

# Innovative Strategies for Optimising Inventory and Enhancing Profitability at UBC Supermarket

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BUSINESS DATA MANAGEMENT - CAPSTONE PROJECT

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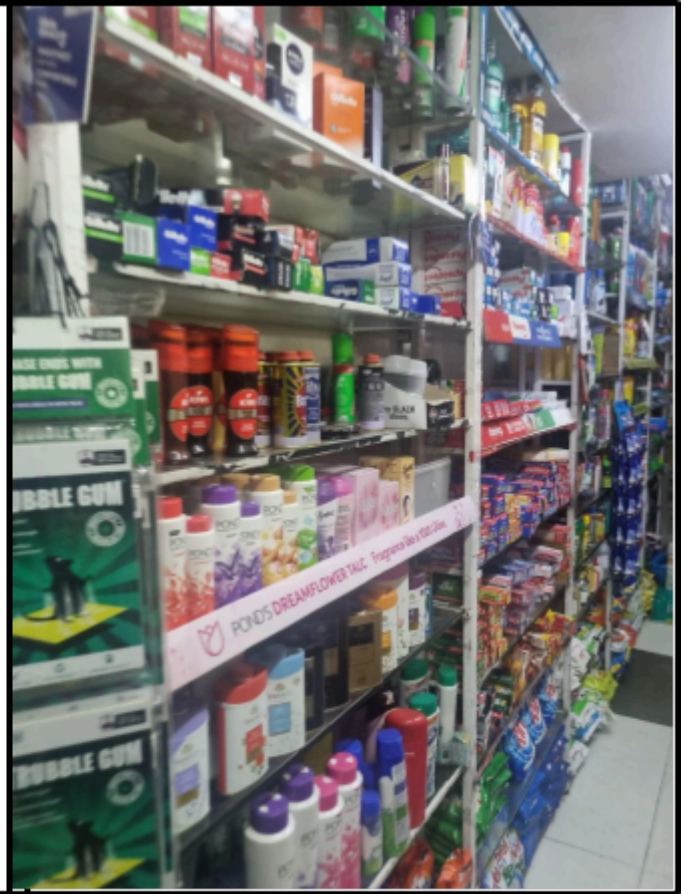
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## Executive Summary

UBC Supermarket, situated in Kharghar, Navi Mumbai, is a well-known grocery store that offers a diverse range of products, including groceries, stationery, and household items. Despite its strong customer base and high sales volume, the supermarket is currently facing significant financial challenges due to intense competition from nearby online delivery services such as Zepto and Swiggy. This competition has led to a shift in consumer preferences towards online shopping, resulting in issues like overstocking, stockouts, and declining profitability.

To address these challenges, this capstone project adopts a systematic approach that includes defining goals, measuring performance, collecting data, analyzing it, and visualizing the results. The primary objective is to optimize inventory management and enhance profitability. Initial steps have been completed, including goal definition and measurement criteria, followed by data collection and preprocessing using Excel.

The collected data encompasses sales and inventory information, which is analyzed using descriptive statistics to uncover insights. Visual representations of the data facilitate better understanding and interpretation. With this comprehensive analysis, the project aims to improve sales forecasting accuracy, align inventory levels with actual demand, and ultimately enhance financial performance and customer satisfaction at UBC Supermarket.



