

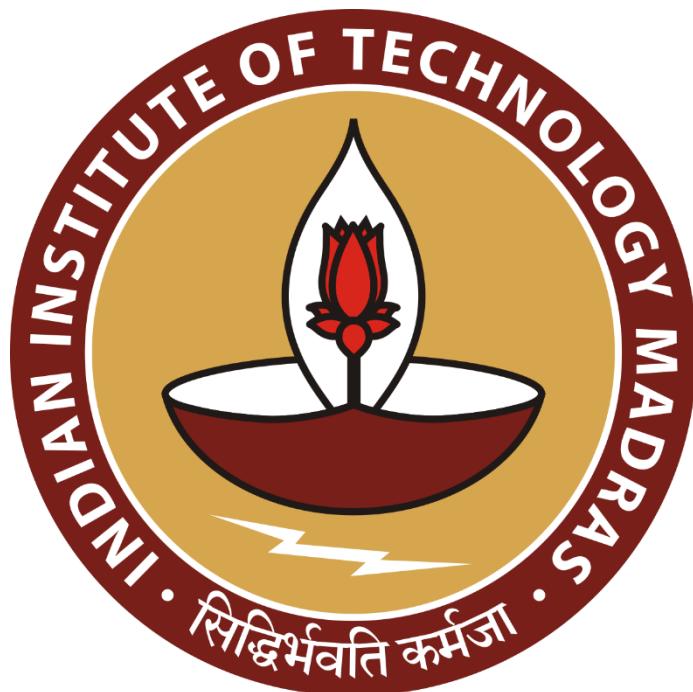
Optimizing Inventory Management and Business Processes for Sustainable Growth in a Manufacturing SME

A Midterm report for the BDM capstone Project

Submitted by

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1 Executive Summary

Sterling Foods and Beverages, a B2B manufacturer of packaged drinking water under the “Cubic” brand in Jaipur, has grown steadily since 2016 but faces recurring challenges in inventory management—frequent overstocking/stockouts and large working capital tied in stock—constraining efficiency and scalability.

The dataset spans April 2022–March 2025 across four worksheets—Sales, Purchase, Raw Material, and Inventory Movement—capturing month, fiscal year, quantity, rate, and value. Descriptive statistics indicate average monthly sales of ₹10.77 lakh (range ₹32,627–₹26.33 lakh) with pronounced volatility; purchases average ₹8.80 lakh (range ₹2,048–₹29.36 lakh) with sharper swings. Inventory Movement (\approx 18 months) shows gaps between manufactured and sold quantities, and Raw Material values vary widely across periods and items, indicating inconsistent consumption patterns.

The analysis to date applies descriptive statistics, trend assessment, and inventory turnover-related metrics to surface patterns and variability. Preliminary findings point to strong top-line growth alongside procurement-inventory misalignment and seasonality-driven fluctuations. Feasible next-phase approaches include time-series demand forecasting and ABC analysis to better align procurement and production with observed demand behavior.

2 Proof of Data Originality



Image 1: Factory Holding



Image 2: One of many machine inside factory

Proof Links :

Interview Video (with English subtitles): [Video Link](#)

Videos of Factory Complex:

- [Video 1](#)
- [Video 2](#)
- [Video 3](#)

Some more photographs of Factory Complex: [Image Folder link](#)

Letter: [Letter Link](#)

Complete Folder Link: [BDM project assets folder](#)

Note: Please use **.iitm.ac.in** mail id to access above content.

3 Metadata

BDM Data Workbook Metadata

The workbook comprises **four worksheets**, each capturing essential aspects of the business's **sales, procurement, raw material consumption, and inventory movement**. Data was collected systematically from **April 2022 to March 2025**, enabling multi-year trend analysis.

Link of Clean Dataset: [Clean Dataset](#)

Link of Raw Dataset: [Raw Data folder](#)

Key Variables Table

Sheet	Variable	Meaning	Unit
Sales Sheet	Month	Transaction month (Apr–Mar)	—
	FY	Fiscal year	—
Purchase Sheet	Sales	Sales revenue	INR
	Month	Purchase month	—
	FY	Fiscal year	—

Sheet	Variable	Meaning	Unit
Raw Material Sheet	Purchase_Value	Procurement cost of raw materials/inputs	INR
	Item	Name of raw material (e.g., PET form, labels, caps)	—
	FY	Fiscal year	—
	Quantity	Amount of material procured/consumed	Kg / Liters / Units
	Rate	Price per unit of material	INR per unit
Inventory Movement Sheet	Value	Total material cost (Quantity × Rate)	INR
	Month	Month of record	—
	FY	Fiscal year	—
	Manufactured Quantity	Number of units produced	Units
	Manufactured Value	Production cost of goods manufactured	INR
	Sold Quantity	Number of units sold	Units
	Sold Value	Sales value of goods sold	INR
	Remaining Quantity	Units left in stock	Units
	Remaining Value	Value of unsold stock	INR

Table 1. Key variables and units (by sheet)

3.1 Sales Sheet

This sheet records monthly sales figures across three financial years. It helps assess revenue growth, seasonality, and performance variability.

