Electric Vehicle Market analysis

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1. Introduction:

The electric vehicle (EV) market in India has been witnessing significant growth in recent years, driven by an increasing emphasis on sustainable transportation. Many transportation services are adopting EVs as a step toward reducing environmental impact and addressing the limitations of traditional fuels. Embracing this shift presents a promising opportunity to not only contribute to environmental conservation but also position your business at the forefront of a rapidly expanding industry.

2. Market Analysis:

i) EVs now represent 14% of global car sales , with India following a similar upward trend.
ii) Incentives like subsidies and tax reductions from the Indian government are crucial in making EVs more accessible and affordable.
iii) States such as Maharashtra and Karnataka are at the forefront of EV adoption, driven by supportive policies and infrastructure investments.

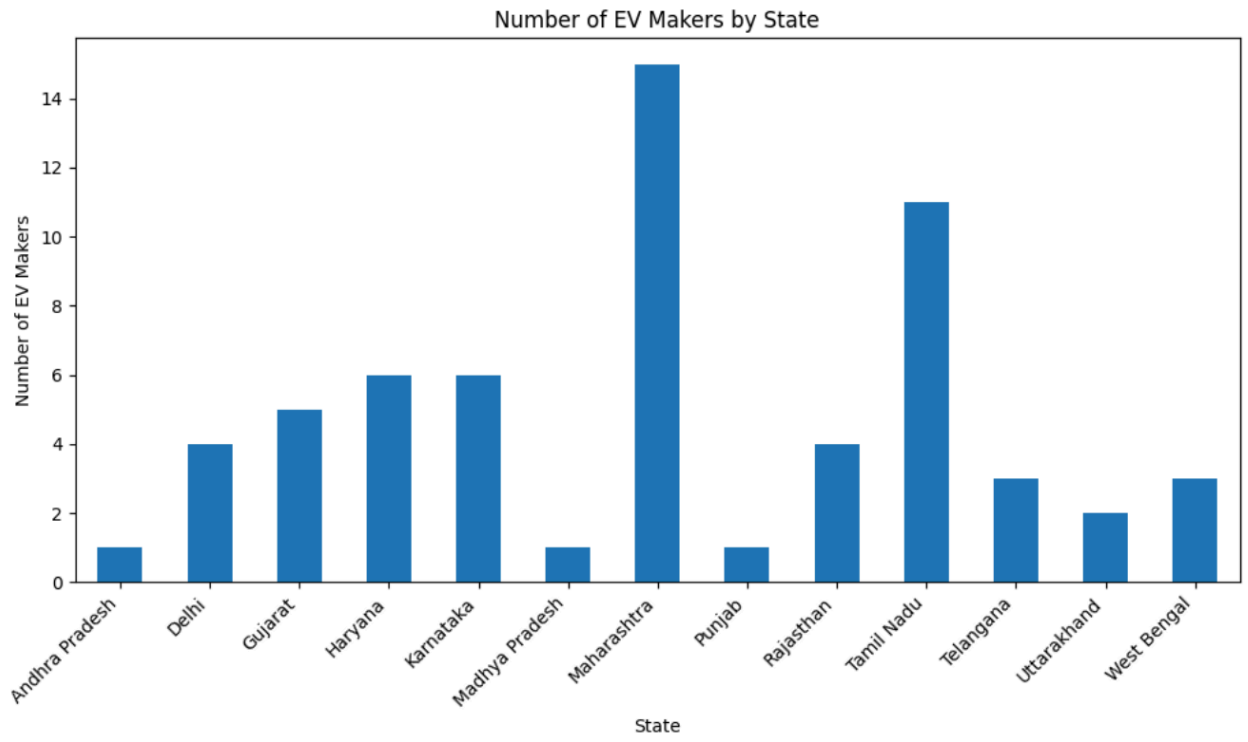
3. **Demographics**:
   a. **Age vs Salary Dist:**
      i) The primary demographic is individuals aged 25-40, mostly professionals with middle-income levels.
      ii) EV manufacturers should focus on creating affordable models that meet the commuting needs of urban dwellers.

   b. **Model Pref**.
      i) People are going for SUVs as they provide versatility and perceived safety.
      ii) Hatchbacks are popular among young professionals in cities, appreciated for their compactness and cost-effectiveness.