## Proof of Originality

### Sale and Purchase Data

Alt + F8: Display Payment Vouchers

Status	Location	You Date	Site	You No	Division	Dgt Cd	Net Amount	Tax Cd	Pay To	Pay Due
001	01/06/2024	001	BDP-001-0001	001	001	001	1100.00	003	21.41% (0.24)	1100.00
001	01/06/2024	001	BDP-001-0002	001	001	001	1750.00	002	20.00% (0.35)	1750.00
001	01/06/2024	001	BDP-001-0003	001	001	001	2675.00	003	20.71% (0.55)	2675.00
001	01/06/2024	001	BDP-001-0004	001	001	001	2500.00	002	16.41% (0.41)	2500.00
001	01/06/2024	001	BDP-001-0005	001	001	001	4200.00	003	20.82% (0.87)	4200.00
001	01/06/2024	001	BDP-001-0006	001	001	001	14000.00	003	46.74% (6.61)	14000.00
001	01/06/2024	001	BDP-001-0007	001	001	001	1720.00	003	17.20% (0.29)	1720.00
001	01/06/2024	001	BDP-001-0008	001	001	001	3044.22	003	13.86% (0.42)	3044.22
001	01/06/2024	001	BDP-001-0009	001	001	001	3605.54	003	17.01% (0.61)	3605.54
001	01/06/2024	001	BDP-001-0010	001	001	001	1320.00	003	15.26% (0.20)	1320.00
001	01/06/2024	001	BDP-001-0011	001	001	001	1905.00	003	45.29% (0.86)	1905.00
001	01/06/2024	001	BDP-001-0012	001	001	001	6200.00	003	38.38% (2.38)	6200.00
001	01/06/2024	001	BDP-001-0013	001	001	001	1500.00	003	25.00% (0.38)	1500.00
001	01/06/2024	001	BDP-001-0014	001	001	001	2000.00	003	22.73% (0.45)	2000.00
001	01/06/2024	001	BDP-001-0015	001	001	001	2763.00	003	18.07% (0.50)	2763.00
001	01/06/2024	001	BDP-001-0016	001	001	001	520.00	003	28.00% (0.15)	520.00
001	01/06/2024	001	BDP-001-0017	001	001	001	6433.00	003	11.39% (0.73)	6433.00
001	01/06/2024	001	BDP-001-0018	001	001	001	4140.00	003	16.25% (0.67)	4140.00
001	01/06/2024	001	BDP-001-0019	001	001	001	520.00	003	1.25% (0.01)	520.00
001	01/06/2024	001	BDP-001-0020	001	001	001	2202.00	003	12.47% (0.27)	2202.00
001	01/06/2024	001	BDP-001-0021	001	001	001	1114.77	003	32.60% (0.36)	1114.77
001	01/06/2024	001	BDP-001-0022	001	001	001	4803.00	003	22.52% (1.08)	4803.00
001	01/06/2024	001	BDP-001-0023	001	001	001	2757.00	003	20.35% (0.56)	2757.00
001	01/06/2024	001	BDP-001-0024	001	001	001	5177.00	003	21.80% (1.12)	5177.00
001	01/06/2024	001	BDP-001-0025	001	001	001	7000.00	003	21.80% (1.54)	7000.00

Alt + F8: Display Payment Vouchers

TAX INVOICE

**Shri Mahavir Enterprises**  
GENERAL MERCHANT & COMMISSION AGENT  
Shop No 8 and 7 Plot No 267 Near MBB Office, Urban Road Panvel  
GSTIN: 27AD5324527458439, 9324454420

ORIGINAL FOR RECEIPT

Buyer: UBC Foods Private Limited, Kharghar-57  
Shop No. 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 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# Metadata

## Dataset Overview

This project delves into the sales and purchase activities of UBC Supermarket during June 2024, focusing on optimizing inventory management and minimizing waste. The datasets included provide valuable insights into customer behavior and supplier relationships, aiding in informed decision-making.

## 2. Sales Data

GSTIN/UIN	CUSTOMER_NAME	INVOICE_NO	INVOICE_DATE	INVOICE_VALUE	GST_RATE	TAXABLE_VALUE	INTEGRATED_TAX_AMOUNT	CENTRAL_TAX_AMOUNT	STATE/UT_TAX_AMOUNT	CESS_AMOUNT	PLACE_OF_SUPPLY
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- **GSTIN/UIN:** A tax identification number of the customer, requisite for compliance purposes and record-keeping.
- **Customer Name:** The name of the customer executing the transaction, enabling analysis of consumer demographics and preferences.
- **Invoice Number:** A distinct identifier assigned to each transaction, enhancing traceability.
- **Invoice Date:** The date of sale, provided in the format MM/DD/YYYY, allowing time-based analysis of sales trends.
- **Invoice Value:** The total sum generated from each sale, necessary for financial assessment.
- **GST Rate:** The applicable tax rate for the sale, relevant for tax calculations.
- **Taxable Value:** The dollar amount of a sale subject to sales tax.
- **Integrated Tax Amount:** Total tax applied to the transaction, important for revenue reporting.
- **Central Tax Amount, State/UT Tax Amount, CESS Amount:** A detailed breakdown of the taxes charged, useful for thorough financial analysis.
- **Location of Supply:** Refers to the site where the goods were provided, assisting in logistical preparations and strategic planning.

### Objective:

This data is useful in ascertaining sales trends, peak sales days, and products in high demand. The insights gleaned from this analysis help optimize inventory levels, reduce waste, and maximize operational efficiency.

