY DATA METADATA:

Sl. No.	Key	Description
1	Name of the Product	Specific Name of the Product available in the shop's inventory
2	Daily Total Inventory	Total Amount of Inventory Stock available on that particular day
3	Average Daily Total Inventory	Average of the Daily Total Inventory on that particular day

CUSTOMER DATA METADATA:

Sl. No.	Key	Description
1	ID Number of the Customer	Specific Names of the Customers could not be used, so each of them were given a unique ID Number
2	Age of the Customer	Specific Age of the Customer
3	Gender of the Customer	Equal number of Males and Females were approached
4	Household Size	Number of Persons in the Customer's House
5	Preferred Product 1, 2, 3	3 most preferred Products
6	Feedback	What the Customers feel, told in one line
7	Rating	Out of 5 points

DESCRIPTIVE STATISTICS

Descriptive statistics refers to a set of methods used to summarize and describe the main features of a dataset, such as its central tendency, variability, and distribution. These methods provide an overview of the data and help identify patterns and relationships. After cleaning and analysing the collected data using Microsoft Excel, a brief overview is given below using descriptive statistics.

SALES DATA DESCRIPTIVE STATISTICS:

Measure	**Quantity Sold**	**Selling Price**	**Revenue Generated**
Sum	2576.5	₹62,036.00	₹1,67,766.00
Mean	151.56	₹3,649.00	₹9,869.00
Standard Deviation	175.19	₹2,998.35	₹7,361.17
Minimum	31	₹310.00	₹1,400.00
Maximum	669	₹12,710.00	₹29,236.00

PURCHASE DATA DESCRIPTIVE STATISTICS:

Measure	**Quantity Purchased**	**Purchase Price**	**Expenditure Incurred**
Sum	9612	₹58,431.00	₹1,55,121.00
Mean	565.41	₹3,437.00	₹9,125.00
Standard Deviation	472.51	₹2,843.66	₹7,418.61
Minimum	88	₹280.00	₹1,247.00
Maximum	1460	₹12,262.00	₹28,756.00

INVENTORY DATA DESCRIPTIVE STATISTICS:

Measure	**Quantity Available**
Sum	1,26,057
Mean	4,066.35
Standard Deviation	2,154.14
Minimum	596
Maximum	7,617.5

CUSTOMER DATA DESCRIPTIVE STATISTICS:

Measure	**Age**	**Household Size**	**Rating**
Mean	38.80	2.50	4.10
Median	38.50	2.00	4.00
Standard Deviation	8.79	1.25	0.94
Minimum	25.00	1.00	2.00
Maximum	55.00	5.00	5.00

ANALYSIS PROCESS / METHOD

The process of data analysis comprises defining the problem, collection of data, cleaning and visualizing the data, applying analysis processes / methods and drawing meaningful conclusions.

To start with the project, about 5 to 6 business owners were approached. Some of them were willing to share information verbally, but were hesitant about sharing any raw data. Finally, one business owner was willing to share the data and help me with my project. This was the beginning and turning point in the project's journey. The very first phase in this process was to collect data pertaining to the defined problem statements. The data collection process lasted for about 31 days, was the longest too. Forms were created and sent daily for collecting the data. The next phase in this process was to clean, organize and visualize the collected data. The raw data was simply just text and numeric values. But the real and interesting part was when all the data was organized and visualized as colourful graphs. That gave the completeness feeling for the data.

Then comes the analysis phase. To optimize the inventory levels, ABC Analysis and Inventory Turnover Analysis would be the appropriate methods. ABC analysis is a method for organizing inventory into three categories based on their value and importance to a business which are high-value items that are typically the most expensive and important, medium-value items that are consistent performers, low-value items that make up the majority of inventory but contribute the least to sales. By identifying which items are most valuable, the business can allocate resources more effectively. Inventory Turnover Analysis is a financial metric that measures how efficiently a business uses its inventory. It is calculated by dividing the Cost of Goods Sold (COGS) by the average inventory value for a given period. This metric provides a clear picture of how well inventory is managed relative to sales performance.

