

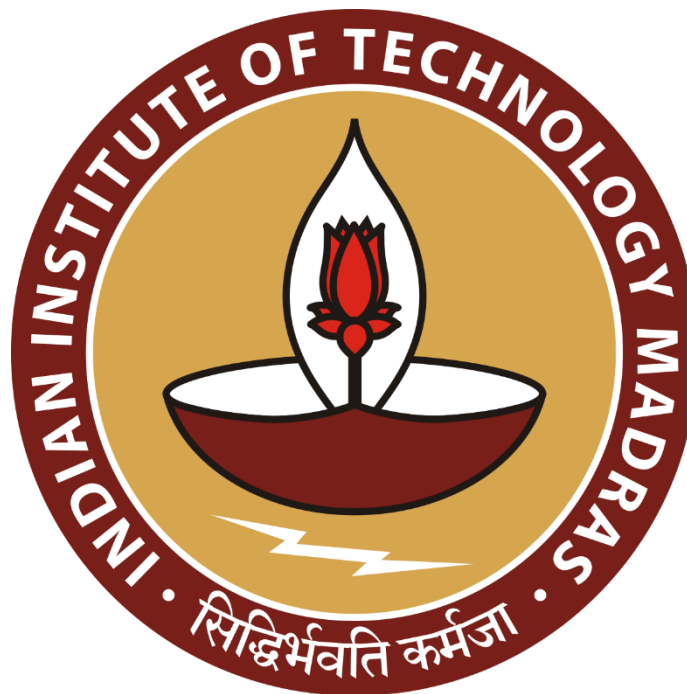
Resolving Inventory Strain and Profitability Gaps in Gift Retail

Mid-term Submission for the BDM capstone project

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1 Executive Summary and Title

Gupta Gift Shop, owned by Mr. Dalip Gupta, has been a reputable retail establishment in the market since 2015. The shop has built a strong presence, benefiting from Mr. Gupta's extensive sales expertise and a deep understanding of the retail industry. Despite its success and reputation, the business is facing operational challenges that threaten its profitability. The most significant issues include the absence of a structured inventory management system and inconsistent pricing strategies, leading to low product margins and inefficiencies in day-to-day operations. These challenges are affecting the shop's overall financial performance, making it difficult to optimize profitability.

To address these challenges, a comprehensive project **“Resolving Inventory Strain and Profitability Gaps in Gift Retail”** has been initiated to improve the shop's operations, with a focus on inventory and pricing strategies. The primary objective is to enhance revenue generation by implementing systematic changes that will optimize both inventory management and pricing strategies. The project will begin with a thorough analysis of inventory and sales data, which will identify inefficiencies and reveal areas for improvement. Based on this analysis, strategic adjustments will be made to both the inventory system and pricing model to improve the business's overall financial health.

The key mid-term goals of the project are twofold: first, to ensure timely restocking of popular items while reducing excess or dead stock. Second, to enhance margin management by analyzing the current pricing strategies and implementing data-driven adjustments based on competitor pricing and market demand. These adjustments will help increase profit margins while maintaining competitiveness in the market. Together, these efforts aim to improve profitability, streamline operations, and contribute to sustainable business growth for Gupta Gift Shop.