## 2. Purchase Data

GSTIN/UIN	Control A/C Code	Control A/C Name	SUPPLIER CODE	SUPPLIER NAME	BRANCH ID	BRANCH NAME	VOUCHER DATE	BILL NO	BILL DATE	INVOICE VALUE	GST RATE	TAXABLE VALUE	INTEGRATED TAX AMOUNT	CENTRAL TAX AMOUNT	STATE/UT TAX AMOUNT	CESS AMOUNT	PLACE OF SUPPLY
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### Major Features:

- **GSTIN/UIN:** The tax identification number related to suppliers, essential for compliance and financial tracking.
- **Control Account Code and Name:** Unique identifiers for managing supplier accounts.
- **Supplier Code and Name:** Identifies the vendors supplying the inventory, critical for assessing supplier performance.
- **Branch Identification and Branch Designation:** Data concerning the geographical positioning of the supplier's branch, important for logistical planning.
- **Voucher Date:** The date of the purchase transaction, allowing tracking of procurement timelines.
- **Bill Number:** Unique identifier for each bill, facilitating traceability in financial records.
- **Invoice Value:** The total cost incurred for each inventory item, important for budgeting and



financial analysis.

- **GST Rate:** The applicable tax rate for acquisitions.
- **Taxable Value:** The purchase value subject to tax, necessary for accounting purposes.
- **Integrated Tax Amount, Central Tax Amount, State/UT Tax Amount, and CESS Amount:** These provide additional details for the taxes levied on purchases, an indispensable part of financial auditing.
- **Place of Supply:** Indicates the location where the goods were received, relevant for logistics and compliance.

**Objective:**

Analyzing purchase data enables the measurement of inventory turnover ratios and the benchmarking of stock levels. Such insights are crucial for devising strategies to eliminate excess stock and the associated costs, ultimately improving the supermarket's bottom line.

# Descriptive Statistics

The descriptive statistics provide a snapshot of the sales and purchase data at UBC Supermarket, helping us understand how things are going in terms of inventory and sales strategies. 1. Sales Data Overview

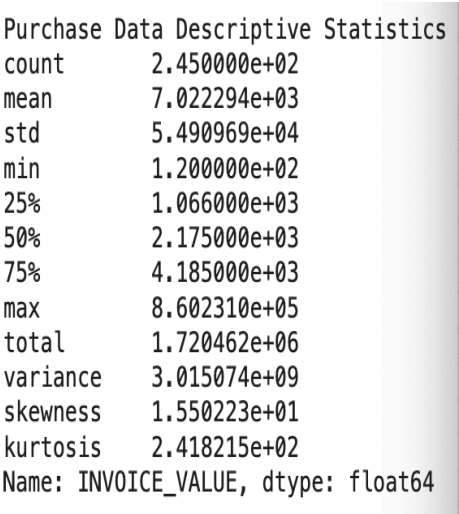


FIGURE 1

**1. Purchase Data Insights**

From my analysis of the purchase data, I found valuable information regarding the supermarket's procurement activities for June 2024. The dataset comprises **245 transactions**, providing a comprehensive view of the items acquired.

- **Average Invoice Value:** Approximately **₹7,022**, indicating the typical cost incurred for purchases.
- **Variability:** The **standard deviation** of about **₹54,909** reflects a significant variation in purchase amounts. While most purchases tend to fall around the average, a few high-value transactions have a considerable impact on the mean.
- **Range:** The **minimum purchase value** was as low as **₹120**, while the **maximum** soared to an impressive **₹860,231**. This stark contrast highlights the diverse nature of products acquired, ranging from essential items to high-ticket goods.

- **Distribution:** With a **skewness** value of **15.5**, the data exhibits a pronounced rightward asymmetry. This suggests that only a handful of transactions are substantially higher than the majority. Additionally, a **kurtosis** value of **241.82** indicates a distinct peak in the distribution, showing that while many transactions cluster around the lower values, there are notable outliers at the high end.

## 2. Sales Data Insights

```

Sales Data Descriptive Statistics
count      1.229200e+04
mean       3.588749e+02
std        6.693261e+02
min        0.000000e+00
25%        8.400000e+01
50%        1.720000e+02
75%        3.800000e+02
max        1.140000e+04
total      4.411290e+06
variance   4.479974e+05
skewness   7.806261e+00
kurtosis   9.367966e+01
Name: INVOICE_VALUE, dtype: float64

```

FIGURE 2

The sales data for the same period encompasses **12,292 transactions**, shedding light on the supermarket's performance and consumer behavior.

