Battery Store Success Engine:

Analytics and Insights for Retail Growth

A Final report for the BDM capstone Project

Submitted by

Name: Satwik Gupta

Roll number: 23f2005647

IITM Online BS Degree Program,

Indian Institute of Technology, Madras, Chennai

Tamil Nadu, India, 600036

Contents

BDM DATA Link : Click Here

Executive Summary

The project focuses on a small battery shop in Varanasi, Uttar Pradesh, specializing in high-quality automotive and home energy batteries. Operating in the B2C sector, the shop offers batteries for cars, motorcycles, and commercial vehicles, along with backup power and solar storage solutions. However, excess inventory leads to high storage costs and tied-up capital, reducing profitability. Additionally, the lack of data-driven pricing and marketing strategies limits competitiveness, affecting business growth.

To address these challenges, this project utilizes analytical techniques to generate actionable insights. Customer behavior, sales patterns, and demand trends are analyzed to improve decision-making. Methods such as Pareto analysis, market basket analysis, and histograms are applied to uncover key insights. Advanced visualizations are developed using Google Colab to optimize inventory management, while Microsoft Excel is used for basic data analysis. By aligning inventory with actual demand, the shop can reduce overstocking, minimize capital blockage, and enhance overall efficiency.

The ultimate objective is to improve profitability and ensure sustainable business growth. A data-driven approach will enable informed pricing and marketing decisions, strengthening the shop's competitive position. By reducing inefficiencies and implementing smarter inventory strategies, the shop can enhance operational efficiency while continuing to provide high-quality battery solutions. This project aims to support long-term success by fostering better inventory control, strategic pricing, and optimized stock management, ensuring the business remains viable and profitable in a competitive market.

Detailed Explanation of Analysis Process/ Method

Pre-Data Cleaning

The data used for this analysis was manually gathered from the shop's receipts and handwritten records. Each transaction was carefully recorded into an Excel sheet to ensure accuracy and completeness. To maintain data integrity, new rows were added to the dataset whenever a new product was introduced into the inventory. Additionally, in adherence to privacy considerations, any personally identifiable customer information, such as names and contact details, was removed before processing the data. This step ensured compliance with ethical data-handling practices while maintaining the focus on sales patterns and inventory trends.

Data Cleaning

To refine the dataset and ensure the accuracy of the analysis, a systematic data-cleaning process was conducted. Product categories that recorded only one or two sales over the four-month period were excluded from the analysis. This decision was based on the premise that such low-selling items did not significantly impact the overall business performance and could skew the insights derived from sales trends. By eliminating these outliers, the dataset became more representative of the shop's actual inventory dynamics, thereby improving the reliability of subsequent analysis.

Analysis Process

- To derive meaningful insights from the sales data, customized pivot tables were created. These tables facilitated an in-depth exploration of key metrics such as total sales volume, revenue contributions, and sales frequency across different time periods.

- The use of Excel formulas further enhanced the analytical process, enabling precise calculations of summary statistics that provided a comprehensive view of the shop's performance.
- In addition to numerical summaries, visual representations were leveraged to enhance clarity and ease of understanding. A series of pie charts were developed to illustrate the proportional contribution of each item category to total sales. One such pie chart highlighted the best-selling products in terms of their share of overall revenue, making it easier to identify high-demand items.
- Line charts were employed to observe fluctuations in sales across different days of the week, offering valuable insights into peak business periods.
- Meanwhile, column charts effectively showcased temporal sales variations, allowing for easy comparison between different product categories over time.
- Furthermore, descriptive statistics were calculated using Excel formulas such as MAX and SUM. These calculations provided insights into the highest and lowest sales recorded during the analysis period, offering valuable data points for inventory management strategies.

By systematically applying these analytical techniques, a clear picture of sales patterns and inventory dynamics emerged, paving the way for actionable recommendations.

Pareto Chart Analysis :

1) Weekly Sales Quantity Analysis :

- The first Pareto chart analyzed weekly sales quantities for each product, arranged in descending order based on the number of units sold. This analysis revealed significant disparities in product demand. The most frequently sold item was **Battery Water (1 gallon),** with a total of **71 units** sold. Following closely behind were the **Exide Motorcycle Battery (62 units)** and the **Exide Inverter Battery (43 units).** In contrast, lower-selling products, such as the **Livguard Inverter Battery,** exhibited minimal sales figures.
- A key takeaway from this analysis was the confirmation of the **80/20 Rule (Pareto Principle)**—approximately 80% of total sales were generated by the top four or five products. The cumulative sales percentage, represented by a red line

on the chart, visually reinforced this principle, emphasizing the shop's reliance on a handful of high-performing products.

