Clustering Report

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1. Number of Clusters Formed

4 clusters were identified as optimal based on the Elbow Method, where SSE reduction starts to exhibit a plateau.

2. Davies-Bouldin Index:

- DB Index Value 1.20
- A smaller Davies-Bouldin Index indicates better-defined clusters. The value of 1.20 is acceptable and indicates that the clusters are reasonably compact and well-separated.

3. Cluster Characteristics

The clustering algorithm identified distinct customer groups based on transaction behavior and region:

Cluster	Total Transaction Value	Average Transaction Value	Transaction Count	Region
0	High	Moderate	High	Region ~1.2
1	Moderate	Moderate	Moderate	Region ~2.5
2	Low	Moderate	Low	Region ~1.0
3	High	High	Low	Region ~1.6

4. Clustering Metrics

- **Elbow Method SSE Values** (Sum of Squared Errors):
  - **2 clusters**: 200
  - **3 clusters**: 150
  - **4 clusters**: 100
  - **5 clusters**: 80
  - **6+ clusters**: Marginal improvement, leading to diminishing returns.
- The **4-cluster configuration** achieved a balance between interpretability and compactness.

5. Visual Insights

- **Pairplot**: The clusters were visualized across key dimensions (e.g., Total Transaction Value, Average Transaction Value, and Transaction Count). The clusters are distinguishable, validating the segmentation.
- **Region Encoding**: Encoding regions provided better differentiation among customer groups, improving clustering effectiveness.

6. Recommendations

- Utilize the clustering results to tailor marketing strategies:
  - Focus on **Cluster 0 and 3** for premium, high-value customers.
  - Engage **Cluster 1 and 2** with personalized promotions to encourage higher spending.
- Further refine segmentation by exploring additional customer attributes (e.g., demographics, loyalty scores).
- Consider advanced clustering techniques (e.g., DBSCAN, Gaussian Mixture Models) for potential improvement. This analysis provides a strong foundation for customer segmentation and actionable business insights.