Electric Vehicle Market Segmentation

Submitted by

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Abstract:

The electric vehicle (EV) market in India is rapidly evolving, driven by factors such as environmental concerns, government incentives, and technological advancements. This report presents a comprehensive analysis of market segmentation strategies for EVs in India, aiming to provide insights into key consumer segments and their preferences.

The analysis begins with an overview of the EV market landscape in India, including current trends, market size, and growth projections. The analysis incorporates a multi-dimensional approach, including demographic, geographic, psychographic, and behavioral segmentation criteria.

Demographic segmentation examines variables such as age, income levels, education, and geographic location to identify target customer groups. Psychographic segmentation explores consumer lifestyles, values, and attitudes toward sustainability, technology adoption, and transportation preferences.

Behavioral segmentation assesses purchasing behavior, including awareness of EVs, purchase intent, brand loyalty, and decision-making criteria. Additionally, the report considers the influence of external factors such as government policies, infrastructure development, and competitive dynamics on market segmentation.

Key findings from the analysis reveal distinct customer segments within the Indian EV market, such as urban commuters, fleet operators, eco-conscious consumers, and tech enthusiasts. Each segment exhibits unique characteristics, including age demographics, income levels, geographic distribution, purchase preferences, charging behavior, and brand loyalty.

The segmentation analysis facilitates the identification of market opportunities, challenges, and trends within the Indian EV market landscape. It also guides the development of targeted marketing strategies, product positioning, pricing models, distribution channels, and customer engagement initiatives tailored to each segment's specific needs and preferences.

Introduction:

The EV market in India has witnessed significant growth in recent years, propelled by increasing awareness of environmental sustainability, rising fuel prices, and government incentives to promote electric mobility. The adoption of EVs is seen as a strategic imperative to reduce carbon emissions, enhance energy security, and transition towards cleaner transportation solutions.

As the world moves towards a cleaner, greener future, the role of EVs in reducing carbon emissions, enhancing energy security, and promoting economic resilience has gained prominence. India's commitment to promoting electric mobility, as evidenced by initiatives such as the Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme, make in India campaign, and infrastructure development efforts, underscores the country's potential as a key player in the global EV market.

The Indian government has introduced various policies and incentives to support the EV ecosystem, including subsidies, tax benefits, infrastructure development grants, and favorable

regulatory frameworks. Initiatives like the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme aim to accelerate EV adoption and localization of EV manufacturing in India.

Advancements in EV technology, particularly in battery efficiency, range, and charging infrastructure, are driving increased consumer confidence in EVs. The emergence of domestic and international players in the EV market has led to a diverse range of electric vehicle models across segments, catering to different customer needs and preferences.

The EV market segmentation analysis aims to dissect the Indian market into distinct customer segments based on demographic, geographic, psychographic, and behavioral criteria. This segmentation approach allows for a deeper understanding of consumer behaviors, purchase motivations, usage patterns, and brand preferences within the EV ecosystem.

Objectives:

The primary objectives of the EV market segmentation analysis in India are to:

- Identify and profile key customer segments within the Indian EV market.

- Understand the unique characteristics, needs, and preferences of each segment.

- Evaluate market opportunities, challenges, and trends for EV adoption.

- Develop targeted marketing strategies, product offerings, and customer engagement initiatives.

- Inform strategic decision-making for industry stakeholders, policymakers, investors, and businesses operating in the Indian EV market.

Data Sources:

Datasets used for this study are obtain from different data sources which are as follows:

https://www.kaggle.com/datasets/atom1991/electric-vehicle-2023

https://github.com/Preetivasaikar05/EV_Customer_Segmentation/blob/main/EV_Data.csv

