



**BDM Capstone Project [JAN  
2025]**

# **Enhancing Global Competitiveness in Machinery Manufacturing:A Strategic Case Study of Macse Enterprises**

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# The Business and The Problems

## About the Business

- **Name of the Business:** Macse Enterprises
- **Type of Business:** B2B machinery manufacturing and trading company, specialising in selling machinery such as: Atta Chakki Machines, Nail Machines, oil Machines etc.
- **Location:** Patna, Bihar
- **Founder:** Mr. Rahul Kumar
- **Background:** The company was founded in April 2016 by the founder with a vision to supply high-quality industrial machinery to small and medium enterprises(SMEs) across India.

## Problems

- **Low Customer Retention:** Despite achieving steady sales over the four-month period from October 2024 to January 2025, Macse Enterprises experienced significantly low levels of repeat purchases.
- **Low Profit Margins:** The business faces low profit margins due to high COGS from expensive raw materials, inefficient supply chain, and misaligned pricing strategies.

## Data Collection

- Collected transactional data (Oct 2024 - Jan 2025) including sales volume, product types and pricing.
- Manual data entry operation was carried on these bill copies to make it eligible for analysis.



# Data Cleaning and Preprocessing

Before going ahead with the analysis part it was necessary to **clean and preprocess the data**. A series of preprocessing operations were carried out on the dataset making the data eligible for the data analysis operations.



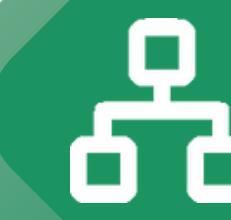
## Data Cleaning

Duplicate bills, incorrect spellings, etc errors were rectified



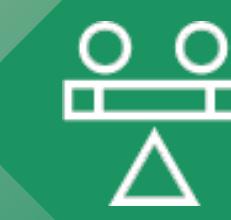
## SKU Clustering

SKUs were clustered into similar types of SKUs using OpenRefine



## Category Classification

23 SKUs were classified into 5 major product categories.



## Quantity Standardisation

The quantities were standardised to a common level of measurement.



## GEO Mapping

The Addresses in the dataset were geocoded to enable them for further analysis

# Objective and the Methods

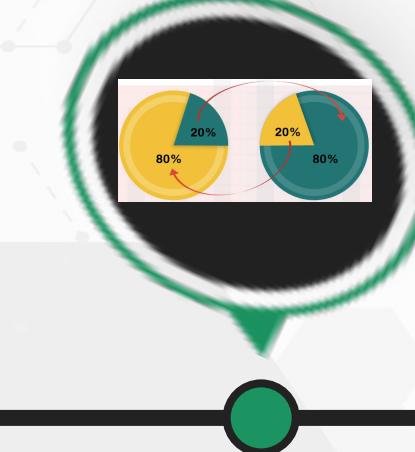
**Objective:** The aim of the project is to analyse the extracted data and draw out actionable insights that may help the business to improve customer retention and profit margins.

**Methods of Analysis:** After thorough data cleaning and preprocessing, five main methods of analysis were applied on the preprocessed dataset to evaluate sales performance, identify key products and customers, analyze profitability patterns, and understand customer behaviour.



## Categorical Influence on Sales

To understand the influence of each product categories that generate consistent sales.



## Pareto Analysis

To identify the top 20% SKUs contributing to approximately 80% of the total revenue. This method helped prioritize high-performing products for strategic focus.



## Time-series Trend Analysis & Customer Analysis

To analyzed daily and monthly sales data using moving averages to detect trends, seasonal spikes, and post-intervention shifts.



## Customer Geo-Mapping

Mapped customer locations using city and state data to identify regional clusters, highlight high-demand zones, and support better targeting strategies.



## Profitability Analysis

Evaluated product-wise gross margins to identify underperforming SKUs and understand cost-to-revenue efficiency. This helped highlight pricing issues and supply chain inefficiencies affecting profitability.

