Optimizing Business Efficiency with Inventory Management Proficiency

A Final Report for the BDM Capstone Project

Submitted by

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Declaration Statement

I am working on a Project Title **"OPTIMIZING BUSINESS EFFICIENCY WITH INVENTORY MANAGEMENT PROFICIENCY"**. I extend my appreciation to TVS - Anjana Motors, for providing the necessary resources that enabled me to conduct my project.

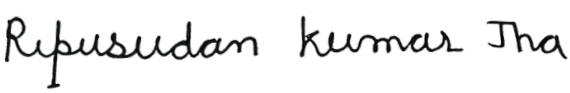
I hereby assert that the data presented and assessed in this project report is genuine and precise to the utmost extent of my knowledge and capabilities. The data has been gathered through primary sources and carefully analyzed to assure its reliability.

Additionally, I affirm that all procedures employed for the purpose of data collection and analysis have 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: (**Digital Signature**)

Name: Ripusudan Kumar Jha

Date: 11 January 2025

1. Executive Summary

The Project titled **"Optimizing Business Efficiency with Inventory Management Proficiency"** aims to improve operational efficiency at TVS Anjana Motors by conducting an in-depth analysis of its inventory and sales data. The study, spanning from April 2024 to August 2024, examines purchasing trends, sales performance, and revenue contributions to identify key areas for improvement. Various analytical techniques such as Regression analysis, ABC analysis etc. were used to generate meaningful insights into inventory management, sales forecasting, and business optimization.

Significant variations in monthly sales and purchases were found by the analysis, which was mostly caused by ineffective inventory management and seasonal demand patterns. As sales dropped by 58% from April to July, with a minor recovery in August of 10%. These fluctuations were linked to ineffective inventory management and external factors like decreased market activity. The strong positive correlation (R^2 = 0.9161) between purchases and sales underscores the critical role of effective inventory planning in ensuring business success.

The most successful model, according to model-specific performance analysis was the TVS Apache-160, which generated a 56% of revenue because of its high demand and premium price. While entry-level models like the TVS Sport and Jupiter-125 underperformed in terms of revenues and sales, mid-tier models like the TVS Raider-125 and XL-100 showed steady demand and reliable inventory management. These results underline the necessity of strategic marketing and procurement modifications based on the performance of certain products.

Based on the results, several recommendations were proposed to improve operational efficiency. These include implementing focused marketing efforts for underperforming products, using just-in-time inventory techniques for high-demand models, and optimizing supply chain operations to reduce delays. Furthermore, TVS Anjana Motors will experience sustainable growth by using predictive analytics to estimate demand and coordinate procurement schedules, which will improve inventory efficiency and customer satisfaction even further.

2. Detailed Explanation of Analysis Process/Method

1. Data Collection and Preprocessing:

- **Data Sources:** The primary data sources included the dealership's purchase records and sales records, covering transactions from April 2024 to August 2024.
  - Purchase Data includes details such as model names, quantities, rates, HSN codes, discounts, and total amounts.
  - Sales Data includes transaction dates, invoice numbers, models sold, engine and frame numbers, and amounts (with and without GST).
- **Data Cleaning:** The data was cleaned to eliminate inconsistencies and ensure correctness. Steps include:
  - Removing redundant entries.
  - Checking for missing or invalid data in important areas (such as quantity and price).
  - Standardizing model names and units to ensure consistency.

2. ABC Analysis:

- **Purpose:** ABC analysis had been employed to categorize inventory according to its value contribution. This helped in identifying high-priority models that require frequent restocking.
- **Process:**
  a. Sales data were sorted in descending order according to total revenue contribution.
  b. Models were categorized into three classes:
    - **Category A:** High-value models contributing to 80% of the revenue.
    - **Category B:** Medium-value models contributing to the next 15% of revenue.
    - **Category C:** Low-value models contributing to the remaining 5%.
  c. Insights were drawn to prioritize stocking and promotional strategies accordingly.

3. Predictive Analysis:

- **Purpose:** Predictive analysis was used to forecast future demand and prevent stockouts or overstocking.

- **Process:**
  a. Historical sales data was analyzed using time series forecasting techniques.
  b. A trend line was fitted to identify seasonal patterns and fluctuations in demand.

4. Regression Analysis:

- **Purpose:** Regression analysis was conducted to determine the relationships between various factors affecting sales, such as price, discounts, and demand patterns.
- **Process:**
  a. The model's fit was evaluated using R^2 values, and significant predictors were discovered.
  b. According to the analysis, pricing and model popularity were important demand drivers.

5. Tools Used:

- **Microsoft Excel:** Used for initial data entry, cleaning, and basic descriptive analysis, including filtering and sorting data. It also facilitated quick visualizations such as bar charts, line graphs etc for trend identification.

