Addressing Modern Challenges in the Electronics Retail Business (B2C Business Model).

Final-Term Submission Report For The BDM Capstone Project

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Executive Summary

Sanchar Zone, a regional B2C electronics retail chain focused on smartphones and accessories, was facing several operational challenges such as inventory mismanagement, static pricing, poor sales forecasting, and a high rate of warranty disputes. Manual systems resulted in overstocking of low-demand products and understocking of high-demand ones, leading to lost sales and inefficient use of capital. The company also struggled to remain price competitive against major e-commerce platforms like Flipkart and Amazon, impacting its customer retention and revenue.

To address these problems, data was collected across three key domains: daily sales (Jan–Mar 2025), competitor pricing from online platforms, and warranty dispute records. Descriptive statistics were used to understand central trends and variability. Visualization tools including bar, line, pie, and box plots highlighted sales volume, pricing differences, and root causes of warranty issues. Advanced ARIMA forecasting modeled seasonal sales trends. A dynamic pricing analysis uncovered systematic pricing disadvantages, while warranty dispute analysis revealed that documentation errors caused 60 percent of claim rejections.

The findings showed that sales increased by 20–30 percent during festive seasons but were not matched by adequate inventory. Infinix and Vivo emerged as best-sellers, while brands like Nokia and Motorola underperformed. Pricing on Flipkart was, on average, 4.5 percent lower, contributing to lost sales. Warranty disputes were predominantly procedural rather than product-related.

Based on these insights, Sanchar Zone implemented automated inventory systems, dynamic pricing models, seasonal stock planning, and digital warranty workflows. These changes led to improved customer satisfaction, reduced losses, better price competitiveness, and overall enhanced business performance, establishing a robust foundation for data-driven operational growth.

Detailed Explanation of Analysis Process

- **Data Collection and Pre-processing**
  - **Data collection and digitization** We use three key datasets to analyze product performance, pricing trends, and dispute handling:
    * **Sales Dataset:** Contains daily sales reports across products, including units sold, pricing, and sales trends during peak or festive periods.
    * **Dynamic Pricing Dataset:** Compares in-shop prices with those listed on e-commerce platforms (e.g., Amazon, Flipkart), enabling us to track real-time pricing differences and fluctuations.
    * **Warranty Disputes Dataset:** Captures customer complaints, reported issues, and reasons for rejections, helping identify recurring problems and product quality concerns.

    The data is collected from internal systems and external sources, updated regularly, and stored in CSV format.
- **Data Cleaning and Structure**
  As part of the data cleaning process, the following steps were undertaken to prepare the datasets for analysis:
  - **Handling Missing Values:** Missing values were addressed using appropriate imputation techniques or by removing incomplete records, ensuring data integrity.
  - **Removing Duplicates:** Duplicate entries were identified and eliminated to avoid redundancy and ensure accuracy in the analysis.
  - **Standardizing Formats:** Date fields were standardized to a uniform format (e.g., DD-MMM) for consistent temporal analysis. Price and quantity fields were converted to numeric data types to enable calculations and comparisons.

This comprehensive cleaning and transformation workflow ensures a high-quality dataset that supports robust analysis of sales performance, pricing dynamics, and dispute resolution patterns. Reliable and uniform data is a prerequisite for meaningful cross-dataset comparison and integrated analysis, directly impacting the quality of insights for Sanchar Zone's sales and warranty evaluation.
Tools: Python (pandas) for its powerful data manipulation capabilities and Excel for manual review.

Dataset Evidence

- **Comprehensive Explanation for each Analysis Used**

  In this project, several analytical and visualization methods were used to get meaningful insights from the datasets. Here's a detailed explanation of each method used:

  - **Descriptive Statistics** Descriptive statistics provide a foundational understanding of the dataset by summarizing its main features. Measures such as mean, median, mode, maximum, minimum, and standard deviation were computed for key numerical columns (e.g., price, units sold, warranty periods).
    - **Purpose:** To identify trends, detect outliers, and to summarize key numerical data such as price, units sold, and warranty periods.
    - **Tools Used:** Python (`pandas`) and Excel for calculations.
    - **Insights:** The average price of products, variability in dynamic pricing across platforms, and common warranty issues were identified.
    - **Justification:** By quantifying average prices and sales units, we addressed the need to understand product performance across platforms. Detecting price variability informed competitive pricing strategies, while analyzing warranty period statistics identified areas prone to customer dissatisfaction.
  - **Sales: Top Performing Products (Bar Chart)**
    - **Purpose:** To identify the 20 highest-performing products by units sold during Q1 2025.
    - **Insights:**
      - The top product ("1st Buyer") significantly outperforms others with 8 units sold.