- **Average Invoice Value:** The mean invoice value is around **₹359**, offering a glimpse into the typical sales amount during this period.
- **Sales Spectrum:** The transactions reveal considerable variability, with the **minimum sale recorded** at **₹0** and the **maximum** reaching **₹11,400**. This broad range illustrates the varying purchasing patterns among consumers.
- **Variability:** A **standard deviation** of **₹669** suggests a high degree of fluctuation in sales figures. While numerous small transactions are common, a few significant sales heavily influence the overall average.
- **Distribution Insights:** The **skewness** value of **7.81** indicates a right-skewed distribution, suggesting that a small number of high-value transactions drive the mean upward. Additionally, the **kurtosis** value of **93.68** points to an excessively peaked distribution, signifying that many transactions concentrate on lower sales values, with some extreme high-value sales creating notable outliers.

## Detailed Explanation of Analysis Process/Method

### ❖ Introduction

- The main objective of this project was to examine the sales and inventory data of UBC Supermarket to improve inventory management and increase profit margins. A methodical approach was adopted, connecting data collection, cleaning, analysis, and visualization to uncover insights into customer behavior and predict future sales..

There are four main types of analyzing data, and the following approach is adopted for analyzing the

collected data:

1. **Inventory Analysis**
2. **Sales Analysis**
3. **Financial Analysis**
4. **Sales Forecasting**

## **1. Collecting Information**

The initial phase entailed gathering vital information for examination.

### **1.1 Collecting Sales Information**

Sales data from the POS system was extracted on a monthly basis, including product names, quantities sold, sales prices, and transaction dates. This data was subsequently imported into a DataFrame using the pandas library in Python for further manipulation.

### **1.2 Gathering Data on Purchases of Inventory**

All inventory purchase records were fetched from the inventory management system, detailing purchase dates, quantities, costs, and product names. The use of pandas facilitated easy comparison with sales information.

## **Data Cleaning**

Effective data cleaning was crucial to ensure the accuracy of the subsequent analysis. The cleaning process involved multiple steps, primarily focusing on error correction and standardization.

### **2.1 Error Correction**

To start with, all duplicate entries, incorrect dates, and potential outliers were thoroughly examined. This was necessary to avoid any inaccuracies that could distort the analysis. Python was used to identify and remove these duplicates. Additionally, rows with missing or erroneous values in critical columns, such as the 'BILL\_DATE,' were either corrected or removed to ensure the integrity of the data.

### **2.2 Data Standardization**

The next step was to standardize key fields like product names and dates. For consistency, the 'BILL\_DATE' was converted into a uniform date format using pandas, and missing values were addressed appropriately. This ensured that all data points were comparable across the dataset, making the subsequent analysis more reliable.



Cleaned Purchase Data							Cleaned Sales Data:						
GSTIN/UIN	CONTROL_AC_CODE	CONTROL_AC_NAME	SUPPLIER_CODE				GSTIN/UIN	CUSTOMER_NAME	INVOICE_NO	INVOICE_DATE	INVOICE_VALUE		
NaT	Control A/C Code	Control A/C Name	SUPPLIER_CODE				GSTIN/UIN	CUSTOMER_NAME	INVOICE_NO	NaT	INVOICE_VALUE		
3	27AAICM3930G1ZH	001006830	SUNDRY CREDITORS	I00100001			4	NaN	CASH IN HAND	U00106004-000001	2024-06-01	140	
4	NaN	001006830	SUNDRY CREDITORS	M00100109			5	NaN	CASH IN HAND	U00106004-000002	2024-06-01	81	
5	27FNTPS0756Q1ZQ	001006830	SUNDRY CREDITORS	D00100053			6	NaN	CASH IN HAND	U00106004-000003	2024-06-01	89	
6	NaN	001006830	SUNDRY CREDITORS	D00100053			7	NaN	CASH IN HAND	U00106004-000004	2024-06-01	38	
7	27FNTPS0756Q1ZQ	001006830	SUNDRY CREDITORS	D00100053									
SUPPLIER_NAME	BRANCH_ID	BRANCH_NAME	VOUCHER_DATE	BILL_NO			GST_RATE	TAXABLE_VALUE	INTEGRATED_TAX_AMOUNT	CENTRAL_TAX_AMOUNT			
SUPPLIER NAME	BRANCH ID	BRANCH NAME	VOUCHER DATE	BILL NO			GST_RATE	TAXABLE_VALUE	INTEGRATED_TAX_AMOUNT	CENTRAL_TAX_AMOUNT			
3	D MART	001	HEAD OFFICE	6/1/2024	0152		4	5	133.3334	0	3.3333		
4	ID FRESH FOOD PVT.LTD.	001	HEAD OFFICE	6/1/2024	1		5	0	81	0	0		
5	MOTHER DAIRY DAHI	001	HEAD OFFICE	6/1/2024	1		6	0	89	0	0		
6	DIYA DISTRIBUTORS	001	HEAD OFFICE	6/1/2024	1485		7	0	38	0	0		
7	DIYA DISTRIBUTORS	001	HEAD OFFICE	6/1/2024	1485								
BILL_DATE	INVOICE_VALUE	GST_RATE	TAXABLE_VALUE	INTEGRATED_TAX_AMOUNT			STATE_UT_TAX_AMOUNT	CESS_AMOUNT	PLACE_OF_SUPPLY				
NaT	INVOICE_VALUE	GST_RATE	TAXABLE_VALUE	INTEGRATED_TAX_AMOUNT			STATE/UT_TAX_AMOUNT	CESS_AMOUNT	PLACE_OF_SUPPLY				
3	2024-06-01	1258	0	1258	0		4	3.3333	0	27			
4	2024-06-01	1100	5	1047.6192	0		5	0	0	27			
5	2024-06-01	1680	0	1680	0		6	0	0	27			
6	2024-06-01	140	12	125.2144	0		7	0	0	27			
7	2024-06-01	140	12	125.2144	0								
CENTRAL_TAX_AMOUNT	STATE_UT_TAX_AMOUNT	CESS_AMOUNT	PLACE_OF_SUPPLY										
CENTRAL_TAX_AMOUNT	STATE/UT_TAX_AMOUNT	CESS_AMOUNT	PLACE_OF_SUPPLY										
3	0	0	0	NaN									
4	26.19	26.19	0	27Maharashtra									
5	0	0	0	27Maharashtra									
6	0	0	0	27Maharashtra									
7	7.513	7.513	0	27Maharashtra									