## ANALYSIS 1

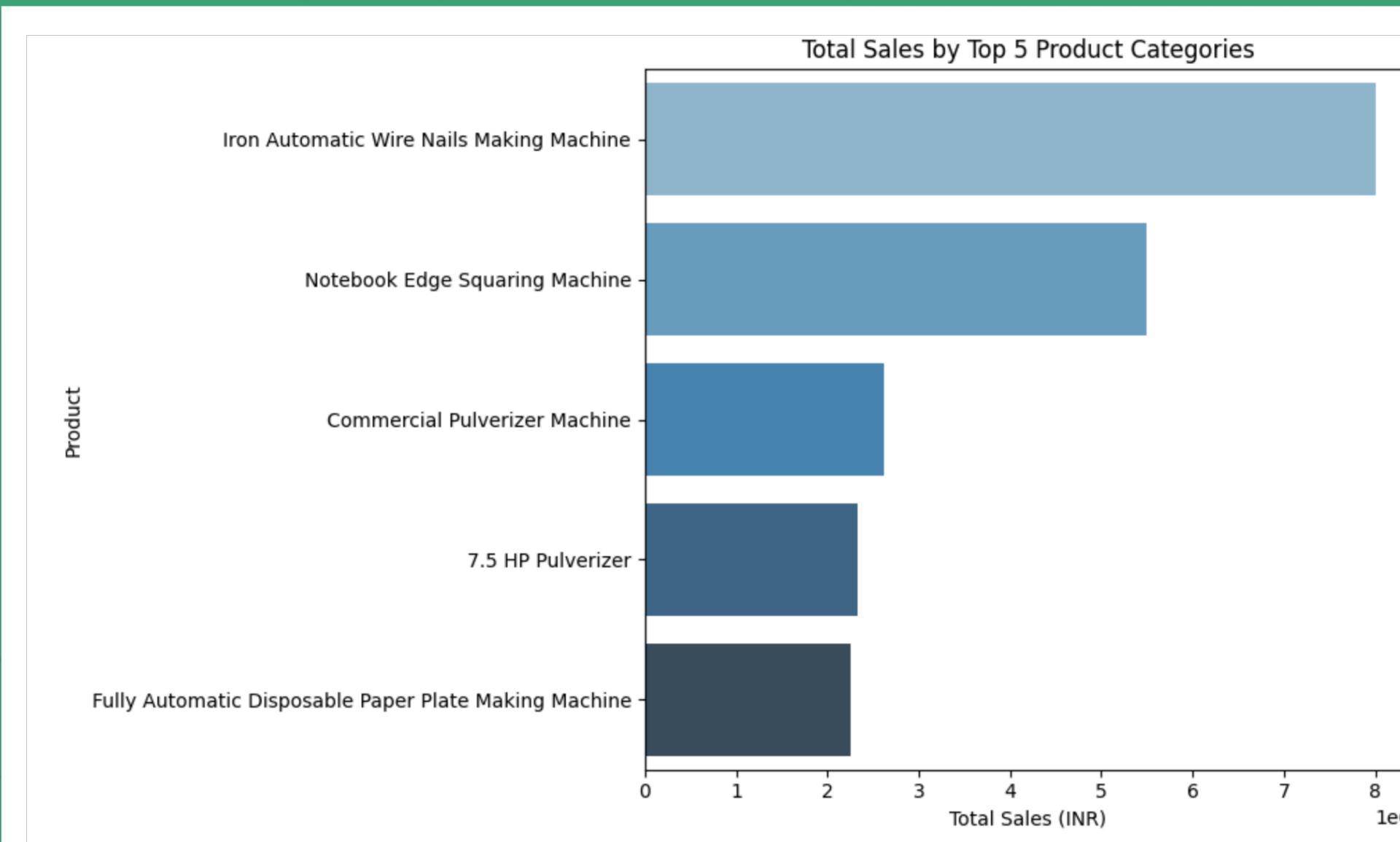
# Categorical Influence on Sales

## Explanation

**Standard Aggregation:** The first graph aggregates the total sales value for each of the top 5 product categories.

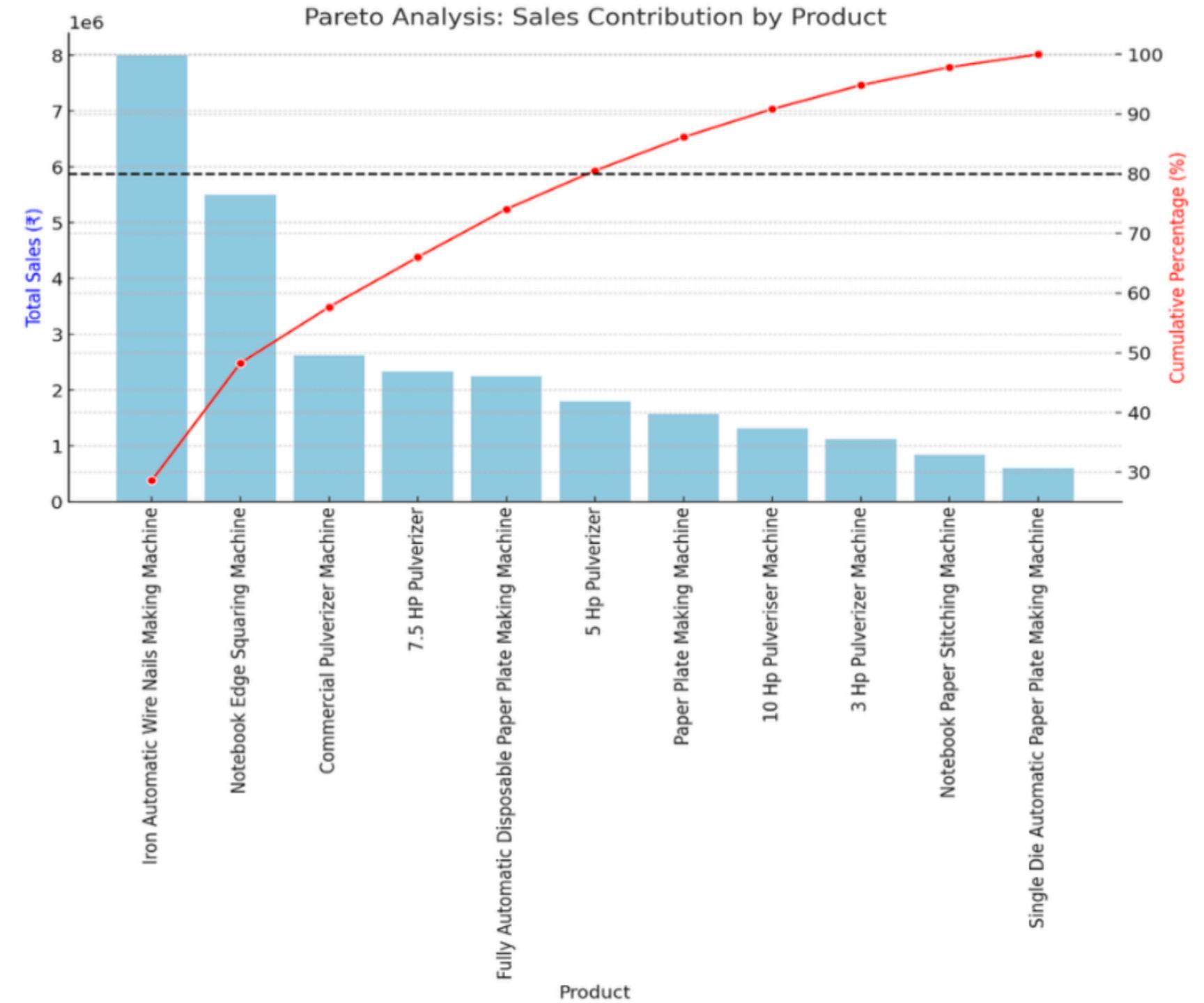
## Results and Findings

- **Iron Automatic Wire Nails Making Machine** is the top-selling product with the highest revenue, having the most influence on the sales, making it the most profitable category to invest in.
- **Notebook Edge Squaring Machine** product category follows, contributing significantly to overall sales while Pulverizer and paper plate machines show moderate to low sales in comparison.
- **Iron Automatic Wire Nails Making Machine** is the most influential product in both charts, showing consistently high total sales and broad transaction spread, indicating performance significantly above average among all SKUs.
- The bottom three—**Commercial Pulverizer Machine, 7.5 HP Pulverizer, and Fully Automatic Disposable Paper Plate Making Machine**—have relatively similar sales figures, but lower than the top two. These product categories show minimal influence in both the charts, indicating a low SKU count and limited sales performance.
- **Automatic Wire Nail Machine** and **Notebook Machine** are the main pillars of sales in the business.



