Electric Vehicle Market Segment Analysis

Sreehari S

Problem Statement

The task is to apply segmentation analysis to study the Indian market for electric vehicles and provide a workable entry strategy that focuses on the demographic, behavioral, demographic, and geographic groups most likely to use the product.

In this study, we assess the Indian Market for electric vehicles utilizing segments like vehicle type (2-wheeler, 4-wheeler), and manufacturers. Also, a behavioral study is done to understand the groups most likely to purchase the product.

Fermi Estimation

Estimation Overview:

For our Electric Vehicle (EV) market analysis in India, we undertook a Fermi estimation to provide a broad estimation framework based on logical approximations. Below is a possible structure for the Fermi estimation regarding the EV market in India:

Population Estimation:

- Approximating the total population of India, for instance, 1.4 billion.
- Estimating the percentage of the population that owns vehicles, let's assume it to be 10%.
- Deriving the number of vehicles in India based on the population estimate, around 140 million vehicles.

Electric Vehicle (EV) Adoption Rate:

- Estimating the percentage of vehicles in India that are electric, for example, 5%.
- Calculating the number of EVs in India based on the estimated number of vehicles, approximately 7 million EVs.

Charging Infrastructure:

- Estimating the number of public charging stations available in India, let's assume it to be 10,000.

- Assuming an average of 2 private charging points per public charging station.

Government Initiatives and Incentives:

- Considering the various governmental policies and incentives promoting EV adoption, such as subsidies, tax benefits, and similar factors.

Market Growth and Future Projections:

- Studying industry reports and reliable studies to understand the anticipated growth rate of the EV market in India.
- Taking into account factors like technological advancements, cost reductions, and the growing environmental awareness to forecast future projections for the market.

Data Collection

For this project, I have worked with three datasets in order to come into a conclusion.

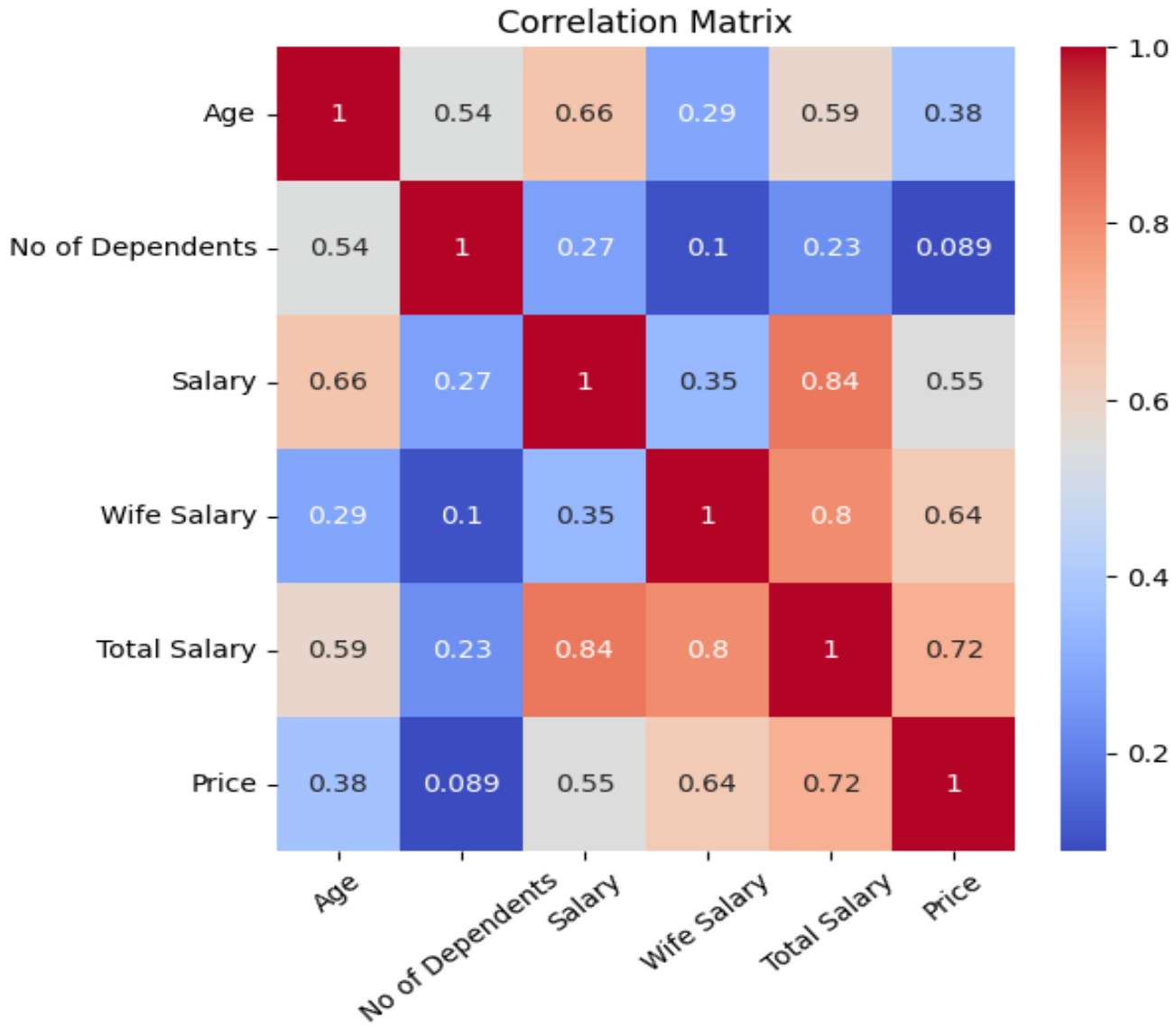
1. Company_wise_sales.xlsx
2. Indian Consumers Cars purchasing behaviour
3. Ev_sales.xlsx