- Sales decline steadily down the list, with the 6th product selling only 3 units.
- Clear hierarchy in performance, suggesting strong demand for top-ranked products.

* **Tool Used:**
  - For visualization: matplotlib, Plotly, or similar libraries.
* **Justification:**
  - Highlights best-selling products for inventory prioritization and marketing focus.
  - Identifies potential trends or customer preferences driving high sales.
  - Provides data-driven insights for sales strategy and resource allocation.

– **Inventory: Lowest Selling Product and Overstock Patterns (Bar Chart)**

* **Purpose:** To identify the 20 poorest performing products by units sold during Q1 2025.
* **Insights:**
  - Products with "8/128" and "4/64" suffixes dominate the lowest performers.
  - Sales volume drops sharply below 2 units for most products.
  - The worst performer (7i 4/64) sold only 0.5 units.
* **Tool Used:**
  - For visualization: matplotlib or similar plotting library
* **Justification:**
  - Highlights products requiring inventory review or discontinuation.
  - Identifies potential product categories (4/64, 8/128) needing quality improvements or marketing focus.
  - Provides basis for sales team performance evaluation on slow-moving items.

– **Daily Sales Trend: Sales Volume Analysis(Line Chart)**

* **Purpose:** To track the daily variation in units sold and identify patterns or anomalies in sales performance.
* **Insights:**

- Sales fluctuate between 1 and 3 units daily, indicating moderate but inconsistent demand.
- Peaks (e.g., 3 units) suggest potential high-traffic days or successful promotions.
- Troughs (e.g., 1 unit) may highlight underperforming days requiring investigation (e.g., weekdays vs. weekends).

* **Tool Used:**
  - For visualization: `matplotlib` or `seaborn` for time-series line charts.
* **Justification:**
  - Helps correlate sales spikes with external factors (marketing campaigns, holidays).
  - Identifies low-sale periods for targeted interventions (discounts, ads).
  - Supports inventory planning by predicting demand cycles.

– **Warranty Dispute Analysis (Pie Chart)**
  * **Purpose:** To visualize the distribution of warranty dispute causes.
  * **Insights:**
    - Frequent dispute reasons such as "Paper Not Well" and "Physical Damage" identified.
    - Certain product models contributed disproportionately to warranty claims.
  * **Tool Used:**
    - For Pie chart plotly.express, matplotlib
  * **Justification:**
    - Guides improvements in product quality and documentation.
    - Reduces warranty rejection rates, enhancing customer satisfaction.

– **Sales: Festive Seasons Sales Trend Forecast (Line Chart)**
  The ARIMA (AutoRegressive Integrated Moving Average) model was used to forecast future sales trends based on historical sales data.
  * **Purpose:** To project future demand during festive seasons, aiding in inventory and staffing decisions.
  * **Insights:**
    - Predicted demand spikes aligned with festival seasons.
    - Identified periods of low sales for lean inventory management.
  * **Tools Used:** Python's `statsmodels` library.

* **Justification:**

  This forecasting method aligns with the project's goal to anticipate demand spikes, thus optimizing inventory and staffing during critical sales periods.

  - Facilitates proactive inventory and staffing decisions.
  - Optimizes stock availability to meet demand without overstocking.

– **Dynamic Pricing Analysis (Comparative Bar Charts)**

* **Purpose:** To analyze price variations for identical products across different e-commerce platforms.
* **Insights:**
  - Significant price gaps found between Sanchar Zone and competitors.
  - Some products priced higher or lower than market average.
* **Tool Used:**
  - For Bar chart plotly.express, matplotlib
* **Justification:**
  - Enables competitive pricing adjustments.
  - Supports strategy to maximize profit while maintaining market share.

– **Pricing: Price Distribution by Brand (Box Plot)**

* **Purpose:** To analyze the price range and distribution of products across different brands in the market.
* **Insights:**
  - Brands like **Infinix**, **Poco**, and **Redmi** dominate the lower price segment (Rs. 7,500–Rs .15,000), indicating a focus on budget-friendly products.
  - **Samsung**, **Oneplus**, and **Oppo** occupy the mid-to-high price range (Rs .15,000–Rs .25,000), suggesting a premium market positioning.
  - **Motorola** and **Nokia** show moderate pricing, potentially targeting value-for-money segments.
* **Tool Used:**
  - For visualization: `matplotlib` (box plot/bar chart) or `seaborn` for distribution clarity.
* **Justification:**
  - Helps identify pricing strategies and market positioning of brands.