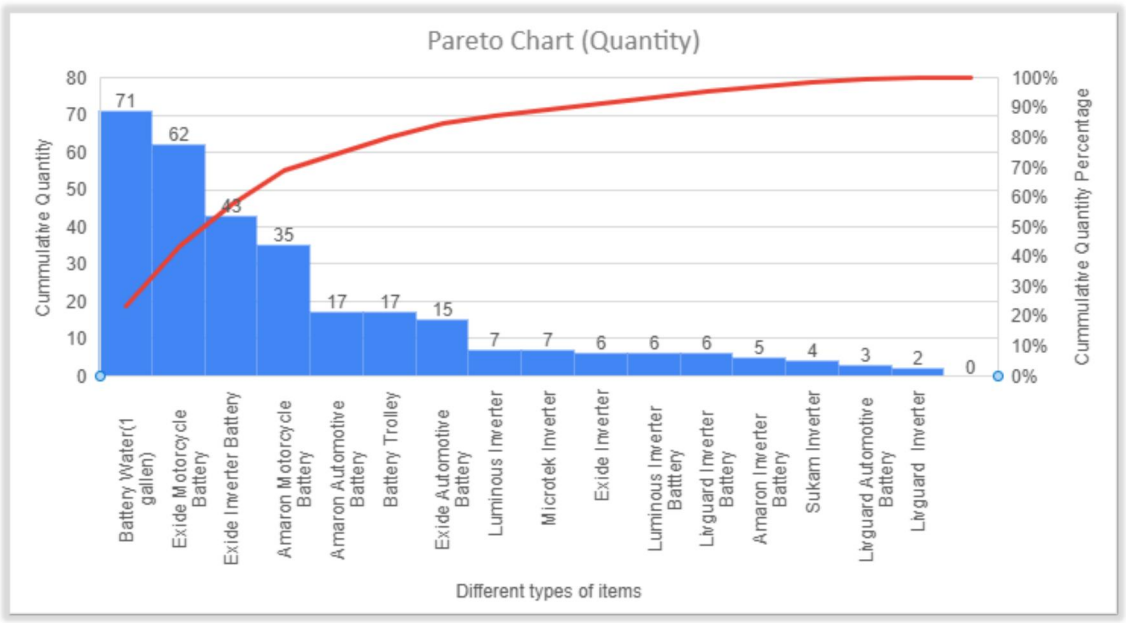

Fig: 1

Insights and Recommendations:

- **Prioritize high-demand products:** The shop should ensure consistent stock availability for top-selling items, as they contribute significantly to revenue.
- **Optimize inventory management:** By closely monitoring the sales performance of low-demand items, the shop can avoid unnecessary overstocking, thereby reducing storage costs.
- **Strategic promotions for slow-moving products:** Offering discounts or bundle deals on less popular items could help improve turnover and free up storage space for higher-demand inventory.

2) Profit Contribution Analysis :

A second Pareto chart was created to analyze profit contributions per product. This visualization revealed that the **Exide Inverter Battery** was the most profitable item, generating **₹47,000** in total profit. Conversely, lower-profit items such as **Battery Water** contributed only **₹1,136** to overall earnings. Similar to the sales quantity analysis, the chart indicated that the top three or four products accounted for nearly

80% of total profit, underscoring the importance of focusing on these high-margin items.

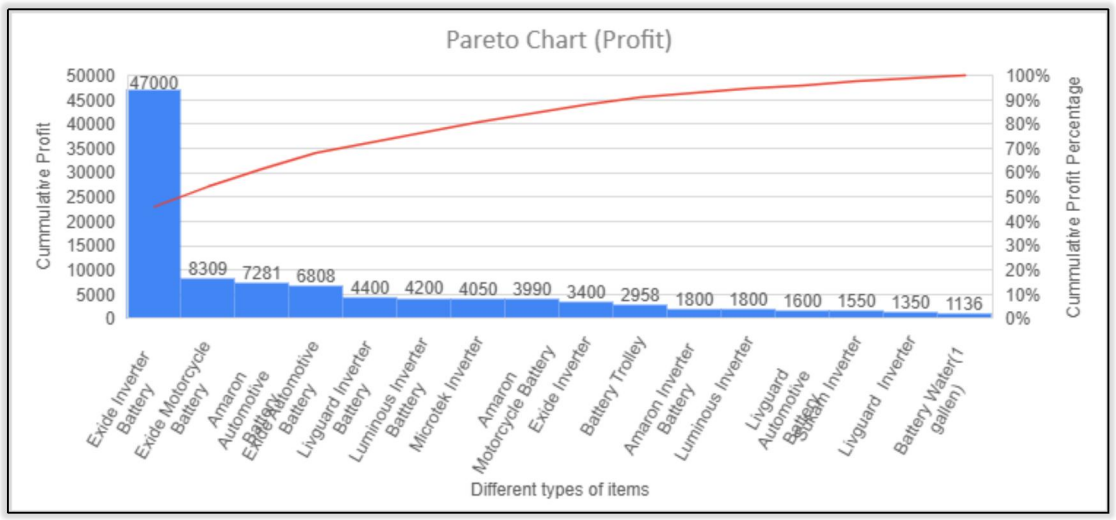

Fig:2

Insights and Recommendations:

- **Stock and promote high-profit products:** Items like the Exide Inverter Battery and Exide Motorcycle Battery should be prioritized for stocking and marketing campaigns.
- **Enhance pricing strategies for mid-tier products:** Optimizing the pricing of moderately profitable items could increase their contribution to overall revenue.
- **Reduce or phase out low-profit items:** By minimizing stock levels of low-margin products, the shop can allocate storage space more efficiently and reduce capital tie-up.
- **Cost-benefit analysis for slow-moving items:** A thorough evaluation should be conducted to determine whether certain low-profit products are worth retaining in the inventory.