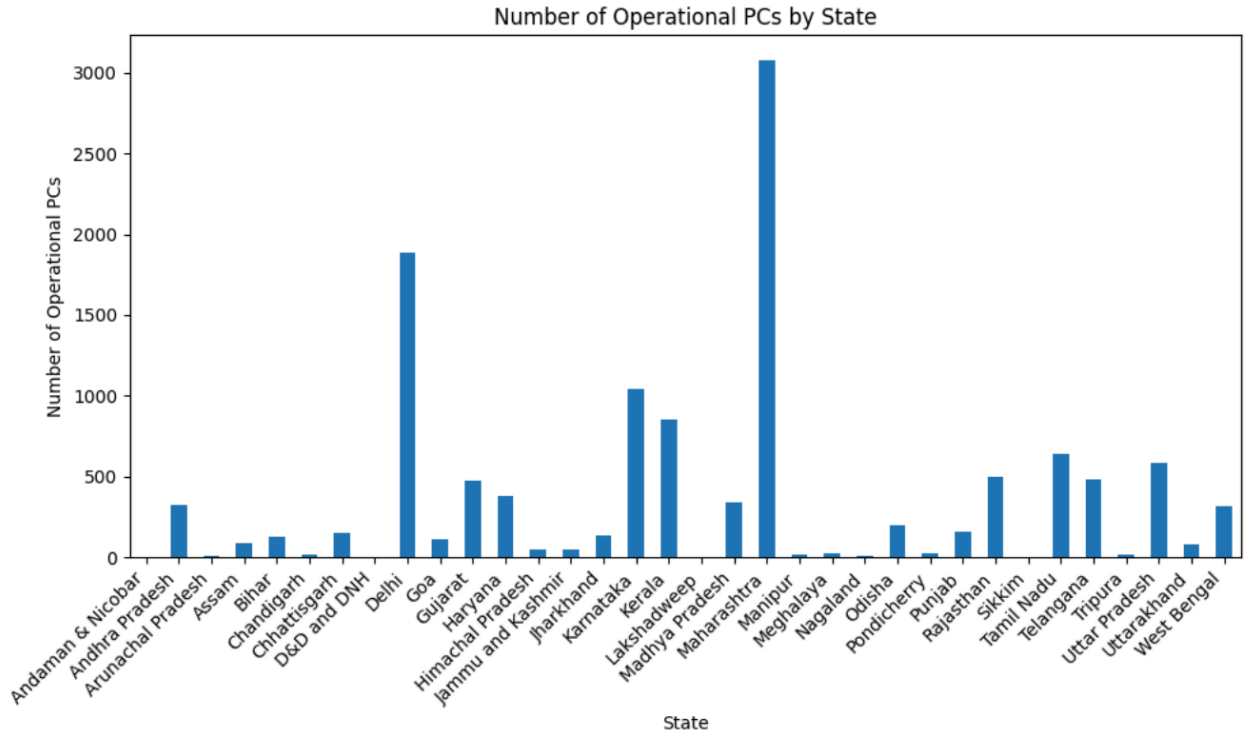
4. **Geographic segmentations**
    a. State-wise Adoption: EV adoption rate also varies state by state in India due to the irregular abundance of the Operational public charging ports.

        i. High Adoption: Maharashtra, Karnataka, and Delhi lead in EV registrations.
        ii. Low Adoption: Regions like Tripura, Bihar, and Assam have lower adoption rates, requiring targeted approaches.

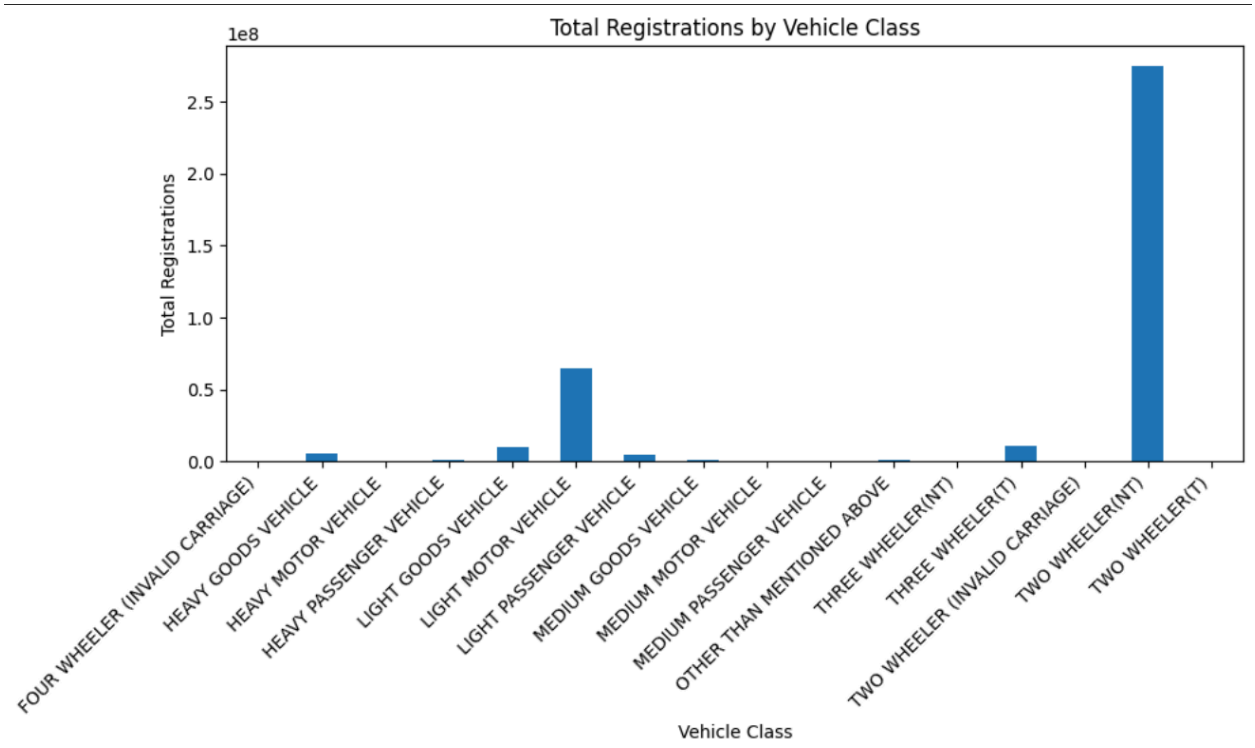
5. **Market Overview and Segmentation**
    To effectively target and serve specific customer segments, it's essential to thoroughly understand their characteristics.
    - **Analysis Approach:** This report uses both numerical and categorical data to segment the market, employing variables such as age, income, profession, and lifestyle factors.
    - **Segmentation Strategy:** The use of K-means clustering reveals distinct market segments based on preferences for EV price and range, helping manufacturers position their products more effectively.