https://github.com/Rohit-Rannavre/Feynn-Labs-Internship-2022/blob/main/Project%202.1%3A%20Market%20Segmentation%20of%20Electric%20Vehicles%20in%20India/Datasets/3_ev_market_india_dataset.xlsx
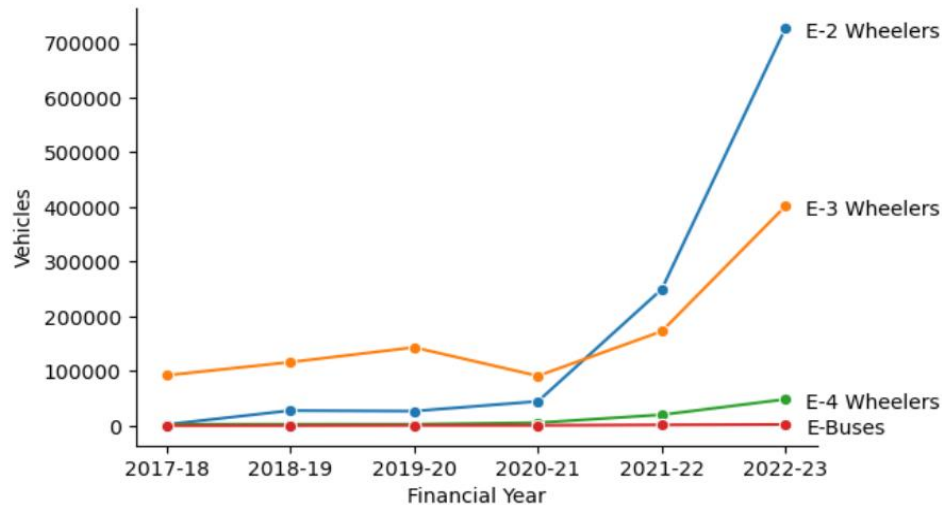
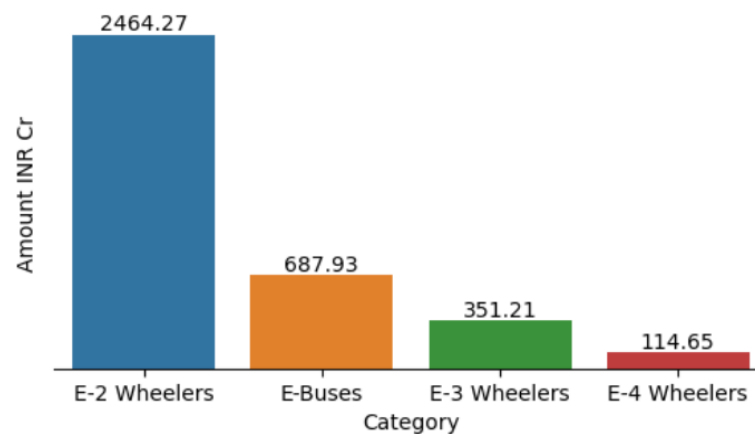https://github.com/kavita07lamani/EVS-indian-market-data-set

I. Samiksha Band

1.0 Segment Extraction:

1.1 Using Sales Data:

The following figure showcases the sales data for the years 2017 to 2023, highlighting the remarkable growth trajectory of India's two-wheeler market in 2023 and underscoring its leading position within the industry.
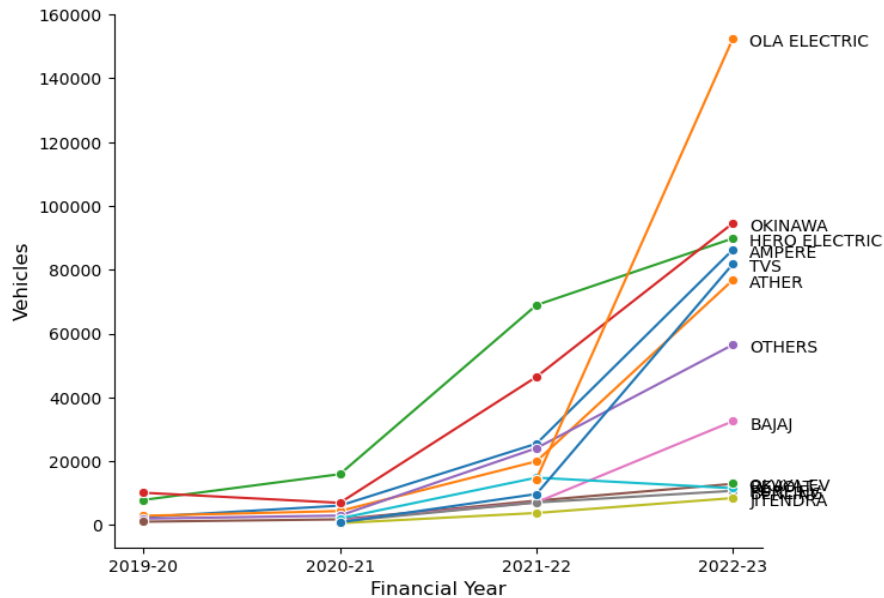

Fig 1.1. India's EV Market

Fig 1.2 India's electric vehicle industry in crores

Figure 1.2 delves into the market's financial perspective, representing the industry's total value in crores. Notably, two-wheelers emerged as the primary revenue generators, highlighting their economic significance.

