Sales Forecasting Analysis Report

**1. Introduction**

Sales forecasting enables businesses to estimate future demand, optimize inventory, and improve operational efficiency. This report analyzes historical sales data of **697,894 products**, with a total quantity sold of **1,000,000 units** and total sales of **$13.27M**, highlighting trends, product cluster performance, promotional impact, and forecasting accuracy.

**2. Observations**

**2.1 Overall Sales**

* **Total Products:** 697,894
* **Total Quantity Sold:** 1,000,000 units
* **Total Sales:** $13.27M
* **Peak Sales Months:** November and December

**2.2 Product Clusters & Distribution**

Products are divided into four clusters:

|  |  |  |  |
| --- | --- | --- | --- |
| **Cluster** | **Description** | **Share of Products** | **Key Observations** |
| Medium Price Steady Sale | Consistent mid-priced products | 36.58% | Most sold in November; highly price sensitive |
| Fast-Moving Low Price | High-volume, low-priced products | 35% | Dominates top-selling SKUs; strong promotional response |
| Moderately Priced Low Volume | Less frequent purchases | 20% | Moderate contribution to total sales |
| Luxury | High-end premium products | 7% | Purchases increased over the years; low price sensitivity |

**Top Products:**

* Product **22850** recorded the highest sales.
* Most top-selling products belong to the Fast-Moving Low Price cluster.

**2.3 Price Elasticity**

* **Luxury Products:** No price elasticity (demand remains stable regardless of price).
* **Low-Mid Steady Products:** Highly sensitive to price changes.

**2.4 Promotion Impact**

* **Sold without Promotion:** 100,807 units
* **Sold during Promotion:** 27,242 units
* **Promotion Effect:** 1.5× increase in sales
* **Observation:** Low-Mid Steady and Fast-Moving Low Price products benefit most from promotions.

**2.5 Forecasting Performance**

* **Average Forecast Accuracy:** -1.76% (slight underestimation overall)
* **Total Forecasting Error:** -1.39M units (forecasted quantity lower than actual sales)
* **Highest Forecast Error:** Product **6200650**, indicating a need for cluster-specific adjustments.

**3. Insights**

1. **Seasonal Trends:**
   * November–December are peak months, requiring accurate demand planning and inventory preparation.
2. **Cluster Behavior:**
   * Fast-Moving Low Price products drive volume and revenue.
   * Low-Mid Steady products are sensitive to pricing and promotions, requiring careful forecasting.
   * Luxury products show consistent growth and can support premium pricing strategies.
3. **Promotional Impact:**
   * Promotions significantly boost sales for certain clusters, but not all.
   * Top-selling SKUs are highly influenced by promotional activities.
4. **Forecasting Challenges:**
   * High forecast error for specific SKUs (e.g., 6200650) highlights limitations in generalized models.
   * Price-sensitive and promotion-affected products contribute to forecast deviations.

**4. Business Pain Points**

1. **Seasonal Demand Peaks**
   * Heavy sales in November and December can strain inventory, logistics, and workforce.
   * Risk of stockouts or missed revenue if demand is underestimated.
2. **Cluster-Specific Challenges**
   * **Fast-Moving Low Price Products:** High volume can lead to frequent stockouts and require efficient supply chain management.
   * **Low-Mid Steady Products:** Highly price-sensitive, so small price changes or promotion mismanagement can drastically affect revenue.
   * **Luxury Products:** Low volume but high value; requires premium customer experience and careful demand forecasting to avoid overstock.
3. **Promotion Management**
   * Promotions drive sales for specific clusters but can erode margins if overused or poorly timed.
   * Coordinating promotions across thousands of SKUs is operationally complex.
4. **Inventory and Supply Chain Risks**
   * With nearly 700k products, maintaining optimal stock levels is challenging.
   * Misalignment between demand and supply can lead to excess inventory or lost sales.
5. **Market Responsiveness**
   * Price changes, market trends, and consumer behavior shifts require agile strategies.
   * Businesses may struggle to quickly react to sudden demand spikes or competitor promotions.
6. **Data-Driven Decision Limitations**
   * With such a large product base, actionable insights can be buried in data, making it difficult to prioritize SKUs, clusters, or marketing efforts.

**5. Business Solutions**

1. **Strategic Inventory Planning** – Allocate stock based on cluster behavior and seasonal trends to avoid overstock or shortages.
2. **Targeted Promotions** – Schedule promotions for clusters most responsive (Low-Mid Steady, Fast-Moving Low Price) to maximize revenue.
3. **Cluster-Specific Management** – Apply differentiated strategies per cluster: fast restocking for high-volume SKUs, careful pricing for price-sensitive products, and trend monitoring for luxury items.