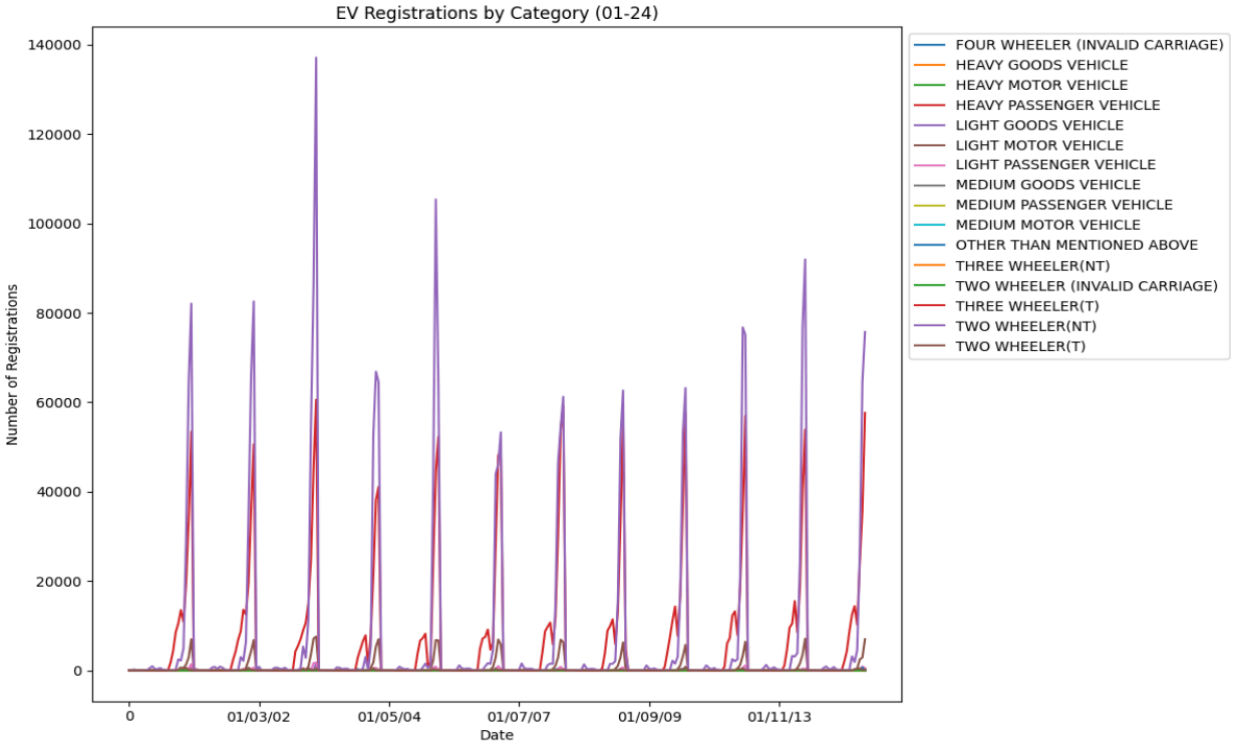


As per the Chart we can see that Maharastra , TamilNadu have the highest number of EV makers in the country



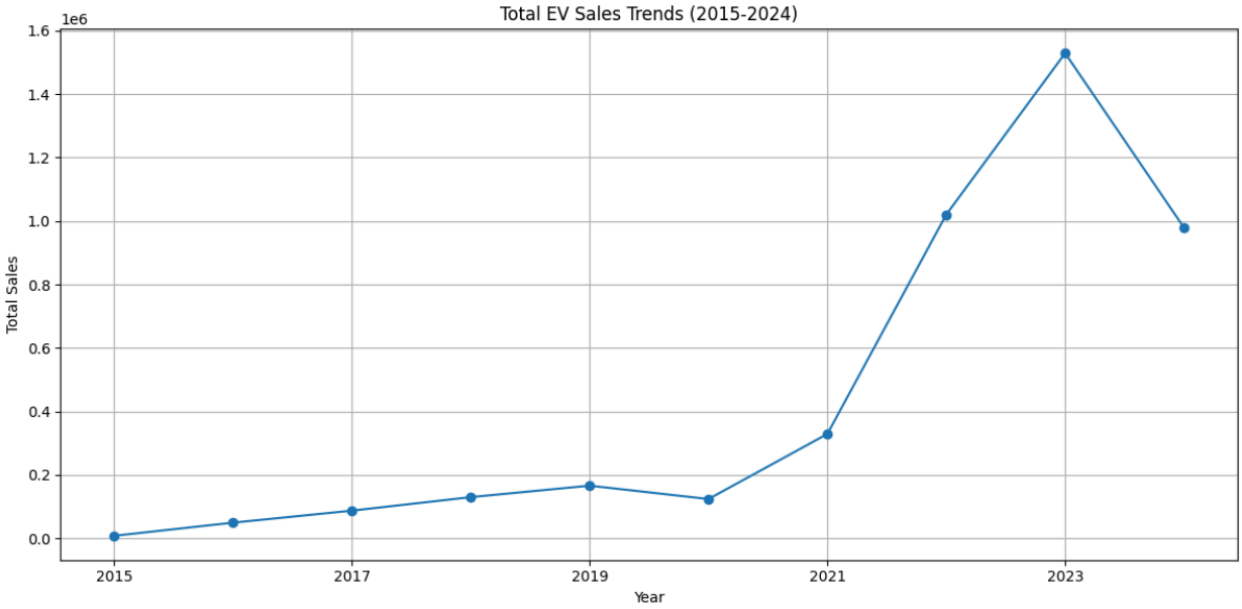
But the Distribution of Operational PCs and the number of EV makers are not matching here , which clearly shows that this is not saturated in our country.