Data Pre-Processing

- I have used Numpy, Pandas for Data Analysis and Manipulation, and Sklearn for preprocessing data.
    - Removed null values from columns
    - Addressed anomalies in the dataset by dropping them and managing column names.
    - Rectifying incorrect values
    - Standardization of data so we can use it more efficiently for K-means clustering.
- Matplotlib and Seaborn libraries were used for EDA.
- Sci-kit learn for training the Machine Learning models

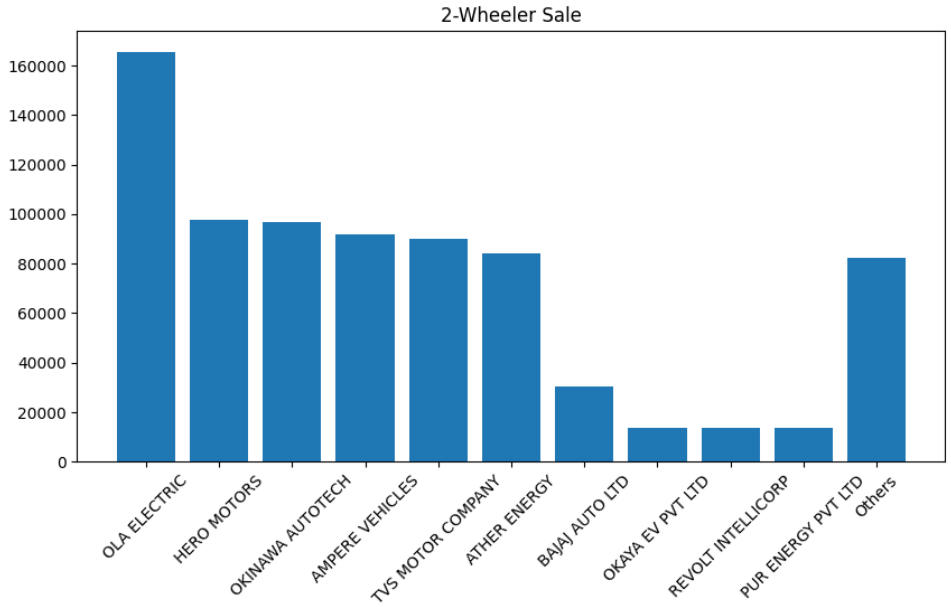
EDA

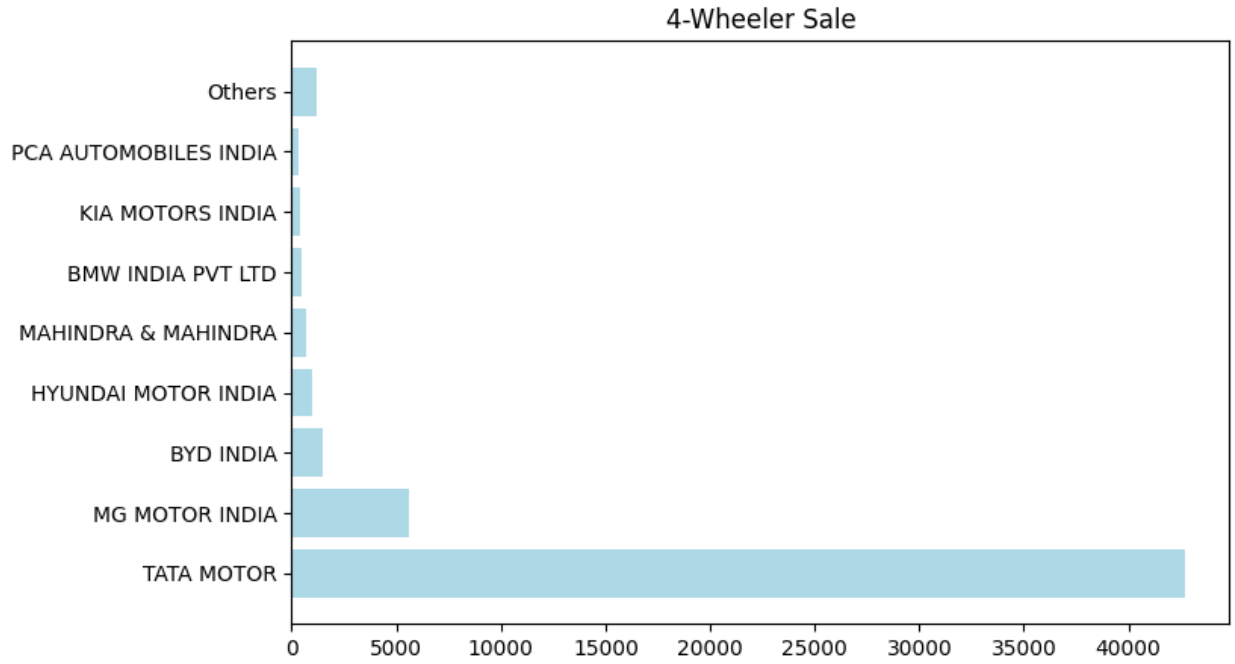
- Visualizing correlation of variables:



Price and number of dependents are highly correlated.

