Optimizing storage constraints and efficient employment of capital among different categories of products in a versatile shop

Mid-term report for the BDM Capstone Project

Submitted by

Name: **ABHIJIT NANDI**

Roll number: **22f1001555**

IITM Online BS Degree Program,

Indian Institute of Technology, Madras, Chennai

Tamil Nadu, India, 600036

Contents

Declaration Statement

I am working on a Project titled "Optimizing storage constraints and efficient employment of capital among different categories of products in a versatile shop". I extend my appreciation to [**NANDI VARIETY**], 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 from primary sources and carefully analyzed to ensure 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 principles 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. In the event that 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 understand that all recommendations made in this project report are within the context of the academic project taken up towards course fulfilment in the BS Degree Program offered by IIT Madras. The institution does not endorse any of the claims or comments.

Abhijit Nandi

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

Name: Abhijit Nandi

Date: 12/01/2024

Executive Summary

This report is constructed to report the initial findings regarding the business problem having two in-person detailed meetings with the owner and two phone call interactions. As already reported the main problem of the business is to manage storage among four different categories of products namely Fast selling and expensive, Fast selling but low cost, Slow selling but expensive and slow selling and low cost and to stock products such that no stock outs or over stocking happens and stocking them in such a way that they don't get contaminated by the poisonous wood/lac polish segment of products.

The data that the business has provided consists of total available storage data, daily sales data for the duration (Jan-May), 2022 and purchase data for the duration of (Oct-May), 2021-22. The data has some inconsistencies and drawbacks, for example, the inventory records are not kept, some products have duplicate entries with slight changes in their nomenclature, exactly same products having different unit sizes, taxation irregularities in purchase bills etc.

The initial steps were data cleaning which involved removing the duplicities in the nomenclature of the products and augmenting them, arranging inventory into different categories and imputing any missing information. These were performed by consulting the owner.

Once the data is clean and consistent, the next step is the identification of 'products of concern' (called POC), demand trend analysis, and categorising each POC into one of the four types and further analysis to find an efficient storing mechanism.

Data

Primary data collected from the firm:

https://drive.google.com/drive/folders/1SM8X98TlvMBXg35iObmlO207MP51MXxT?usp=sharing

A short conversation with the owner of the firm:
https://drive.google.com/file/d/13lEqIyJrA6sTq99XGPtcU1lN7SCb1r43/view?usp=sharing

Some pictures of the storage areas taken during the visit:

Figure 1: letter from the firm in their official letterhead
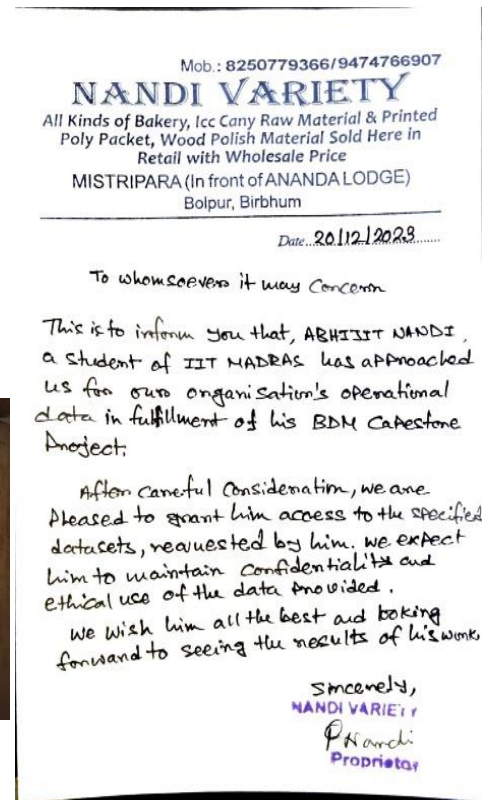

Figure 2 some pictures from the storage godowns

Metadata

Storage Space:

storage, length (ft), breadth (ft), height (ft), total volume (Cu. ft),available storage for ice cream products (Cu. ft), Available for wood polish products (Cu. ft), Available for bakery products (Cu. ft)

Sales Report :

Duration: 01/01/2022-31/05/2022

    i.   Sale report: Date, Invoice No, Party Name, Total Amount, Payment Type, Received/Paid Amount, Balance Due.

    ii.   Item Details: Date, Invoice No./Txn No., Item Name, Category, Quantity, Unit, Unit Price, Transaction Type, Amount, Month.

Purchase Report:

Duration: 1/10/2021-31/05/2022

    i.   Purchase Report: Date, Supplier name, Total Amount.

    ii.   Item Details: Date, Item name, Category, Quantity, Unit, Unit Price without tax, Discount Percent, Discount, Tax Percent, Tax, Amount, Unit Price with Tax, month.