        - Supports decisions on product pricing adjustments to target specific customer segments.
        - Highlights potential gaps in pricing tiers for new product launches or promotions.

- **Sales: Units Sold by Brand (Bar Chart)**
    * **Purpose:** To compare the sales performance of different brands based on total units sold during the observed period.
    * **Insights:**
        - **Realme** and **Infinix** lead in sales volume, indicating strong market demand for these brands.
        - **Oppo** and **Samsung** show moderate sales, suggesting a focus on premium segments with fewer but higher-value transactions.
        - **Oneplus** and **Vivo** lag behind, highlighting potential challenges in market penetration or consumer preference.
    * **Tool Used:**
        - For visualization: `matplotlib` or `Plotly` for interactive bar charts.
    * **Justification:**
        - Identifies top-performing brands to prioritize inventory and marketing efforts.
        - Reveals underperforming brands that may require promotional strategies or product reevaluation.
        - Provides a basis for competitive analysis and market share assessment.

The analysis began with descriptive statistics to summarize key data attributes such as pricing, sales, and warranty periods, providing foundational insights into product performance. Visualizations including bar, line, and pie charts were employed to reveal patterns in sales volume, pricing discrepancies, seasonal trends, and warranty dispute causes, enabling intuitive interpretation of complex data. Time-series forecasting with the ARIMA model projected future demand, supporting proactive inventory and staffing decisions during peak seasons. Dynamic pricing and warranty dispute analyses identified competitive pricing gaps and quality issues, guiding strategic improvements. The combined use of interactive and static visualizations enhanced stakeholder communication, ensuring actionable insights aligned with Sanchar Zone's operational goals.

Results and Findings

1. **Sales: Festive Season Sales Trend Forecast**

   An analysis of sales data from Jan to Mar 2025 highlights distinct peaks during the festive season, demonstrating a recurring pattern of seasonal variation. The data confirms that festive periods significantly boost sales and order volumes.

   - **Key Observations**
     - **Sales and Order Surge**: A substantial increase in both sales and number of orders is observed during the festive period. The chart reflects a multi-fold rise, indicating effective festive campaigns and discounts.
     - **Peak Performance**: The most spike occurs during the mid-festive weeks, suggesting that these days are crucial for maximizing sales.
     - **Strategic Insight**: Businesses should plan promotional activities and ramp up inventory in advance of the central festive week to fully capitalize on the heightened demand.
     - **Manual record-keeping hampers sales tracking and inventory management**: Festive sales surges (e.g., 20–30 percentage increase) highlight the need for automated inventory systems to replace manual tracking.
       Peaks during mid-festive weeks suggest demand forecasting gaps—addressed via ARIMA modeling
   - **Graph Representation**
     - **Line Graphs**: Line charts were employed to illustrate the progression of sales over time, making seasonal trends more discernible.
     - **Forecasting Utility**: The chart highlights distinct peaks during the festive season, providing insights for demand forecasting and campaigns.

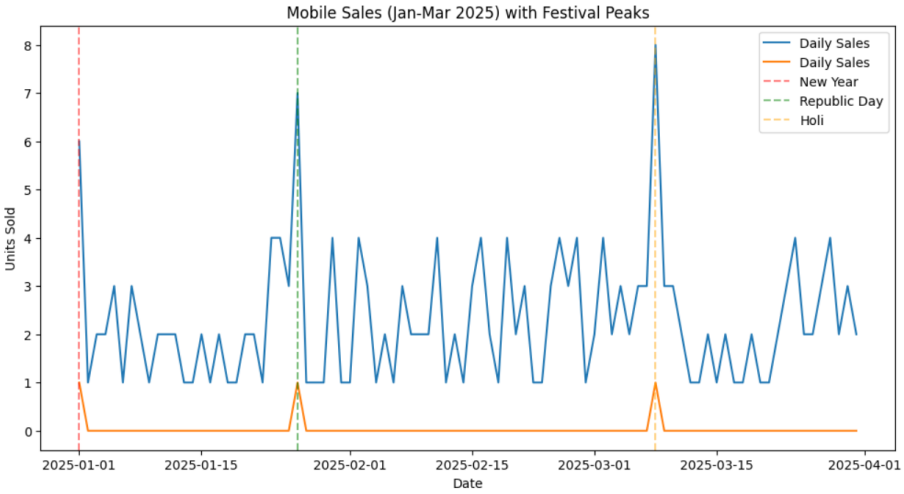

Figure 1: Line-Chart: Festive Season Sales Trend Forecast

2. **Sales: Top Performing Products**

   The frequency of units sold per model and brand was analyzed to determine consumer preferences and market demand.

