GEOGRAPHICAL SEGMENTATION OF EV MARKETS IN INDIA

CONCLUSION

Our project successfully segmented Indian states into four distinct EV market clusters based on two key metrics: **2-Wheeler (2W)** and **4-Wheeler (4W)** electric vehicle sales. Using K-Means clustering, we derived actionable insights that highlight the current state of EV adoption and offer strategic guidance for phased rollouts. The major conclusion is:

Cluster 1 (🔵 High Adoption): These states (e.g., Maharashtra, Delhi) exhibit strong adoption of both 2W and 4W EVs and have mature infrastructure. Ideal for launching EV cars.

Cluster 2 (🟢 Moderate Adoption): States like Tamil Nadu and Gujarat have high 2W sales but moderate 4W sales. These are well-suited for an initial rollout of electric scooters.

Cluster 0 (🔴 Low Adoption): These states show low adoption across the board and are not yet ready for major EV initiatives.

Cluster 3 (🟣 Emerging): These regions are in a very early stage with minimal adoption, showing potential for long-term growth but not immediate action.

These insights enable a **targeted go-to-market strategy** and smarter infrastructure investments.

PROCESS AND TOOLS USED

The project was executed using **Python 3.9** in a **Jupyter Notebook** environment. Below is the step-by-step methodology:

DATA PREPARATION:

Loaded EV registration data (`electric_vehicle_sales_by_state.csv`)

Cleaned and aggregated state-wise data by vehicle category (2W, 4W)

Normalized sales data per 100,000 residents (for fair comparison)

Created pivot tables for clearer analysis

LIBRARIES AND FRAMEWORKS:

`pandas` , `numpy` : Data manipulation

`matplotlib` , `seaborn` : Static data visualization

`scikit-learn` : KMeans clustering and feature scaling

`StandardScaler` : Used to normalize the range of values before clustering

CLUSTERING:

Used the **Elbow Method** to determine optimal number of clusters (k=4)

Applied **KMeans** clustering on 2W and 4W sales data

Assigned cluster labels to each state

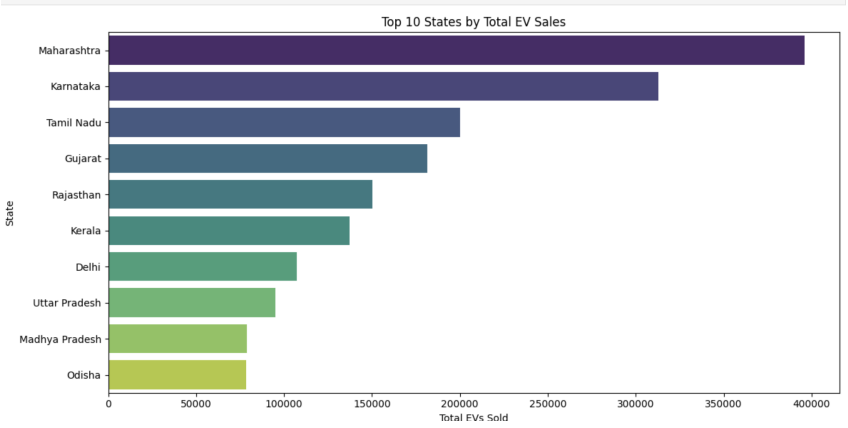
VALIDATION:

Used **scatter plots** to visually validate the clustering

Interpreted clusters based on real-world EV sales performance

GRAPHS AND VISUALIZATIONS

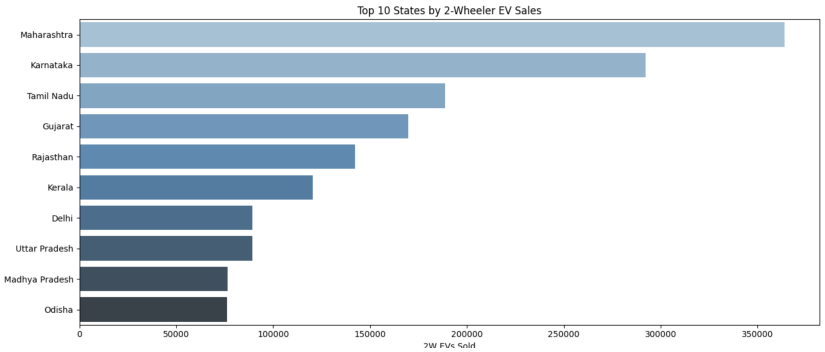
▶️ FIG. 1 – TOP 10 STATES BY TOTAL EV SALES



Highlights leading states in overall EV adoption.