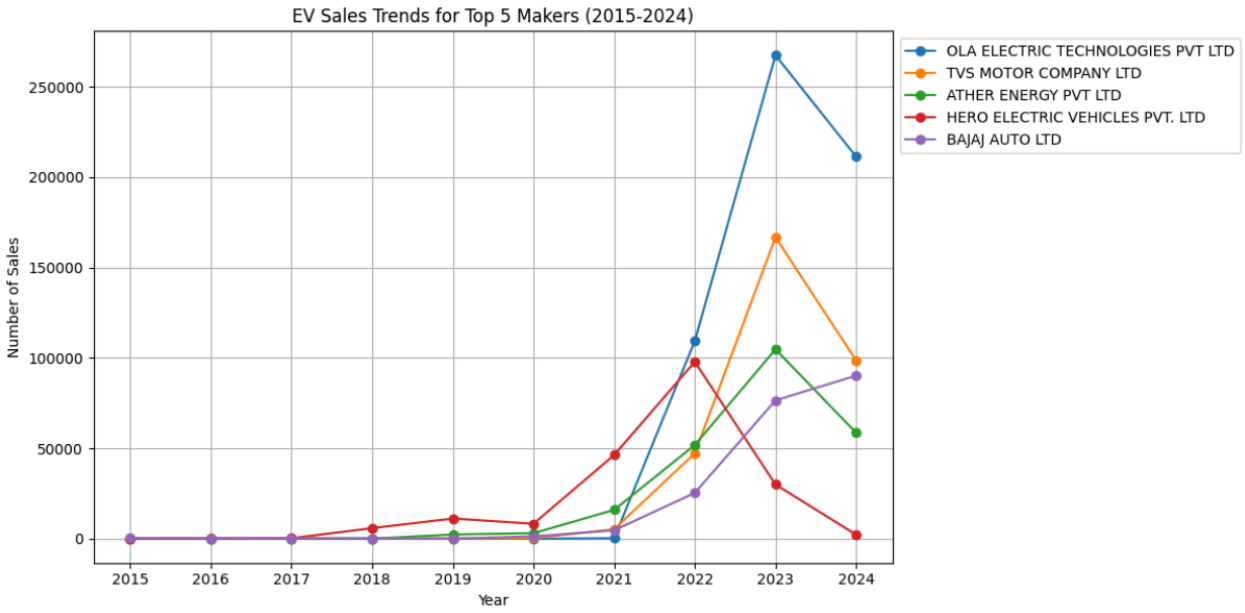




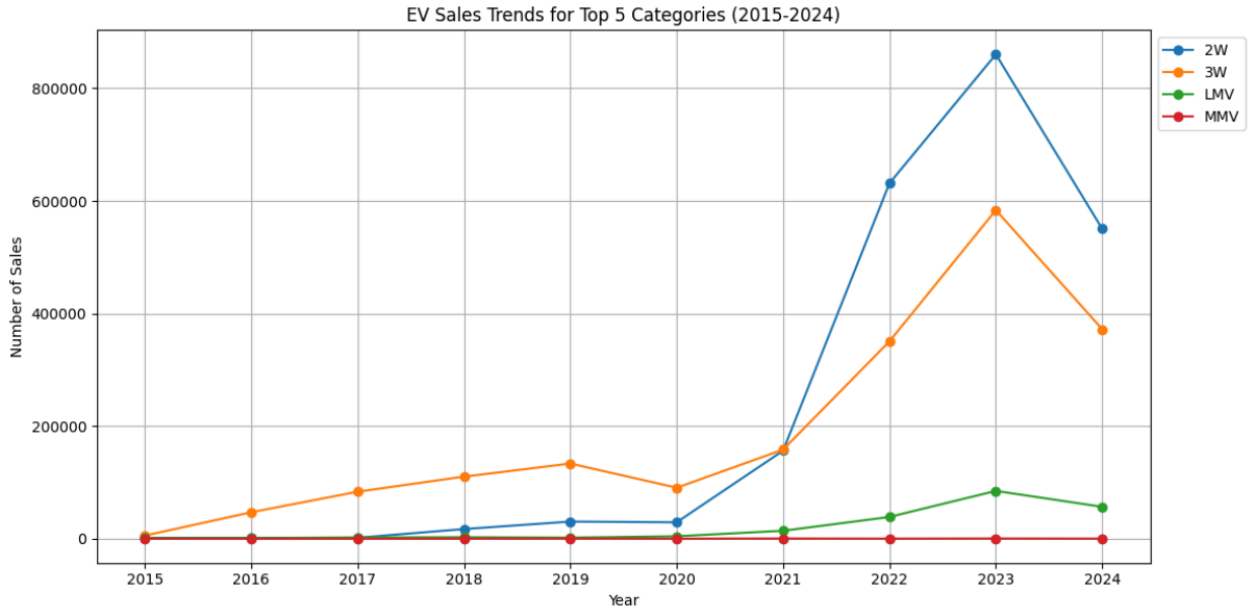
Here we can see the registration of different classes and categories of the vehicles .

