Exploratory Data Analysis (EDA) and Business Insights Report

Overview

This report presents key business insights derived from the clustering analysis of customer behavior in the eCommerce dataset, focusing on transaction patterns and customer segmentation.

1. **Customer Value Segmentation**

   Insight:

   - Cluster 3 demonstrates highest average transaction value (~$1,100) with consistent spending patterns
   - Cluster 4 represents budget segment with average transactions around $280.
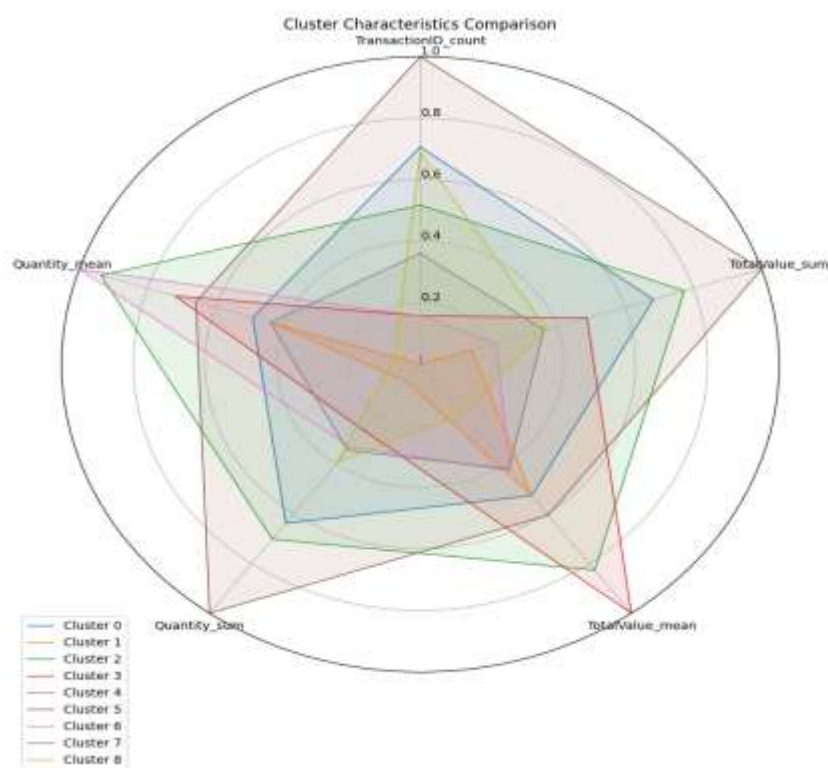
   Actionable Recommendations:

   - Develop premium service offerings for Cluster 3 customers
   - Create value-based promotions for Cluster 4 to encourage higher spending
   - Implement tiered loyalty programs based on spending patterns

2. **Seasonal Purchase Patterns**

   Insight:

   - Significant transaction value increase during October-December
   - Clusters 0 and 3 maintain consistent high-value transactions throughout the year
   - Other clusters show volatile spending patterns.
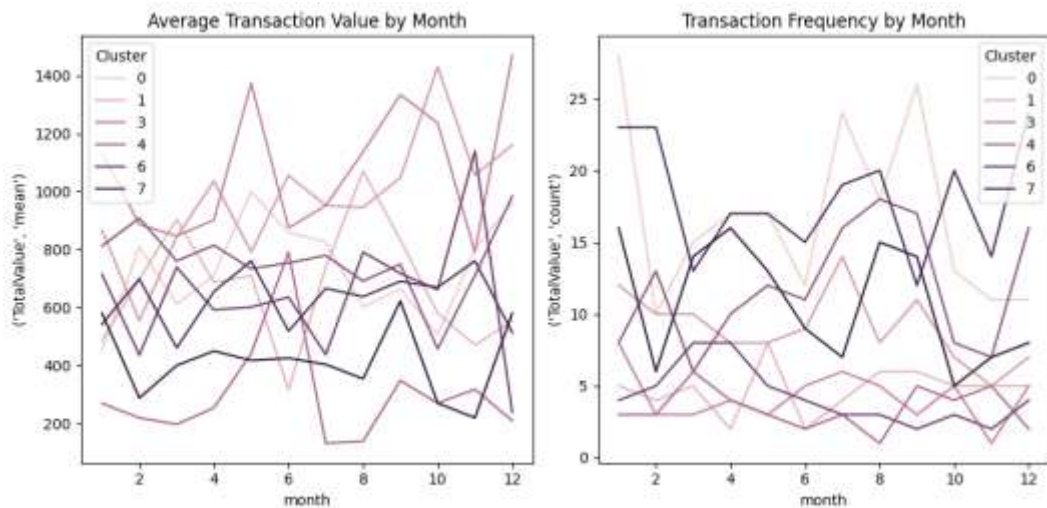
Actionable Recommendations:

   - Optimize inventory for Q4 holiday season peaks

   - Develop year-round engagement strategies for consistent spenders

   - Create seasonal marketing campaigns aligned with spending patterns

3. Feature Importance Analysis

Insight:

- TotalValue_sum, Quantity_mean, and TotalValue_mean each contribute ~20% to customer segmentation

- Transaction frequency has less impact than purchase value

- Purchase volume and value equally influence customer behavior.
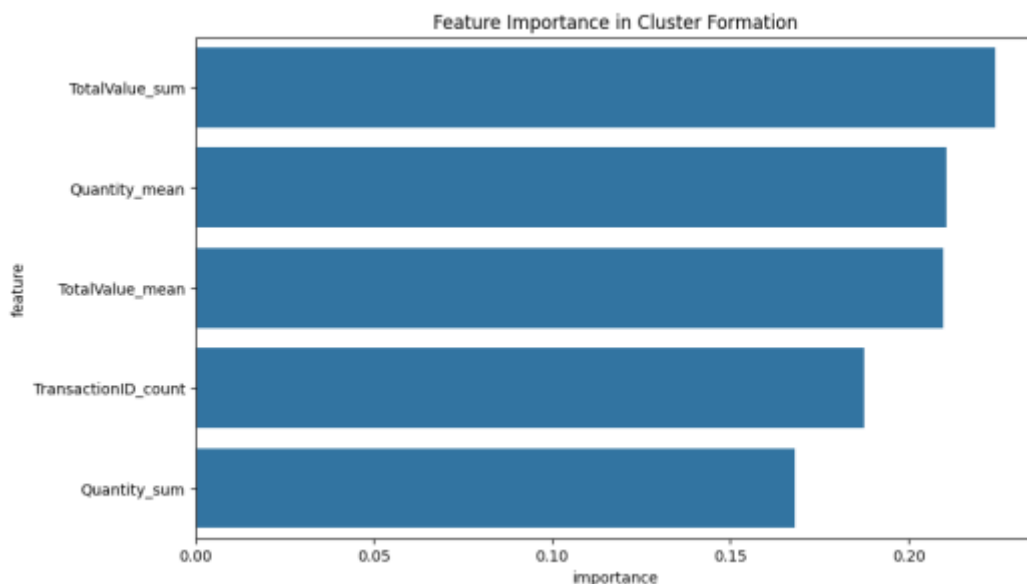
Actionable Recommendations:

   - Focus on increasing basket value rather than purchase frequency

   - Design promotions that encourage higher quantity purchases

   - Develop strategies to maximize total customer value

4. Customer Lifecycle Patterns

Insight:

- PCA visualization reveals clear progression paths between segments
- Natural overlap indicates customer transition between segments
- Well-defined customer lifecycle stages identified.