Statistical Analysis :

To identify how each item's **total inventory** compares to the overall distribution by using **mean and standard deviation**. This helps detect outliers or items that are overstocked or understocked.

Step-by-Step Analysis Method

1. Data Preparation

- **Source Data**: Inventory or sales totals per item, likely summed from daily data.
- **Format**: A table with items in rows and a column representing the total quantity sold or inventoried.

Name of the Item	TOTAL
Exide Automotive Battery	15
Exide Motorcycle Battery	62
Exide Inverter	6
Exide Inverter Battery	43
Amaron Automotive Battery	17
Amaron Motorcycle Battery	35
Amaron Inverter Battery	5
Luminous Inverter	7
Luminous Inverter Batttery	6
Battery Trolley	17
Livguard Automotive Battery	3
Livguard Inverter	2
Livguard Inverter Battery	6
Battery Water(1 gallen)	71
Microtek Inverter	7
Sukam Inverter	4
TOTAL QUANTITY	306

Table : 1

2. Calculate Key Statistics

- **Mean (Average)**: Average of the "Total Quantity" values.

  Mean = ∑Total Quantities / Number of Items

- **Standard Deviation (SD)**: Measures how spread out the values are from the mean.
- Compute: 1) **+1 SD Line**: Mean + 1 × SD

  2) **-1 SD Line**: Mean - 1 × SD

These create boundaries that help assess whether a quantity is unusually high or low.

3. Create the Chart

- **Type: Vertical bar chart.**
- **X-axis**: Item names.
- **Y-axis**: Total quantity.
- **Bars**: Represent the total quantity per item.
- **Horizontal Lines**: Green dashed line → Mean

Red dashed lines → ±1 Standard Deviation thresholds

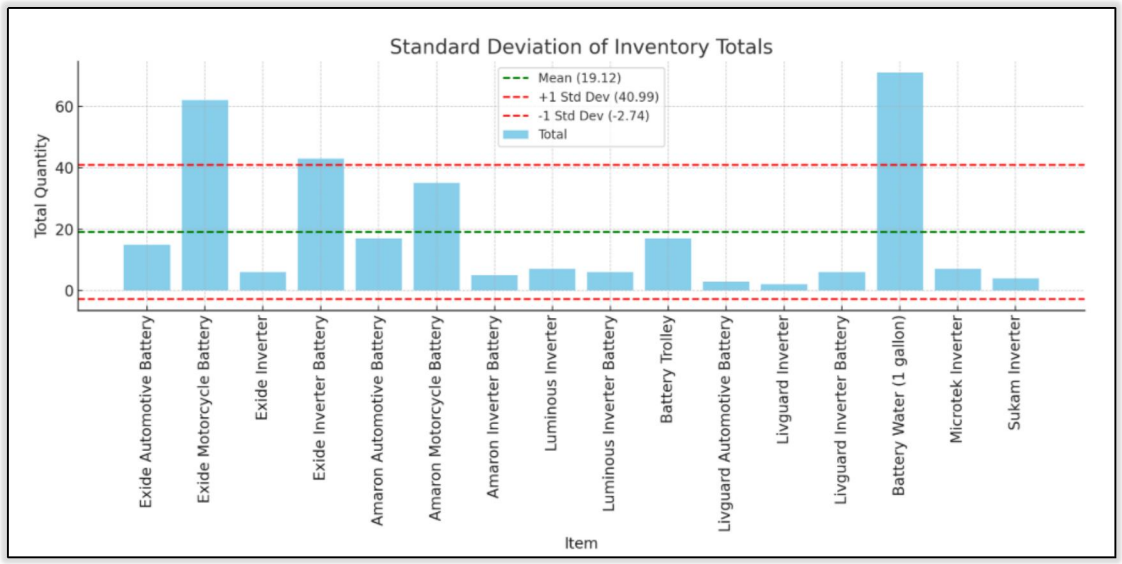

Fig : 3

Interpretation

- Items **above +1 SD** are **significantly overstocked** or high-performing in sales.
- Items **below -1 SD** may be **understocked** or low-performing.
- Items **within ±1 SD** are in the **normal range**.

Results and Findings

Insights Drawn from the Data Analysis:

1) Identifying the Brand with the Highest Demand:

A **brand analysis** was conducted to determine which battery manufacturer had the highest demand among consumers. The results, visualized in a pie chart, showed that **EXIDE** emerged as the most popular brand, commanding the largest share of total sales. This finding underscores the strong customer preference for Exide batteries, making it a strategic focus for future procurement and marketing efforts.