The trend of Vehicle sales from 2015 to 2024 is

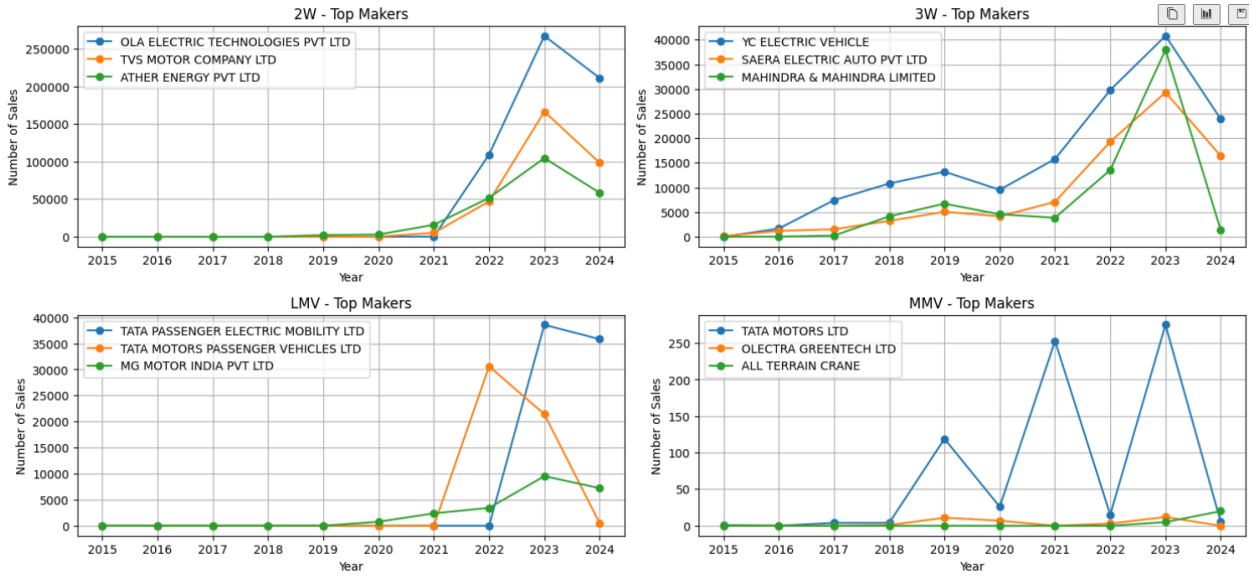




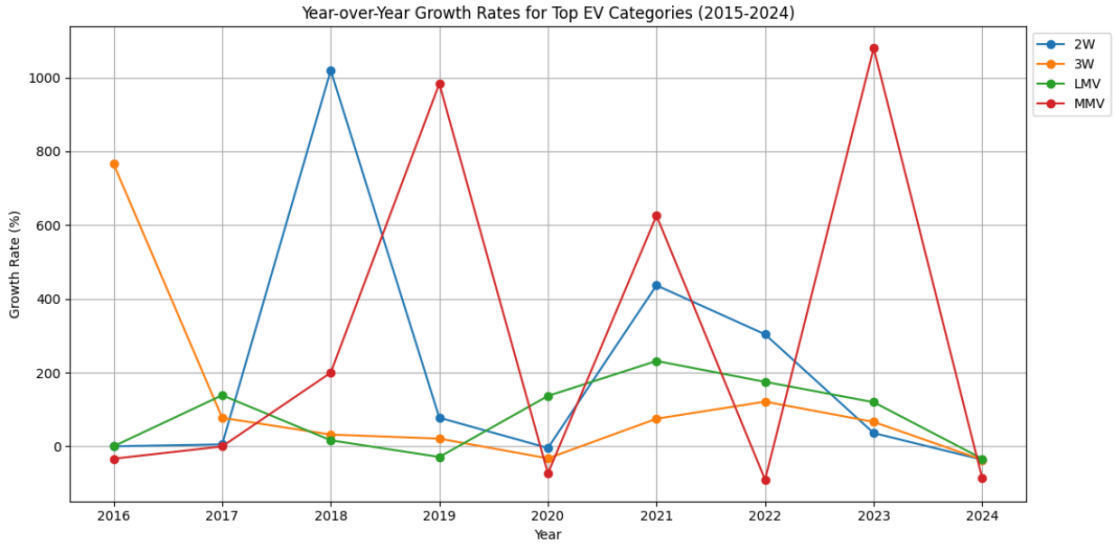
As per the trends we can see the 2 wheeler and 3 wheeler cars getting popularity among the people from 2015 to 2024.