***Link to the Project Data:** Click here

3. Results & Findings

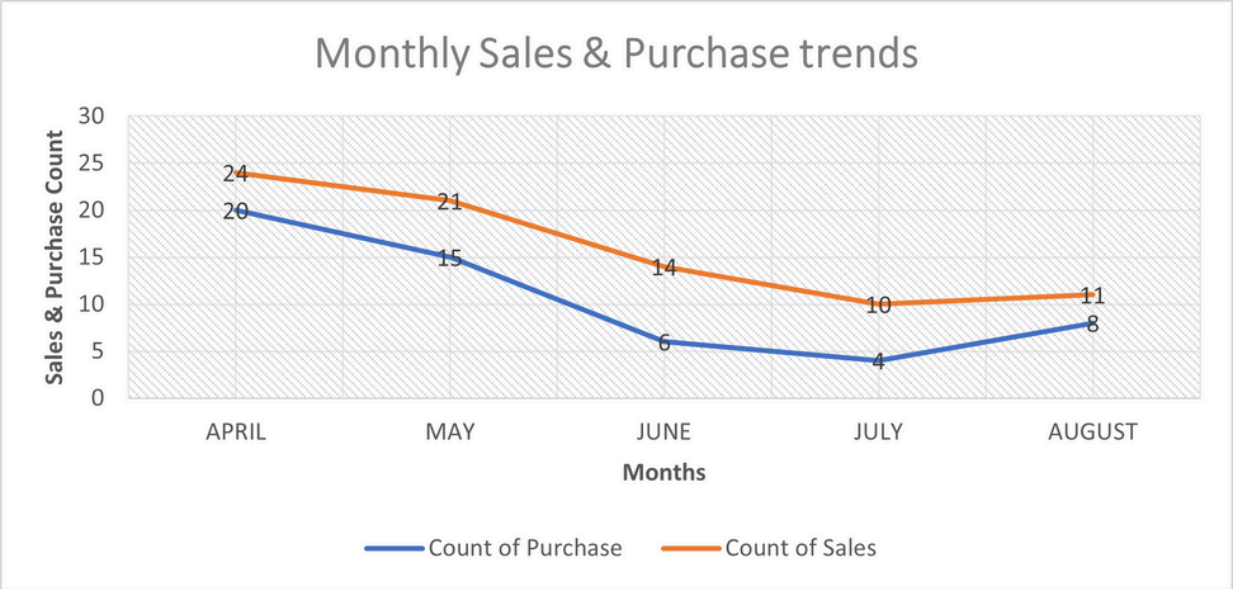


Figure 1: Monthly Sales & Purchase trends

- From April to July, there is a noticeable decline in both sales and purchase counts, sales dropped from 24 units in April to 10 units in July. Likewise purchases dropped from 20 units in April to 4 units in July.
- In August, there is a noticeable rebound, though as purchases increase to 8 units and sales increase to 11 units.

- The decreasing trend in both sales and purchases from April to July was observed because of several factors:

    - **Seasonal Demand Fluctuation:**
        - It is likely that demand for products will fall during these months, either because of lower market activity or a change in client preferences.
    - **Inventory Management Issues:**
        - A steady fall in purchase count indicate a probable delays or inefficiencies in inventory replenishing, resulting in lower sales.
    - **Recovery in August:**
        - The slight increase in August is a result of new promotional campaigns or better availability of products, indicating improved inventory management.