3.2 Purchase Sheet

This sheet tracks monthly procurement expenditure on raw materials and inputs needed for manufacturing. It enables comparison with sales data to evaluate procurement efficiency.

3.3 Raw Material Sheet

This sheet provides detailed records of raw materials purchased or consumed, including volumes and valuations. It is crucial for cost analysis and inventory planning.

3.4 Inventory Movement Sheet

Captures monthly manufacturing output, sales, and remaining stock levels. It provides insight into production planning, inventory turnover, and working capital utilization.

Data Collection Duration:

April 2022 – March 2025 (36 months)

Dataset Dimensions:

- Sales: ~36 rows × 3 columns
- Purchase: ~36 rows × 3 columns
- Raw Material: ~20 rows × 5 columns
- Inventory Movement (Data available of 1.5 years only): ~20 rows × 8 columns

4 Descriptive Statistics

The analysis includes measures of central tendency and variability for Sales, Purchase Value, Raw Material Value, Manufactured Value, and Sold Value.

4.1 Measures of Central Tendency and Variability

These values represent the typical amounts observed in each category:

Metric	Std. Deviation	Range	Min	Max	Mean	Median	Mode
Sales	₹8,16,661	₹26,00,514	₹32,627	₹26,33,141	₹10,77,046	₹10,77,046	₹10,77,046
Purchase Value	₹8,14,441	₹29,34,452	₹2,048	₹29,36,500	₹8,80,573	₹9,24,811	₹4,248
Raw Material Value	₹1,94,162	₹8,24,801	₹122.88	₹8,24,924	₹1,38,696	₹82,725	₹122.88
Manufactured Value	₹1,03,816	₹3,53,621	₹30,101	₹3,83,722	₹1,74,439	₹1,64,113	₹3,62,734
Sold Value	₹1,39,880	₹4,10,159	₹70,199	₹4,80,358	₹2,38,797	₹1,75,115	₹4,80,358

Table 2. Descriptive statistics (Sales, Purchases, Raw Material, Manufactured, Sold)

4.2 Key Insights

- Sales (avg ₹10.77 lakh; wide range): High month-to-month variability indicates demand seasonality and operational volatility.
- Purchases (avg ₹8.80 lakh; very wide range): Procurement spikes are more erratic than sales, suggesting timing/quantity misalignment.
- Raw Material Value (avg ₹1.39 lakh): Irregular consumption patterns across items and months imply planning gaps.
- Manufactured vs. Sold Value (avg ₹1.74 lakh vs. ₹2.39 lakh): Variability highlights inconsistent production-to-sales alignment and stock buildup risk.

5. Justification: How These Statistics Relate to the Problem Statement

1. Inefficient Inventory Management

- High variability in manufactured/sold values shows inconsistent stock, leading to overstocking or stockouts.
- Fluctuations highlight the need for automated inventory systems for stability and reliability.

2. Working Capital and Cash Flow Gaps

- Large raw material peaks (up to ₹8.24 lakh) and erratic purchases (₹2,048–₹29.36 lakh) tie up capital in inventory.
- This restricts cash flow and limits investment opportunities.
- Stronger control and planning are essential to free working capital for growth.

5 Analysis Process/Method

5.1 Data Cleaning and Preprocessing

- **Initial Review:** The raw dataset was spread across four sheets (Sales, Purchases, Raw Materials, and Inventory Movement). Each contained month-wise and fiscal-year-wise records for a span of 36 months.
- **Handling Missing Values:** Blank or missing entries (e.g., in sales or purchase columns) were identified and either filled using **logical interpolation**, mean, median or excluded from calculations to avoid skewing results (**in grey cells**).
- **Removing Duplicates:** Duplicate rows, especially in monthly data, were checked and removed to ensure each period/item was only counted once.
- **Standardizing Formats:** Inconsistent naming and numerical formats were standardized for seamless aggregation and analysis.
- **Consolidation:** Data from different sheets were aligned using common keys (Month, FY) to allow for multi-metric analysis (e.g., linking sales to purchases and inventory for the same period).

