## A Mid-Term Submission Report for the BDM Capstone Project

# Optimizing Inventory Management through Customer Behaviour Analysis

Submitted by

Name**: AISWARYA T**

Roll Number: **24DS1000117**


IITM BS Degree Program,

Indian Institute of Technology, Madras, Chennai

Tamil Nadu, India, 600031

# Contents

1. Executive Summary and Title 4

2. Proof of Originality of Data 4

2.1 Letter from Organization 5

2.2 Picture of the Organization 5

3.Meta Data and Descriptive Statistics

3.1 Meta Data 7

3.2 Data Quality and processing 8

3.3 3.3 Descriptive Statistics 9

4. Detailed Explanation of Analysis Process/Method 10

5. Results and Findings 11

# Declaration Statement

I am working on a Project Title Strategic Capital and Inventory Optimization to Drive Business Performance. I extend my appreciation to, SATHANA ELECTRICAL 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 has 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. 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 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:

Name: AISWARYA .T

Date: 03/04/2025

# 1 Executive Summary and Title:

This project, titled **"Optimizing Inventory Management through Customer Behavior Analysis,"** aims to examine the purchasing patterns at **Sadhana Electrical,** a leading electrical components retailer. Utilizing sales and purchase data from **October 2024 to November 2024,** this analysis seeks to address the challenges faced by the shop due to fluctuating sales trends.
A key concern identified is the **instability in sales,** with periods of low demand followed by sudden spikes. This inconsistency creates difficulties in inventory planning, leading to **excess stock accumulation in slow-moving products** while fast-selling items frequently go out of stock. As a result, capital remains tied up in unsold inventory, causing **cash flow constraints and supplier payment delays.**

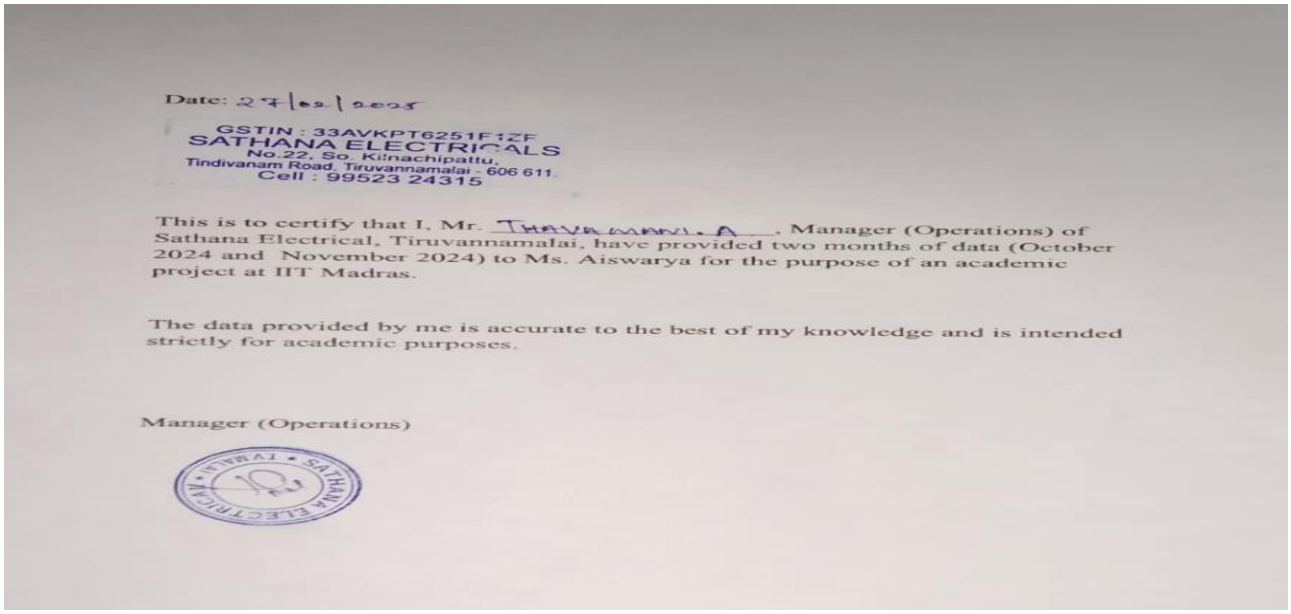
With a significant portion of capital **locked in unpaid invoices and overstocked inventory,** the shop struggles to maintain a steady supply of in-demand products. This inefficient inventory tracking results in lost sales, reduced customer satisfaction, and strained relationships with suppliers due to delayed payments.