2 Proof of Originality

- 1) Photos regarding the owner and the organization

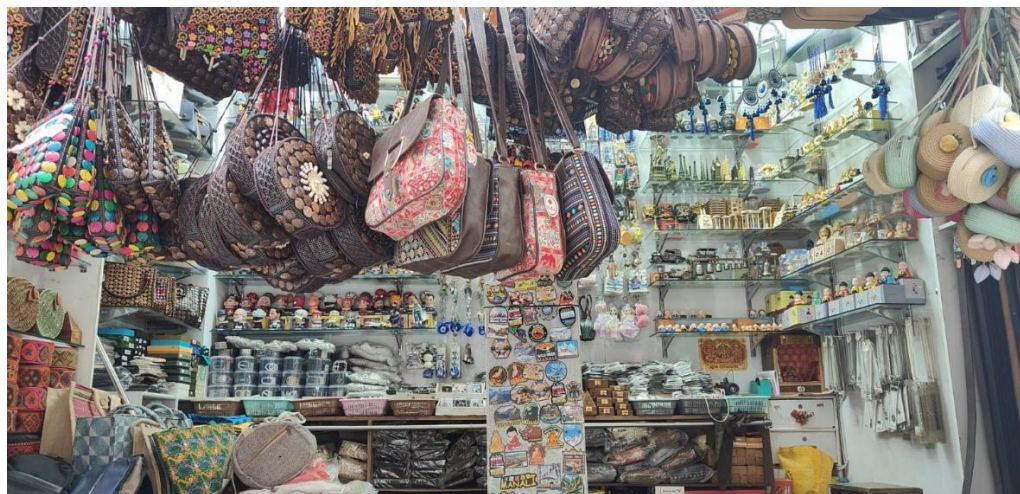


Image 2.1: Front view of the shop



Image 2.2: Shop's Owner Mr. Dalip Gupta

- 2) Letter of Authorization from the organization: [Letter](#)
- 3) Recorded Video with the owner of the organization: [Video](#)
- 4) Link for the finalized dataset: [Dataset](#)

3 Metadata & Descriptive Statistics

3.1 Metadata

The dataset consists of 2,400 entries, each capturing daily sales activity. These records are organized around key features that are critical for analyzing and visualizing sales trends. The sales data includes the following variables: **"date (x1)"**, **"day (x2)"**, **"category (x3)"**, **"cost_price (x4)"**, **"quantity (x5)"**, **"selling_price (x6)"**, **"revenue (x7)"**, and **"profit (x8)"**. In addition to the sales data, inventory-related information was also collected, comprising features such as **"week_start_date (x1)"**, **"category (x2)"**, **"opening_stock (x3)"**, **"weekly_sales (x4)"**, **"closing_stock (x5)"**, and **"restock_quantity (x6)"**. Together, these variables provide a comprehensive view of both sales performance and inventory management, forming the foundation for effectively addressing the underlying problem statement.

The sales and inventory data were sourced directly from the business records maintained by the owner, Mr. Dalip Gupta, including both daily transaction and bookkeeping records. This dataset encompasses key metrics such as daily sales figures, revenue generated, profit earned, and quantity of items sold. Data collection began on **April 1, 2024**, and continued through **November 30, 2024**. This dataset provides comprehensive view of the business's day-to-day sales performance over the specified period.

The data cleaning process involved applying standard techniques to enhance the accuracy and usability of the dataset. Initially, redundant or duplicate records were identified and removed to avoid skewed results. Missing values were addressed using appropriate imputation methods or were excluded based on relevance and impact. Data types were reviewed and corrected to ensure consistency across all columns, aligning with their respective formats. Additionally, outliers were carefully detected and treated to maintain the integrity of the data and prevent distortion in trend analysis.

3.2 Descriptive Statistics

The dataset was analyzed to examine its central tendencies and variability across key features. All analyses were conducted using **Google Colab**, leveraging the **Pandas** library in Python. Within Pandas, built-in functions such as `describe()` were utilized to generate comprehensive descriptive statistics, including measures such as mean, median, mode. These statistical insights provided a foundational understanding of the data distribution and overall structure. A summary of the key statistical findings is presented below.

3.2.1: Stats For Sales Data

Column	cost price	quantity	selling price	revenue	profit
count	2440	2440	2440	2440	2440
mean	100.6	3.857787	168	612.532787	190.837705
std	46.81173	4.825689	64.789817	788.246674	220.861626
min	30	0	80	0	0
25%	50	0	100	0	0
50%	104	2	175	300	120
75%	150	6	200	900	300
max	165	36	280	4600	1430

Table 1: Descriptive Stats for Sales Data

3.2.2: Description & Justification :