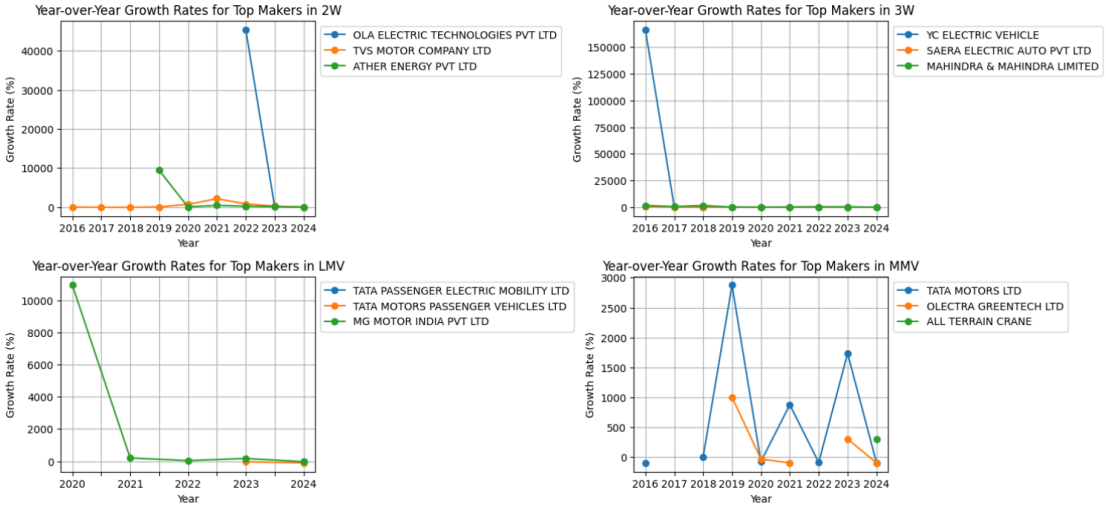


If we see the top maker of EV in the different classes of EV-

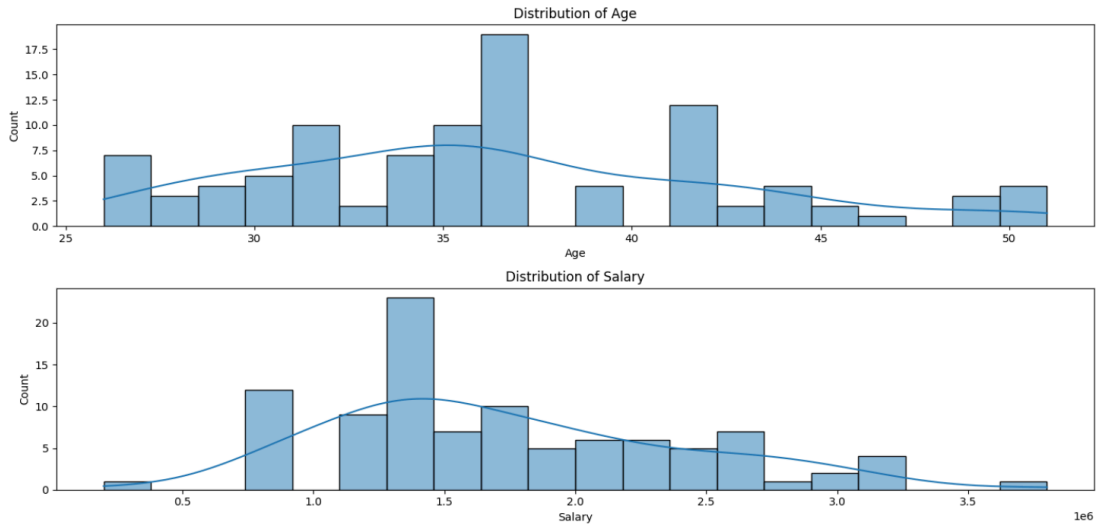


The trend of the growth rate of these classes in the field is not regular ,-



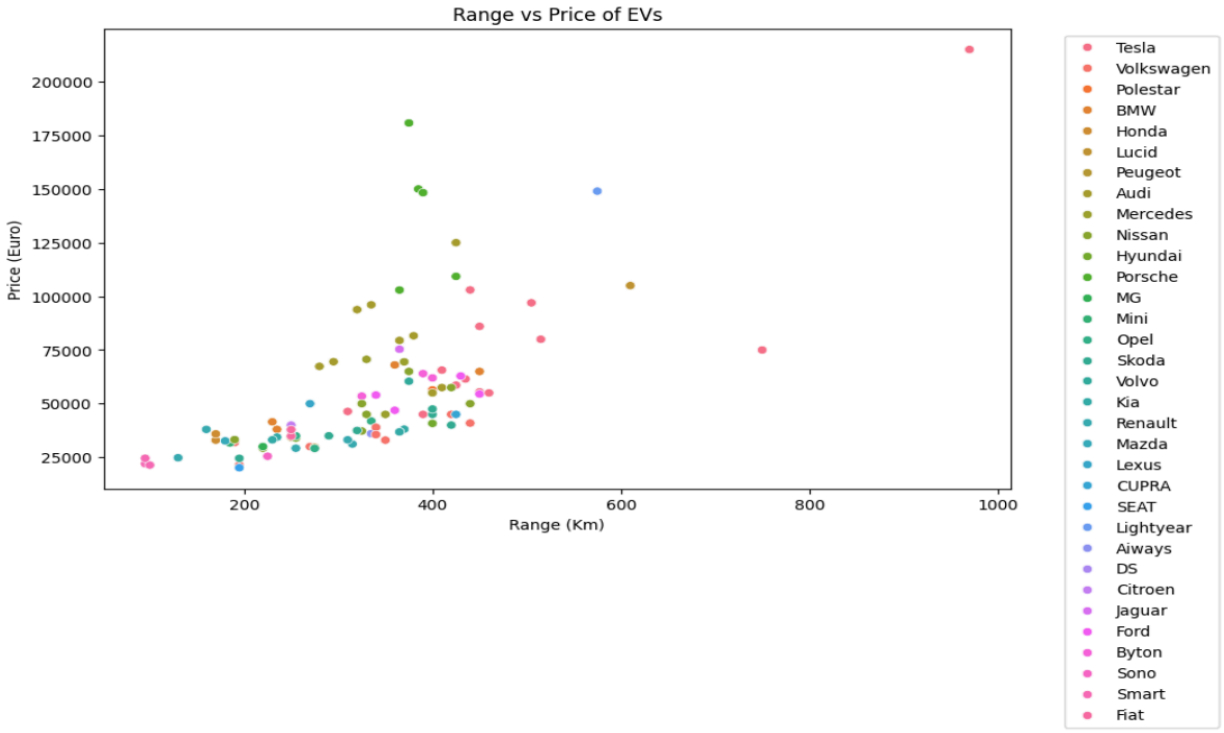


Now if look into the customers age and salary distribution it looks like -



Here we can see the customers are between 30 to 40 and their salary is in between 1 Lakh to 2 Lakh.