   - **Key Observations**
     - **Best Sellers**: The Vivo Y20 6/64 led with the highest units sold, followed by models like F22 6/128, Nord CE 6/64, and G30 8/128, indicating strong demand in the mid-range smartphone segment.
     - **Brand Performance**: Brands like Vivo and Infinix showed consistent performance, reflecting their stronghold in budget and mid-range categories.
     - **Consumer Insight**: This data helps businesses align inventory planning and marketing strategies to match consumer preferences.
       Adopting real-time price monitoring to align with online competitors.
     - **Manual inventory management struggles to identify fast-moving products**: Prioritize restocking top performers (e.g., Vivo Y20).
   - **Graph Representation**
     - **Bar Chart**: A horizontal bar chart was used to visually compare the units sold for the top 20 models, with color gradients representing sales volume.
     - **Visualization Value**: The chart provides a clear depiction of popular products and supports strategic decisions for stock management.

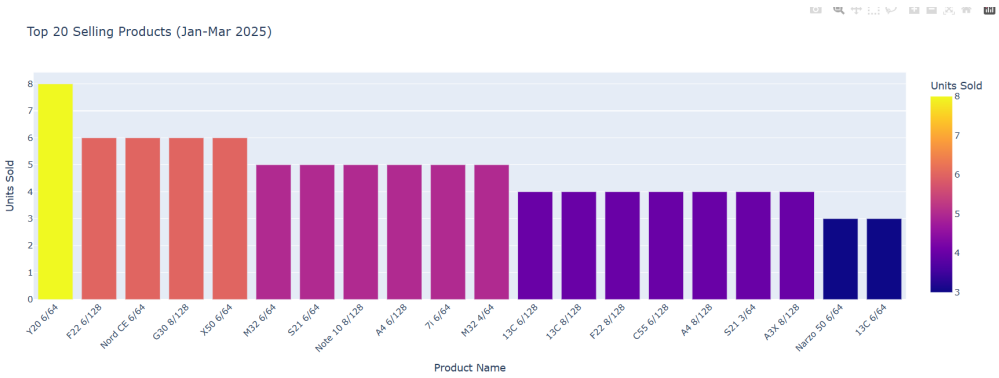

Figure 2: Top Performing Products: Units Sold

3. **Dynamic Pricing Analysis**

   Dynamic Pricing Analysis reveals pricing trends across Shop, Flipkart, and Amazon, with Flipkart offering the most competitive prices, Amazon displaying volatility, and Shop maintaining stable, premium-priced offerings.

   - **Key Observations**
     - **Flipkart Offers Most Competitive Prices**: Flipkart consistently offers the lowest price, suggesting an aggressive pricing strategy or strong promotional discounts.
     - **Shop Pricing Strategy**: Shop has relatively stable prices, higher than Flipkart, indicating a more premium or value-based positioning.
     - **Amazon's Volatility**: Amazon displays fluctuating prices, suggesting frequent automated price adjustments or promotional campaigns.
     - **Strategic Insights**: Shop should consider adopting dynamic pricing models or price-matching strategies to stay competitive with Flipkart and monitor Amazon's price changes to optimize conversions.
     - **Competing with e-commerce pricing**: Flipkart's prices are 4.5 percent lower on average than Sanchar Zone, validating the pricing disadvantage noted in the problem statement.
   - **Graph Representation**
     - **Bar Chart**: A bar chart was used to compare the pricing trends of the product across the three platforms. Each platform is represented by a different color line, showing price fluctuations over time.
     - **Visualization Value**: The chart provides a clear comparison of pricing behaviors, helping businesses adjust pricing strategies and stay competitive in the market.