Fig 1.3 Top electric two-wheeler companies

Figure 1.3 focused on specific electric two-wheeler companies, highlighting Ola Electric as the market leader in 2023. This illustrates their industry leadership and competitiveness in the market.

After conducting a thorough analysis of these figures, it became clear that the electric two-wheeler segment is the most promising area for our detailed study. Its strong growth, revenue dominance, and market leadership collectively indicate its significance and potential, making it the ideal focus for our detailed study.

1.2 Using k-Means:

Figure 1.4, revealing a distinct elbow at four segments. This marked point indicates a substantial reduction in distances, signifying the optimal number of segments for our analysis. By incorporating insights from these analyses, our focus remained finely tuned on the electric two-wheeler segment, ensuring precision and relevance in our market segmentation approach.
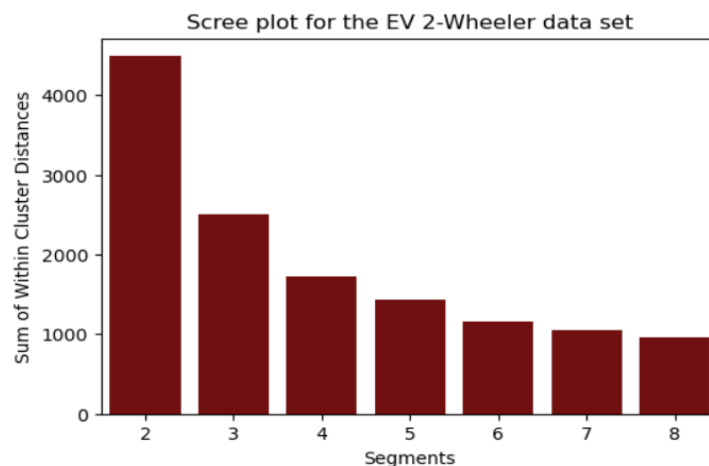
**Figure 1.4 Scree plot for the electric vehicle data set**

2.0 Profiling Segments:

This section provides an in-depth analysis of our consumer segments, as depicted in Figure 2.1. The graph visually encapsulates the varied perceptions among different segments. Segment 0, comprising 15% of consumers, places value on the electric two-wheeler for its visual appeal, reliability, performance, service experience, and comfort. In contrast, Segment 1 (39% of consumers) expresses dissatisfaction across all aspects, making them the largest but least satisfied group. Segment 2 (33% of consumers) appreciates the visual appeal, reliability, service experience, and comfort, and notably, perceives a strong value for money. Lastly, Segment 3 (13% of consumers), the smallest segment, values visual appeal, reliability, performance, service experience, extra features, and maintenance cost, showcasing distinct perceptions, particularly regarding features and costs.
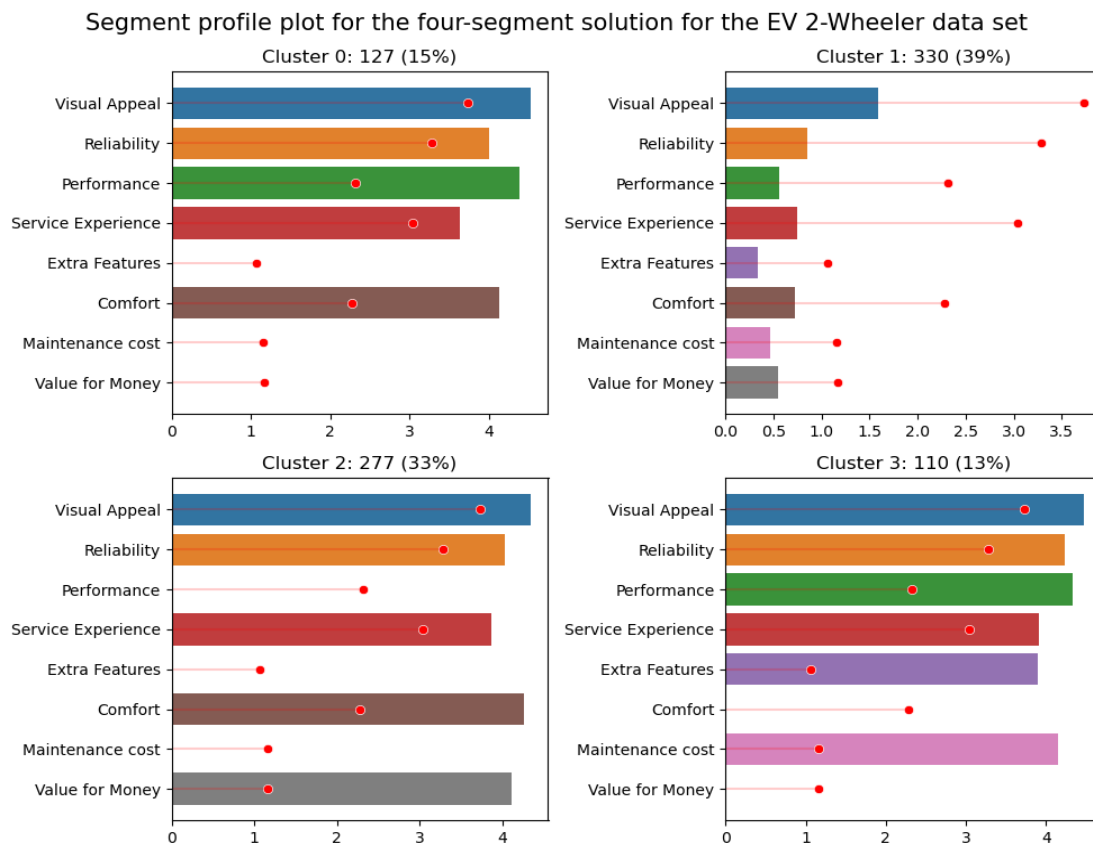
**Fig 2.1. Segment profile plot for the four-segment solution**