5.2 Analytical Approaches Applied

The following preliminary methods were employed to study the data and link it to the company's inventory management challenges

1. Descriptive Statistics

- *Formulas:* Mean ($\mu = \frac{\sum x}{n}$), Median, Mode, Standard Deviation ($\sigma = \sqrt{\frac{\sum(x-\mu)^2}{n}}$).
- *Justification:* Summarizes variability in sales, purchases, and inventory, helping identify volatility that leads to stockouts or overstocking.
- *Rationale:* Directly connects to the problem of inconsistent stock management and cash flow uncertainty.

2. Time-Series and Trend Analysis

- Methods: Line plots and moving averages ($MA_t = \frac{x_{t-k-1} + \dots + x_t}{k}$) to capture seasonality and month-to-month variation.
- *Justification:* Helps uncover demand peaks and lean months.
- *Rationale:* Informs procurement cycles to reduce mismatch between demand and supply.

3. Correlation Analysis

- Methods: Pearson's correlation coefficient ($r = \frac{\sum(x-\mu_x)(y-\mu_y)}{\sqrt{\sum(x-\mu_x)^2} \sqrt{\sum(y-\mu_y)^2}}$).
- *Justification:* Tests if purchases are aligned with sales or leading to excess stock.
- *Rationale:* Essential to identify whether funds are being locked in raw materials unnecessarily

4. Inventory Turnover & Working Capital Metrics

- *Formulas:*
 - *Inventory Turnover* = $\frac{Cost\ of\ Goods\ Sold}{Average\ Inventory}$
 - *Working Capital Tied in Inventory* = $\frac{Inventory\ Value}{Total\ current\ assets} * 100\%$

- *Justification:* Measures efficiency of stock movement and highlights capital locked in unsold goods.
- *Rationale:* Directly addresses the company's challenge of liquidity gaps due to high inventory holding.

5.3 Feasible Approaches for Next Phase

- Application of demand forecasting techniques (e.g., exponential smoothing, ARIMA) on sales data to anticipate peaks.
- Performing ABC analysis to prioritize critical raw materials and reduce overstocking.
- Exploring automation feasibility using simple digital tools (Excel macros, Python scripts) to transition away from manual tracking

6 Results and Findings

1. Sales and Revenue Trends

Monthly sales data across 36 months revealed significant fluctuations. Sales peaked at ₹26.33 lakh in March FY24–25 and dipped to a low of ₹32,627 in July FY22–23. Seasonal peaks were observed consistently in March and October, reflecting festival-driven demand, while mid-year months such as May and June recorded relatively lower sales. Year-on-year analysis confirms steady growth in revenue, with average monthly sales at ₹10.77 lakh.

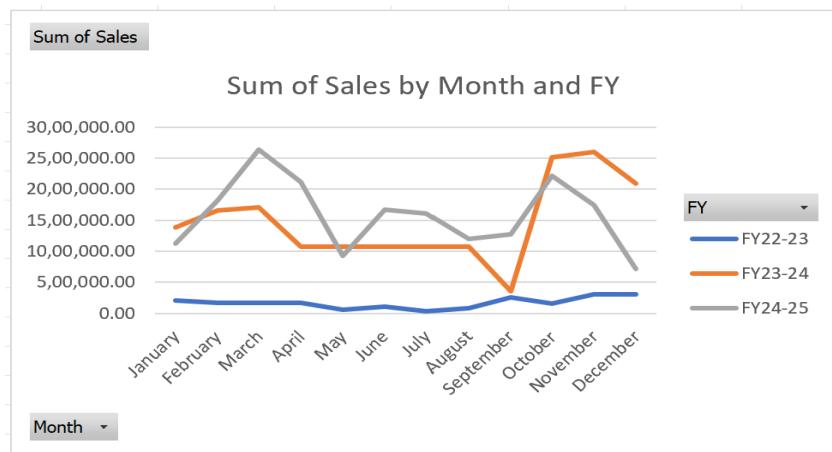


Figure 1. Monthly sales trends highlighting seasonal peaks and troughs.

2. Purchase and Procurement Patterns

Procurement values displayed even greater variability than sales. Purchases ranged from as low as ₹2,048 (December FY22–23) to as high as ₹29.36 lakh (October FY24–25). While higher purchases often preceded strong sales months, mismatches were also observed, leading to overstocking. Average monthly purchases stood at ₹8.8 lakh.