Customer Segments Visualization (PCA)
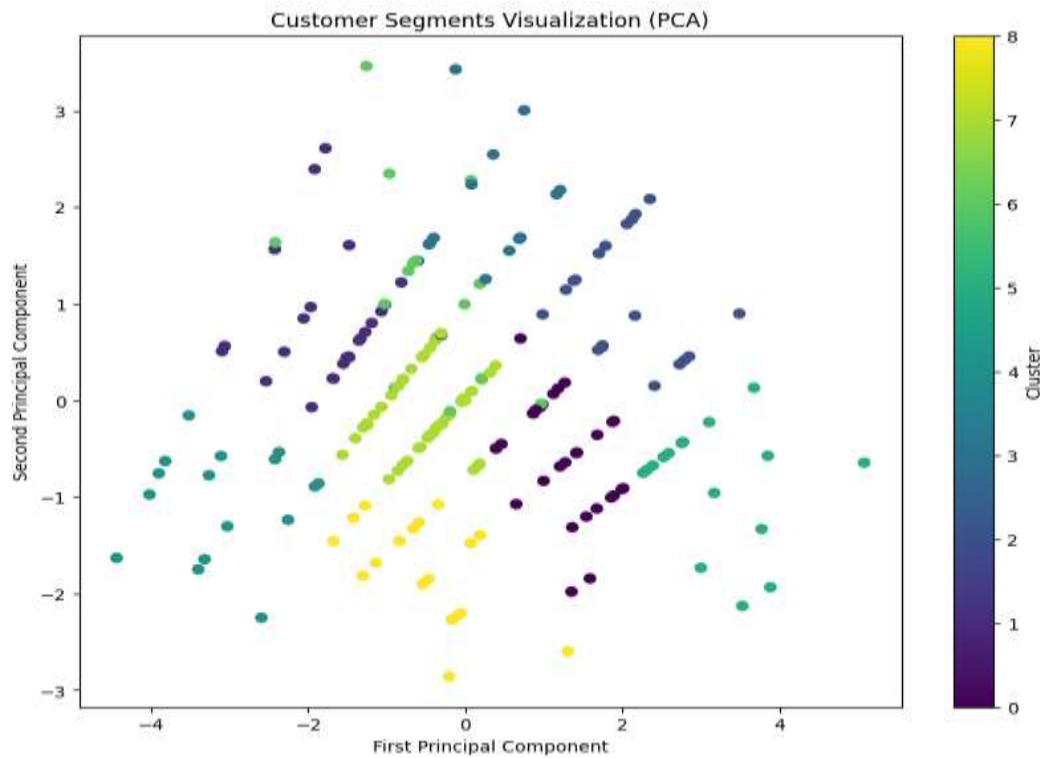
Actionable Recommendations:

- Create targeted upgrade paths for customer progression
- Develop intervention strategies for at-risk customers
- Implement segment-specific retention programs.

5. Cluster Characteristics

Insight:

- Cluster 5: High performance across all metrics (most valuable segment)
- Cluster 2: Balanced behavior with moderate values
- Cluster 4: Low current values but high growth potential.
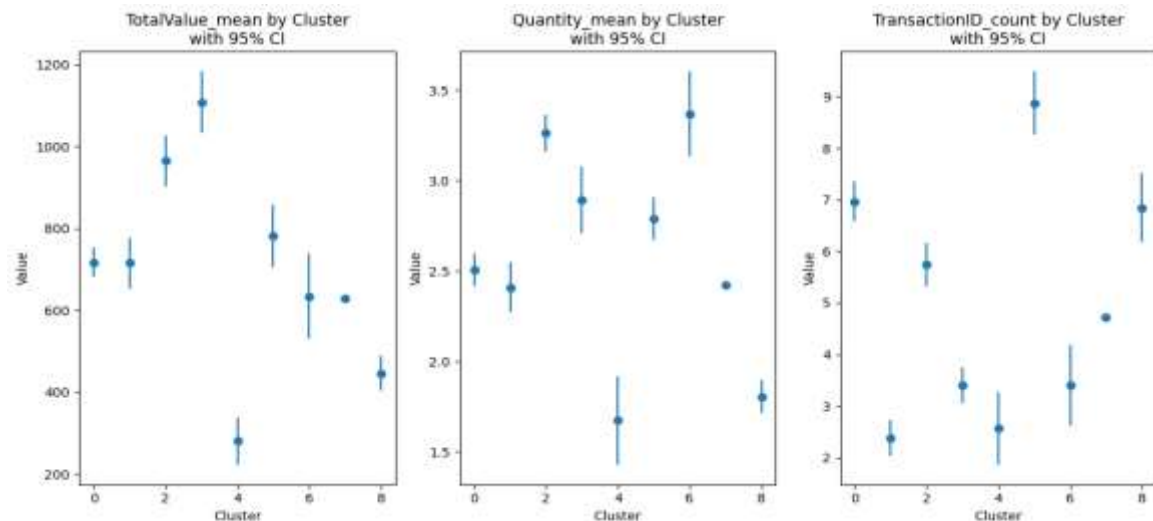
Actionable Recommendations:
- Implement VIP programs for Cluster 5 retention
- Create growth-focused campaigns for Cluster 2
- Develop engagement strategies for Cluster 4 development.