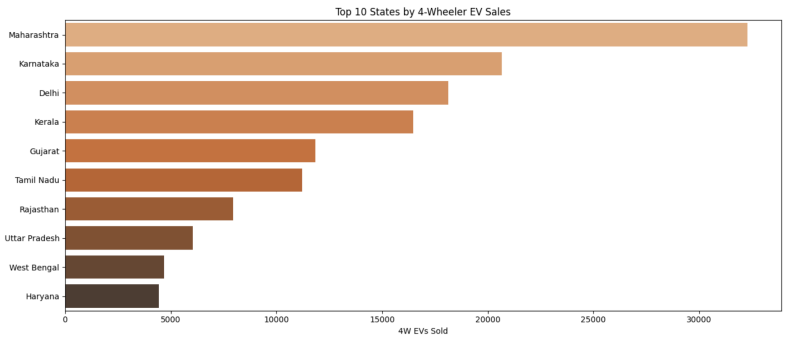
Maharashtra and Karnatak stand out as top performers.

▶️ FIG. 2 – TOP 10 STATES BY 2-WHEELER EV SALES



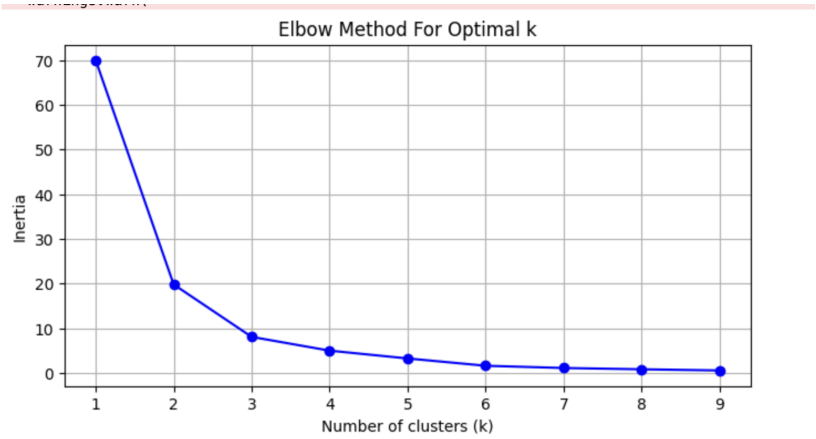
Shows regional focus on scooters, with MH and Karnataka leading.

▶️ FIG. 3 – TOP 10 STATES BY 4-WHEELER EV SALES



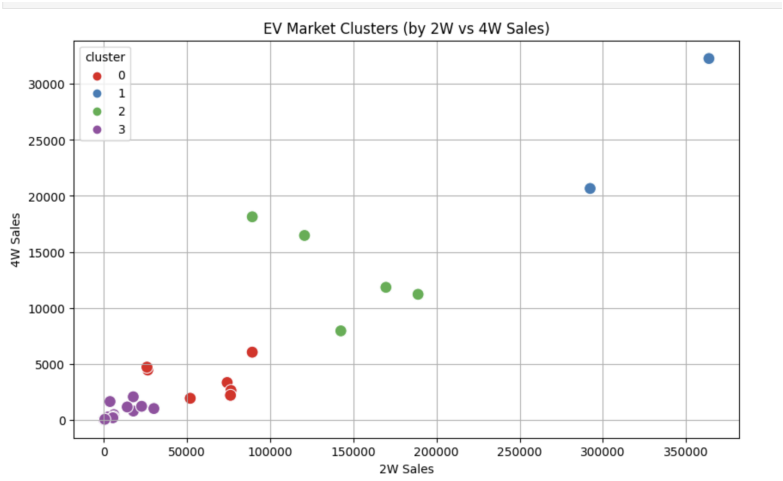
Car EV sales are heavily concentrated in metro regions with solid infrastructure.

▶️ FIG. 4 – ELBOW METHOD TO IDENTIFY OPTIMAL CLUSTERS



Shows that 4 is the ideal number of clusters for this dataset.

▶️ FIG. 5 – CLUSTER SCATTERPLOT (2W VS. 4W SALES)



Visual confirmation of cluster separations and interpretation of EV maturity levels.

BUSINESS SOLUTION & RECOMMENDATIONS

Based on the clustering and market maturity, the following strategy is recommended for a phased EV rollout:

1. CHOOSE THE RIGHT PRODUCT FOR THE RIGHT MARKET

Cluster 2 (Moderate Adoption):

Roll out **Electric Scooters (2W)** in Tamil Nadu, Gujarat, and Delhi.

These markets already show high scooter demand and moderate infrastructure.

Cluster 1 (High Adoption):

Launch **Electric Cars (4W)** in Karnataka and Maharashtra.

These states have strong infrastructure and high EV awareness.

2. DEFINE TARGET CUSTOMERS

Scooter Buyers (Cluster 2):

Age: 20–40

Income: ₹3–6 LPA

Professions: Delivery agents, college students, office commuters

Car Buyers (Cluster 1):

Age: 30–45

Income: ₹8+ LPA

Professions: Tech employees, professionals, fleet owners

3. NEXT STEPS

Pilot Launch:

500 scooters in Tamil Nadu or Delhi

100 cars in Karnataka or Maharashtra

Partnerships:

Collaborate with local governments, ride-hailing companies, and charging station providers.

Performance Metrics to Track:

Monthly sales

Charging station usage

Customer feedback and NPS

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