- **Cost Price (x4):** The average daily cost price was approximately ₹100.6, with a standard deviation of ₹46.81, indicating a moderate to high variation. The maximum recorded cost price was ₹165. This feature is important for analysis as it helps evaluate pricing consistency and assess the impact of cost fluctuations on overall profitability.
- **Quantity (x5):** The average quantity sold per day was 3.86 units, with a standard deviation of 4.83. The highest recorded quantity sold in a single day was 36 units. Understanding quantity trends is crucial for demand forecasting and inventory planning.
- **Revenue (x7):** Daily revenue averaged ₹612.53, with a significant standard deviation of ₹788.24, and a peak value of ₹4,600. This feature is vital for assessing sales performance over time and identifying periods of high or low business activity.
- **Profit (x8):** The business generated an average daily profit of ₹190.83, with a high standard deviation of ₹220.86. Profit values ranged from ₹0 to ₹1,430. The high variability in profit highlights differences in sales performance and is essential for identifying which segments or categories contribute most to overall profitability.

3.2.3 Stats for Inventory Data

Column	Opening_Stock	Weekly_Sales	Closing_Stock	Restock_Quantity
Count	360	360	360	360
mean	121.11	26.08	95.03	27.07
std	65.42	29.78	60.28	27.07
min	23	0	0	0
25%	64.75	5	46	0
50%	107.5	15	86.5	0
75%	179.5	37	130.5	45
max	315	132	275	199

Table 2: Descriptive Stats for Inventory data

3.2.4: Description & Justification:

- **Opening Stock (x3):** The average weekly opening stock was 121.11 units, with a standard deviation of 65.42. Values ranged from 23 to 315 units. This feature is important for understanding baseline inventory levels and planning restocking strategies based on demand.
- **Weekly Sales (x4):** The average weekly sales volume was 26.08 units, with a standard deviation of 29.78, and ranged from 0 to 132 units per week. This metric is essential for analyzing product movement and aligning inventory levels with actual sales performance.
- **Closing Stock (x5):** The average stock closing was 95.03 units per week, with a standard deviation of 60.28. Weekly values ranged from 0 to 275 units. This feature is critical for identifying inventory turnover rates and potential overstock or stockout scenarios.
- **Restock Quantity (x6):** The average weekly restock quantity was 27.07 units, with a standard deviation of 47.33, ranging from 0 to 199 units. Monitoring restock quantities is vital for optimizing inventory replenishment cycles and maintaining adequate stock levels without overinvesting in inventory.

4 Detailed Explanation of Analysis Process & Methods

The explanation of methods employed will be divided into three main categories, which are, “Data collection”, “Data cleaning and preprocessing”, “quantitative data analysis” and “qualitative insights”.

4.1 Data Collection:

The analysis commenced with the compilation of a dataset containing approximately 2,400 records, each representing daily sales data categorized by product type. This data was aggregated from multiple sources, including records directly provided by the business owner, ensuring accuracy and completeness. The sales data spans an eight-month period, from April to November. Additionally, the inventory dataset comprises around 342 entries, capturing key metrics such as weekly stock levels, quantities sold per week, and restocking volumes—providing valuable insights into inventory flow and stock management patterns.

4.2 Data Cleaning & Preprocessing:

Before proceeding with any analysis, the collected data underwent a structured pre-processing phase to ensure its accuracy, consistency, and analytical readiness:

1. Data Inspection

- **Explanation:** This allows us to identify any missing values, incorrect data types, and potential issues with data formatting.
- **Justification:** The inspection phase ensures that we have a comprehensive understanding of the dataset's structure, enabling us to tailor the cleaning and analysis methods accordingly.

2. Handling Missing Data

- **Explanation:** Missing values can lead to biased or incomplete analysis. Imputation or deletion methods ensure the dataset remains complete and reliable.
- **Justification:** Imputing values ensures that data size is maintained while preventing the loss of valuable records. Deleting rows is considered when missing data is extensive and cannot be reasonably imputed.

3. Duplicate Removal

- **Methodology:** Identify and remove duplicate records based on key columns (such as product ID, date, or transaction ID).
- **Explanation:** Duplicate records can artificially inflate metrics like revenue, quantity sold, or stock, leading to inaccurate analyses.