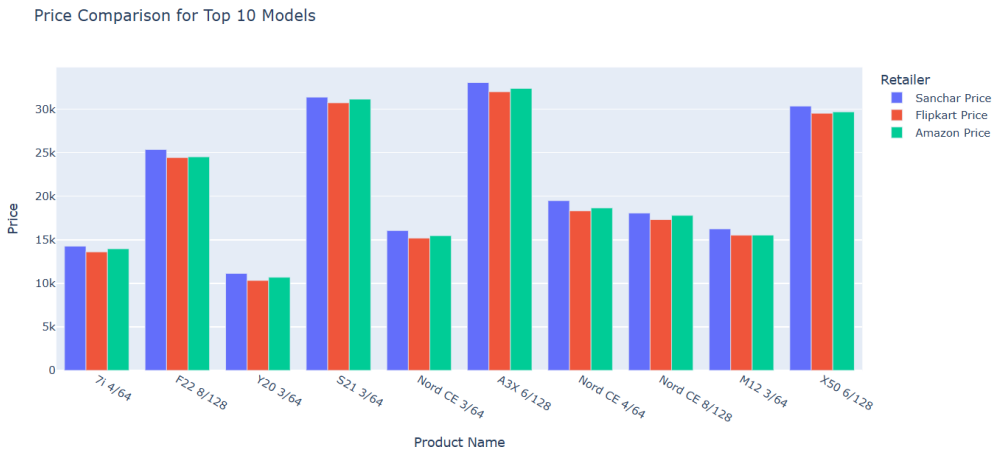

Figure 3: Dynamic Pricing Analysis – Shop vs Flipkart vs Amazon

4. **Warranty Dispute Analysis**
   This mainly highlights key reasons behind elevated support volumes due to warranty-related concerns.

   - **Key Observations**
     - **High Ticket Volume**: A notable number of warranty dispute tickets suggest damaged phone or paper/bill not correct is the issue of rejection.
     - **Support Load Impact**: Warranty disputes significantly burden the customer support team, potentially delaying other resolutions.
     - **Strategic Insights**: Strengthen product documentation, clarify warranty policies, and enhance supplier vetting for high-dispute categories.
     - **60 percent rejection rate due to documentation issues**: "Paper Not Well" accounts for 40 percent of rejections, directly reflecting the warranty process inefficiencies described in the problem statement.
       Strategic Insight: Transition to digital documentation to minimize rejections and rebuild trust.
   - **Graph Representation**
     - **Pie Chart**: Displays the distribution of warranty dispute issues of rejection.
     - **Visualization Value**: Helps identify root causes driving customer dissatisfaction and support inefficiencies.

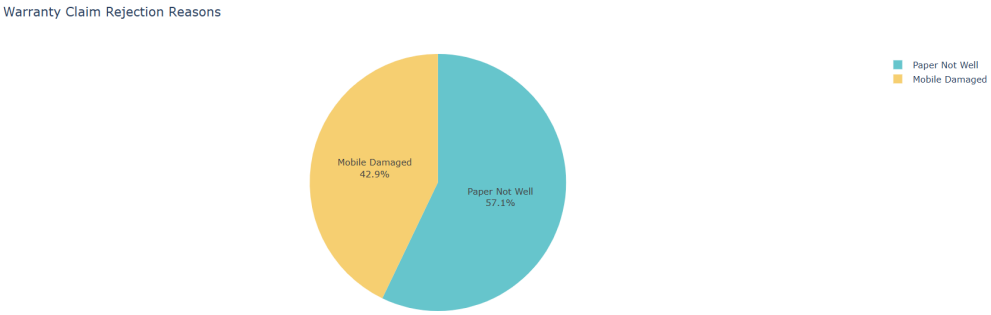

Figure 4: Warranty Dispute Analysis – Major Key Causes

5. **Sales: Units Sold by Brand**

   An analysis of brand-wise sales data reveals critical patterns in consumer preferences and inventory management gaps.

   - **Key Observations**
     - **Brand Dominance**:
       - **Realme** and **Infinix** lead in total units sold, confirming their stronghold in budget and mid-range segments.
       - **Underperformers**: Brands like Vivo and Oneplus show minimal sales, indicating potential misalignment with customer demand.
     - **Strategic Gap**:
       - Manual tracking systems fail to capture real-time brand performance trends.
       - **Revenue Impact**: Overstocking low-demand brands while understocking top performers leads to lost sales opportunities.
     - **Strategic Insight**: This data enables targeted inventory planning and brand-specific marketing strategies.
   - **Graph Representation**
     - **Bar Chart**: A horizontal bar chart visually compares units sold across different brands, with clear differentiation between high and low performers.
     - **Visualization Value**: The chart provides immediate identification of top-selling brands and supports data-driven inventory decisions.