Both ABC Analysis and Inventory Turnover Analysis rely on readily available data (like Sales Data and Inventory Data) and don't require complex software or algorithms. This accessibility ensures that businesses of all sizes can adopt these methods without significant investments. The clarity provided by these analyses allows for immediate action. For instance, recognizing that 'A' items are under strict inventory control can lead to strategies like more frequent reordering or establishing stronger supplier relationships. While ABC Analysis focuses on the value of items, Inventory Turnover Analysis assesses the efficiency of inventory. Together, they provide a holistic view of inventory health. Unlike more intricate methods like Material Requirements Planning (MRP) or Just In Time (JIT), which might require substantial infrastructural changes and investments, ABC Analysis and Inventory Turnover Analysis can be conducted with minimal costs.

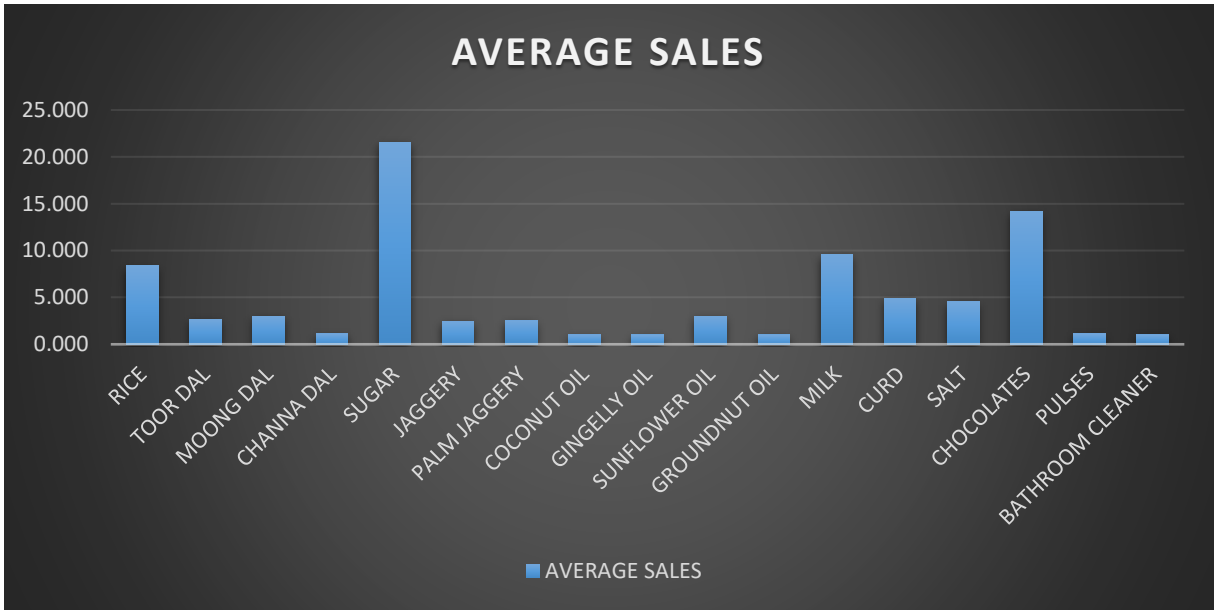
To improve the sustainability practices in the store operations, RFM Analysis and Market Basket Analysis would be the appropriate methods. RFM analysis helps businesses understand and categorize customers based on their purchasing habits. RFM stands for Recency, Frequency, and Monetary value. The analysis evaluates customers by scoring them in each of these three categories on a scale of 1 to 5, from worst to best. Customers who frequently purchase can be encouraged to participate in sustainable practices like using reusable bags or buying in bulk to reduce packaging waste. Market Basket Analysis identifies the relationships between items frequently purchased together. It uses association rules to uncover patterns in customer purchases. If customers who buy organic products also tend to buy eco-friendly cleaning products, the store can promote these items as bundles, encouraging more sustainable shopping habits.

Both RFM Analysis and Market Basket Analysis rely on Customer Data, which is readily available and ensure that sustainability efforts are aligned with actual customer behavior, making them more effective. These methods focus on understanding and influencing customer behavior, which is crucial for promoting sustainability. Both of these methods are scalable and can be applied to stores of all sizes and can also be adapted over time as customer behavior evolves, ensuring that sustainability efforts remain relevant and effective. RFM Analysis provides a deep understanding of customer segments, while Market Basket Analysis offers insights into product associations. Together, they provide a comprehensive view of how to promote sustainability throughout the customer journey.