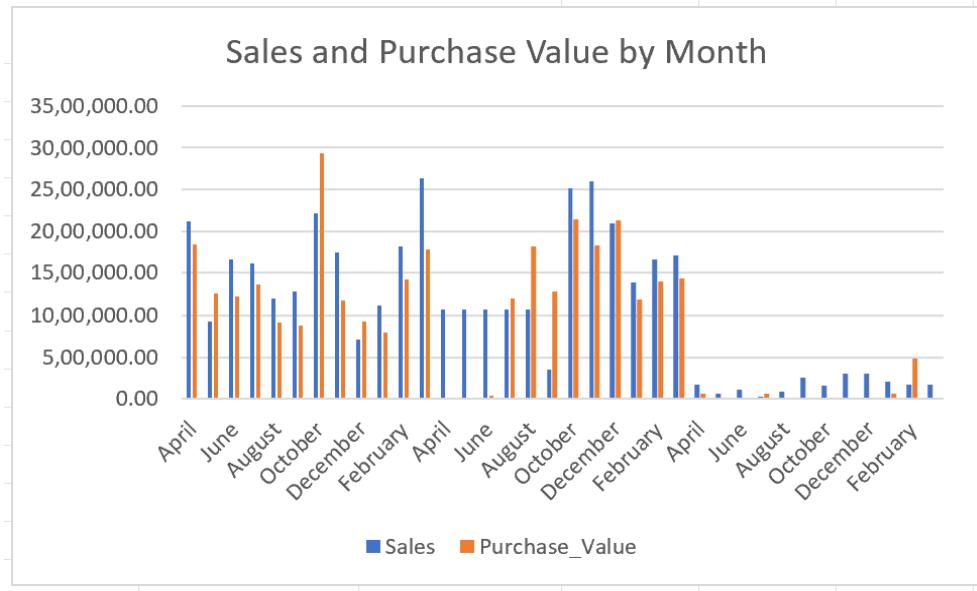


Figure 2. Monthly Sales and Purchase Value Comparison

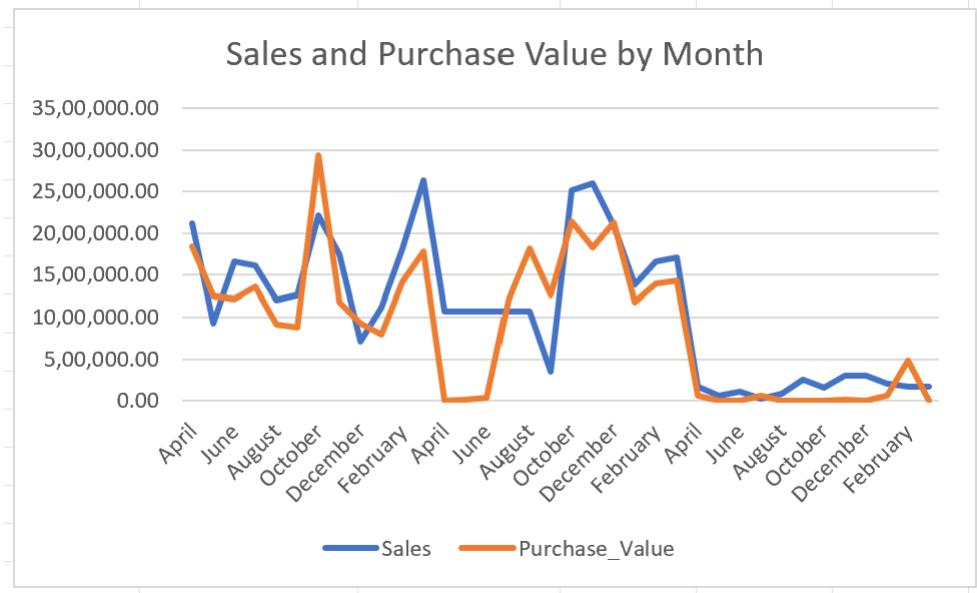


Figure 3. Month-wise purchase patterns compared against sales.

3. Inventory and Manufacturing Insights

Manufacturing quantities largely followed sales trends but often exceeded them, resulting in inventory buildup. For instance, months with high production but moderate sales led to a rise in unsold stock. Inventory movement analysis showed average manufactured value of ₹1.74 lakh and sold value of ₹2.39 lakh, but variability was high, indicating inconsistencies in aligning production with demand.