- **Justification:** Removing duplicates is necessary to ensure that each data point represents a unique transaction or observation, thus preserving the accuracy of the dataset.

4. Mathematical Validation of Calculations

- **Methodology:** Validate key calculations in the sales and inventory data by applying predefined business formulas:
 - Sales data:
 - $\text{Revenue} = \text{Selling Price} \times \text{Quantity Sold}$
 - $\text{Profit} = \text{Revenue} - \text{Cost Price}$
 - Inventory data: $\text{Closing Stock} = \text{Opening Stock} + \text{Restock Quantity} - \text{Weekly Sales}$
- **Explanation:** These calculations ensure that financial figures and stock levels are computed correctly and are logically consistent.
- **Justification:** These formulas reflect core business operations and need to be validated to ensure that reported figures are correct.

4.3 Qualitative & Quantitative Analysis

- **Qualitative Analysis:** It typically focusses on understanding the non-numerical aspects of the data. It involves looking for trends, patterns, and potential insights that are derived from textual or categorical variables. Here are the steps:
 - **Data Inspection:** Review the categorical data such as product categories, day of the week, and other non-numeric variables.
 - **Sales by Day or Category:** Understand if specific days or product categories show consistent patterns that can be used for promotional strategies or inventory planning.
 - **Business Insights:** Based on patterns in the data, identify qualitative insights like:
 - Which product categories have the highest demand?
 - Does sales performance vary significantly on specific days of the week?
 - Is there a need for restocking certain categories more frequently?
- **Quantitative Analysis:** This analysis focuses on numerical data, and this involves using statistical methods to summarize the dataset, find relationships between variables, and potentially make predictions. Here are the steps for quantitative analysis:

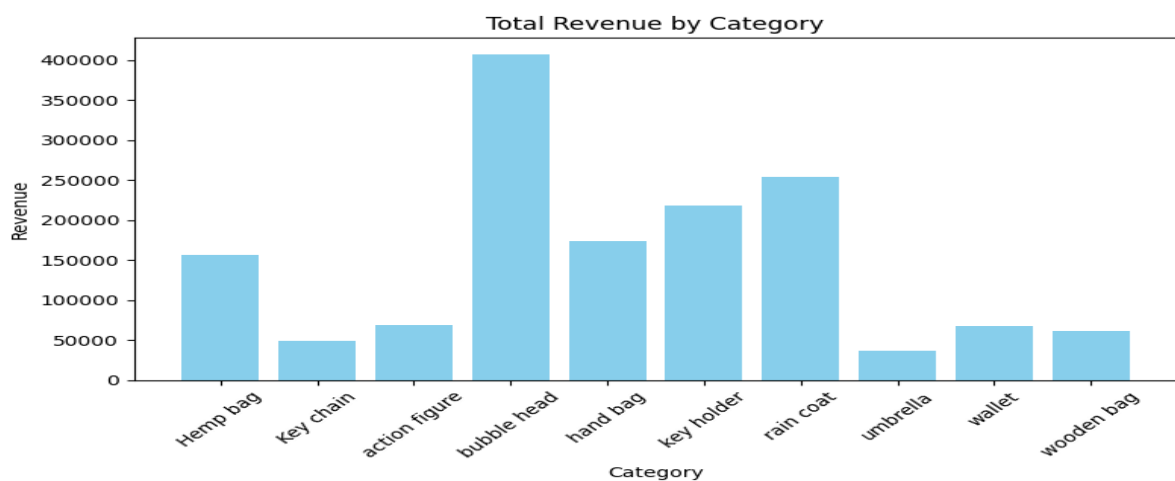
- **Descriptive Statistics:** Mean, median, standard deviation of numerical values like price, revenue, and quantity sold. This will give us understanding of the central tendency and spread of the data.
- **Correlation Analysis:** Find correlations between sales, cost, profit, and quantity to understand relationships. For example, is there a strong positive correlation between quantity sold and revenue?
- **Revenue and Profit Analysis:**
 - Calculate total revenue and profit for different product categories.
 - Compare revenue versus cost to assess profitability for each product category.