Descriptive Statistics

Storage space:

The following table on the left gives the measured storage space with the segment of the business using the storage. The chart on the right shows the percentage distribution of storage among all the business segments.

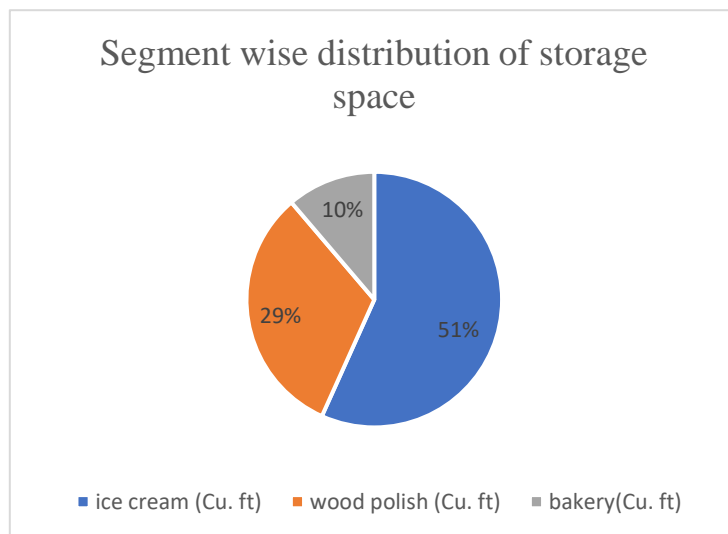| Storage Space	Total volume	Used by business segment
Small Storage Room	630 Cu. ft	Wood polish, ice cream, bakery
Medium Storage Room	1080 Cu. ft	Ice cream, bakery
Godown 1 (small)	1040 Cu. ft	Ice cream, bakery
Godown 2 (medium)	1200 Cu. ft	Wood polish, Ice cream
Godown 3 (large)	1760 Cu. ft	Ice cream
Godown 4 (large)	1500 Cu. ft	wood polish

Table 1: Storage volume with current segment of the business using it, Chart 1: Pie chart of segment-wise storage space distribution

Sales Report:

Duration: January to May, 2022

Business Segment: Ice Cream

Different types of products sold: 130

Total Revenue: ₹ 35,59,443.84

Total categories in which each product can be classified: 8

The category which generated the maximum revenue: Powder and crystalline Food products (42%) followed by Plastic products (28%).

Maximum revenue generated in month: April (₹ 11,97,316.90)

Maximum revenue generated by product: Sacarin.

Purchase Report:

Since no previous inventory was available, purchases made from October to December 2021 are taken as inventory.

Duration: October to March, 2021-22

Business Segment: Ice Cream

Total Expenditure: ₹ 30,93,962.48

Maximum expenditure on inventory for the month: October

Maximum expenditure on bulk stocking during the off-season: Sacarin (₹ 1,02,500.00)

Maximum expenditure for the month: April

Overall maximum expenditure on the product: Chocopaste (₹ 3,29,461.41)

Data Analysis Methods

Products of concern identification:

To identify the 'products of concern' (POC) a revenue Pareto is suitable as it reveals the top products which are generating the most revenue for the business. These items must be adequately stocked and the price fluctuation or the demand trends of these items must be analysed.

Demand Trends:

To stock the POCs, the trends in demand need to be understood. All the POCs will not have the same demand trend, some POCs might have constant demand and some may have fluctuating demands.

Categorization of POCs:

Another parameter in maintaining inventory and efficient deployment of capital among so many different types of products is categorizing the POCs according to their price and day-to-day sales volume. According to this POCs can be categorised as follows:

- Fast selling and expensive Products: Products under this category are most prioritized in terms of storage space usage and capital employment, as they are most demanded and generate the most revenue.
- Fast selling and low-cost products: In terms of priority next in line are products which sell fast but generate lower revenues than the first category.
- Slow selling and expensive products: next priority should be given to products which generate high revenue once they are sold but their demand is low.
- Slow selling and low-cost products: Finally comes the products which do not generate significant revenue and are not high in demand either but are still critical for customer retention.

To categorize the POCs in these groups, their standardized packaged price and standardized average daily demand are calculated and a scatterplot between these two variables for all POCs is also plotted. To distinguish the categories median value of the variables is used as a reference.