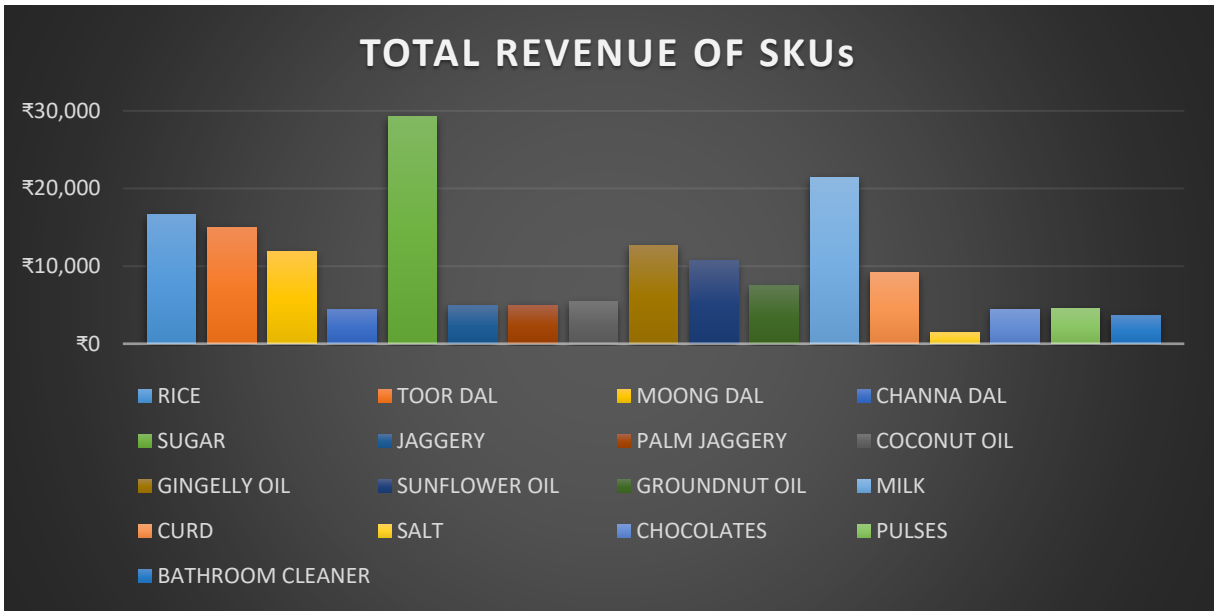
RESULTS AND FINDINGS

Here are a few results found from the sales data of the 17 products:

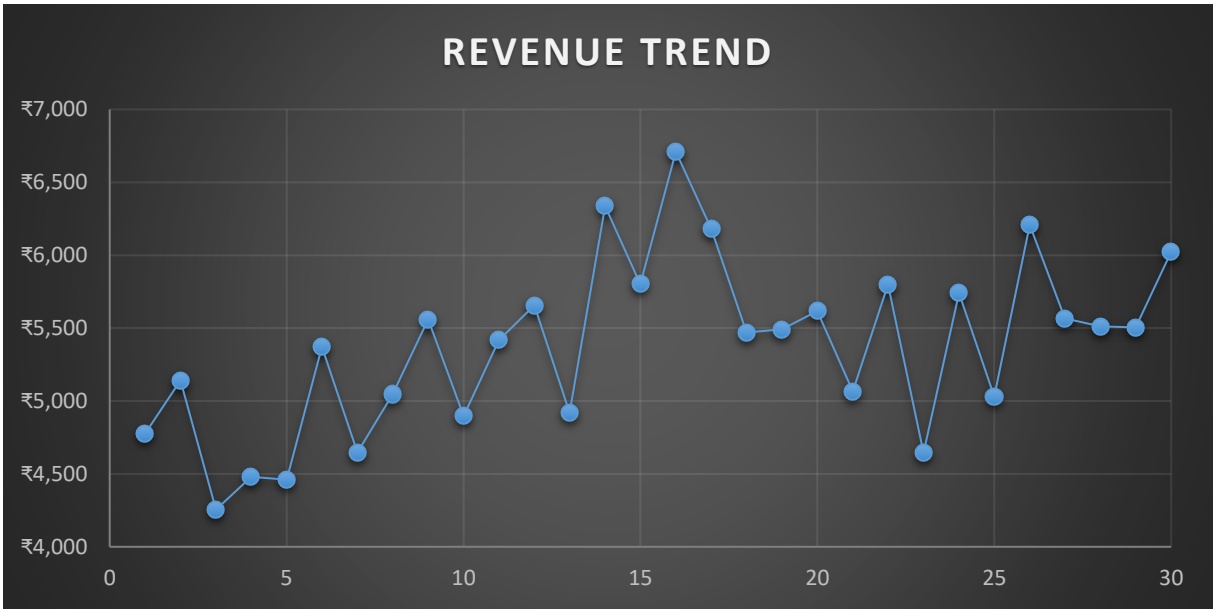
1. The top 5 products with highest average sales are Sugar, Chocolates, Milk, Rice and Curd.