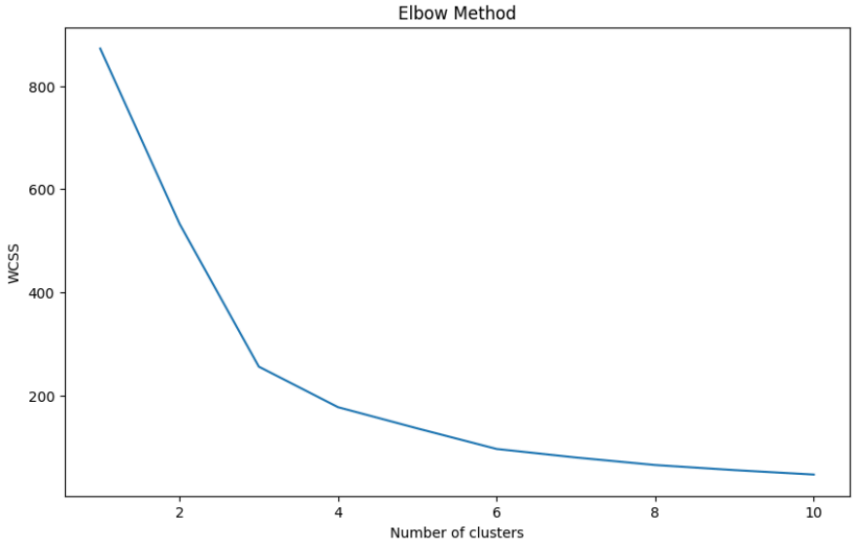
The Range of the car vs price distribution is -

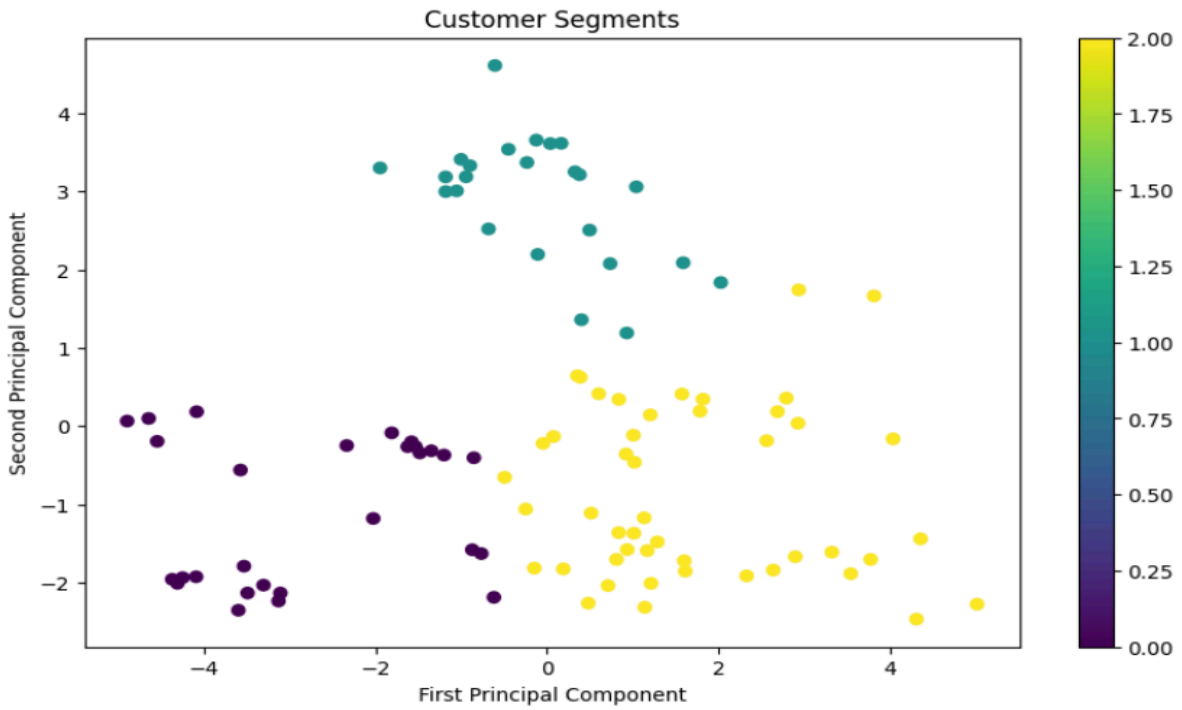


Segment Extraction

K-Means Clustering is one of the most popular Unsupervised Machine Learning Algorithms Used for Solving Classification Problems. K Means segregates the unlabeled data into various groups, called clusters, based on having similar features, common patterns.