## ANALYSIS 2

# Pareto Analysis



## Explanation

The **Pareto chart** separates products based on their contribution to total revenue:

- **Blue bars** represent the actual sales for each SKU.
- The **red line** shows the **cumulative percentage** of total sales.

This dual-axis visualization helps pinpoint the most profitable products and highlights the long tail of low performers. It clearly shows that a small number of high-performing SKUs drive the majority of revenue, while many other products contribute marginally and may require strategic reassessment.

## Results and Findings

- **Iron Automatic Wire Nails Making Machine** alone contributes **over 40%** of total sales.
- The top 3 products including **Iron Automatic Wire Nail Making Machine**, **Notebook Edge Squaring Machine** and **Commercial Pulveriser Machine** are together account for approximately 80% of the total revenue(A-Class SKUs).
- Several low-performing products, such as: **Notebook Paper Stitching Machine** and **Single Die Automatic Paper Plate Marking Machine** contribute minimally to overall sales, falling into the C-Class zone.

### ANALYSIS 3

# Time Series Analysis & Customer Retention

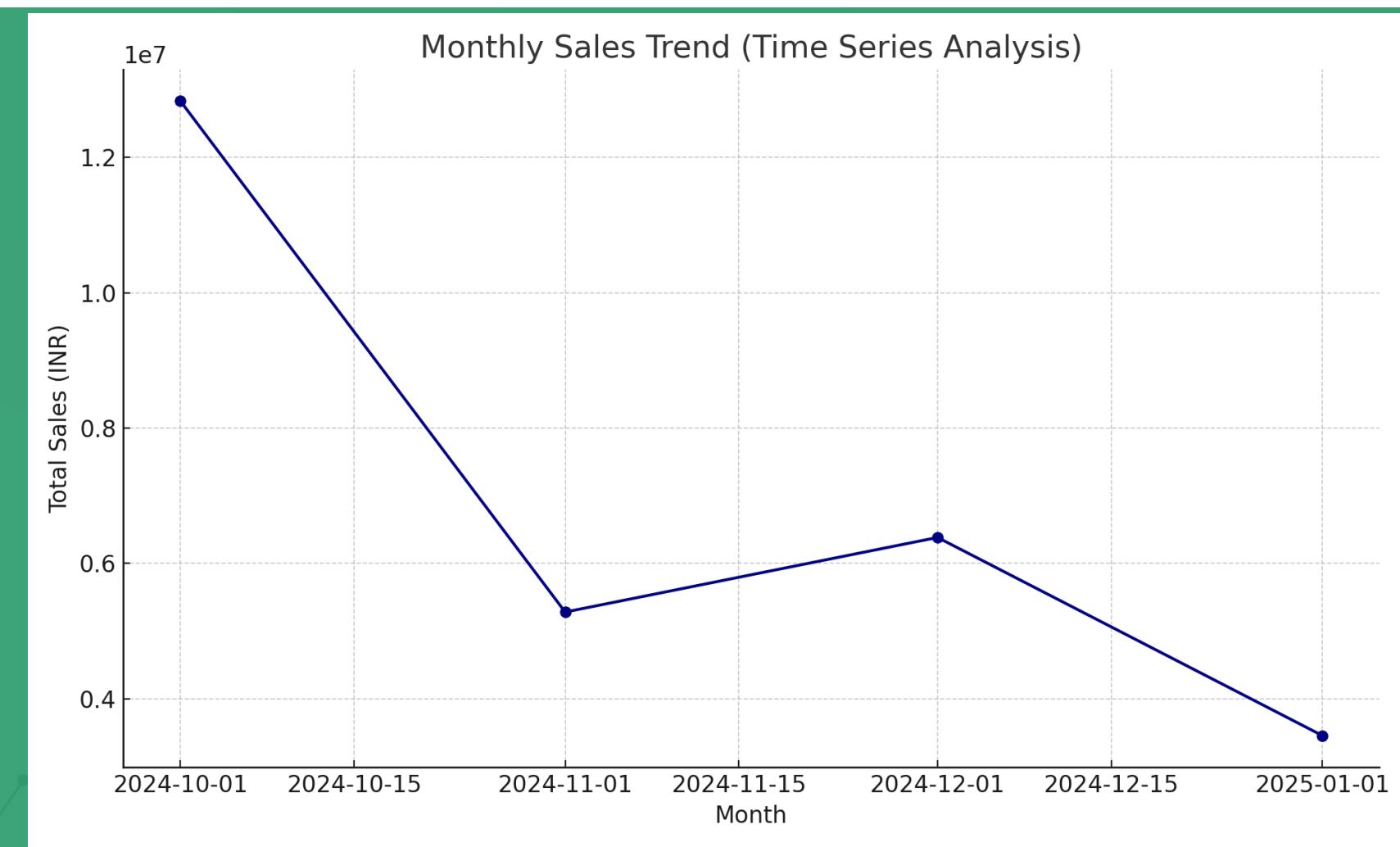
## Explanation

The time series line chart visualizes the monthly sales performance of MACSE Enterprises over the recorded period. Each point on the graph represents the total sales for a given month, helping identify patterns, seasonality, and anomalies in revenue generation.

The bar chart shows that only 23 customers (24.05%) made repeat purchases, while 144 customers (75.95%) purchased only once, indicating a low customer retention rate.

## Results and Findings

- **Sales peaks** are observed between **October and December**, aligning with festive demand and year-end business cycles.
- Sales dip significantly between **February and July**, indicating a clear off-season. This **mid-year** slowdown in demand leads to noticeable revenue drops, posing challenges in maintaining consistent profit margins and complicating inventory and production planning.
- MACSE Enterprises faces a major retention challenge, with most customers not returning. This leads to high acquisition costs, low customer lifetime value (CLTV), and missed opportunities for loyalty, cross-selling, and organic growth.