- Manufacturers and Sales

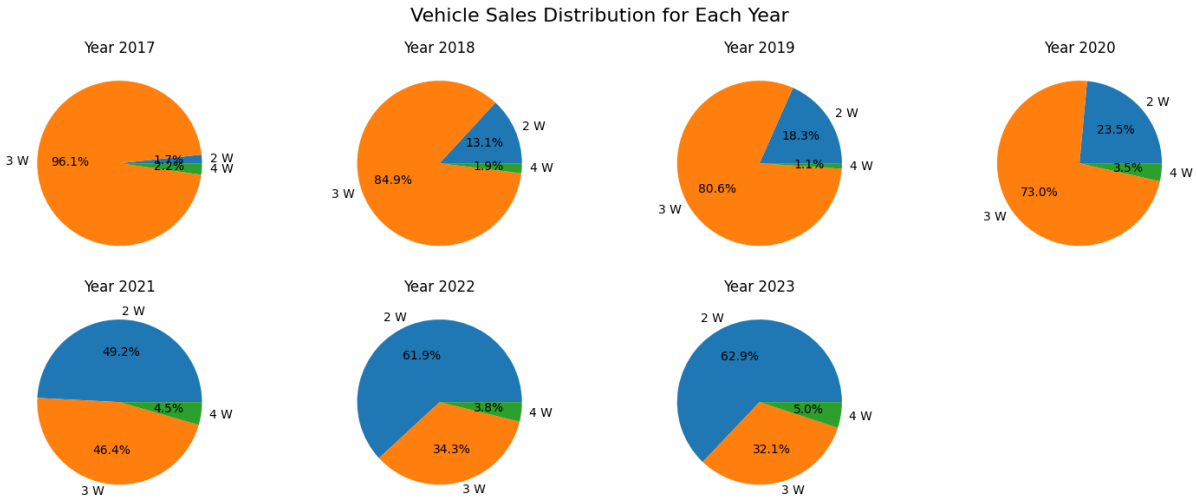




In the electric two-wheeler market, 6 out of 10 companies are performing exceptionally well, with OLA dominating the segment, accounting for approximately 22% of the total sales in India.

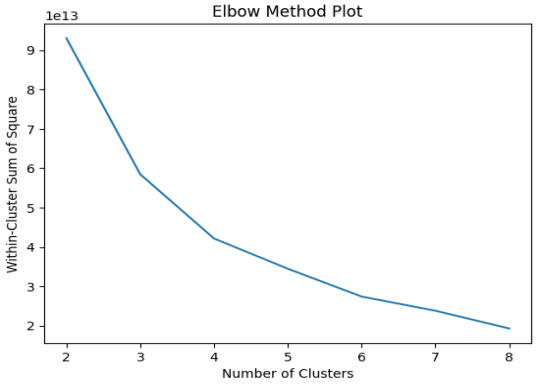
Similarly, in the four-wheeler EV market, MG Motors India and Tata Motors are the key players, with Tata Motors securing a significant share, approximately 80% of the total sales in India.

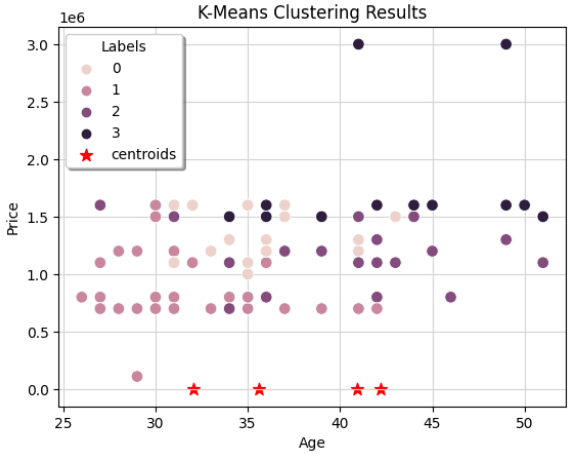
- Vehicle Sales Distribution for Each Year



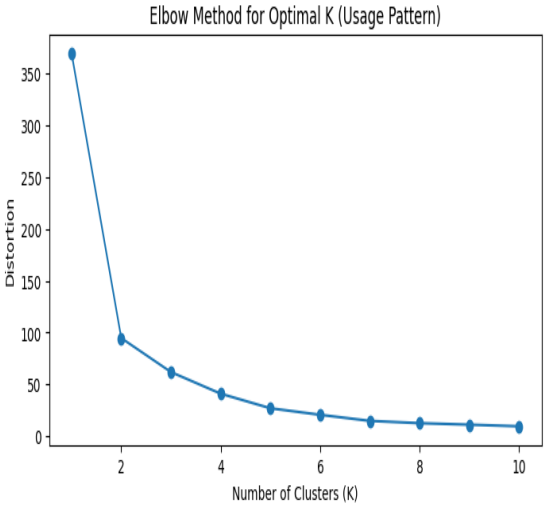
Based on the dataset utilized, the sales trend showed a considerable upturn in 3-wheeler sales in 2017. However, over time, there was a noticeable shift towards 2-wheeler sales. Moreover, the sales of 4-wheelers have shown a consistent upward trajectory.