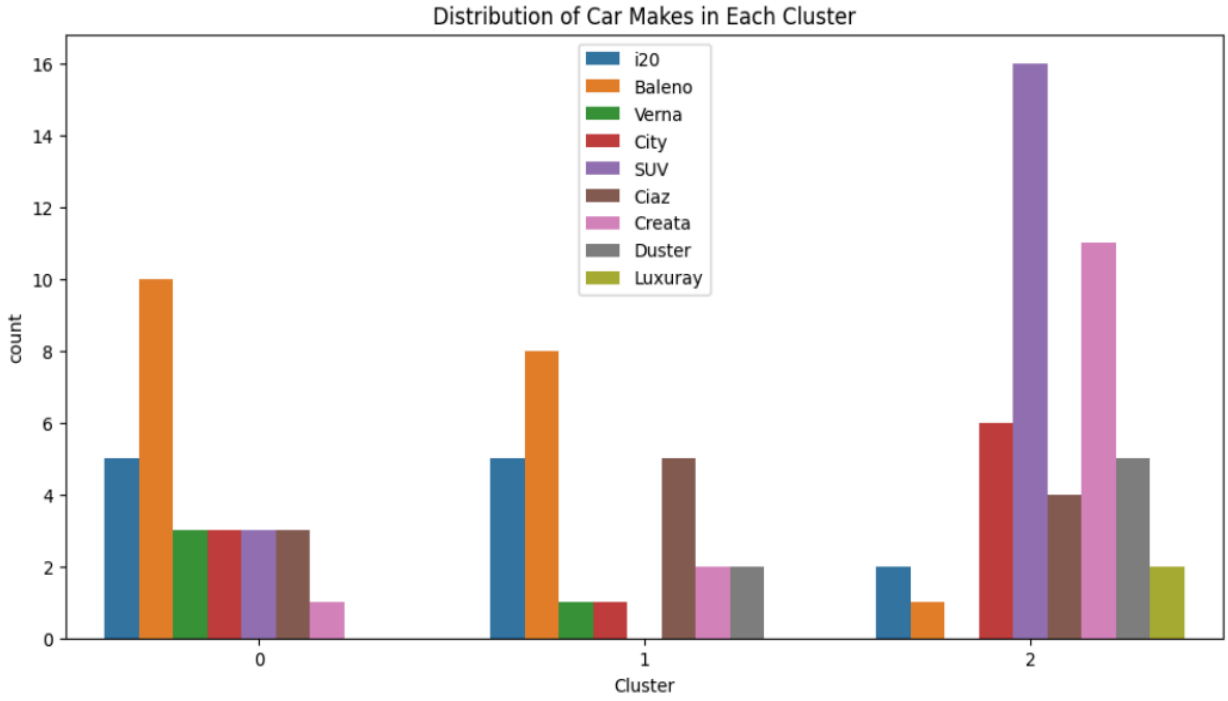
Suppose we have N number of Unlabeled Multivariate Datasets of various features like water- availability, price, city etc. from our dataset. The technique to segregate Datasets into various groups, on the basis of having similar features and characteristics, is called Clustering. The groups being Formed are known as Clusters. Clustering is being used in Unsupervised Learning Algorithms in Machine Learning as it can segregate multivariate data into various groups, without any supervisor, on the basis of a common pattern hidden inside the datasets.
In the Elbow method, we are actually varying the number of clusters (K) from 1-10. For each value of K, we are calculating WCSS (Within-Cluster Sum of Square). WCSS is the sum of squared distance between each point and the centroid in a cluster. When we plot the WCSS with the K value, the plot looks like an Elbow.As the number of clusters increases, the WCSS value will start to decrease. WCSS value is largest when K 1. When we analyze the graph, we can see that the graph will rapidly change at a point and thus creating an elbow shape. From this point, the graph starts to move almost parallel to the X-axis. The K value corresponding to this point is the optimal K value or an optimal number of clusters.





The average silhouette score is: 0.49019348886952613

Now if we see the distribution of the cluster vs car makers then we can get a clear view of the market-



6. **Conclusion**
    - **Market Growth:** The Indian EV market is rapidly expanding, supported by environmental awareness, government policies, and technological advancements.
    - **Consumer Demographics**: The primary market consists of middle income individuals aged 25-40 who prefer affordable, compact EV models.
    - **Vehicle Preferences**: SUVs and hatchbacks dominate consumer preferences, indicating a need for manufacturers to focus on these segments.
    - **Regional Disparities**: Significant differences in EV adoption rates exist between states, with a need for targeted strategies to boost adoption in lagging regions.
    - **Infrastructure Challenges**: The current public charging infrastructure is inadequate, necessitating expansion to support the growing EV population.

7. **Target Segments for EV companies**
    - **Urban Young Professionals**: Focus on producing affordable electric hatchbacks and compact SUVs that appeal to environmentally conscious young professionals in urban areas.
    - **Budget-Conscious Families**: Target middle-income families with affordable, spacious EV models.
    - **Fleet Operators**: Engage with businesses and fleet operators transitioning to electric vehicles to reduce costs and meet sustainability goals.
    - **High-Income Consumers**: Develop premium EVs with advanced features for affluent customers who prioritize luxury and cutting-edge technology.
    - **Regional Focus**: Implement tailored marketing strategies in high potential states while addressing the unique challenges in regions with lower adoption rates

Github Code