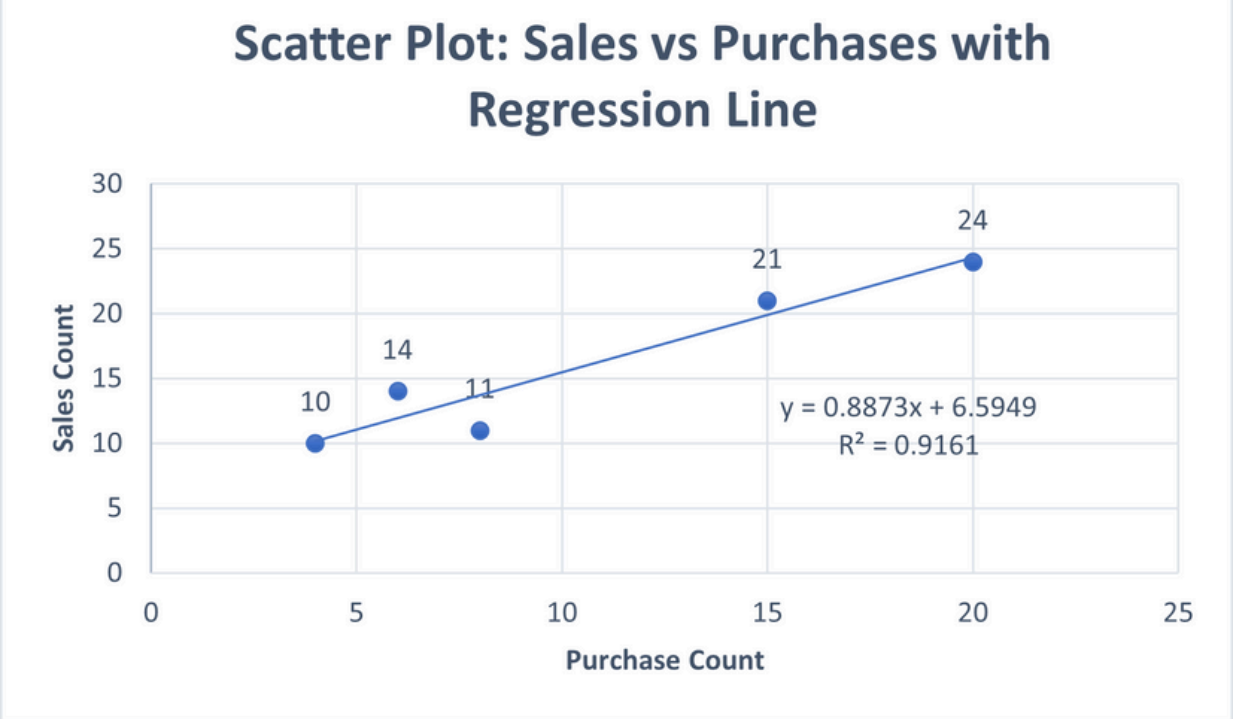


Figure 2: Sales vs Purchases with Regression line

- The scatter plot of sales vs. purchases shows a positive correlation, with an R^2 value of 0.9161, indicating a strong linear relationship. The regression line equation $y = 0.8873x + 6.5949$ suggests that as purchases increase, sales also increase with a slight constant offset.

- Fitting a linear trend is crucial for identifying consistent patterns that can be used for planning and decision-making. The high R^2 value implies that most of the variation in sales can be explained by the variation in purchases.

- This insight is necessary for inventory management like when the dealership increases its purchases, it can expect a proportional increase in sales. Moreover, the linear trend allows for better forecasting of sales based on expected purchase quantities.

- This approach helps prevent under-stocking or over-stocking issues, optimizing both storage costs and customer satisfaction.

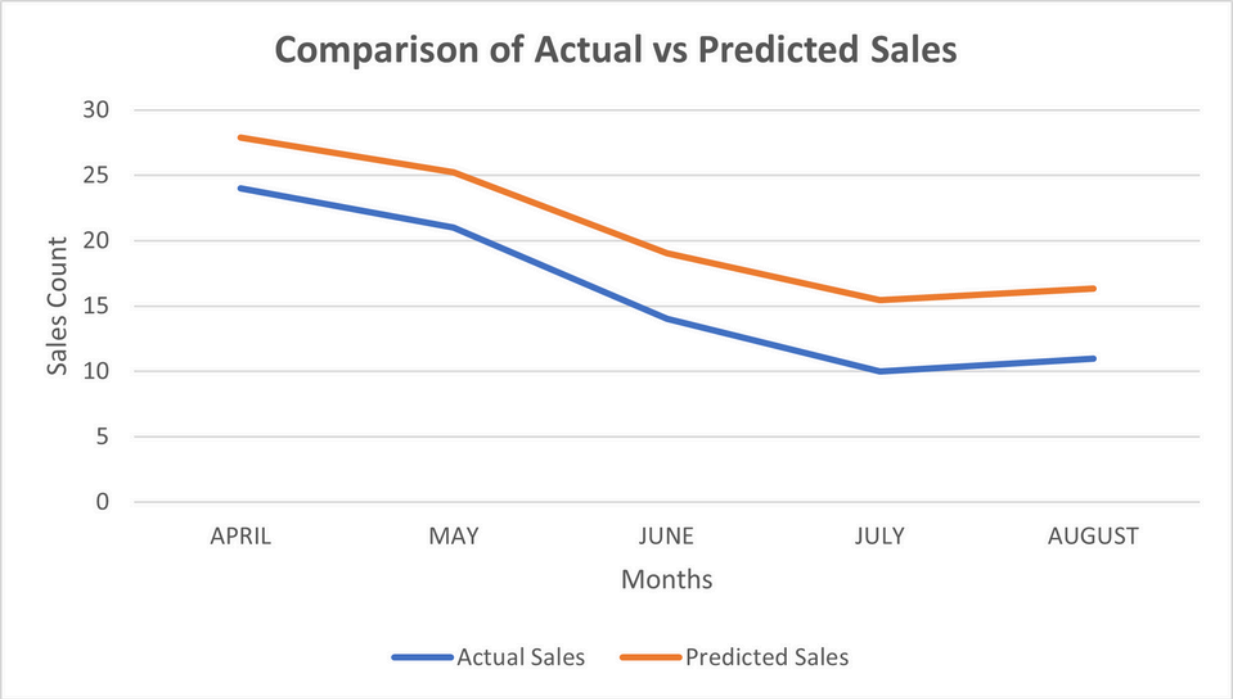


Figure 3: Comparison of Actual vs Predicted Sales

- The expected sales pattern roughly matches the actual sales trend in all months, with small overestimations in June and July. During these months, projected sales are consistently slightly higher than the actual sales.

- Both actual and predicted sales showed a noticeable declining trend from April to July.
- This consistent decrease can be attributed to multiple contributing factors:

1. **External factors:**
   - Changes in customer behavior, economic conditions, and competition have resulted in lower than expected sales during these particular months (April to July 2024).

2. **Assumptions of the linear model:**
   - This method assumes a consistent relationship between purchases and sales.
   - However, in real-world circumstances this relationship may change due to non-linear factors like as promotions, market sentiment, or product lifecycle stages.