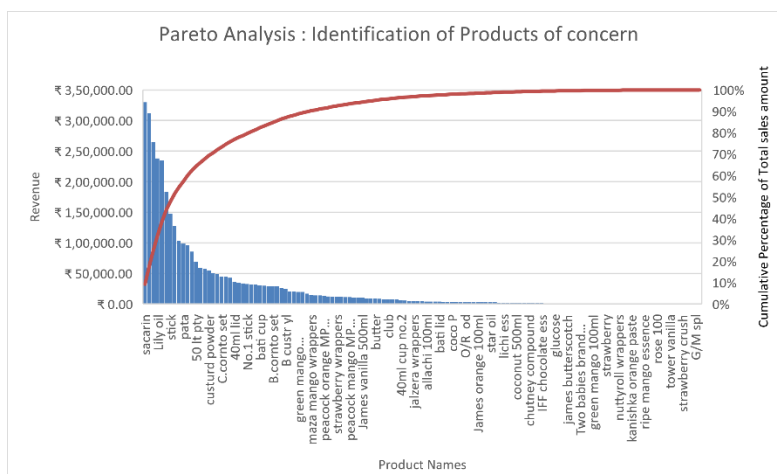**Results and Findings**

Revenue Pareto Analysis:

Chart 2: Revenue Pareto

From the revenue Pareto out of 130 types of products 25 products are found to be responsible for 80% of the total generated revenue. These are identified as POC, they are:

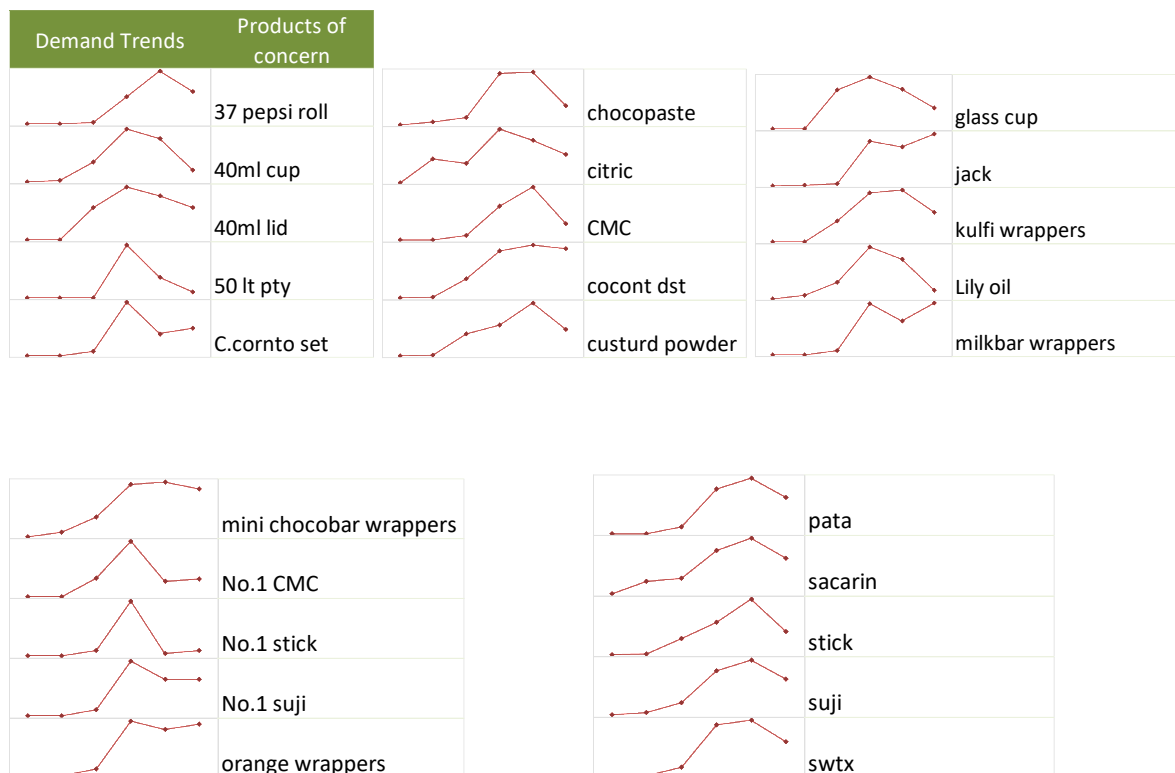| sacarin	swtx	mini chocobar wrappers	Lily oil	chocopaste
37 pepsi roll	stick	jack	kulfi wrappers	No.1 CMC
40ml cup	pata	suji	citric	50 lt pty
orange wrappers	glass cup	custurd powder	C.cornto set	No.1 suji
milkbar wrappers	40ml lid	CMC	cocont dst	No.1 stick

Demand trend sparklines:

Chart 3: Demand sparklines of POCs

The sparkline for each POC depicts the trend in monthly demand. It can be seen that as the summer sets in the demand for the POCs continuously rises and then falls slightly as monsoon approaches. The main inference that can be made is that some products (e.g. cocont dst) have a steady demand while products like (e.g. 50 lt pty) have fluctuating demands during the season.