Through a structured data-driven approach, this project examines stock movement trends, helping in **identifying high-demand products, reducing overstocking, and ensuring optimal capital allocation.** The findings are presented using **graphs and visual representations** to provide clear insights into inventory inefficiencies and their impact on revenue.

By addressing these challenges, the analysis aims to improve inventory **tracking, demand forecasting, and stock optimization strategies,** ensuring a steady supply of essential products while minimizing financial risks associated with excess inventory.

# 2 Proof of Originality of Data:

## 2.1 Letter from Organization



Date: 27/09/2025

GSTIN : 33AVKPT6251F1ZF
SATHANA ELECTRICALS
No.22, So. Kilnachipattu,
Tindivanam Road, Tiruvannamalai - 606 611.
Cell : 99523 24315

This is to certify that I, Mr. THAVAMANI. A, Manager (Operations) of Sathana Electrical, Tiruvannamalai, have provided two months of data (October 2024 and November 2024) to Ms. Aiswarya for the purpose of an academic project at IIT Madras.

The data provided by me is accurate to the best of my knowledge and is intended strictly for academic purposes.

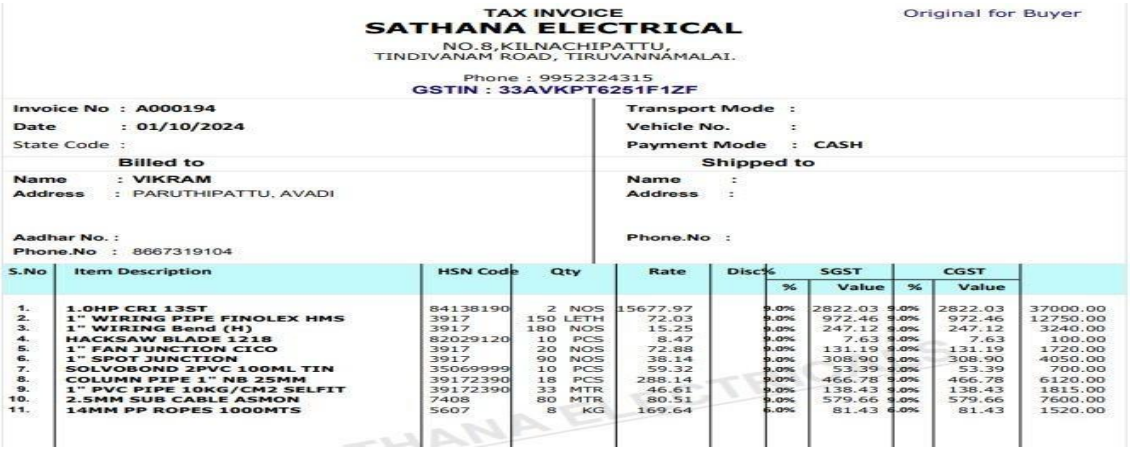
Manager (Operations)

## 2.2 Picture of the Organization:


Video Link: [video link]

# 3 Meta Data and Descriptive Statistics:

- ## Snapshot of the data:



TAX INVOICE — Original for Buyer

**SATHANA ELECTRICAL**

NO.8,KILNACHIPATTU,
TINDIVANAM ROAD, TIRUVANNAMALAI.

Phone : 9952324315
GSTIN : 33AVKPT6251F1ZF

| | | | |
|---|---|---|---|
| Invoice No | : A000194 | Transport Mode | : |
| Date | : 01/10/2024 | Vehicle No. | : |
| State Code | : | Payment Mode | : CASH |

| Billed to | | Shipped to | |
|---|---|---|---|
| Name | : VIKRAM | Name | : |
| Address | : PARUTHIPATTU, AVADI | Address | : |
| Aadhar No. | : | Phone.No | : |
| Phone.No | : 8667319104 | | |