Figure 2.2, utilizing principal components, further emphasizes these differences. Notably, Segment 1, despite being the largest segment, lacks specific opinions, making them unique in their lack of satisfaction.
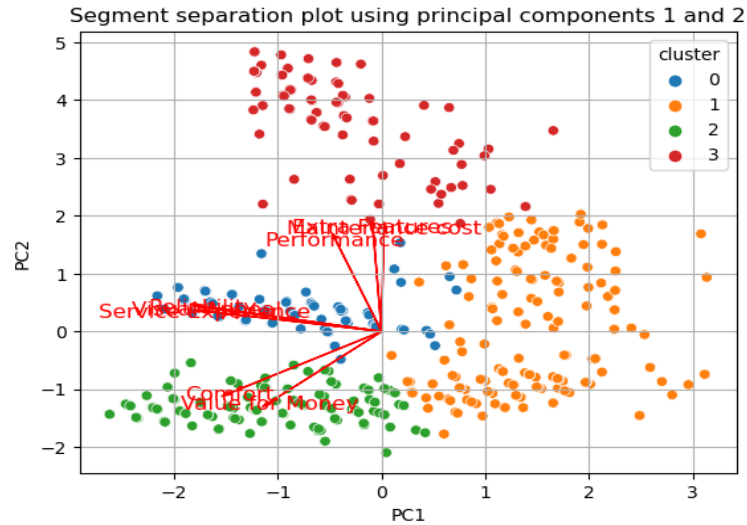
**Figure 2.2. Segment separation plot using principal components 1 and 2**

3.0 Describing Segments:

Figure 3.1 explores consumer sentiments, revealing that all segments, except Segment 1, exhibit positive sentiments. Segment 1 consumers stand out with negative sentiments, indicating dissatisfaction across various aspects.
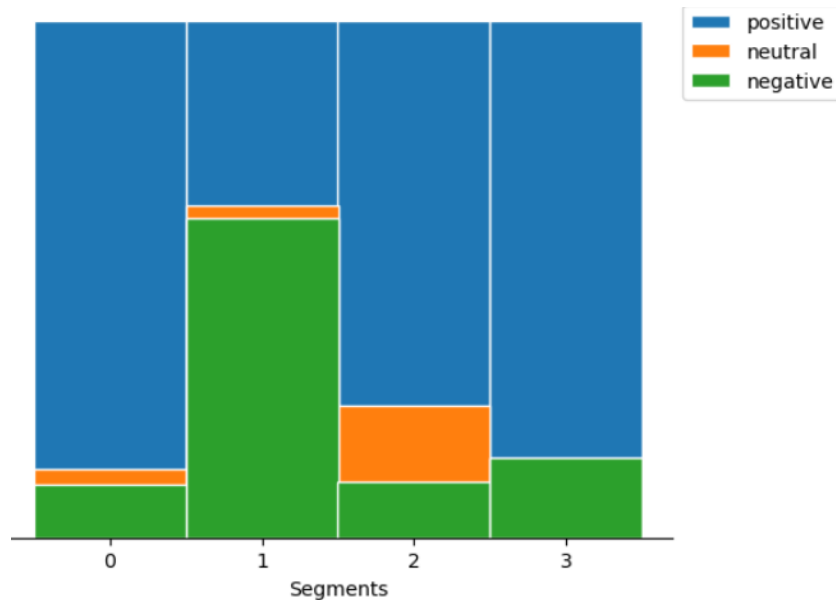