BRANDS	QUANTITY
EXIDE	126
AMARON	57
LIVGAURD	11
LUMINOUS	13
SUKAM	4
MICROTEK	7

Table : 3

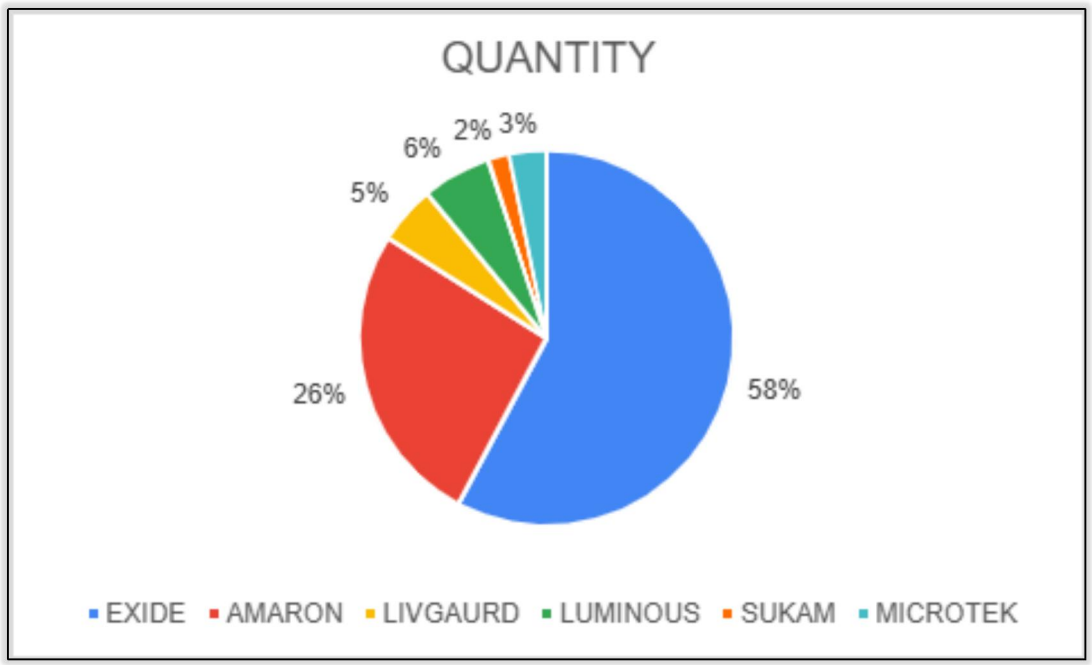

Fig : 3

Insights and Recommendations:

- **Prioritize stocking Exide products:** Given their high demand, maintaining adequate inventory levels of Exide batteries will ensure steady sales and customer satisfaction.
- **Leverage brand loyalty in marketing campaigns:** Promotions and advertisements highlighting the reliability and benefits of Exide products could further enhance sales performance.

2) Analyzing Stock Flow Trends:

A line graph was used to analyze monthly stock outflow trends over the four-month period. The results indicated a **gradual decline in sales volume, particularly during the later months.** One possible explanation for this trend is seasonal variation—demand for high-power supply products tends to decrease during winter months when electricity consumption is lower.

Months	TOTAL QUANTITY
July	87
August	81
September	76
October	62

Table : 4

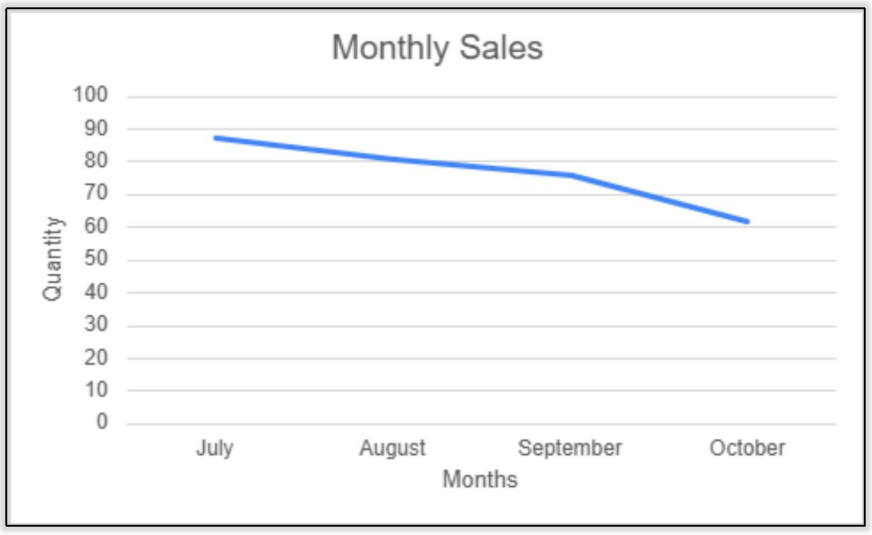

Fig : 4

Insights and Recommendations:

- **Anticipate seasonal fluctuations:** The shop should adjust inventory levels based on seasonal demand patterns to avoid overstocking during low-sales periods.
- **Implement dynamic pricing strategies:** Offering discounts or promotional incentives during off-peak seasons could help maintain steady sales.