2. The top 5 products generating highest revenue are Sugar, Milk, Rice, Toor Dal and Gingelly Oil.



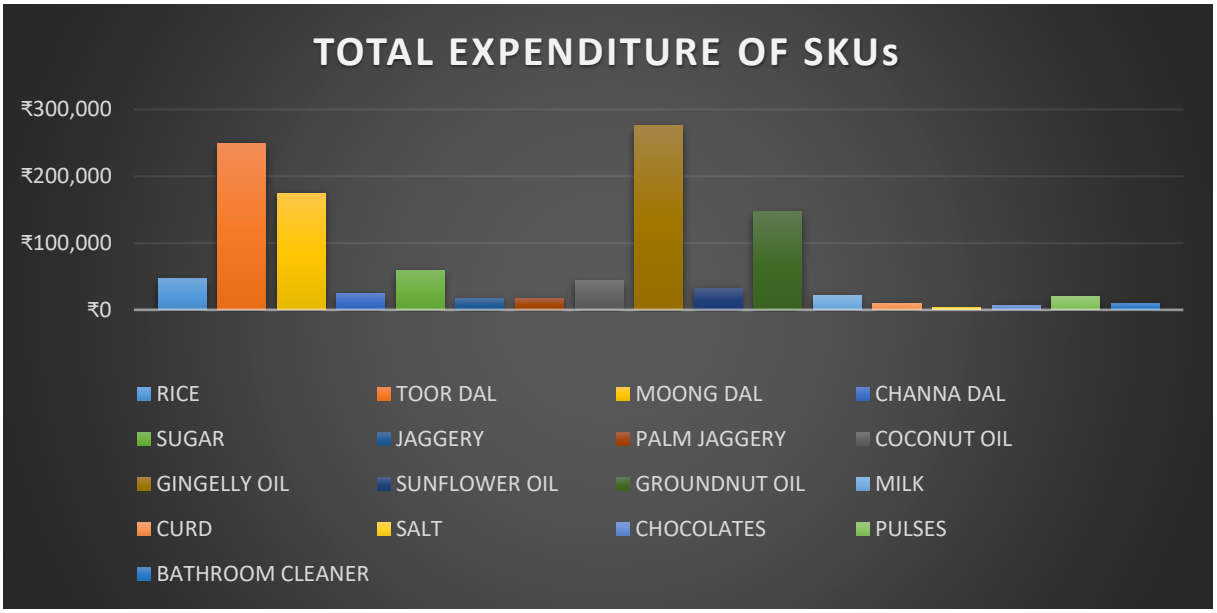
3. The revenue trend had a maximum of ₹6710 on 10 July 2024.