## ANALYSIS 4

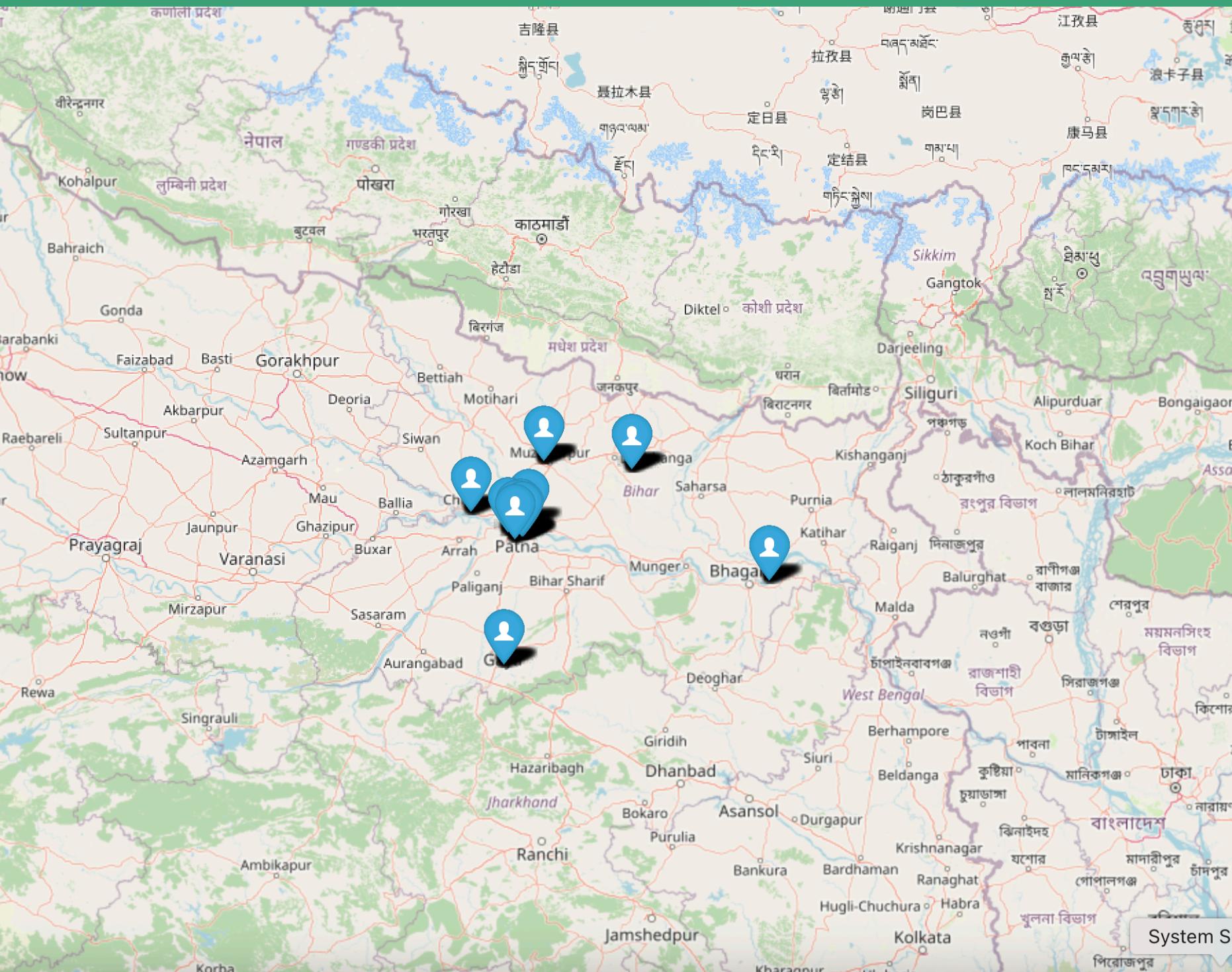
# Customer Geo-Mapping

## Explanation

- The Map visualises Macse Enterprises' customer distribution, mainly across **urban and semi-urban districts of Bihar**.
- Patna** is the central hub, with visible customer clusters in **Muzaffarpur, Bhagalpur, Gaya, and Begusarai**.
- A few spillover cases are seen near the **Bihar–Jharkhand border**, suggesting untapped cross-border potential.

## Results and Findings

- Patna Region Dominates:** Strong customer base driven by accessibility, awareness, and infrastructure.
- Growth Potential in Secondary Cities:** Cities like **Bhagalpur and Muzaffarpur** show early signs of demand—ideal for regional campaigns..
- The Market Gaps Identified:** Areas in **Western Bihar and Jharkhand** lack customer presence, highlighting a need for better outreach and logistics planning.
- Strategic Implication:** Tailoring marketing and service efforts to emerging and underutilized zones can **boost retention and expand market share**.