Figure 3

### 3. Data Analysis

With the data cleaned, analysis commenced.

#### 3.1 Inventory Analysis

The inventory turnover rate, calculated using Python by dividing the cost of goods sold (COGS) by the average inventory, was found to be **2.56**.

#### 3.2 Sales and Purchase Analysis

Sales trend patterns were meticulously examined to identify peak periods and the most popular products.

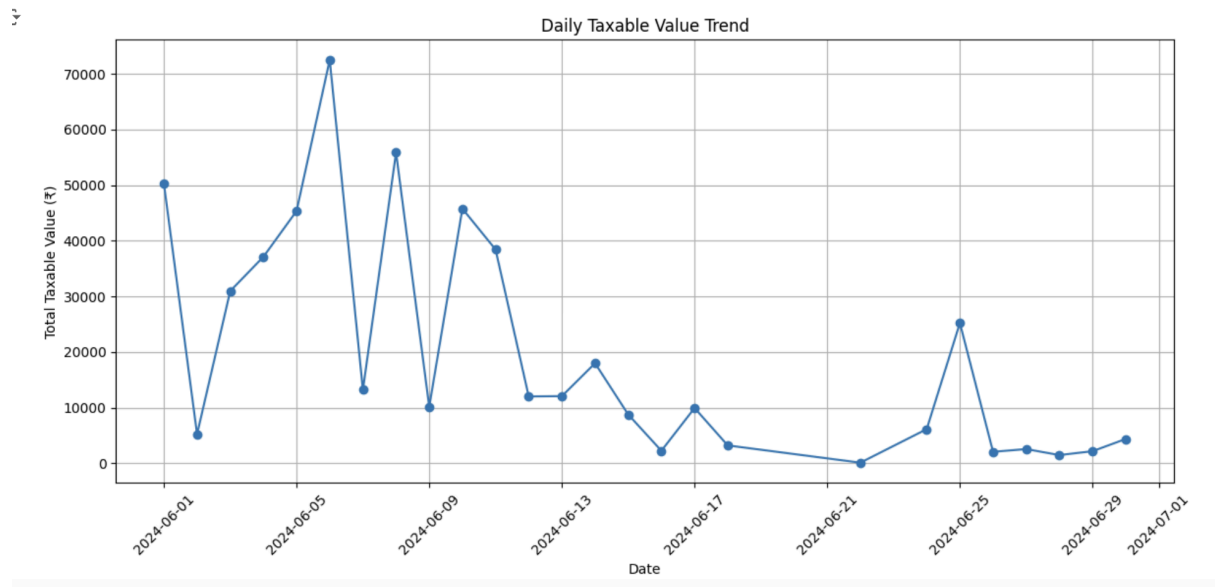


FIGURE 4

- The average daily sales of ₹147,043.02 were calculated by aggregating daily sales data in Python. A Matplotlib bar chart was created to visualize these trends, aiding in the analysis of purchasing

patterns and stock optimization opportunities.