Figure 3.1 Mosaic plot displaying consumer sentiments towards electric vehicles

In Figure 3.2, the mosaic plot illustrates that all segments predominantly use electric vehicles for daily commuting, with limited usage for tours, occasional commuting, and leisure rides.
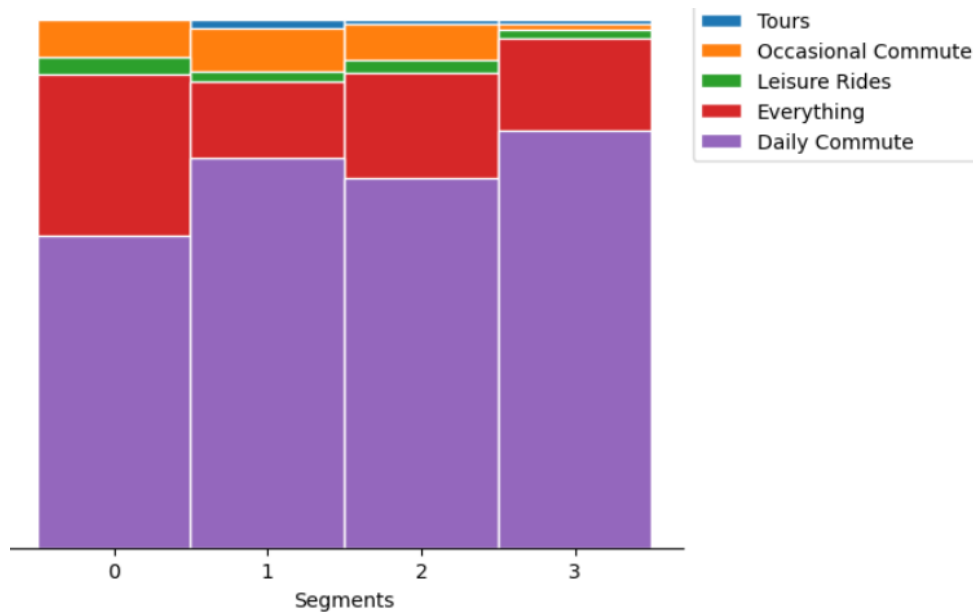
Figure 3.2. Mosaic plot showcasing electric vehicle usage patterns across segments

In Figure 3.3, the plot delineates the ownership duration of electric vehicles among segments. Segment 1 stands out, owning electric vehicles for more than a year, while Segment 0 has no prior ownership experience. Segment 2 members moderately own vehicles ranging from less than 3 months to over a year, and Segment 3 consumers have owned electric vehicles for a few days to less than 3 months.
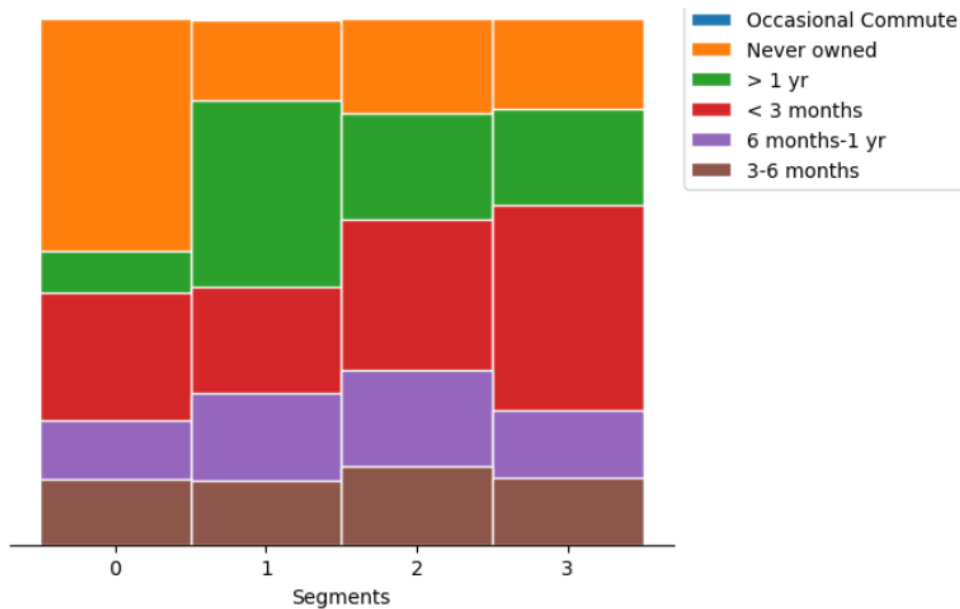
**Fig 3.3 Mosaic plot depicting the ownership duration of electric vehicles across segments**