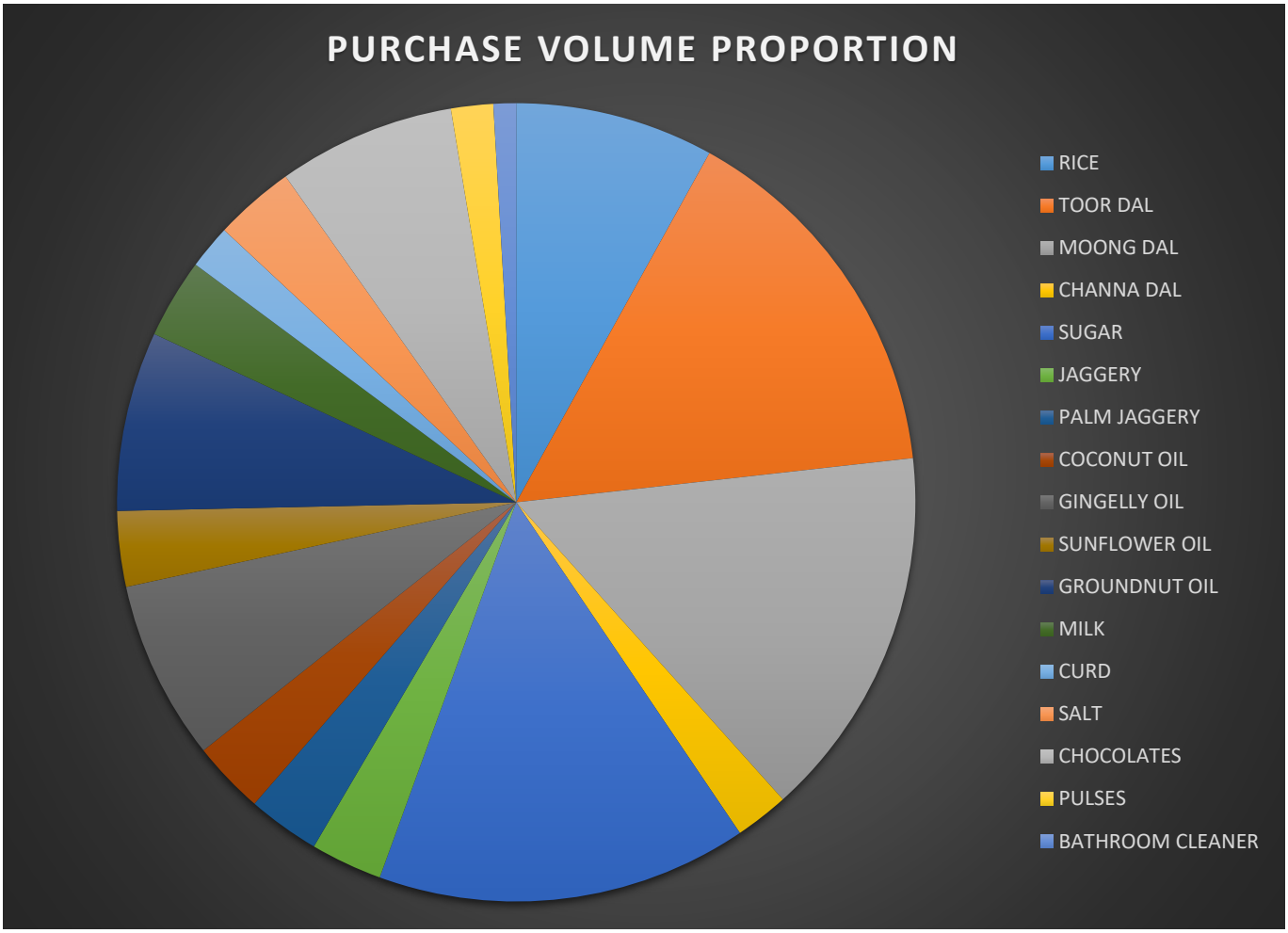
4. From 25 June 2024 to 25 July 2024, a total revenue of ₹167766 was generated from all the 17 products, with an average revenue of ₹9869.
5. From 25 June 2024 to 25 July 2024, the total revenue of salt was the minimum (₹1400) and that of sugar was the maximum (₹29236).

Here are a few results and findings from the purchase data of the 17 products:

1. The top 3 products incurring highest expenditure are Gingelly Oil, Toor and Moong Dal.



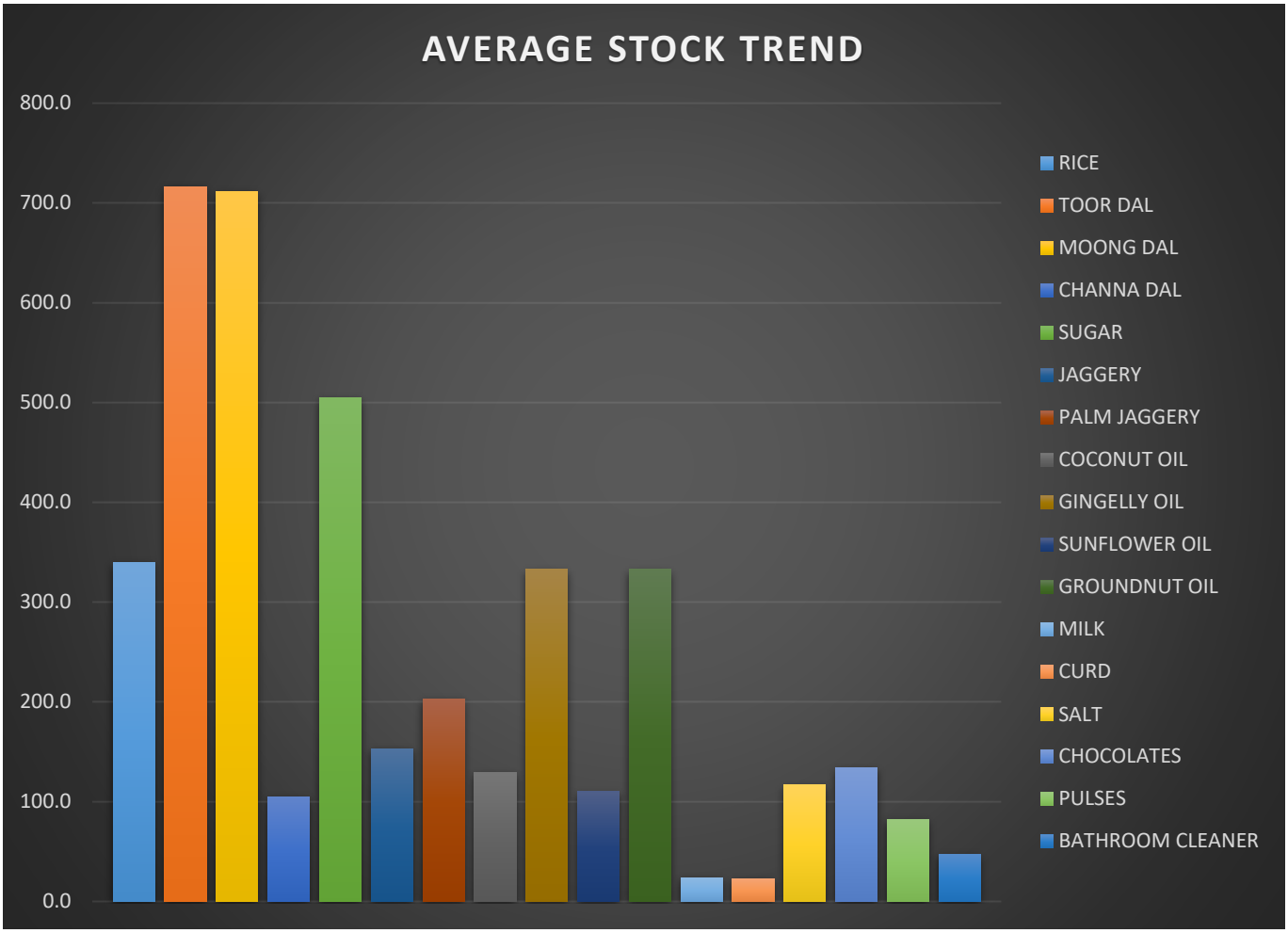
2. The top 5 products with the highest purchase volume proportion are Toor Dal, Moong Dal, Sugar, Rice, Gingelly Oil and Groundnut Oil.



3. From 25 June 2024 to 25 July 2024, a total expenditure of ₹155121 was incurred from all the 17 products, with an average revenue of ₹9125.
4. From 25 June 2024 to 25 July 2024, the total expenditure of salt was the minimum (₹1247) and that of sugar was the maximum (₹28756).
5. Of all the 17 products, the highest average purchase price was of Gingelly Oil (₹396) and the lowest average purchase price was of Salt (₹9).
6. Of all the 17 products, the highest average purchase quantity was of Toor Dal (47.09) and the lowest average purchase quantity was of Bathroom Cleaner (2.83).

Here are a few results and findings from the inventory data of the 17 products:

1. The highest average stock value was of Toor Dal (716.5) and the lowest average stock value was of Curd (23.1).



2. The average inventory trend line was continuously increasing from 35 (on 25 June 2024) to 448 (on 25 July 2024).
3. The highest initial inventory expenditure was of Toor Dal (₹9000) and the lowest initial inventory expenditure was of Chocolates (₹30).
4. The highest final inventory expenditure was of Gingelly Oil (₹266738) and the lowest final inventory expenditure was of Curd (₹1450).
5. The difference between the overall final inventory expenditure and the overall initial inventory expenditure was ₹1003473.