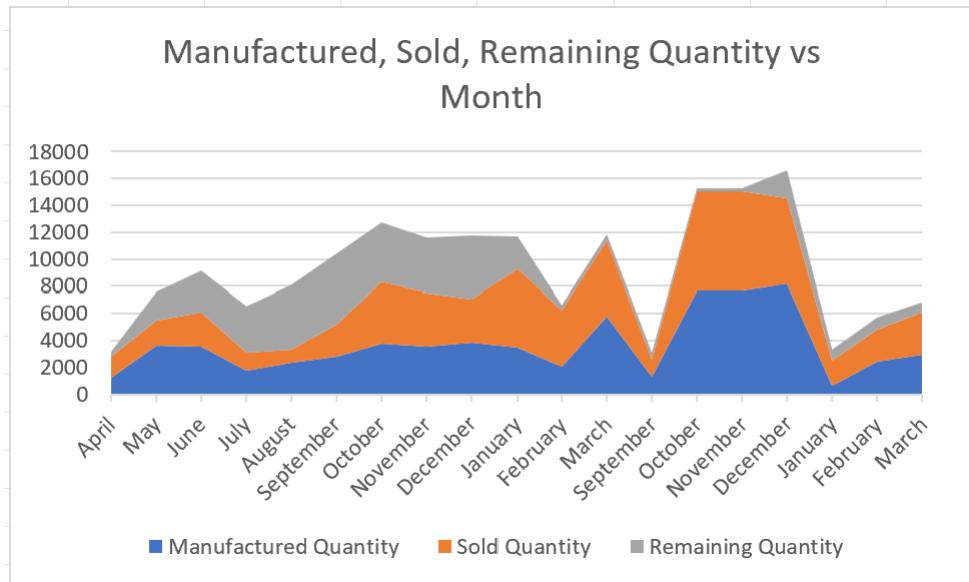


Figure 4. Manufactured vs Sold vs Remaining (quantity, monthly)

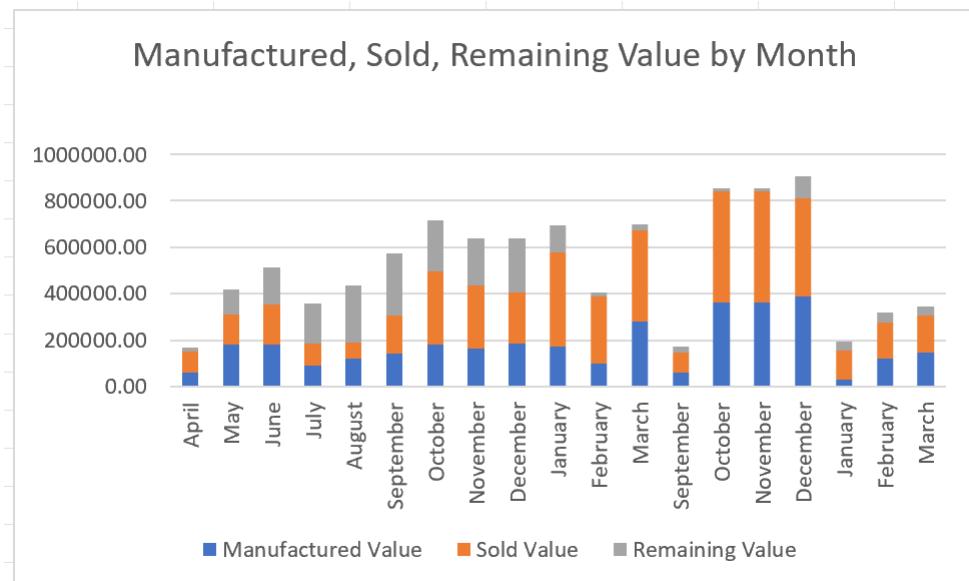


Figure 5. Manufactured vs. sold value with corresponding stock levels.

4. Raw Material Consumption

Raw material usage also showed high volatility, ranging from ₹122.88 to ₹8.24 lakh per month. Key inputs such as PET forms and bottles contributed the most to cost, while lower-value items like labels and caps fluctuated unpredictably. This irregularity highlights gaps in procurement planning and the absence of systematic consumption monitoring.

5. Key Patterns and Insights

- Sales Growth with Volatility: The company has achieved steady revenue growth, but large swings between peak and lean months create instability.
- Procurement-Inventory Mismatch: Purchases do not always align with sales, leading to both overstocking and stockouts.
- Capital Lock-in: High-value purchases and raw material stock tie up working capital, impacting liquidity.
- Seasonal Demand Cycles: Sales spikes around March and October reinforce the need for seasonality-aware planning.

6. Preliminary Insights

The findings suggest that while Sterling Foods and Beverages is growing, it faces persistent challenges in procurement alignment, production scheduling, and inventory management. High fluctuations in purchases and raw material usage point to inefficient planning, while sales seasonality indicates predictable demand cycles that can be better leveraged.