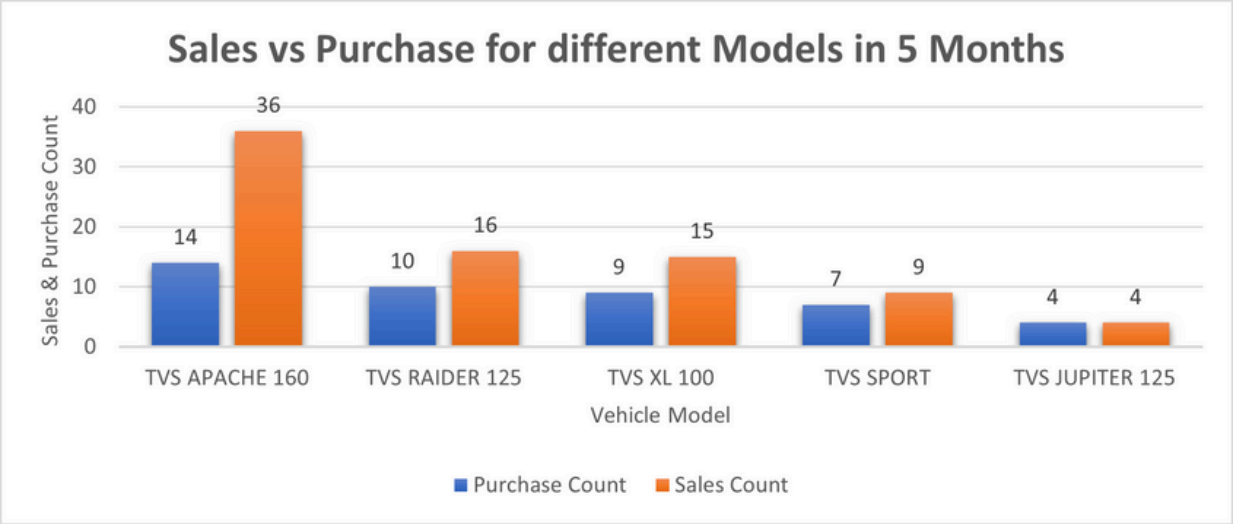


Figure 4: Sales vs Purchase for different Models

- The graph shows the sales and purchase counts of 5 different TVS models over a period of 5 months. Among these models, the TVS Apache-160 has the highest sales count of 36 units and purchase count of 14 units. Other models like TVS Raider-125, TVS XL-100, and TVS Sport show moderate sales and purchase counts, whereas TVS Jupiter-125 has the lowest.

- Despite having a relatively lower purchase count of 14 units, the sales count of TVS Apache-160 is disproportionately higher sales count of 36 units, suggesting effective stock utilization.

- The higher revenue generated by TVS Apache-160 can be attributed to its combination of higher sales volume and premium pricing compared to other models. This model is more popular among customers due to its better performance, sporty design, and strong market reputation.

- Both models, TVS Raider-125 and TVS XL-100 show fairly balanced sales and purchase counts, indicating consistent demand and stable inventory management. However, they contribute less revenue overall compared to Apache-160 due to lower sales volumes and likely lower price points.

- The low sales and purchase counts for TVS Sport and TVS Jupiter-125 is a result of lower customer demand, which is due to less marketing efforts.

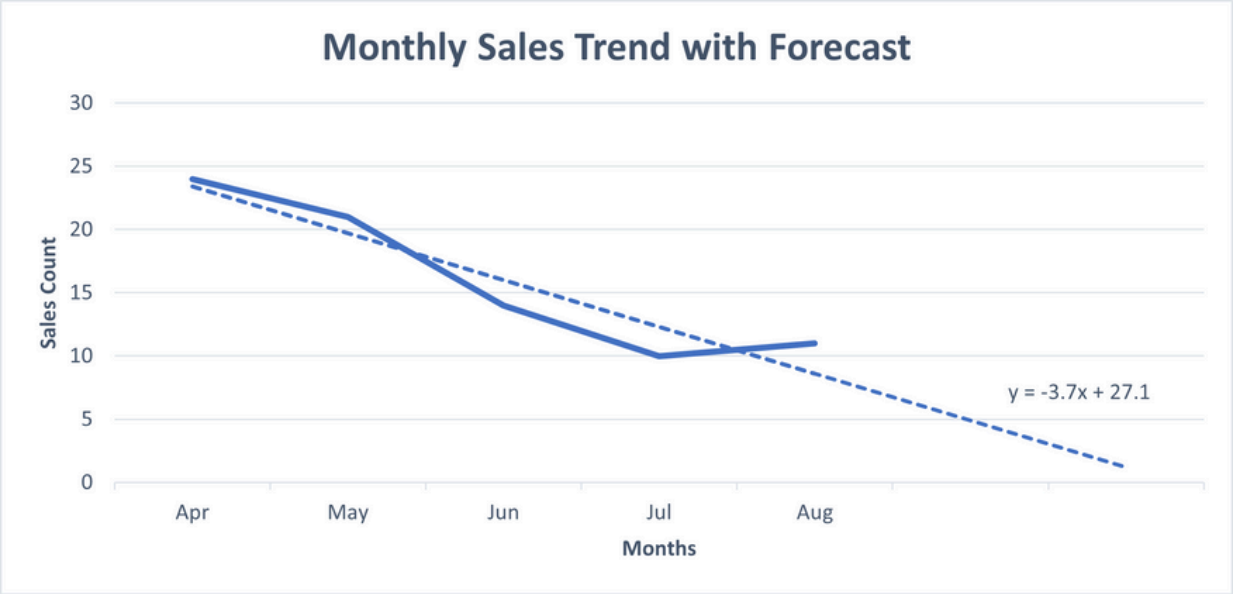


Figure 5: Monthly Sales trend with Forecast

- Sales indicate a distinct decline from April to August, with a peak of 24 units in April and a low of 11 units in August. The forecast line indicates a continuous downward trend, with a negative slope of -3.7, which indicates a potential decrease to sales if this trend continues.