## ANALYSIS 5

# Profitability Analysis

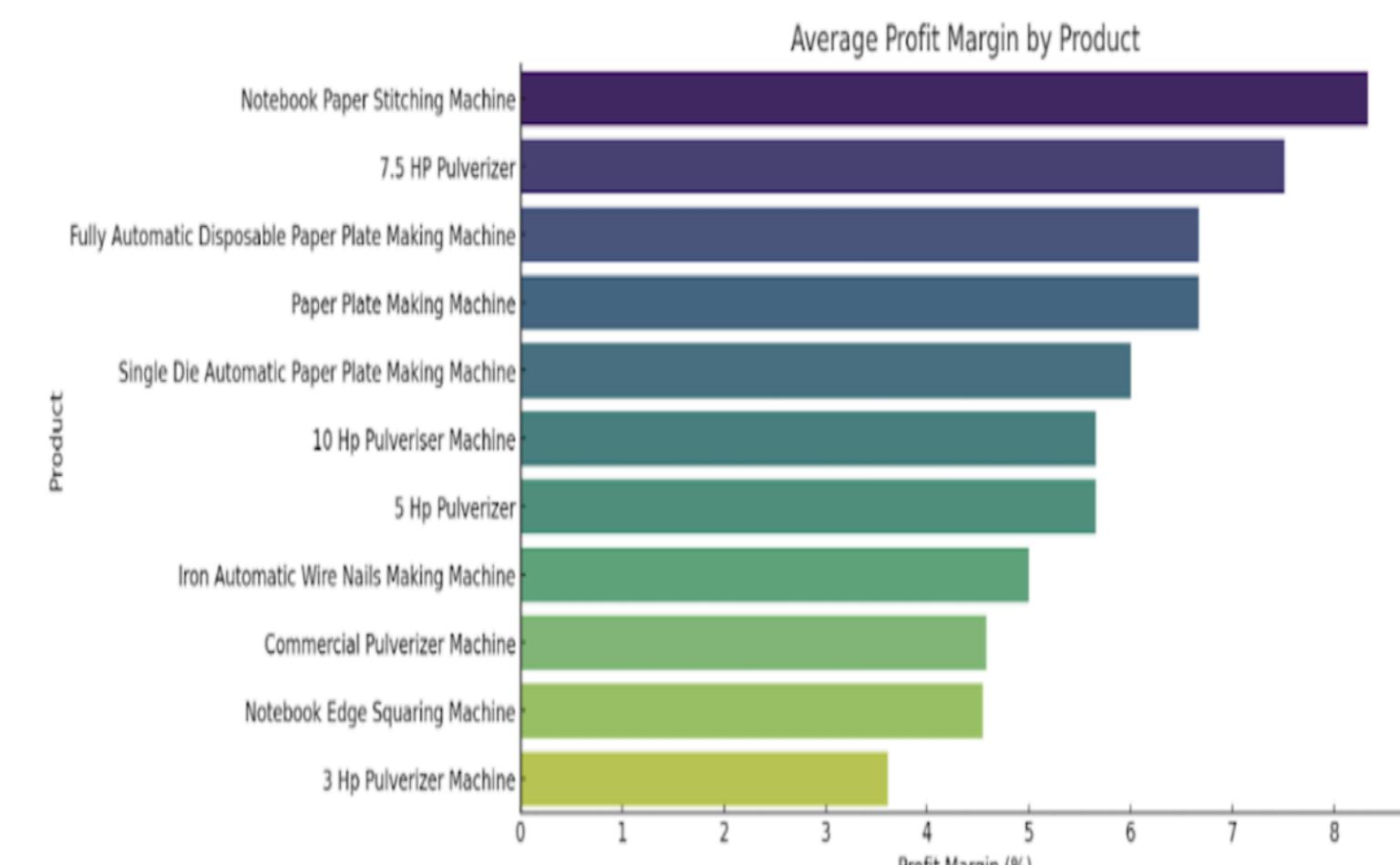