| S.No | Item Description | HSN Code | Qty | Rate | Disc% | SGST % | SGST Value | CGST % | CGST Value | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 1.0HP CRI 13ST | 84138190 | 2 NOS | 15677.97 | | 9.0% | 2822.03 | 9.0% | 2822.03 | 37000.00 |
| 2. | 1" WIRING PIPE FINOLEX HMS | 3917 | 150 LETH | 72.03 | | 9.0% | 972.46 | 9.0% | 972.46 | 12750.00 |
| 3. | 1" WIRING Bend (H) | 3917 | 180 NOS | 15.25 | | 9.0% | 247.12 | 9.0% | 247.12 | 3240.00 |
| 4. | HACKSAW BLADE 1218 | 82029120 | 10 PCS | 8.47 | | 9.0% | 7.63 | 9.0% | 7.63 | 100.00 |
| 5. | 1" FAN JUNCTION CICO | 3917 | 20 NOS | 72.88 | | 9.0% | 131.19 | 9.0% | 131.19 | 1720.00 |
| 6. | 1" SPOT JUNCTION | 3917 | 90 NOS | 38.14 | | 9.0% | 308.90 | 9.0% | 308.90 | 4050.00 |
| 7. | SOLVOBOND 2PVC 100ML TIN | 35069999 | 10 PCS | 59.32 | | 9.0% | 53.39 | 9.0% | 53.39 | 700.00 |
| 8. | COLUMN PIPE 1" NB 25MM | 39172390 | 18 PCS | 288.14 | | 9.0% | 466.78 | 9.0% | 466.78 | 6120.00 |
| 9. | 1" PVC PIPE 10KG/CM2 SELFIT | 39172390 | 33 MTR | 46.61 | | 9.0% | 138.43 | 9.0% | 138.43 | 1815.00 |
| 10. | 2.5MM SUB CABLE ASMON | 7408 | 80 MTR | 80.51 | | 9.0% | 579.66 | 9.0% | 579.66 | 7600.00 |
| 11. | 14MM PP ROPES 1000MTS | 5607 | 8 KG | 169.64 | | 9.0% | 81.43 | 9.0% | 81.43 | 1520.00 |

**Google Drive link for the raw data:** Raw Data link

## 1 Metadata:

- **Data Source:** The dataset was provided by **Sadhana Electrical**, a leading electronics retailer.
- **Data Collection Period:** Data was collected over **two months**, from **1st October 2024 to 30th November 2024**.
- **Data Collection Method:** The data was recorded through **invoice bills** stored in **PDF format** for both **sales and purchase transactions**.
- **Data Format:** The original data was in multiple-**invoice PDF files**, which were processed and converted into a structured **Excel file** for analysis.

**Data Attributes:** Both **Sales Data** and **Purchase Data** contain the following fields:

- DATE– Date of the transaction.
- BILLED TO NAME – Name of the customer (for sales) or supplier (for purchases).
- ITEMS DESCRIPTION– Name and details of the purchased product.

- QUANTITY– Number of units purchased.
- RATE – Price per unit of the product.
- DISCOUNT% – Discount percentage applied to the purchase.
- TAX%– Applicable tax percentage.
- AMOUNT – Total amount after tax and discount.
- PAYMENT MODE – Mode of payment

## 2 Data Quality & Processing

- The dataset initially contained **missing values** and **inconsistencies** due to variations in invoice formats.
- **Regular Expressions (Regex)** were used to extract relevant fields from the invoice PDFs.
- A **data cleaning process** was applied, including:
    a. Handling **missing values**
    b. **Standardizing inconsistent formats** (e.g., different date formats, product descriptions).
    c. **Merging multiple invoice PDFs** into a **single Excel file** for structured analysis.
    d. **Integrating both sales and purchase data** into separate sheets for comparison
    Use the following drive link to access the cleaned Data.

Spreadsheet: Spread Sheet link

### 3.1 Descriptive Statistics

When analysing the **sales data**, the following descriptive statistics were observed:

### 3.2 Sales

- **Mean Sales Amount:** The average sales amount is **Rs. 2802.80**.
- **Median Sales Amount:** The middle value of sales is **Rs. 1400**.
- **Mode Sales Amount:** Can be determined separately.

- **Maximum Sales:** Sales range from a **minimum of Rs. 10** to a **maximum of Rs. 102,900**.
- **Average Customer Bill Amount:** On average, each customer's bill amounts to **Rs. 2802.80**.
- **Monthly Average Sales:** Monthly sales trends need further breakdown for October and November.
- **Average Deviation from Mean:** The standard deviation of sales values is **Rs. 4819.86**, indicating high variability.

### 3.3 Quantity

- **Mean Quantity Sold:** The average quantity sold is **23 units**.
- **Median Quantity Sold:** The middle quantity value is **6 units**.
- **Mode Quantity Sold:** The most frequently sold quantity needs further calculation.
- **Minimum and Maximum Quantity:** Quantity sold ranges from a **minimum of 0 units** to a **maximum of 1080 units**.
- **Highest Quantity Product:** The product with the highest quantity sold can be extracted from item descriptions. That is KEI wires.