- From April to August, reduced demand is a result of seasonal variations, which significantly impact customer purchasing patterns. This natural dip in consumer interest during these months could explain the consistent decline in sales, highlighting the need for seasonal strategies.

- Less marketing activities led to lower brand visibility and customer engagement. An active marketing campaign is essential to keep the brand top of mind, boost sales, and maintain customer loyalty.

- Inventory shortages or delivery delays may have disappointed potential customers, leading them to go elsewhere. Consistent stock availability is crucial for steady sales. Improving supply chain management and keeping popular models in stock would boost customer satisfaction and prevent missed opportunities.

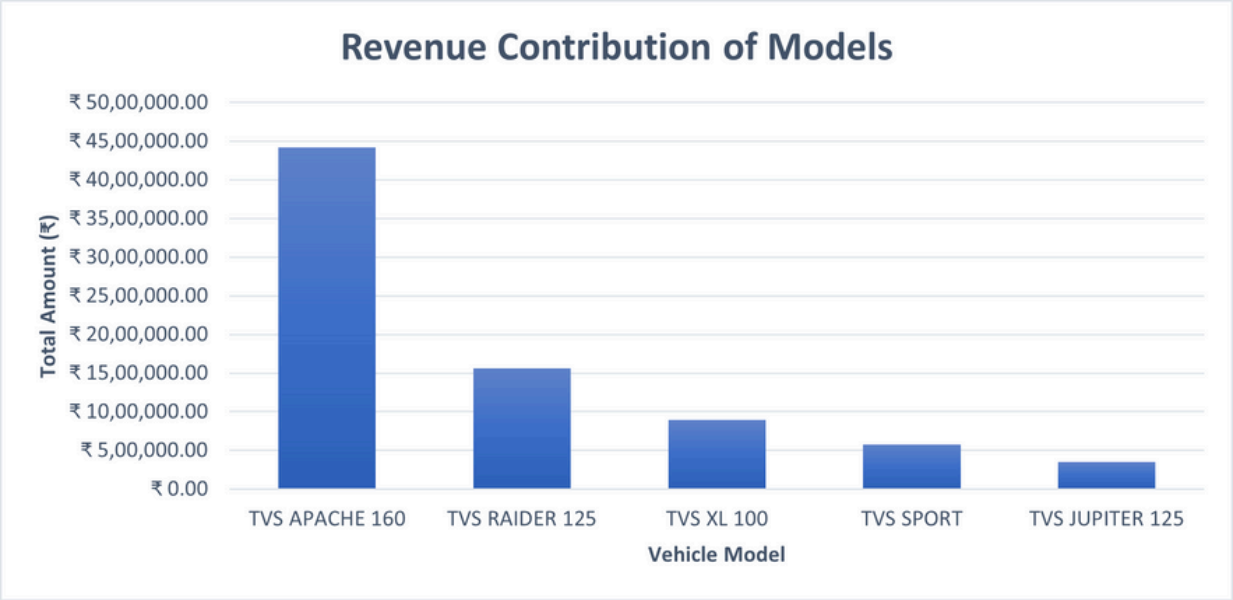


Figure 6: Revenue Contribution by Models

- The **TVS Apache-160** emerges as the best-performing model in terms of revenue generation. It has achieved the highest revenue among all models, with total earnings exceeding an impressive ₹44,16,590.50. This significant contribution highlights the popularity and strong market demand for the Apache-160.

- The **TVS Raider-125** ranks second in revenue performance, with a total revenue of ₹15,57,769. While this statistic is significantly lower than that of the Apache-160, it indicates the Raider-125 have also solid market position.

- The **TVS XL-100** generates a moderate amount of revenue, ranging from ₹5,00,000 to ₹10,00,000. The XL-100 is known for its affordability and usability, and it appeals to a certain demographic, including rural and small-business owners.

- The **TVS Sport** generates somewhat lower revenue than the XL-100, with values just above ₹5,00,000. Despite its decreased income contribution, its steady performance in this range highlights its position in the entry-level commuter bike category.

- The **TVS Jupiter-125** ranks at the bottom of the revenue spectrum, contributing the least of any model. Its total revenue is lower than ₹5,00,000, indicating poor market traction.