6. Statistical Validation
Insight:
- Optimal number of clusters: 9
- Davies-Bouldin score: 1.0221
- Silhouette score: 0.35 indicating moderate cluster separation.
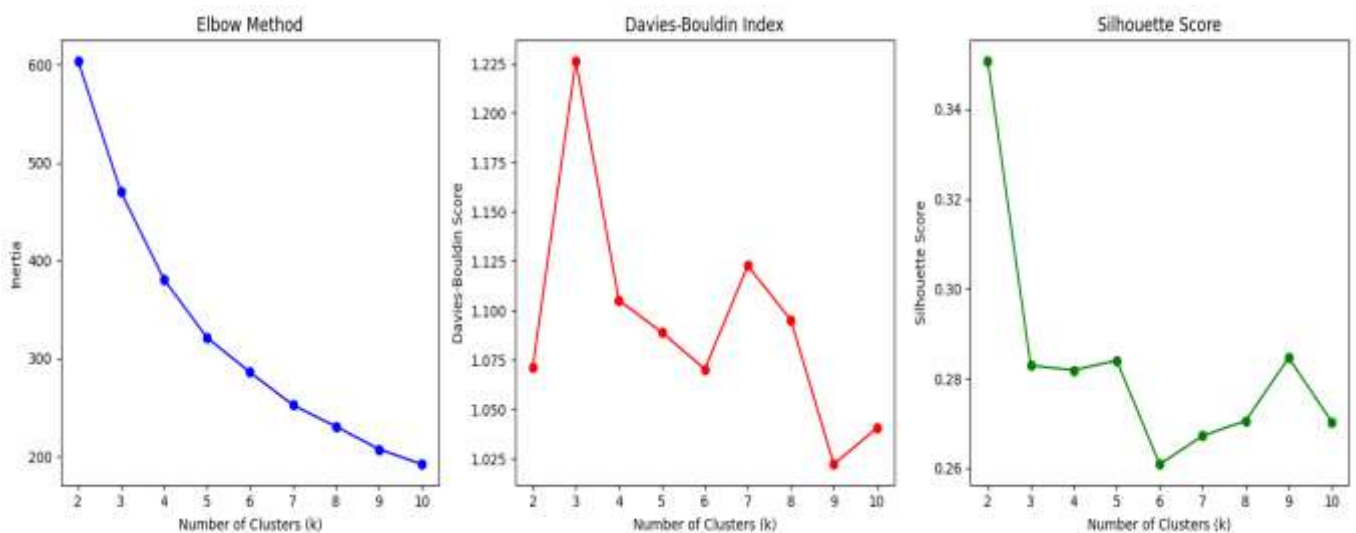
Actionable Recommendations:
- Use segmentation for targeted marketing campaigns
- Maintain flexibility in customer classification
- Regular monitoring of segment stability.