Figure 3.4 delves into the distances covered by consumers, indicating that all segments predominantly use electric vehicles for commuting, with most users covering distances below 5000 kms. A small portion falls in the 5000 to 10000 kms range, aligning with their commuting needs.
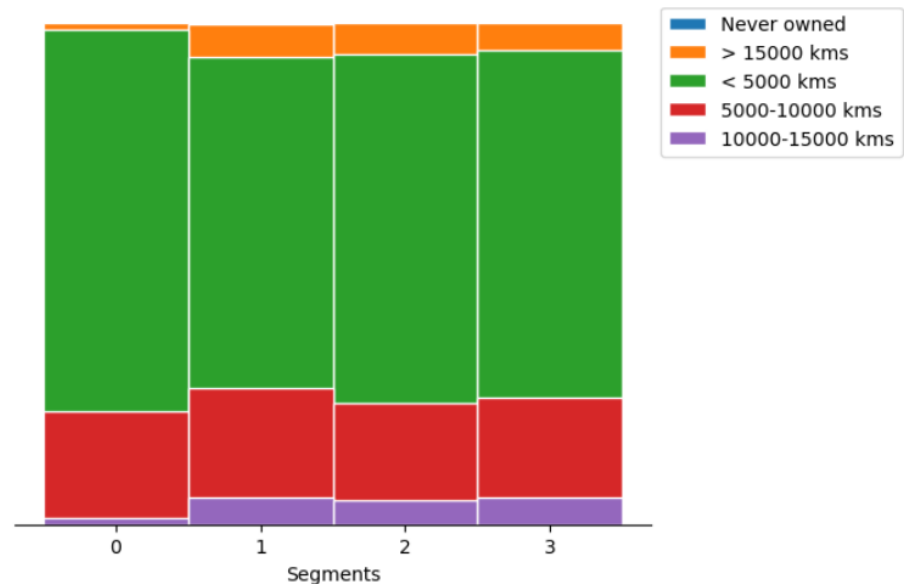

Fig 3.4 Mosaic plot outlining consumers distance covered by consumers on ev

Figure 3.5, a parallel box and whisker plot, emphasizes significant differences in average ratings among segments. Specifically, Segment 1 consumers express dissatisfaction across all perceptions, leading to lower overall ratings. These graphical representations offer nuanced insights into consumer behaviors, sentiments, and preferences, guiding our strategic decisions for a more tailored approach in the electric vehicle market.
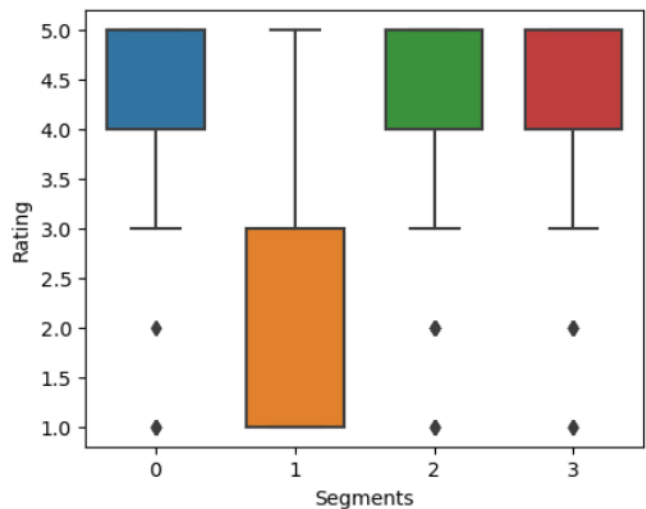
Figure 3.5 Parallel box-and-whisker plot showcasing consumer ratings across segments