3) Identifying the Highest Profit-Generating Category:

An additional analysis was conducted to identify the product category generating the highest profit. The findings revealed that **Exide Inverter Batteries consistently produced the most significant profit margins** compared to other categories. Based on this insight, the shop owner may consider prioritizing the stocking of this product to maximize revenue.

Name of the Item	Profit Generated	
Exide Automotive Battery	₹	6,808.00
Exide Motorcycle Battery	₹	8,309.00
Exide Inverter	₹	3,400.00
Exide Inverter Battery	₹	47,000.00
Amaron Automotive Battery	₹	7,281.00
Amaron Motorcycle Battery	₹	3,990.00
Amaron Inverter Battery	₹	1,800.00
Luminous Inverter	₹	1,800.00
Luminous Inverter Batttery	₹	4,200.00
Battery Trolley	₹	2,958.00
Livguard Automotive Battery	₹	1,600.00
Livguard Inverter	₹	1,350.00
Livguard Inverter Battery	₹	4,400.00
Battery Water(1 gallen)	₹	1,136.00
Microtek Inverter	₹	4,050.00
Sukam Inverter	₹	1,550.00
TOTAL QUANTITY	₹	101,632.00

Table : 5

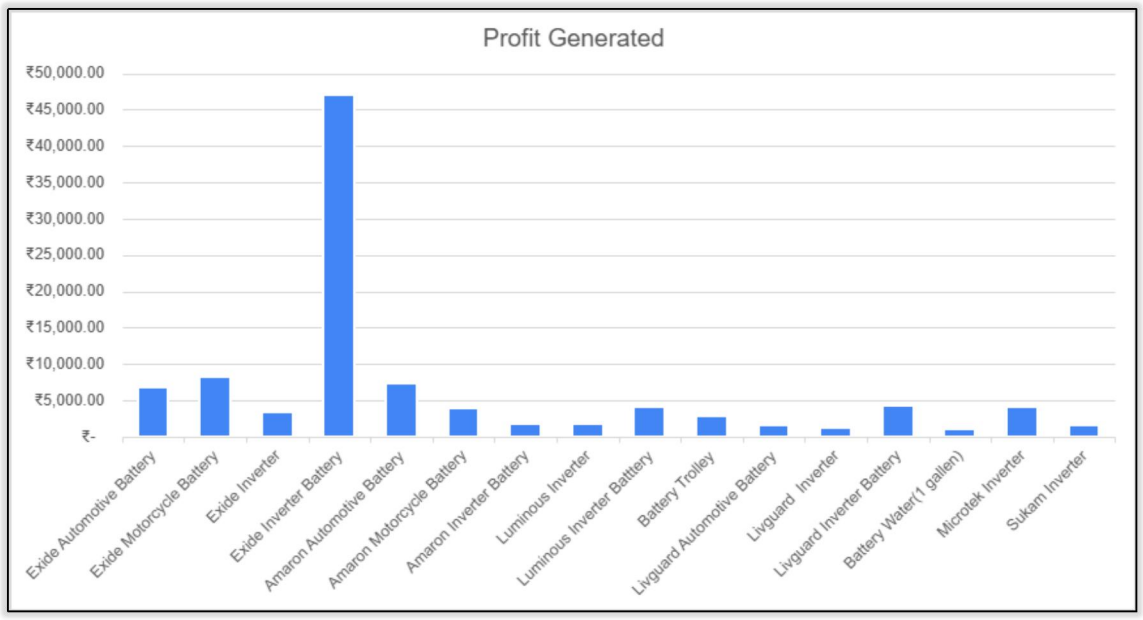

Fig : 5

Insights and Recommendations:

- **Focus on high-margin products:** By dedicating more shelf space and marketing efforts to Exide Inverter Batteries, the shop can enhance its profitability.
- **Bundle profitable items with slow-moving inventory:** Creating attractive bundles that pair high-margin products with lower-selling items may increase overall sales volume.
- **Continuously monitor sales trends:** Keeping a close eye on profit contribution across different categories will allow the shop to make informed stocking decisions.

4) Identifying the Customer engaging Categories :

Another analysis highlights the most engaging product categories that attract more customers. The motorcycle battery category emerges as the top-selling item. Inverter and inverter battery categories follow in second and third positions, respectively, in terms of customer interest.