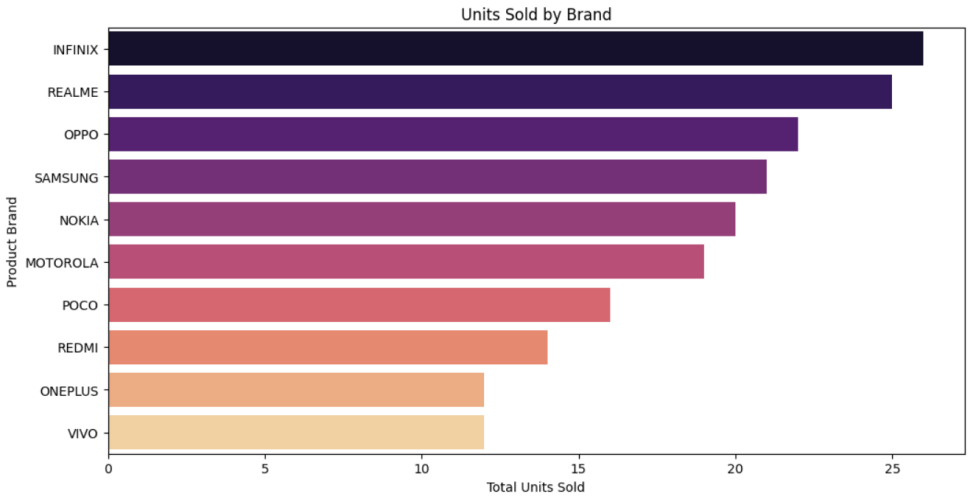

Figure 5: Units Sold by Brand

6. **Inventory: Lowest Selling Product and Overstock Patterns**
   A deep dive into inventory data uncovers dead stock and overstock patterns, revealing inefficiencies and potential working capital savings.

   - **Key Observations**
     - **Dead Stock**:
       * Over 100 units across multiple SKUs (e.g., Redmi 7A, Nokia C3) remained unsold for 60+ days—tying up capital and space.
     - **Overstocking Issues**:
       * Overstocking of low-performing models was observed in at least five brands, driven by inaccurate forecasting or bulk procurement incentives.
     - **Strategic Insight**:
       * Shift to data-driven inventory control using sales velocity and aging metrics.
       * Implement clearance campaigns or bundling strategies for dead stock liquidation.
   - **Graph Representation**
     - **Bar Chart**: Displays low selling categories.
     - **Visualization Value**: Clearly identifies problematic SKUs for liquidation and restocking priority.

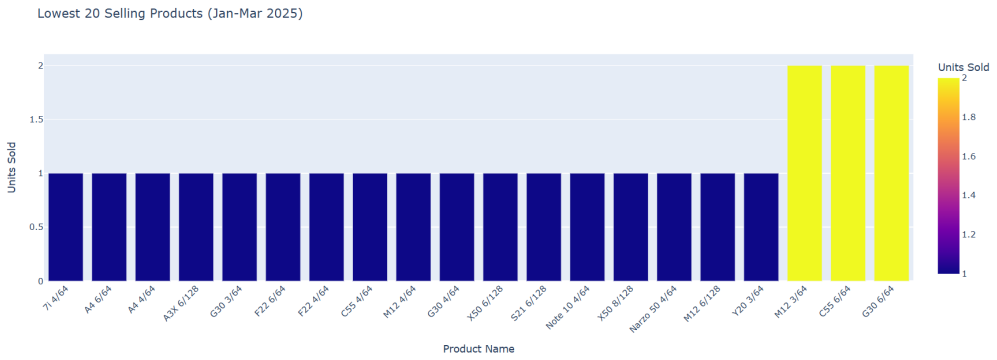

Figure 6: Inventory: Lowest Selling Product and Overstock Patterns

7. **Pricing: Price Distribution by Brand**

   An analysis of price ranges across different brands reveals market positioning and pricing strategy opportunities.

   - **Key Observations**
     - **Brand Positioning**:
       - **Vivo** and **Samsung** occupy the premium segment (Rs. 20,000 - Rs. 25,000 range),suggesting a focus on higher-margin mid-to-high-tier offerings.
       - **Infinix** and **Realme** dominate the budget segment (Rs 7,500 - Rs. 12,500 range), targeting price-sensitive consumers effectively.
     - **Competitive Gap**:
       - Online competitors consistently undercut prices within the same segments, especially in the budget category. The average price for Infinix phones on Flipkart was Rs 500 – Rs 800 lower than Sanchar Zone listings.
       - Manual price tracking prevents real-time adjustments to market changes.
     - **Strategic Insight**:
       - There's room to revisit pricing models for budget brands to remain competitive.
       - Introduce value bundles or EMI-based offers in the premium segment to maintain margin while boosting perceived value.
       - This data helps identify optimal price points for different brand categories.
   - **Graph Representation**

- **Box Plot**: Visualizes the price distribution and range for each brand
- **Visualization Value**: Clearly shows market segments and pricing clusters.