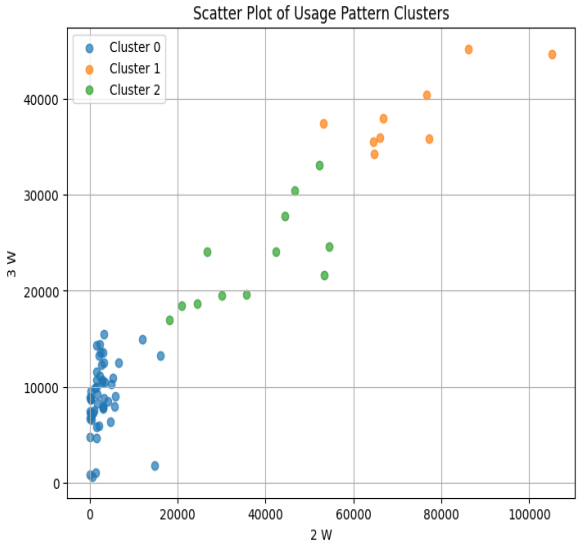
- K-means Clustering





K means clustering on the [Indian Consumers Cars purchasing behaviour] dataset, with the ‘Age’ and ‘Price’ features. Using the Elbow method an optimal number of clusters is obtained following it Scatterplot is used for visualization.





K-means clustering is used to analyze the usage pattern on Ev_sales.xlsx dataset, specifically for the features 2 Wheeler(''2 W') and 3 Wheeler ('3 W').
Initially, an Elbow Method plot is generated to determine the optimal number of clusters (K) based on distortions, indicating that the most suitable value for the clusters is found at K = 3. Subsequently, K-means clustering is performed with three clusters for usage pattern analysis, and the clustered data points are visually represented in a scatter plot. Each cluster is differentiated by its distribution of '2 W' and '3 W' features, demonstrating distinct usage patterns among the clusters.

Segment Extraction

I utilized K-means clustering as a segment extraction method for 2 datasets. KMeans is a clustering algorithm from the sklearn library. It is commonly used in market segmentation to partition customers into different groups or segments based on similarities within data.

EV Market Buying Behavior:

- Young Professionals aged 32 to 38 display a notable interest in EVs.
- Middle-income earners with annual earnings ranging from 800,000 to 3,200,000 significantly contribute to EV purchases.
- Predominant market preference lies in Baleno and SUV models among EV buyers.
- Advanced educational qualifications correspond to a stronger value for sustainability and modern technology, indicating a greater awareness of EV benefits.

Customizing the market mix

The marketing mix for Electric Vehicles (EVs) focuses on four key elements: Price, Product, Promotion, and Place.

- **Price:** Affordability is a critical challenge hindering EV expansion. Optimal pricing between 10 to 20 lakh aligns with the preferred range of potential buyers, ensuring cost-effectiveness in both purchase and maintenance.

- **Product:** Manufacturers should diversify their EV offerings, catering to varied psychographic segments. Luxury, practical, budget-friendly, and environmentally-conscious EVs should be available to address the diverse preferences of consumers.

- **Place:** Developing a robust distribution strategy is essential. This includes dealership partnerships, urban charging infrastructure, and home charging solutions to accommodate convenience-oriented buyers.

- **Promotion:** Tailored promotional strategies are key. Targeted social media campaigns, influencer marketing, and specific event sponsorships cater to the distinct interests of each psychographic segment. For example, environmental events for eco-conscious consumers or tech fairs for tech-savvy buyers.

Most Optimal Market Segments

In the Indian Electric Vehicle (EV) market, finding the best customer groups means picking those that are most likely to widely embrace and succeed with EVs. These groups often share certain features:

- They have a strong interest in EVs.
- They can afford EVs.
- They're a good fit for EVs in terms of their lifestyle or business.

GitHub Link

https://github.com/sree-hari-s/EV-Market-Segmentation