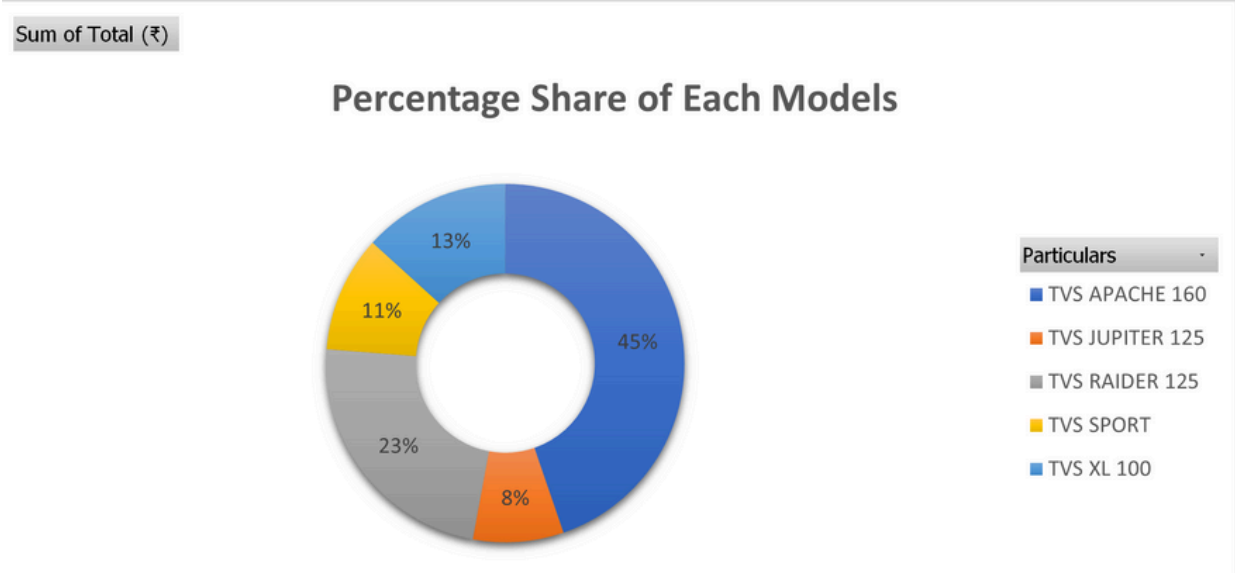


Figure 7: Percentage share by Models in Inventory

- **TVS Apache-160** constitutes 45% of the total purchase, indicating it is the most in-demand model and requires maintaining a higher inventory level to avoid stockouts.

- **TVS Raider-125** holds a significant share of 23% of the total purchase, highlighting its steady demand, which address optimal stock management for continuous availability, while preventing stockouts. Maintaining an adequate supply of the Raider-125 is essential to capitalize on its popularity and sustain sales momentum.

- The **TVS XL-100**, contributing 13% to the total purchase, reflects a consistent and moderate demand. This model's persistent success is primarily driven by its widespread acceptance in rural and semi-urban markets.

- The **TVS Sport**, with an 11% purchase share, indicates a stable but lower-volume demand. This steady yet moderate demand suggests the need for a moderate stock level to ensure availability for customers while minimizing excess inventory.

- The **TVS Jupiter-125** has the smallest purchase share of 8%, showing a lower turnover rate than other models. Its comparatively low demand requires a measured approach to stock management, as slower-moving model can tie up working capital and raise holding costs.

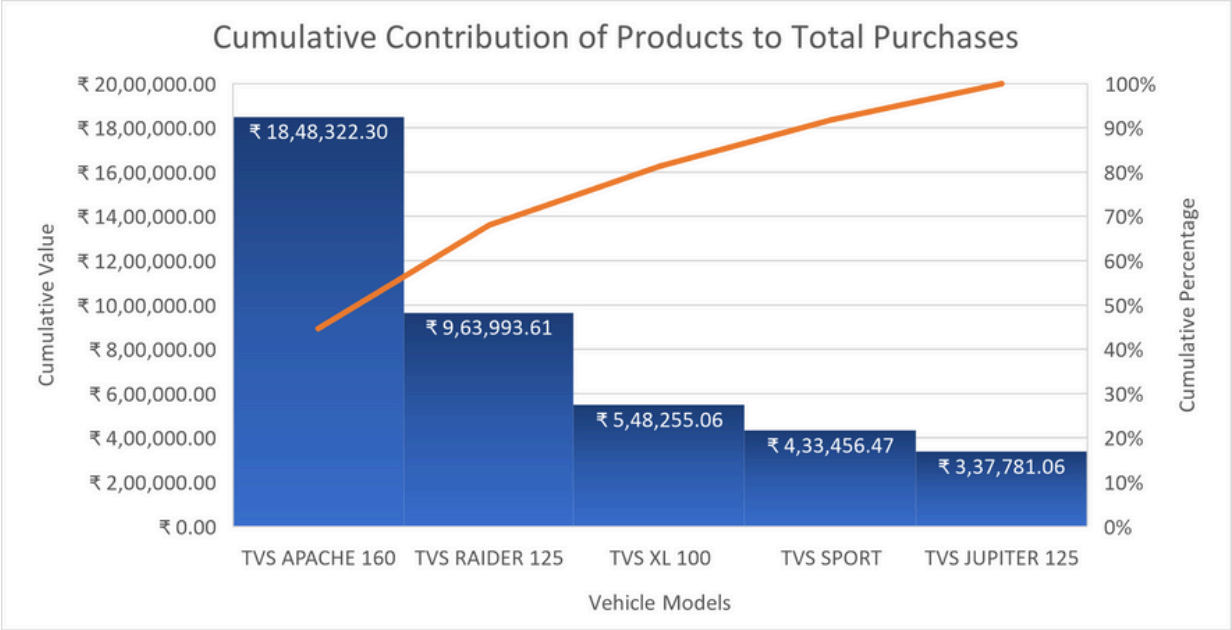


Figure 8: Cumulative Contribution of Products to Total Purchases

1. Category A (High-value, high-priority models):

- TVS Apache-160 and TVS Raider-125 fall under this category.
- These two models contribute to 68% of total purchasing value because they are in high demand and have a high value that's why reorder levels and safety stock must be closely monitored.

