EV Market Segmentation – Report

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GitHub link: EVMarketSegStatewise

EV Market Segmentation:

India's electric vehicle (EV) market is rapidly evolving due to policy support and increasing environmental consciousness. The widespread adoption of EVs, backed by government subsidies and infrastructure development, is transforming the country's automotive landscape. This report segments the EV market in India using clustering algorithms based on state-wise EV sales data.

Market Analysis

1. Dataset Overview

The dataset included key columns such as:

- Year, Month_Name

- State, Vehicle_Category

- EV_Sales_Quantity

Initial cleaning steps:

- Removed rows with missing values in critical columns

- Resulted in a cleaned dataset: df_clean

2. State-Wise EV Sales Aggregation

- State-wise aggregation was done using:

```
state_sales = df.groupby('State')['EV_Sales_Quantity'].sum().reset_index()
```

- This allowed for understanding which states lead in EV adoption.

3. Feature Scaling

- Since sales numbers had large differences in scale, StandardScaler was applied:

```
scaled_sales = scaler.fit_transform(state_sales[['EV_Sales_Quantity']])
```
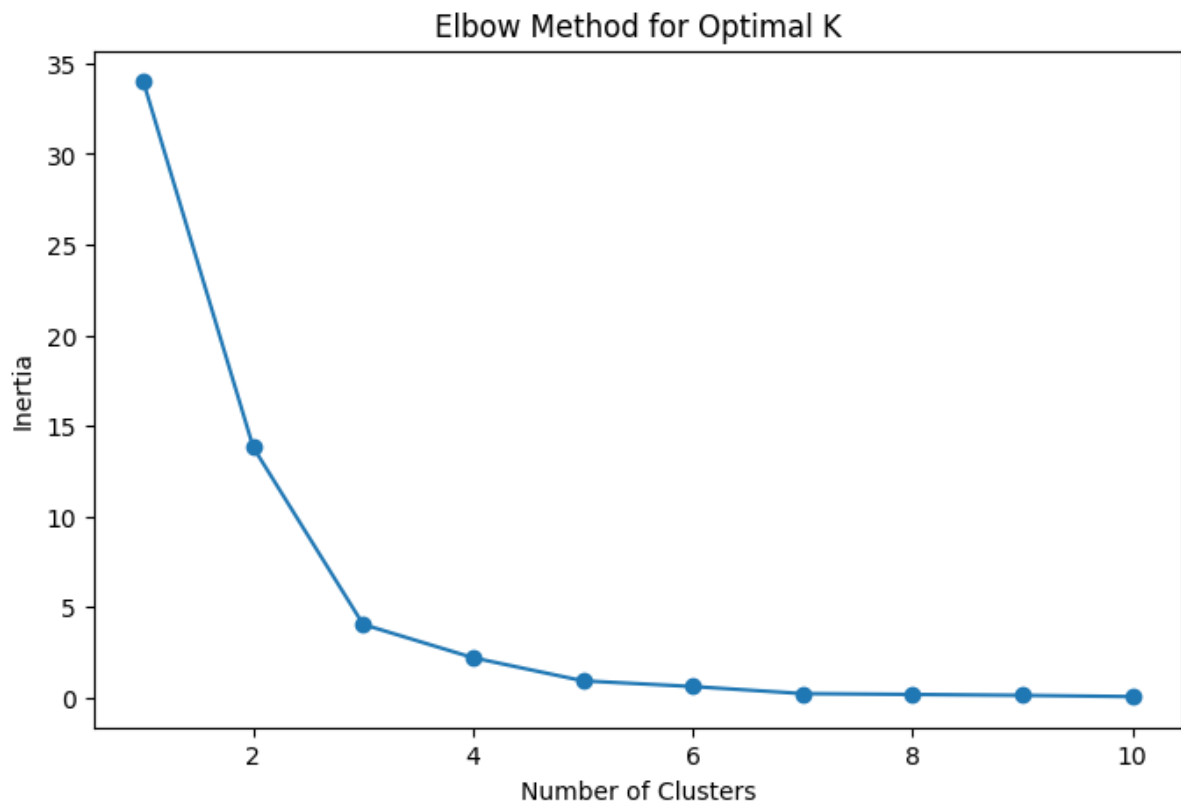
4. Clustering Algorithm – KMeans

- KMeans was used to segment Indian states based on total EV sales.