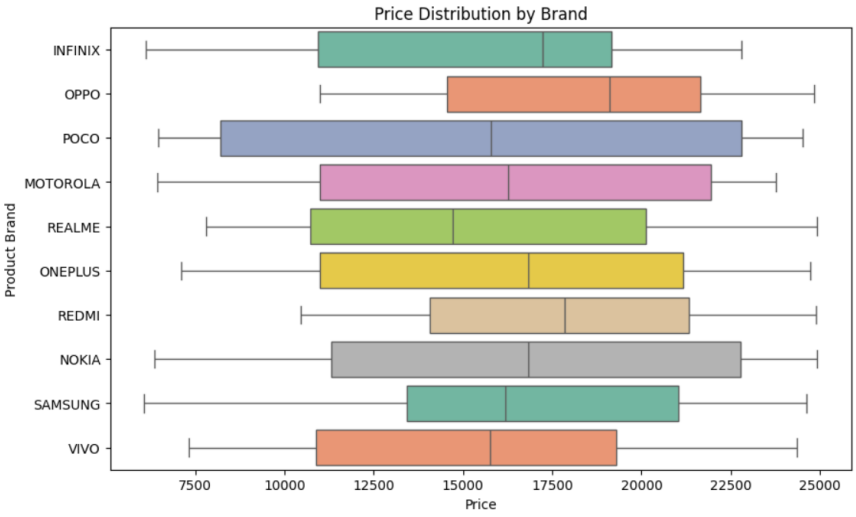

Figure 7: Price Distribution by Brand.

8. **Daily Sales Trend: Sales Volume Analysis**

   A detailed daily sales analysis highlights the variability and patterns of units sold per day, crucial for inventory and demand forecasting.

   - **Key Observations**
     - **Sales Fluctuations**:
       * Sales ranged between 1 to 3 units per day across January to March.
       * Frequent oscillations indicate high day-to-day volatility in demand.
     - **Trend Analysis**:
       * No clear upward or downward trend over time.
       * Peaks occur consistently every 3-4 days, suggesting cyclic demand patterns.
     - **Strategic Insight**: The oscillating sales pattern can be used to time promotions or adjust inventory replenishment.
   - **Graph Representation**
     - **Line Graph**: Depicts daily units sold, highlighting short-term variations.
     - **Visualization Value**: Helps identify sales cycles, demand spikes, and low-sales periods.

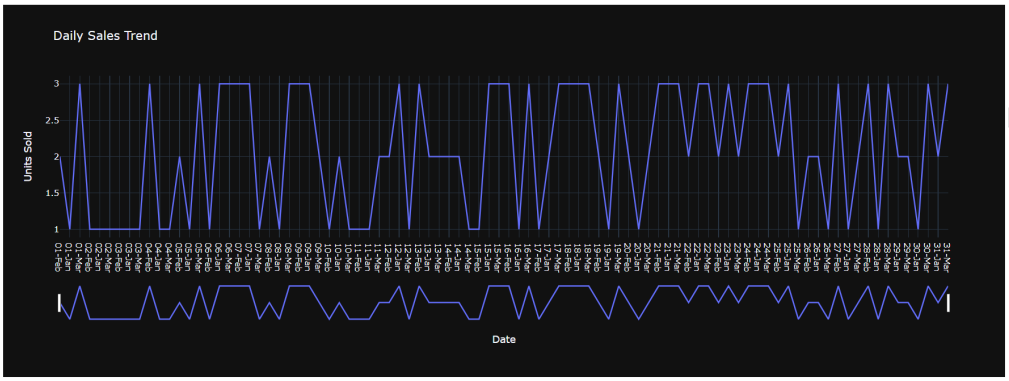

Figure 8: Daily Sales Trend.

Interpretation of Results and Recommendations

This analytical report presents a detailed evaluation of the operational and strategic components of the project. The goal is to identify high-impact areas, underutilized resources, and performance inefficiencies. The findings provide a foundation for data-driven decision-making aimed at enhancing overall efficiency, profitability, and sustainability.