5 Results & Findings

By the end of mid-term, the following are all the results/findings:

➤ Total Revenue by Category:

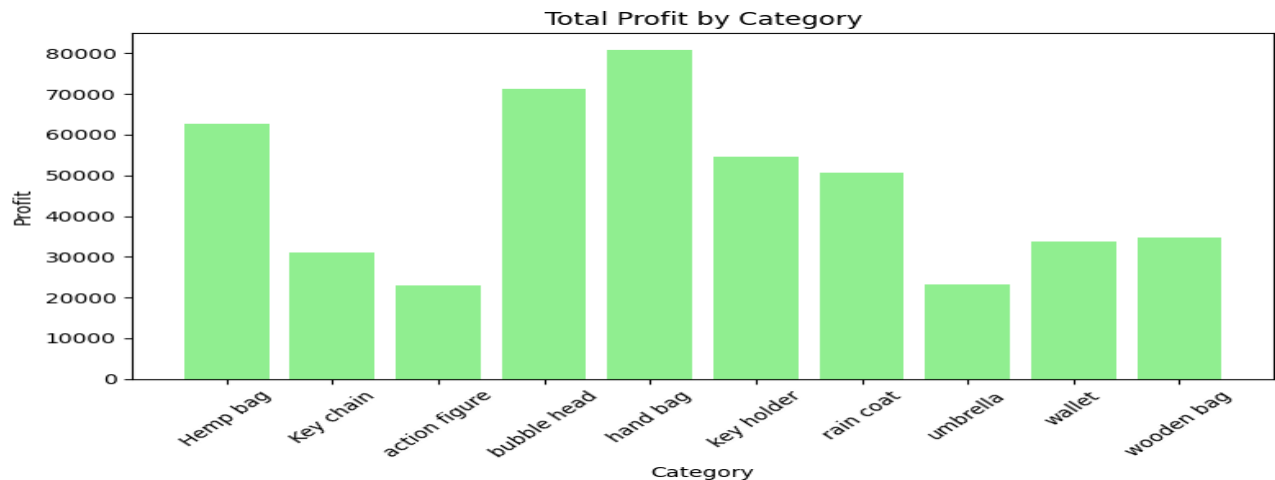
- This bar chart displays the total revenue generated by each product category (e.g., Hemp bag, Key chain, etc.) and the height of each bar represents the sum of revenue from all transactions for that category.
- **Insights:** Top revenue generators: Categories like Hemp Bag and Wooden Bag stand out — they are your best sellers. Moderate performance: Key Chains and Wallets perform decently. The umbrella shows the least contribution to revenue.



5.1: Image – Total Revenue by Category

➤ **Total Profit by Category:**

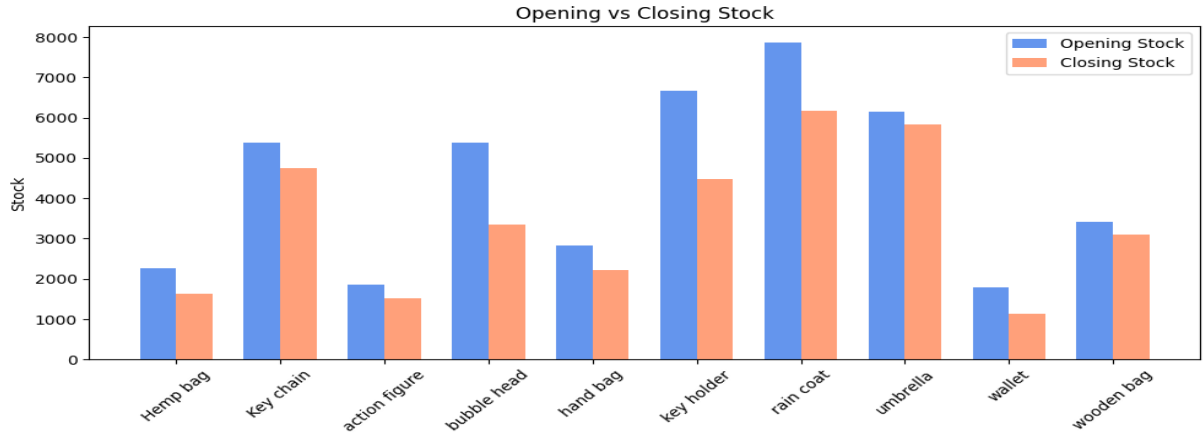
- This graph shows net profit earned per category after subtracting costs.
- Calculated: Profit = (Selling Price - Cost Price) × Quantity
- Insights: Hemp Bags and Wooden Bags again dominate, indicating not just good sales but also high-profit margins. Umbrellas have the lowest profit, showing both low sales and low margins.