In analyzing the technical specifications of electric vehicles across segments, distinct patterns emerge. These technical specifications, visually represented in respective figures, underscore the nuanced preferences and priorities of each segment, shaping the landscape of the electric vehicle market in India.
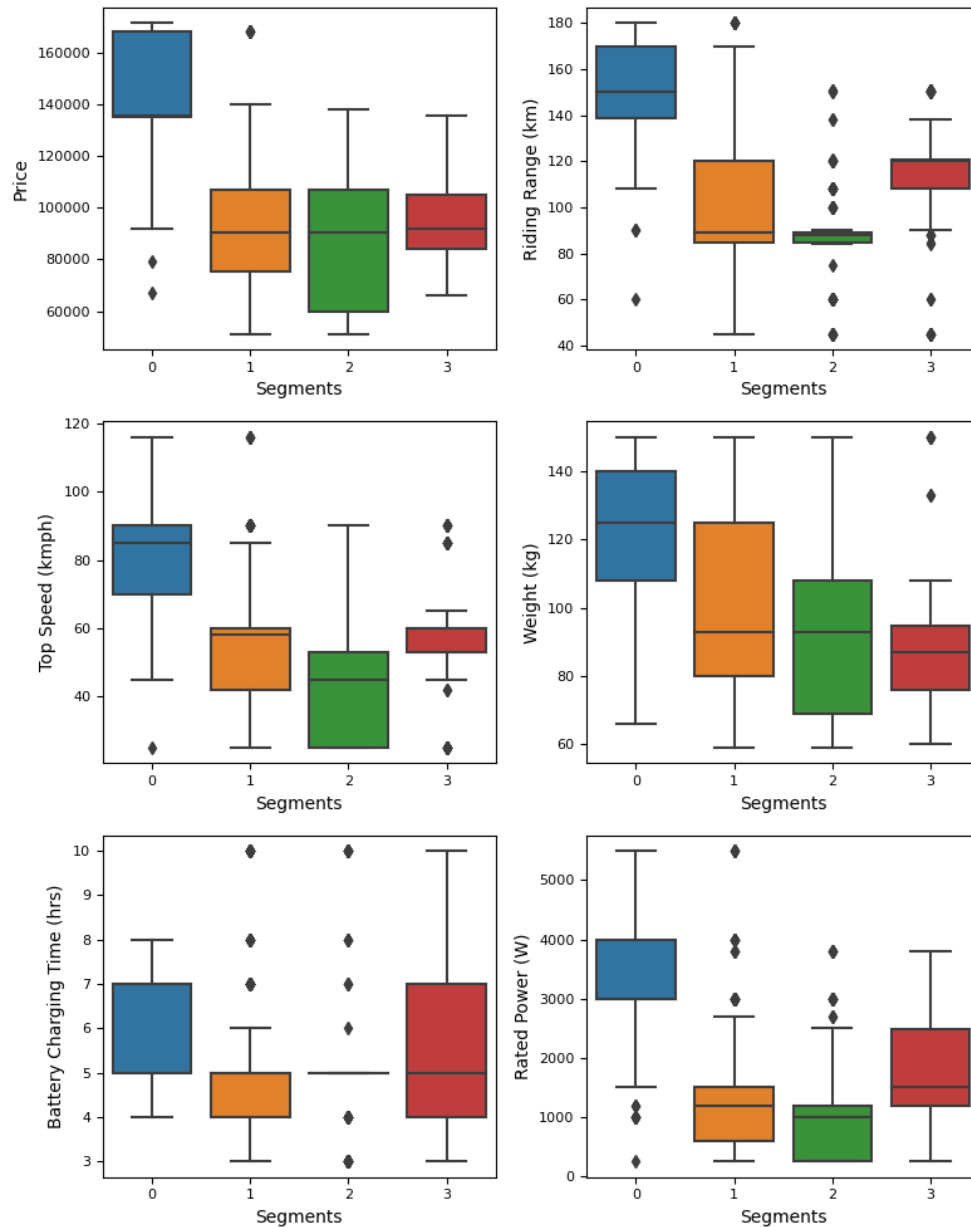
Fig 3.6. Parallel box-and-whisker plot of technical specification of electric vehicle by segment

4.0 Selection of Target Segment:

In the strategic selection of our target segment for the electric vehicle market, Segment 1 and Segment 2 stand out as potential focal points. Upon careful analysis, Segment 1 offers a unique challenge and opportunity. By comprehensively addressing their dissatisfaction points and crafting electric vehicles that specifically counter these concerns, our strategy can yield remarkable results. Simultaneously, understanding Segment 2's positive perceptions provides a foundation for enhancing these features further, ensuring a positive customer experience and reinforcing brand loyalty.