## 4 Detailed Explanation of Analysis Process/method:

The sales data for October 2024 and November 2024, the initial step involved converting the raw PDF files into Excel format to facilitate structured data processing. The primary tools used for analysis included Microsoft Excel for data review and transformation, along with Python libraries such as Pandas, Matplotlib, and Seaborn for deeper data processing and visualization. Following data cleaning, key attributes such as Segment and Brand information were extracted from the "Item Description" column. Utilizing Excel's functionalities, patterns were visualized, pivot tables were constructed, and insights were drawn.

The analysis process unfolded as follows:

**Data Cleansing:** Initial focus was on data cleaning, involving the removal of rows or columns containing missing or erroneous data.

**Descriptive Statistics:** The subsequent step encompassed the calculation of descriptive statistics, comprising metrics such as mean, median, mode, standard deviation, and range.

**Segment and Brand Segregation**: The third phase centred on the creation of distinct Segment and Brand columns from the "ITEMS DESCRIPTION" column. Categorization was performed based on product descriptions, thereby assigning items to their respective segments and brands.

**Pivot Table Creation:** Pivot tables were developed to facilitate a comprehensive examination of sales data.These tables enabled an in-depth analysis of various aspects, including **weekly and daily sales trends**, product performance, and customer purchasing patterns.

**Data Visualization:** To enhance interpretability, multiple visual representations were created.. **Bar charts** illustrated item sales across different brands and segments. **Line graphs** provided insights into **weekly and monthly sales fluctuations**.

**Data Analysis & Key Findings**: A significantly higher number of transactions were conducted on credit compared to cash. This suggests that a substantial portion of sales revenue is yet to be received, leading to delayed cash flow.A steady increase in sales was observed over time, indicating potential seasonality or promotional effects.

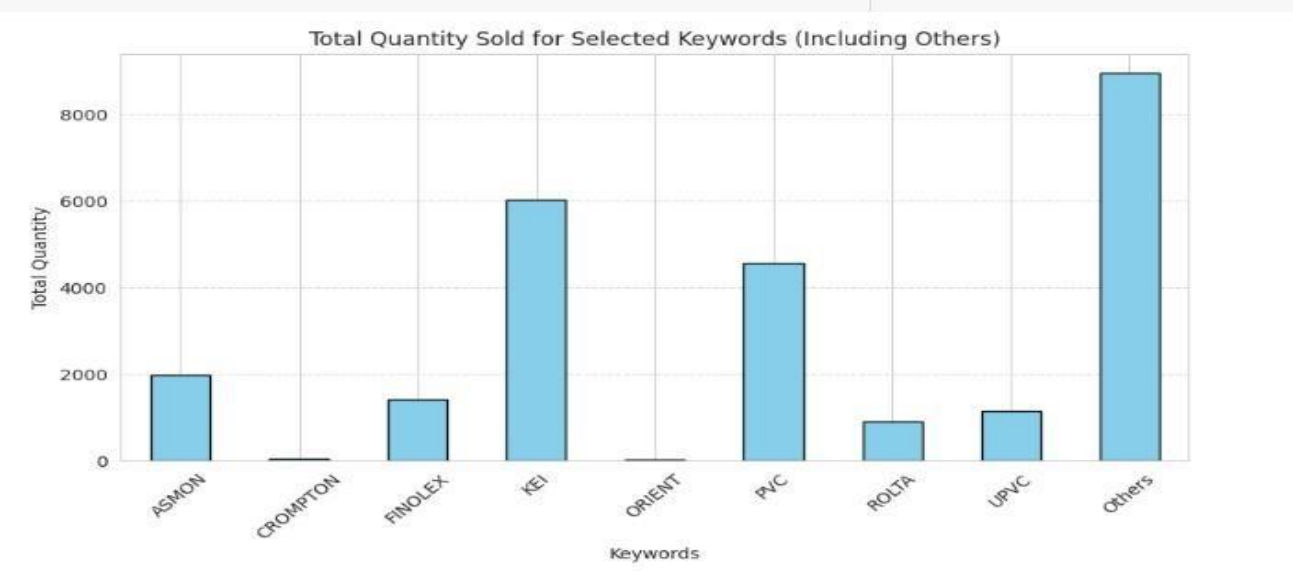
**Conclusion & Strategic Recommendations**: Prioritize stocking high-demand brands like KEI and PVC while reassessing inventory levels for low-selling brands. Implement demand forecasting techniques to maintain optimal stock levels and avoid overstocking or stockouts. Since most sales are credit-based, efforts should be made to improve collection efficiency. Offering discounts for early payments or implementing stricter credit policies could improve cash inflow.

