1. The optimal number of clusters: 4.

2. The calculated DB Index for the chosen number of clusters is: 1.22

2.a) A lower DB Index indicates better-defined clusters.

Cluster 0: Customers with high total transactions and quantity purchased.

Cluster 1: Customers with moderate spending across diverse categories.

Cluster 2: Low-activity customers with occasional purchases.

Cluster 3: High-value customers concentrated in specific regions.

3. PCA Plot shows the separation of clusters in 2D space.

Cluster Metrics:

3.1) Average transaction value per cluster.

2) Distribution of regions across clusters.

3) Product categories contributing to each cluster.