Automotive Battery	35
Motorcycle Battery	97
Inverter	26
Inverter Battery	60
Battery Water(1 gallen)	71
Battery Trolley	17
TOTAL QUANTITY	306

Table : 6

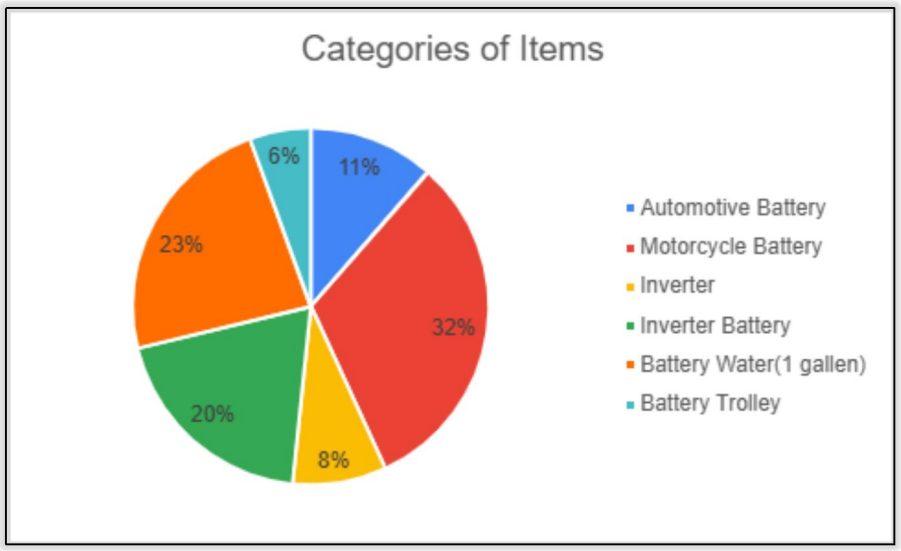

Fig : 6

- **Some more visuals representing top categories with top brands :**

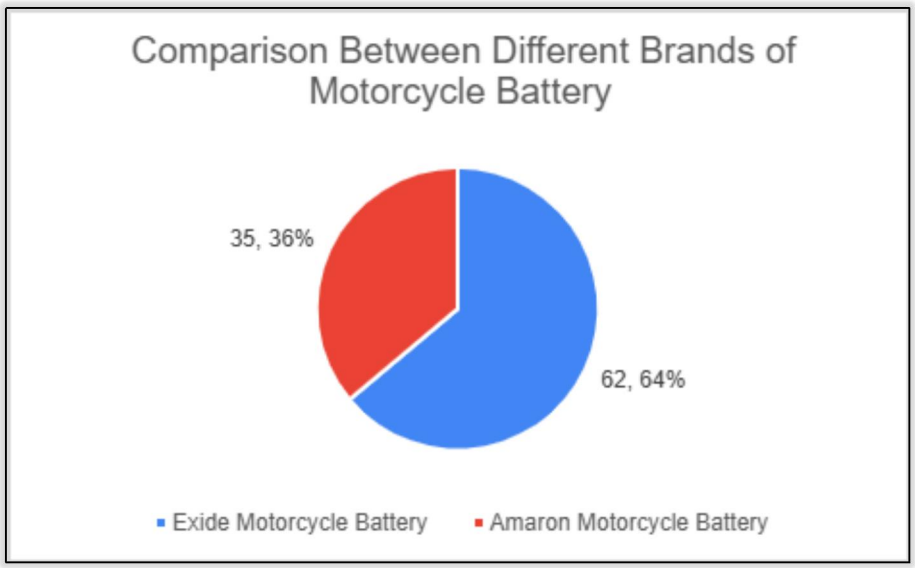

Fig : 7

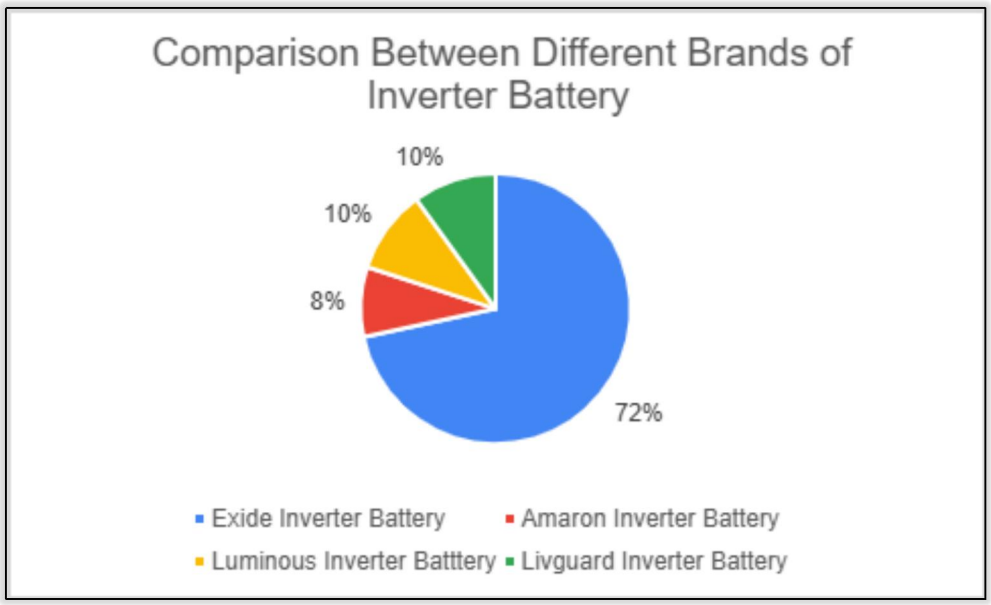
Comparison Between Different Brands of Inverter Battery
10%
10%
8%
72%
Exide Inverter Battery
Amaron Inverter Battery
Luminous Inverter Batttery
Livguard Inverter Battery