- Elbow Method (Fig 1) was used to determine the optimal number of clusters:

```
```inertia = []

for k in range(1, 11):

  ...```
```


Fig 1: Elbow Method for Finding Optimal K

- Optimal K selected: **4**

- Final clustering applied:

```
```kmeans = KMeans(n_clusters=4)

state_sales['Cluster'] = kmeans.fit_predict(scaled_sales)```
```
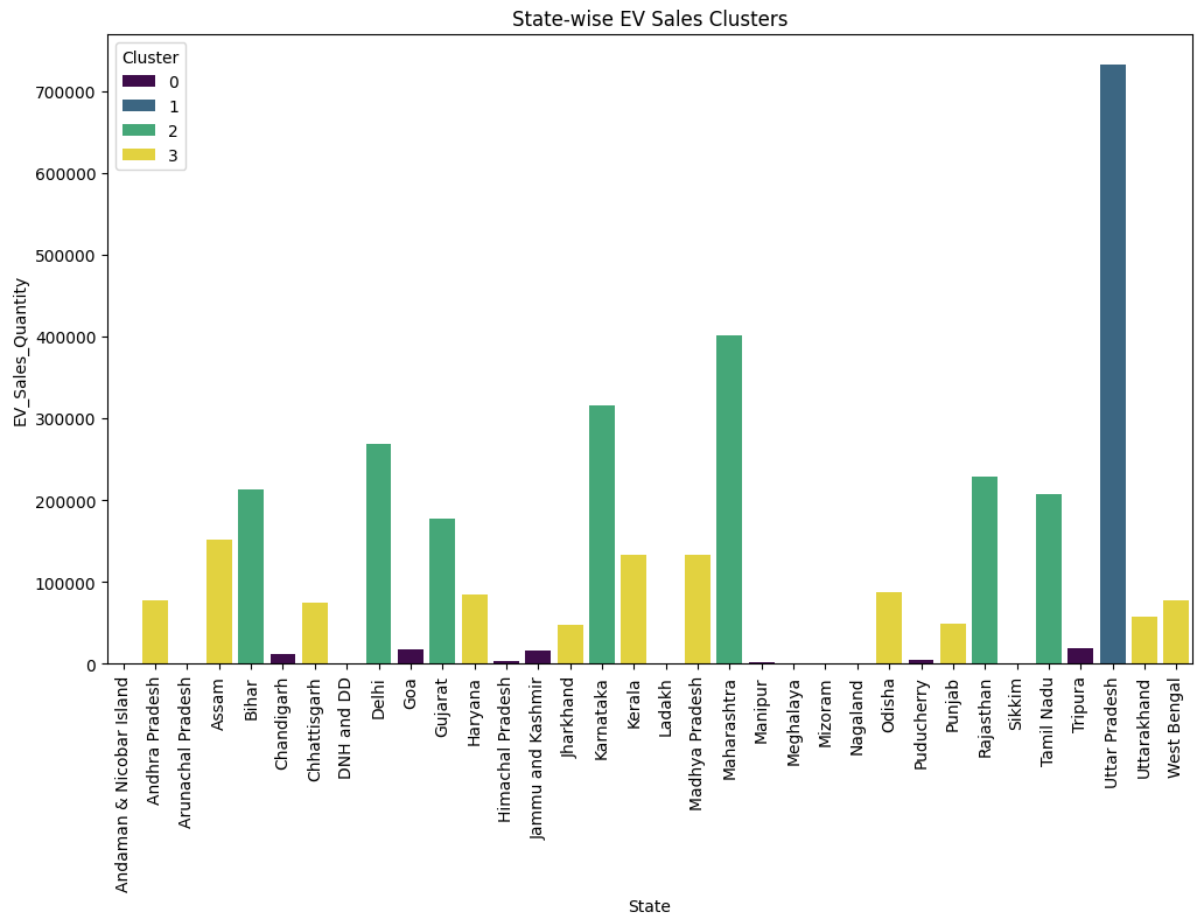
Fig 2: Bar Plot of EV Sales Clustered by State
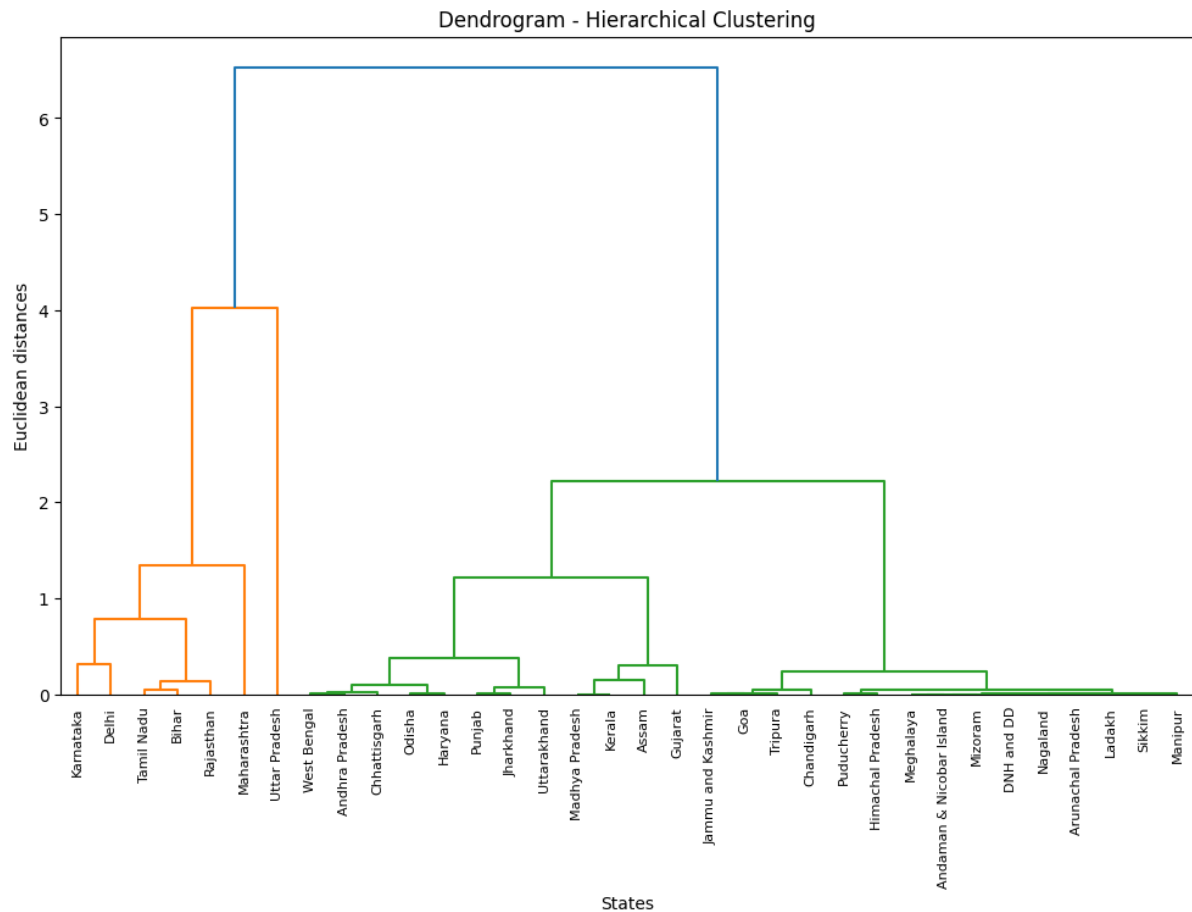
- Clear segmentation shows which states have:
  - High EV sales (Cluster 0)
  - Moderate EV adoption (Cluster 1 & 2)
  - Emerging EV markets (Cluster 3)

5. Hierarchical Clustering & Dendrogram

- Dendrogram generated using scipy:

```linked = linkage(scaled_sales, method='ward')```

dendrogram(linked, ...)

Fig 3: Dendrogram of Hierarchical Clustering

- States grouped by similarity in EV sales
- Offers insight for targeted infrastructure development

Insights

- **Top States by EV Sales:** Uttar Pradesh, Delhi, Maharashtra, Karnataka

- **Cluster 0 States:** Highly EV-ready states with developed infrastructure

- **Cluster 3 States:** Potential markets for EV investment

- **Hierarchical clustering confirms KMeans groupings with minor variations**

Conclusion:

- KMeans successfully segmented Indian states into 4 clusters based on EV sales.

- Strategic policy and infrastructure investment can be prioritized based on cluster results.

- Hierarchical clustering provides additional verification of segmentation.

- EV adoption is concentrated in a few regions targeted policies can help scale nationwide adoption.