2. Category B (Moderate-value, medium-priority models):

- TVS XL-100 and TVS Sport fall under this category.
- These models contribute to 24% of total purchasing value, should have reasonable stock levels. Procurement should be optimized by balancing order size and frequency to reduce carrying costs because demand for certain models vary seasonally.

3. Category C (Low-Priority Model):

- TVS Jupiter-125 fall under this category.
- This model is a slow-moving item, accounting for only 8% of total purchases, and should be kept in low stock to avoid unnecessary inventory expenses.

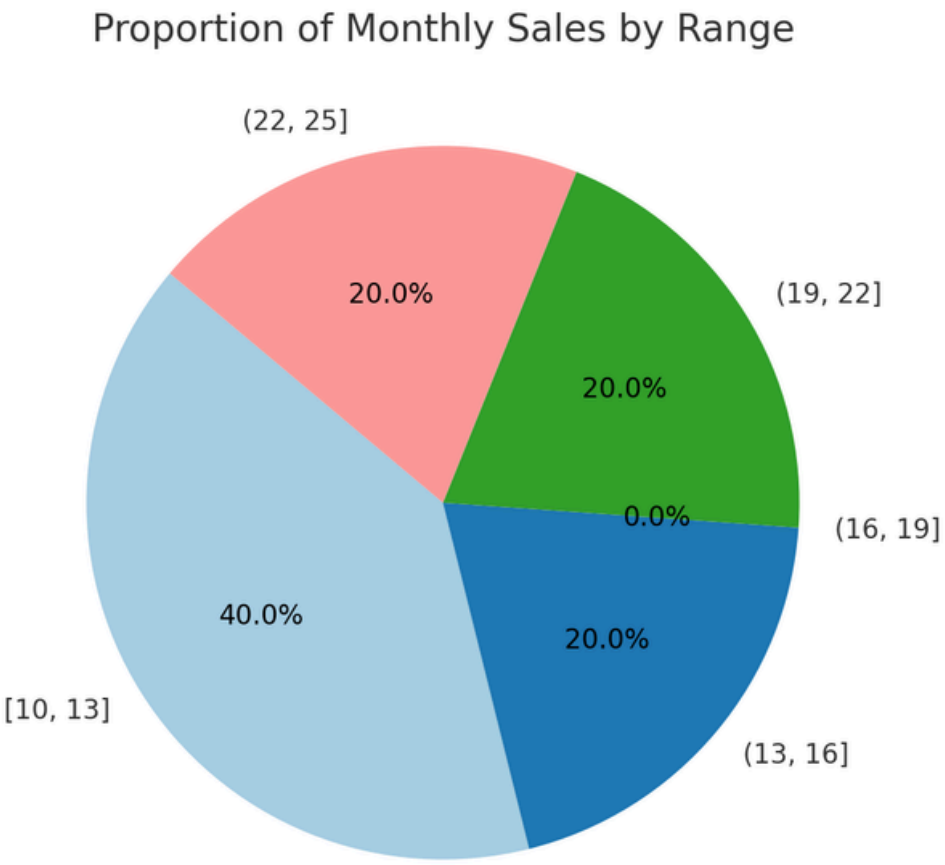


Figure 9: Proportion of Monthly Sales by range

- The pie chart illustrates the proportion of monthly sales across several sales ranges, which are split into intervals of three units: [10, 13], [13, 16], [16, 19], [19, 22], and [22, 25]. The appropriate frequency of occurrences is represented as percentages.

- **Highest sales in the range [10, 13]:**
  - The largest sales frequency was reported in the range [10, 13], contributing to 40% of total sales.

- **Moderate sales in the ranges of (13, 16], (19, 22], and (22, 25]:**
  - Each of these periods amounts for 20% of total sales, indicating moderate sales activity over these times.

- **No sales in the range (16, 19]:**
  - The sales frequency in the range (16, 19] is 0%, suggesting that no transactions occurred in this interval.