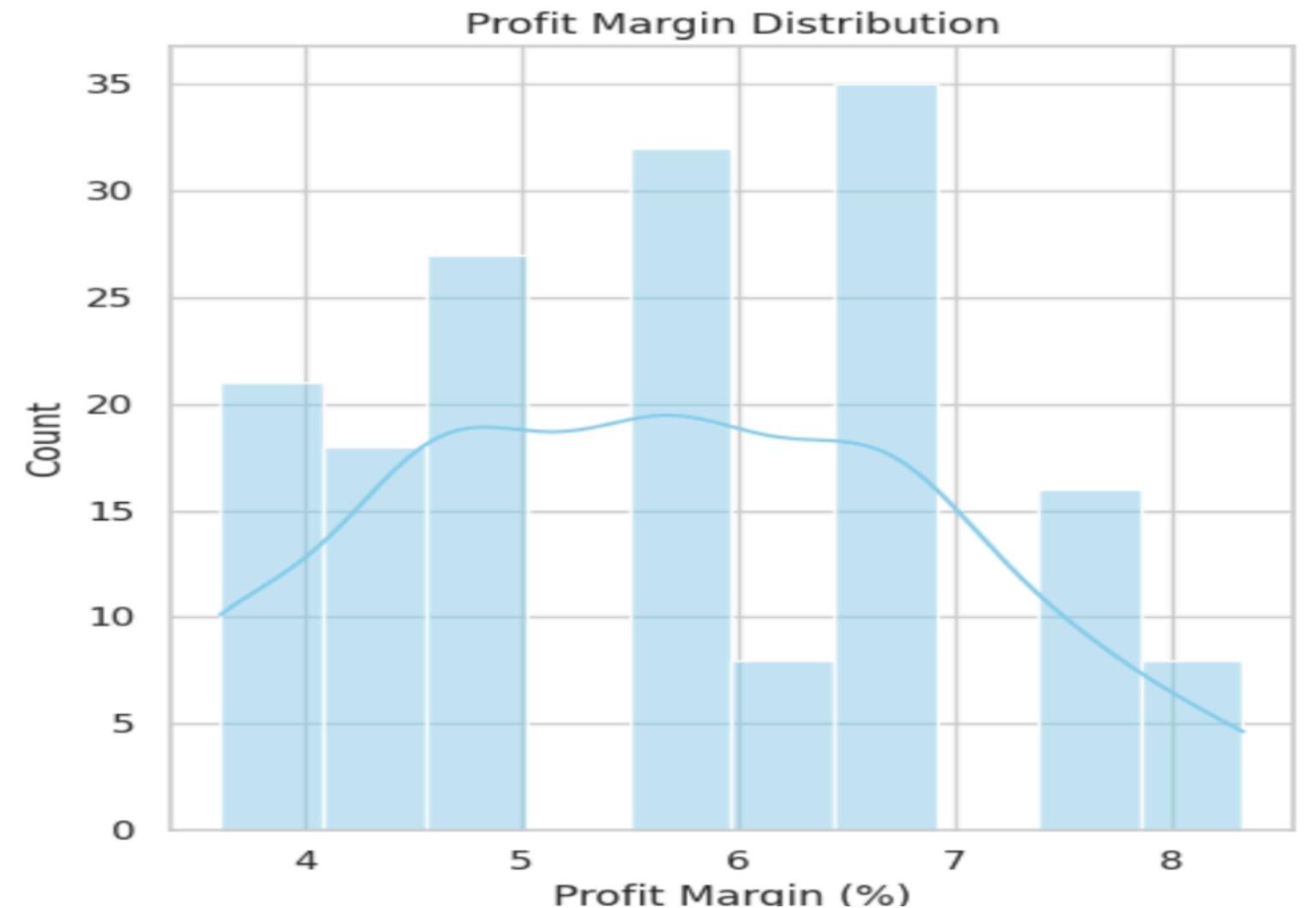
### Explanation