Fig : 8

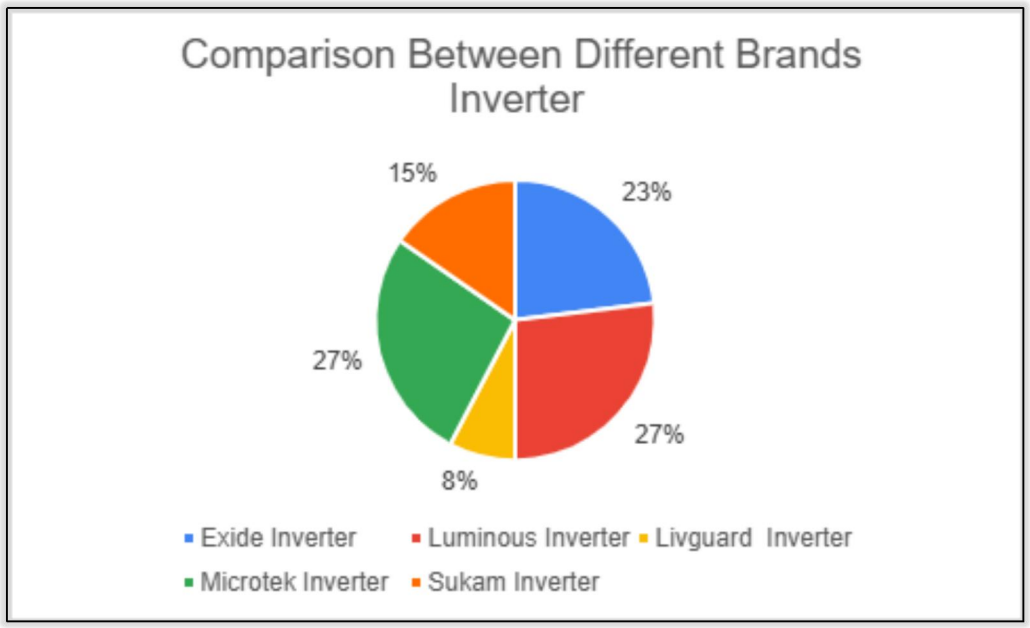
Comparison Between Different Brands Inverter
15%
23%
27%
27%
8%
Exide Inverter
Luminous Inverter
Livguard Inverter
Microtek Inverter
Sukam Inverter

Fig : 9

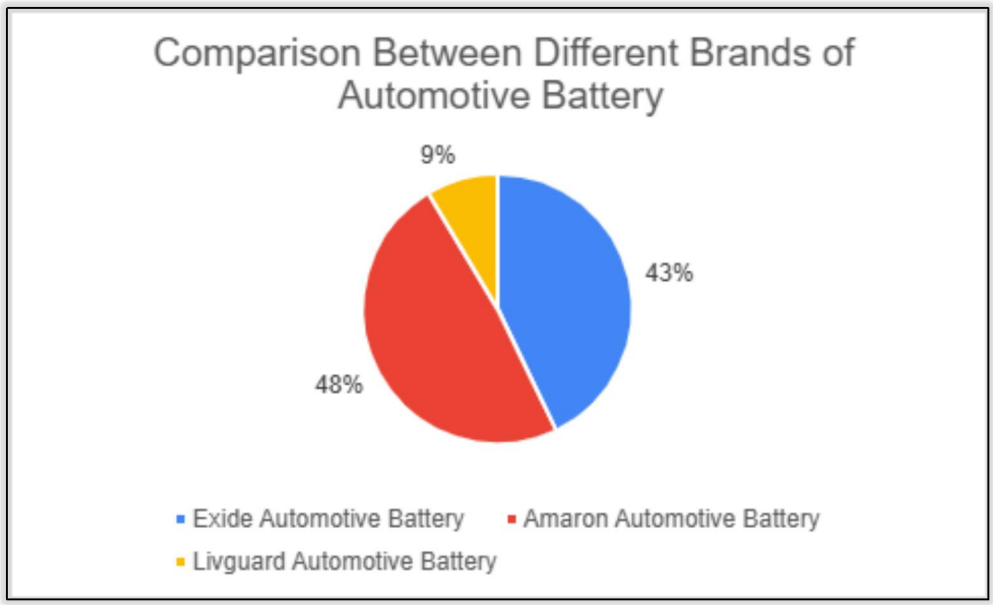

Fig : 10

Insights and Recommendations:

- **Motorcycle Batteries Drive Sales :** The motorcycle battery category leads in customer purchases, indicating strong market demand. Stocking more options in this segment and highlighting them in promotions can further engage customers and boost conversions.
- **Inverter Products Show High Engagement :** Inverter and inverter battery categories rank second and third, reflecting sustained interest in power backup solutions. Expanding inventory and offering attractive combo deals can enhance customer engagement and drive sales.
- **Customer Preference for Practical, Essential Products :** The trend shows customers are drawn to essential utility items. Ensuring availability and visibility of these products can improve customer experience and attract more traffic to the platform.