5.2: Image – Total Profit by category

➤ **Opening vs. Closing Stock by Category:**

- Compare how much stock each category had at the beginning and end of the period.
- Two bars per category: Opening Stock (inventory at start) and Closing Stock (inventory at end)
- Insights: Minimal change in stock (e.g., Umbrellas): Suggests low sales or overstocking and large stock consumption (Hemp Bag, Wooden Bag): Indicates strong sales velocity. This chart helps track how efficiently inventory is moving.

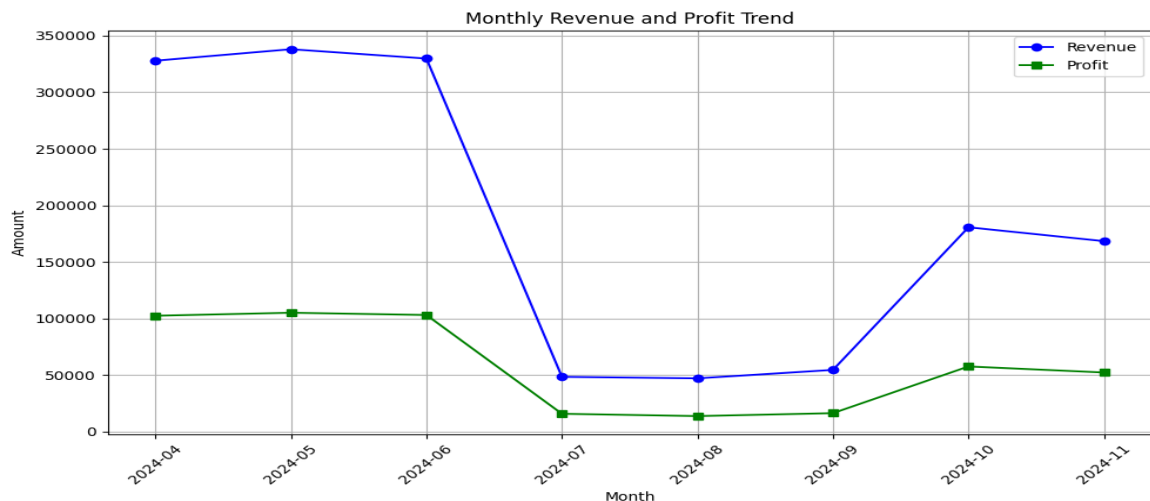


5.3: Image – Opening vs Closing Stock

- **Monthly Revenue and Profit Trend:** This graph displays monthly total revenue and total profit based on your sales data. Each point on the lines represents the aggregate for one month, and both metrics are plotted together for easy comparison.

Insights:

- **High-performing Months:** Any peaks in both lines show periods of strong sales and profitability. Example: If April has high revenue and profit, it might align with a seasonal or promotional boost.
- **Low-performing Months:** Months with noticeable drops in both revenue and profit might signal: Off-season periods, inventory stock-outs, lower consumer demand.
- **Profit Efficiency:** If profit grows faster than revenue, it means cost management is improving and if revenue grows but profit remains flat, there may be rising costs or discounting strategies eating into margins.



5.4: Image – Monthly Revenue and Profit Trend