POC categorization scatterplot:

Products	Standardized Average quantity sold daily	Standardized Average price	Product type 1	Product type 2
37 pepsi roll	0.254065041	₹ 5,800.31	Fast Selling	Expensive
40ml cup	0.154403794	₹ 5,503.33	Fast Selling	Low Cost
40ml lid	0.056981707	₹ 5,251.20	Slow Selling	Low Cost
50 lt pty	0.219512195	₹ 2,593.33	Fast Selling	Low Cost
C.cornto set	0.271544715	₹ 1,361.86	Fast Selling	Low Cost
chocopaste	0.297154472	₹ 6,621.58	Fast Selling	Expensive
citric	0.095463415	₹ 7,553.61	Slow Selling	Expensive
CMC	0.030227642	₹ 9,356.44	Slow Selling	Expensive
cocont dst	0.05495935	₹ 5,047.30	Slow Selling	Low Cost
custurd powder	0.188276423	₹ 2,411.65	Fast Selling	Low Cost
glass cup	0.580487805	₹ 871.53	Fast Selling	Low Cost
jack	1.170162602	₹ 890.06	Fast Selling	Low Cost
kulfi wrappers	0.047444832	₹ 8,806.71	Slow Selling	Expensive
Lily oil	0.350265583	₹ 3,054.76	Fast Selling	Low Cost
milkbar wrappers	0.039663182	₹ 8,840.76	Slow Selling	Expensive
mini chocobar wrappers	0.248074332	₹ 8,795.24	Fast Selling	Expensive
No.1 CMC	0.035837398	₹ 11,205.88	Slow Selling	Expensive
No.1 stick	0.118140244	₹ 2,304.00	Slow Selling	Low Cost
No.1 suji	0.037723577	₹ 9,500.00	Slow Selling	Expensive
orange wrappers	0.054587689	₹ 8,760.32	Slow Selling	Expensive
pata	0.099707317	₹ 7,942.98	Slow Selling	Expensive
sacarin	0.59796748	₹ 4,545.44	Fast Selling	Low Cost
stick	0.580538618	₹ 2,075.63	Fast Selling	Low Cost
suji	0.09904065	₹ 7,994.53	Slow Selling	Expensive
swtx	0.199268293	₹ 12,864.80	Fast Selling	Expensive
Median	**0.154403794**	**₹ 5,800.31**		

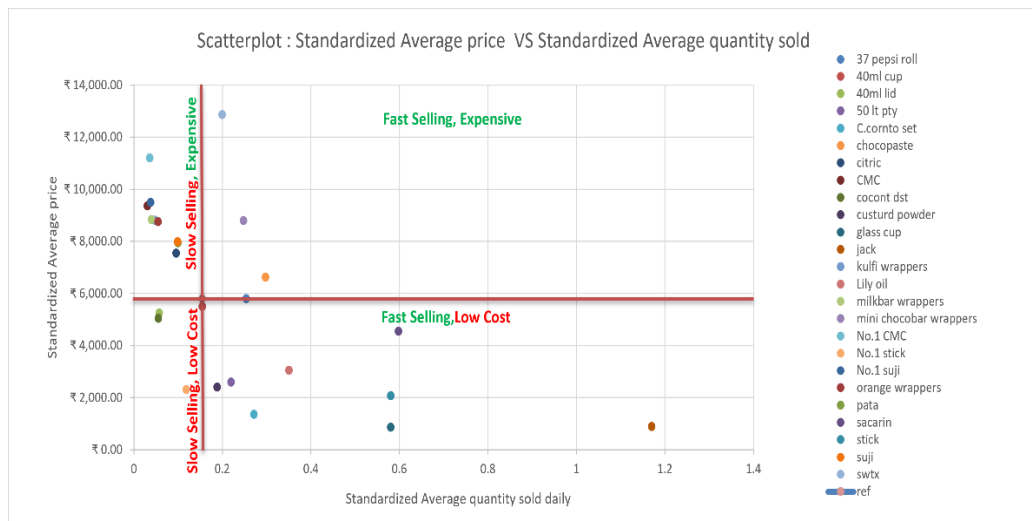Table 2: POCs according to their sub-categories

Chart 4: Scatterplot of POCs according to their average price and average daily sales

A scatterplot between the average unit price and average quantity sold daily shows all POCs as data points. The horizontal and vertical line is drawn taking the median standardized average unit price and standardized average quantity sold daily as the reference.

Using the above table and scatterplot each POC is categorised into one of the four categories and will be prioritised as explained earlier.

This is all the analyses that has been done up till now and are reported in this mid-term submission report.

The next objective of this project will be to analyse the fluctuation in the purchase price of the POCs, supply trends, product product-wise expenditure trends etc. and to find a way for smoother capital employment and to negate the supply disruption the supply trends of POCs need to be seen.