

# Clustering Report

## 1. Number of Clusters Formed:

- The optimal number of clusters is determined based on the Davies-Bouldin Index (DB Index). For this dataset:
- Optimal number of clusters: **10**

## 2. Davies-Bouldin Index:

- DB Index measures intra-cluster compactness and inter-cluster separation. Lower values indicate better clustering quality:
- DB Index for optimal clustering: **0.7900283857568402**

## 3. Silhouette Score:

- Silhouette score evaluates how similar each point is to its cluster versus other clusters. Higher values indicate better-defined clusters:
- Silhouette score for optimal clustering: **0.4376314340223128**

## 4. Visualization:

- PCA was used to reduce dimensionality for 2D visualization.
- Clusters are well-separated in the scatter plot, showing clear groupings of customers based on their profiles and transaction behavior.

## 5. Key Insights:

- Customers are grouped based on their transaction value, quantity purchased, number of transactions, and region.
- Cluster-level insights can guide personalized marketing strategies for each segment.
- Higher-spending customers form distinct clusters, highlighting opportunities for loyalty programs or premium offerings.