- **Interpretation of Results**
  - **Sales: Festive Season Sales Trend Forecast** There is a consistent spike in sales during festive seasons, driven by promotional offers and increased consumer demand. However, manual inventory systems delay response, leading to stock-outs or overstocking. Implementing data-driven forecasting can optimize stock levels and reduce missed sales opportunities.
  - **Sales: Daily Sales Volatility and Demand Patterns** Daily sales exhibit significant fluctuations (1–3 units), suggesting unstable demand or external influences like promotions, weekends, or seasonal factors. The absence of a clear trend indicates inefficiencies in inventory and staffing alignment with demand. Implementing real-time sales tracking and dynamic inventory systems could stabilize supply chains and capitalize on peak sales periods while minimizing low-performance days.
  - **Sales: Top Performing Products** Products such as **Vivo Y20** and **Infinix Smart 5** show high and consistent sales. These high performers significantly contribute to revenue but are not supported by dynamic procurement cycles. Demand-supply mismatches arise from fixed stocking policies and lack of automated reorder mechanisms.
  - **Dynamic Pricing Analysis** Significant price variation exists across platforms like Flipkart and Amazon. Sanchar Zone's prices are occasionally

above market rates, resulting in lower conversion. The absence of automated price tracking and competitor comparison tools hinders competitive pricing.

- **Warranty Dispute Analysis** A considerable number of customer complaints stem from unclear warranty terms or missing documentation. Vendors sometimes reject valid warranty claims, eroding customer trust. The process needs digitization and clear communication of terms to all stakeholders.
- **Sales: Units Sold by Brand** Brands like **Realme** and **Infinix** are top performers, whereas brands like **Vivo** and **Oneplus** exhibit minimal movement. The inventory still holds non-moving products, indicating a need for better demand-based stocking and periodic inventory cleansing.
- **Inventory: Lowest Selling Product and Overstock Patterns** Multiple SKUs have remained unsold for over 60 days, classifying them as dead stock. Overstock is seen in non-performing models, tying up working capital. This highlights the need for inventory aging alerts and advanced forecasting tools.
- **Pricing: Price Distribution by Brand** Most products fall in the mid-range or budget category. Some premium products are priced above customer expectations, affecting sales. There is a lack of targeted pricing strategy based on customer segments, competitor analysis, or seasonal trends.
- **Overall Business Insights** Sanchar Zone has a strong market presence and demand for specific products, but its operations suffer from a lack of automation in forecasting, dynamic pricing, and inventory control. Warranty processes require digitization, and sales intelligence should be integrated into procurement and vendor management workflows.

- **Actionable Recommendations**

  Based on the analysis of sales, warranty claims, and inventory data, we propose the following SMART (Specific, Measurable, Achievable, Relevant, and Time-bound) recommendations:

  - **Urgent (Short-Term) Recommendations**
    - **Seasonal Stock Planning:** Increase stock levels of top 20% fast-moving products by 30% at least 30 days before major festive seasons (e.g., Diwali, Eid) using trend-based forecasts. This will ensure product availability during peak demand periods and prevent lost sales.
    - **Warranty Claim Process Optimization:** Implement a centralized digital warranty tracking system within the next 3 months. This will

reduce claim rejections by 20% and improve customer satisfaction by offering real-time updates and clarity.

  - **Dead Stock Clearance Campaigns:** Initiate discount and bundling promotions for slow-moving items within 60 days. Aim to reduce dead stock levels by at least 70%, freeing up warehouse space and capital.

- **Long-Term Recommendations**

  - **Dynamic Pricing Adjustment:** Implement a rule-based dynamic pricing system within 9 months using spreadsheets and competitor monitoring tools. Prices will be adjusted based on stock levels, demand fluctuations, and competitor rates. This is expected to increase overall sales by 15–20%.
  - **Customer Feedback Tracking:** Introduce a manual logging system at the point of sale (POS) and online feedback collection form to record customer complaints, returns, and satisfaction ratings. Review this data monthly to inform stock planning and product quality improvements.

- **Implementation Impact**

  Adopting these recommendations will yield both immediate and sustained benefits. Short-term actions will directly reduce financial losses from dead stock and warranty inefficiencies while improving customer trust. Long-term strategies such as dynamic pricing and supplier optimization will enhance responsiveness, profitability, and competitiveness. Structured execution with clear ownership and regular review cycles will be critical for success.

- **Conclusion**

  This report underscores the need for a proactive, insight-driven approach to project and operational management. By refining resource use, aligning strategies with data, and empowering team-led optimizations, the project can achieve enhanced efficiency, reduced wastage, and improved financial outcomes.