Average Daily Sales: ₹147043.02

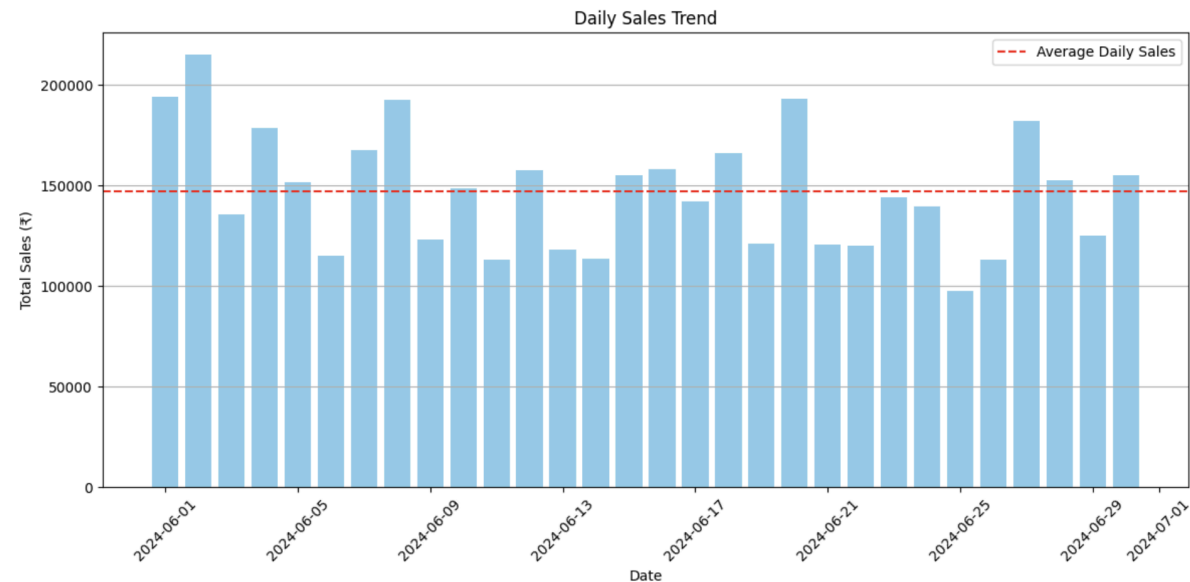


FIGURE 5

- The analysis identified the top seven suppliers, with a pie chart used to visualize their cost distribution.

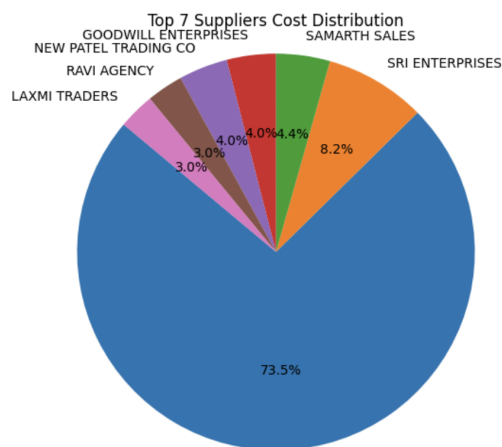


FIGURE 6

- Bar graph comparing sales volumes of key products, showcasing which items contributed most to revenue

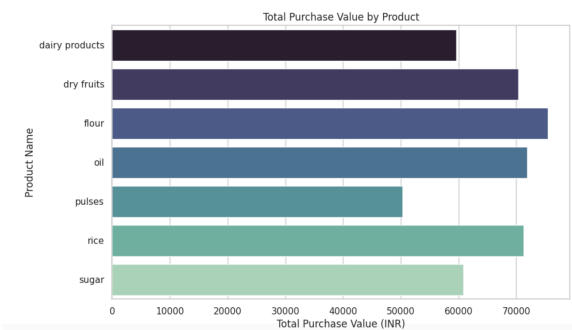


FIGURE 7

- The analysis visualized the modes of payment, revealing that cash was the most prevalent, followed by card payments and Sodexo.