Interpretation of Results & Strategic Recommendations

1. Sales Quantity Analysis (Pareto Principle - 80/20 Rule)

Interpretation:

- The top-selling products (e.g., Battery Water, Exide Motorcycle Battery, Exide Inverter Battery) accounted for the majority of total units sold.
- A small group of products generated around **80% of sales**, validating the **Pareto Principle**.
- Low-demand products (e.g., Livguard Inverter Battery) contributed minimally and may not justify continued stocking.

Recommendations:

Focus Inventory on High-Movers: Maintain ample stock of high-demand items to prevent stockouts and missed revenue opportunities.

Discontinue or Reduce Slow-Movers: Gradually reduce orders or phase out low-selling items unless they serve a niche market need.

Promotional Strategies: Offer bundle deals or discounts for slow-moving items to clear inventory and free up space.

2. Profit Contribution Analysis

Interpretation:

- High-selling items do not always equate to high profitability. For instance, Battery Water sold the most units but generated relatively low profits.
- The **Exide Inverter Battery**, despite lower unit sales, contributed the **highest profit** due to its high margin.
- Again, the Pareto pattern is evident — a few products drive the majority of profits.

Recommendations:

- **Prioritize High-Profit Products:** Ensure consistent stock of Exide Inverter and Motorcycle Batteries, which are top profit generators.
- **Reassess Low-Margin Items:** Items like Battery Water, while high in volume, should be evaluated for margin optimization or bulk pricing.
- **Tiered Pricing Strategy:** Explore price adjustments for mid-performing items to improve profit contribution.

3. Statistical Inventory Analysis (Mean ± Standard Deviation)

Interpretation:

- Items significantly **above +1 SD** may indicate overstocking or fast-moving products that need attention.
- Items **below -1 SD** could either be understocked or slow sellers.
- Items within ±1 SD are performing within a typical range.

Recommendations:

- **Balance Inventory Levels:** Maintain a watchlist of products outside the ±1 SD band to either replenish or reduce stock accordingly.
- **Monitor Overstocked Items:** Avoid tying up capital in excessive stock, especially if the demand is inconsistent.
- **Refine Procurement Plans:** Use SD-based thresholds to adjust reordering schedules more precisely.

4. Brand Demand Analysis (EXIDE Dominance)

Interpretation:

- **Exide** products dominate sales, indicating strong customer preference and brand loyalty.
- Other brands show significantly lower traction.

Recommendations:

- **Double Down on Exide:** Secure favorable terms with Exide suppliers and promote the brand prominently in-store and through marketing channels.
- **Brand Promotions:** Leverage customer trust in Exide by offering warranties, service packages, or loyalty discounts.

5. Monthly Stock Flow Trend (Seasonality Detection)

Interpretation:

- There is a noticeable **decline in stock outflow** (and by extension, sales) in later months — likely due to **seasonal demand variation** (e.g., lower energy needs during winter).

Recommendations:

- **Seasonal Forecasting:** Align procurement with seasonal trends to avoid excess inventory and related holding costs.
- **Off-Season Promotions:** Drive sales with limited-time offers or bundle deals during slow months.
- **Diversify Offerings:** Introduce complementary products that may have stable demand regardless of season (e.g., maintenance items or accessories).

6. Profit by Category

Interpretation:

- **Exide Inverter Batteries** stand out as the highest profit-generating category.
- Some categories, while having sales volume, don't significantly contribute to profit.

Recommendations:

- **Product Mix Optimization:** Allocate more shelf space and marketing resources to high-profit categories.
- **Cross-Selling Opportunities:** Pair profitable items with accessories or related lower-selling products to enhance total sales value.

- **Continuous Monitoring:** Regularly assess category-wise profitability to dynamically adapt the product lineup.

Overall Strategic Takeaways

Area	Key Insight	Strategic Action
Sales Volume	Few products dominate sales	Maintain stock levels and reorder points for these items
Profitability	High-profit items ≠ high-sale volume items	Promote high-margin products, reassess low-profit ones
Brand Preference	Exide leads with a clear margin	Use brand equity to drive sales and customer trust
Inventory Levels	Normal distribution helps identify excess or inadequate stock	Stock items in the optimal ±1 SD range
Seasonal Trends	Sales dip in later months due to reduced power demand	Adapt stock levels and use promotions during low-demand periods
Category Profitability	Certain categories contribute significantly more to profit	Prioritize them for stock, space, and sales focus

Conclusion :

By leveraging data-driven insights and analytical techniques, this project has provided a clear roadmap for optimizing inventory management and improving profitability. The findings highlight key sales trends, profit contributors, and seasonal demand fluctuations, enabling the shop to refine its stocking strategies. Implementing the recommended actions—such as prioritizing high-demand items, optimizing pricing, and managing seasonal fluctuations—will significantly enhance operational efficiency. Moving forward, continuous data monitoring and strategic decision-making will be essential in ensuring long-term business success and competitive sustainability.