# 5 Results And Findings:

- **Dominance of "Others" Category**

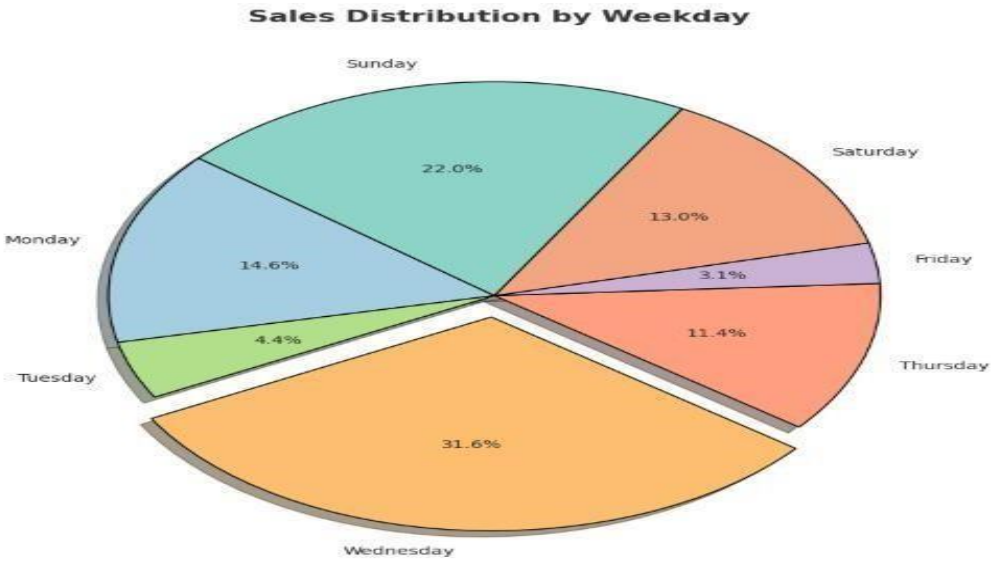
- The highest quantity sold belongs to the **"Others"** category, significantly surpassing all other individual brands or segments. This suggests a large variety of products that do not fall into the predefined keyword categories.

- **Top-Selling Keywords**
- **KEI and ORIENT** are the leading brands in terms of sales quantity, indicating strong customer preference for these products.
- **PVC** also has a substantial sales volume, showing that it is a commonly purchased product.
- **Low-Selling Keywords**
- **CROMPTON** has the lowest recorded sales, which may indicate either low demand or limited stock availability.
- **ROLTA, UPVC, and FINOLEX** also show relatively lower sales compared to other categories, suggesting potential areas for marketing improvement.




- **Peak Sales on Wednesday**
- **Wednesday accounts for the highest sales (31.6%)**, significantly outperforming other days. This indicates that mid-week is the busiest period, potentially due to customer preferences or store promotions.
- **Strong Sales on Sunday**

- **Sunday (22%) also shows high sales activity**, suggesting that weekend shopping plays a crucial role in overall revenue generation.




Businesses should **closely monitor credit sales trends** and ensure that payment terms are welldefined to avoid liquidity issues. **Optimizing stock levels** based on credit cycle patterns can help prevent overstocking or stockouts. Here most of them are credit.


## Insights from the Sales Revenue Trend Graph

1. **Significant Peak in Sales**
    a. A sharp spike in sales is observed on **October 9, 2024**, with a peak revenue of ₹70,435.
    b. This suggests a special event, promotional offer, or bulk order on this date.
2. **Steady Sales Growth Post-Peak**
    a. After the peak, sales declined significantly but showed a **gradual upward trend** over time.
    b. This indicates a possible **recovery phase or increased customer demand** in the later weeks.
3. **Sales Performance Over Time**
    a. The **sales remained relatively stable with slight growth** until mid-November.
    b. The increasing trend suggests improving business performance, possibly due to **seasonal demand, marketing strategies, or increased customer engagement.**

Sathana Electrical's sales analysis will boost customer satisfaction, reduce stock issues, and enhance efficiency. Optimized inventory and capital management will increase profitability and cut excess costs.