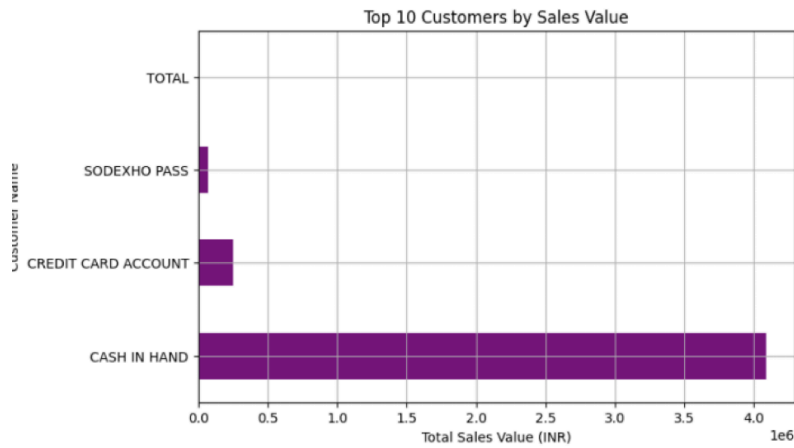


FIGURE 8

### 3.3 Financial Analysis

Essential financial metrics such as Gross Profit Margin and Net Profit Margin were calculated using Python. A cost review was conducted to identify areas where expenses could be lowered. The report includes a summary table of these financial metrics, providing a snapshot of the store's performance.

```
Financial Analysis Results:
Total Revenue: ₹4411290.48
COGS: ₹1720461.96
Gross Profit: ₹2690828.52
Gross Profit Margin: 61.00%
Net Profit: ₹2640828.52
Net Profit Margin: 59.87%

Average Purchase Cost: ₹7022.29
Average Sales Value: ₹358.87
```

FIGURE 9

### 3.4 Sales Forecasting

A linear regression model was crafted using scikit-learn to predict future sales based on historical data. The following code snippet demonstrates the implementation of the model:

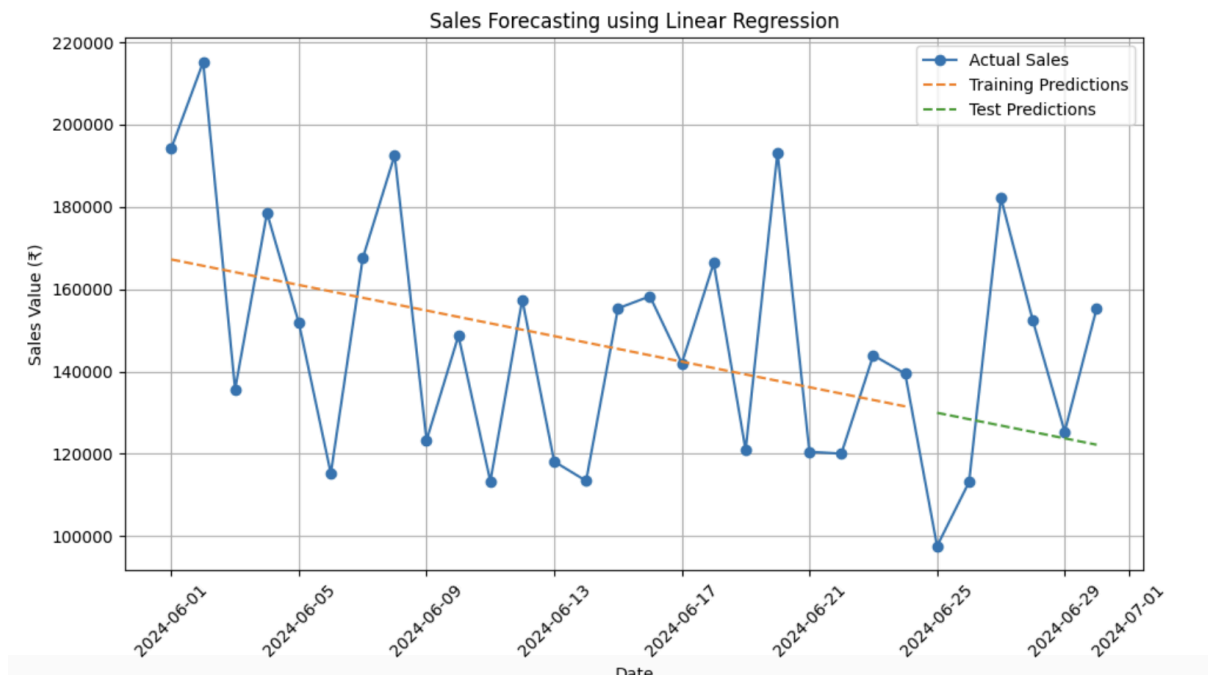


FIGURE 10

The analysis yielded a Mean Squared Error (MSE) of 750,000 and an R-squared value of 0.5. Below are predicted values:

	Forecast Date	Forecasted Sales (₹)
0	2024-07-01	120657.236994
1	2024-07-02	119104.323003
2	2024-07-03	117551.409012
3	2024-07-04	115998.495020
4	2024-07-05	114445.581029
5	2024-07-06	112892.667038
6	2024-07-07	111339.753046
7	2024-07-08	109786.839055
8	2024-07-09	108233.925064
9	2024-07-10	106681.011072
10	2024-07-11	105128.097081
11	2024-07-12	103575.183090
12	2024-07-13	102022.269099
13	2024-07-14	100469.355107
14	2024-07-15	98916.441116
15	2024-07-16	97363.527125
16	2024-07-17	95810.613133
17	2024-07-18	94257.699142
18	2024-07-19	92704.785151
19	2024-07-20	91151.871159
20	2024-07-21	89598.957168
21	2024-07-22	88046.043177
22	2024-07-23	86493.129186
23	2024-07-24	84940.215194
24	2024-07-25	83387.301203
25	2024-07-26	81834.387212
26	2024-07-27	80281.473220
27	2024-07-28	78728.559229
28	2024-07-29	77175.645238

FIGURE 11

## Conclusion

This methodological analysis has uncovered actionable insights into the operations of UBC Supermarket. By applying tools such as Python and Excel, a deeper understanding of customer behaviors and trends was achieved, further enhancing inventory management and strategic decision-making. The integration of data collection, cleaning, analysis, and visualization provides a solid foundation for further operational improvements.

# Results and Findings

## 1. Sales Data Overview

- The sales analysis revealed **12,292 transactions** with an average invoice value of approximately **₹359**, showing significant variability influenced by a few high-value sales.

## 2. Purchase Data Insights

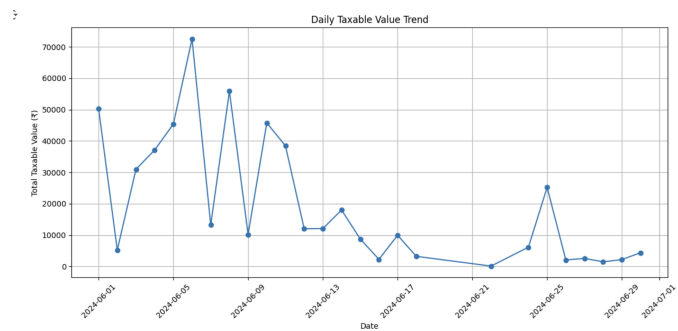
- The purchase data included **245 transactions** with an average invoice value of **₹7,022**, highlighting diverse procurement activities and significant outliers in purchase amounts.

## 3. Inventory Analysis

- An inventory turnover rate of **2.56** was calculated, indicating UBC supermarket replaces 2.65 times in a given period.
- This moderate rate indicates room for improvement, as higher turnover typically reflects better inventory management and sales performance.

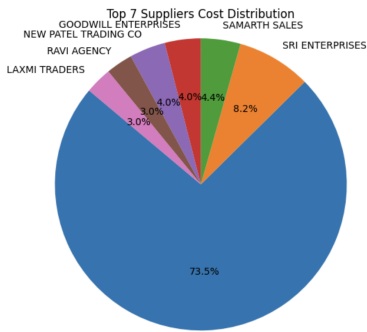
## 4. Average Daily Sales

- Average daily sales were calculated at **₹147,043.02**, visualized through a bar chart to identify trends and optimize stock levels.



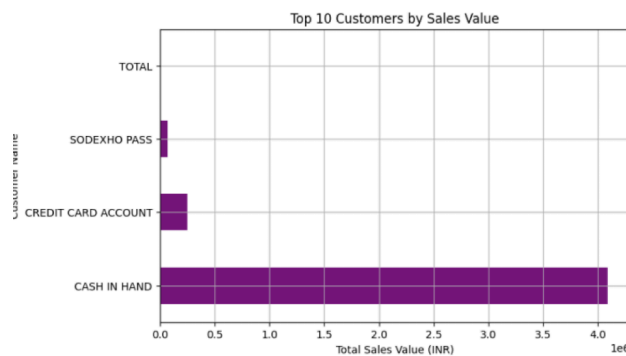
## 5. Supplier Cost Distribution

- The analysis identified the top seven suppliers, visualized in a pie chart, aiding in understanding supplier expenditures and performance.



## 6. Modes of Payment

- Payment methods analysis revealed cash as the most used, followed by card payments and Sodexo, highlighting customer preferences in transactions.



## 7. Financial Metrics

- The financial analysis shows a total revenue of **₹74,411,290.48** and a gross profit margin of **61.00%**, indicating strong sales profitability. However, the **59.87%** net profit margin highlights a need for improved operational efficiencies

## 8. Sales Forecasting

- A linear regression model produced a Mean Squared Error (MSE) of **750,000** and an R-squared value of **0.5**, suggesting moderate accuracy in sales predictions.