This above histogram displays the distribution of profit margins across all products, helping understand how profitability is spread within the product portfolio.

This below bar chart shows the average profit margins for each product offered by Macse Enterprises. It highlights significant variation in profitability across SKUs.

### Results and Findings

- Most profit margins are clustered between 5% and 7%, showing a moderately right-skewed distribution.
- A small number of products exceed 7% margin, while several fall below 5%.
- Products like Notebook Paper Stitching Machine and 7.5 HP Pulverizer achieve higher margins (>7%).
- Products such as the 3 HP Pulverizer and Notebook Edge Squaring Machine have lower margins (<5%).



# Recommendations

1

## **Prioritize High-Performing Categories**

→ Focus marketing and inventory on top categories like *Food Processing Machines* and *Fastener Machines* which consistently generate higher sales (from **Categorical Influence Analysis**).

2

## **Optimize Product Line Using Pareto Insights**

Retain and promote A-Class SKUs that drive ~80% of sales; phase out or bundle C-Class products with minimal contribution.

3

## **Launch Loyalty & Referral Program**

Improve retention by rewarding repeat purchases and referrals, addressing the 75.95% one-time customer issue.

4

## **Use Seasonal Trends to Time Campaigns**

Run aggressive promotions during Oct–Dec peak season and special offers in off-season months to stabilize revenue.

5

## **Implement Predictive Demand Forecasting**

Use time series data to forecast sales, manage inventory efficiently, and improve margin consistency.

6

## **Expand into Under-penetrated Regions**

Target Jharkhand and West Bihar through regional campaigns and local distributor partnerships.

7

## **Track Profitability per Category and Product**

Continuously monitor margin performance; reprice or cut low-margin SKUs to raise overall profitability above 5.67%.

8

## **Segment Customers for Personalized Offers**

Use RFM analysis to engage high-value and mid-value customers with tailored upselling and retention strategies.