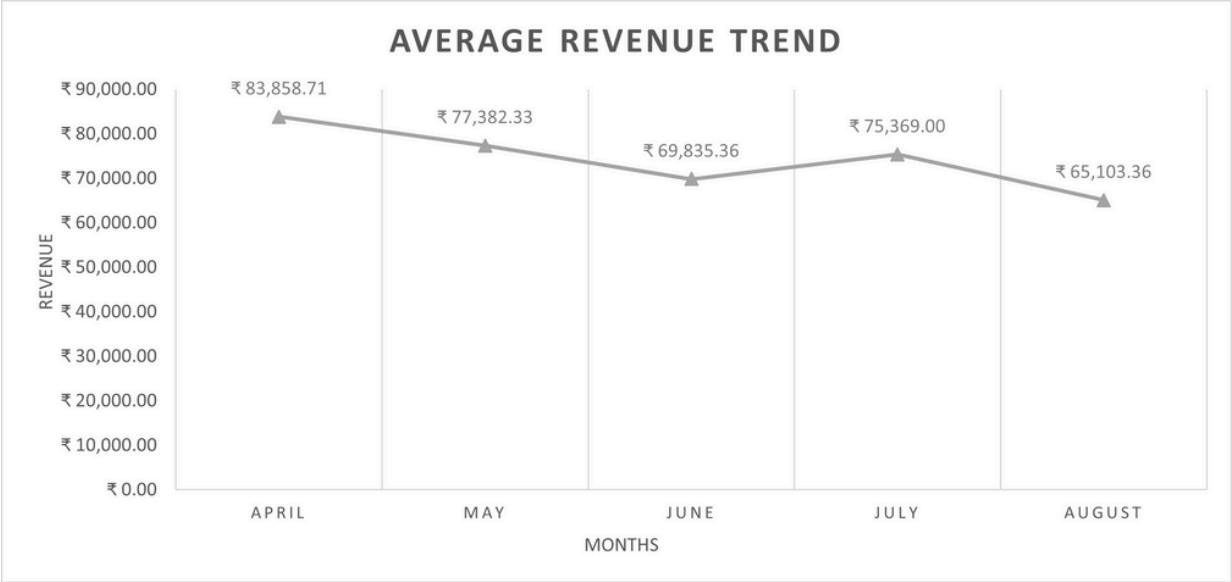


Figure 10: Average Revenue Trend by Month

1. Highest Revenue in April:

- April recorded the highest average revenue of ₹83,858.71. This is due to seasonal demand and promotions at the start of the financial year, which increase sales drastically.

2. Declining Trend from May to June:

- Revenue decreased from May (₹77,382.33) to June (₹69,835.36). This result is attributed to less customer footfall, market saturation, and a lack of promotions during these months.

3. Slight Recovery in July:

- In July, revenue increased slightly to ₹75,369.00, Because of mid-year sales efforts, increased customer engagement, or special occasions that boost revenue.

4. Significant Drop in August:

- In August, revenue dropped significantly to ₹65,103.36, the lowest recorded during the analysis period. This is due to seasonal factors like monsoons affecting transportation and sales, lower consumer spending.

4. Interpretation of Results and Recommendation

The analysis of inventory and sales data for **TVS Anjana Motors** yields several key insights.

1. Sales Trends and Patterns:

- Sales and Purchases (Figure 1) both showed a declining trend from April to July, with a minor comeback in August. This was due to seasonal demand changes and inventory management challenges.
- Effective inventory replenishment (Figure 2) has a direct impact on the performance of sales, as seen by the positive correlation ($R^2 = 0.9161$).

2. Model wise Performance:

- TVS Apache-160 emerged as the best-performing model, making the largest revenue of ₹44,16,590.50 and having disproportionately high sales compared to its purchase count, showing its popularity and market demand.
- TVS Raider-125 and TVS XL-100 showed continuous demand and solid inventory performance, contributing moderately to revenue.
- TVS Sport and TVS Jupiter-125 performed poorly, with decreased sales and revenues. The Jupiter-125's poor market traction highlights a need for targeted marketing.

3. ABC Analysis:

- Category A models (Apache-160 and Raider-125) contributed to 68% of the overall purchase value, highlighting the importance of closely monitoring inventory levels to avoid stockouts.
- To maximize costs, Category B models (XL-100 and Sport) require balanced procurement strategies.
- Because of its low demand, the Category C model (Jupiter-125) should be kept to a minimum of inventory.

4. Forecasting and Predictive Insights:

- Time series forecasting (Figure 5) showed declining sales from April to August, highlighting the need for seasonal4. Forecasting and Predictive Insights: adjustments in stock planning.
- Regression analysis revealed that pricing and model popularity have a significant impact on sales.

5. Revenue Trends:

- Monthly revenue trends (Figure 10) revealed April as the peak revenue month (₹83,858.71), with a steady decline in subsequent months, attributed to reduced demand, seasonal factors, and marketing inefficiencies.

Based on the results, the following recommendations are made to increase business efficiency:

1. Optimize Inventory Management:

- Regularly forecast inventory levels for high-demand models such as the Apache-160 and Raider-125.
- Implement just-in-time practices to minimize cost while maintaining availability.

2. Target Marketing and Promotions:

- Focus promotional efforts on underperforming models such as the Jupiter-125.
- Align marketing campaigns with seasonal demand patterns and customer data insights.

3. Streamline Supply Chain:

- Strengthen supplier relationships to reduce supply times.
- Use predictive analytics to align procurement schedules with demand forecasts.

4. Product and Pricing Strategy:

- Introduce new models or reprice existing ones to meet market trends.
- Re-evaluate underperforming models like Sport and Jupiter-125 to improve their market positioning.

By addressing these areas, **TVS Anjana Motors** can achieve better inventory management, improved customer satisfaction, and sustainable business growth.