Incorporating these perceptions within the respective segments, our strategy will focus on refining existing features, addressing dissatisfaction points, and enhancing positive elements. By aligning our electric vehicles with the distinct expectations of Segment 1 and Segment 2, our approach will be finely tuned to meet the specific needs of these segments, ensuring a competitive edge and sustained market growth.

5.0 Customizing the Marketing Mix:

In our electric vehicle market strategy, customizing the marketing mix is paramount for appealing to Segment 1 and Segment 2, our identified target segments.

- **Product:**

For Product Customization, we plan to enhance features tailored to the specific desires of each segment. Addressing dissatisfaction points, such as improving performance and service experience for Segment 1, and emphasizing visual appeal and value for money for Segment 2, is central to product refinement. Diverse offerings within each segment ensure a broad spectrum of choices, aligning with varied tastes and budgets.

- **Price:**

Price Customization involves setting competitive and flexible pricing structures. Segment 1 will benefit from affordable options, while Segment 2 might accept a slightly higher price point for value-added features.

- **Promotion:**

Promotion Customization demands targeted advertising, focusing on reliability and service improvements for Segment 1, and aesthetics and affordability for Segment 2. Tailored promotional events and online campaigns further engage these segments effectively.

- **Place:**

In terms of Place Customization, we'll establish accessible distribution channels in urban areas for Segment 1 and in suburban and semi-urban regions for Segment 2. Strengthening our online presence ensures seamless online purchasing experiences, emphasizing virtual showrooms and customer support platforms.

6.0 Conclusion:

In summary, our in-depth analysis of India's electric vehicle market led us to identify Segment 1 as the optimal target. With a significant 39% consumer base, this segment represents a substantial market opportunity. By tailoring our electric two-wheeler specifications to meet the preferences of this segment, we ensure our products align seamlessly with the demands of a large customer base. This strategic decision is grounded in a thorough understanding of market segmentation, consumer behavior, and technical specifications.

These insights provide a clear direction for our market entry, emphasizing precision and relevance in both product development and marketing strategies. Moving forward, this approach equips us with a solid foundation, ensuring our offerings resonate effectively within India's evolving electric vehicle landscape.

II. Bhawana Jirapure

1.0 Behavioral and Psychographic Analysis:

- Tata, Hyundai, Honda, KIA are the Brands that Customers own most.

  After having discussions with Automobile Domain Experts. Below are the details about what each brand is well known for,

  Tata - Robust, Safety, Affordable

  Hyundai - Unique design, Comfort

  Honda - Durability, Performance

  KIA - Innovative Features, efficiency.

- Family with 3-5 members are more interested in EV.
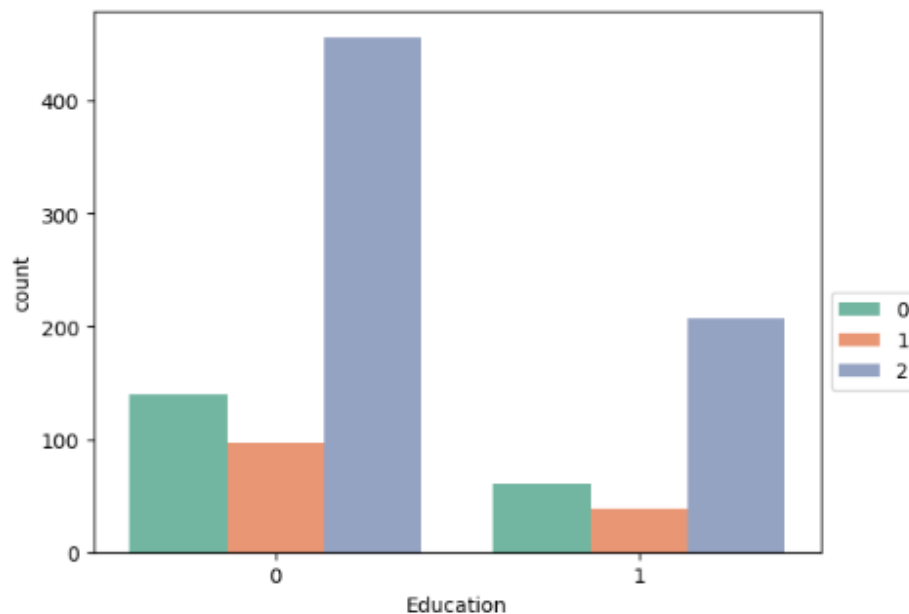
Fig. 1.1 Relation between consumers' education and the vehicles they tend to replacing

2.0 Demographic Analysis:
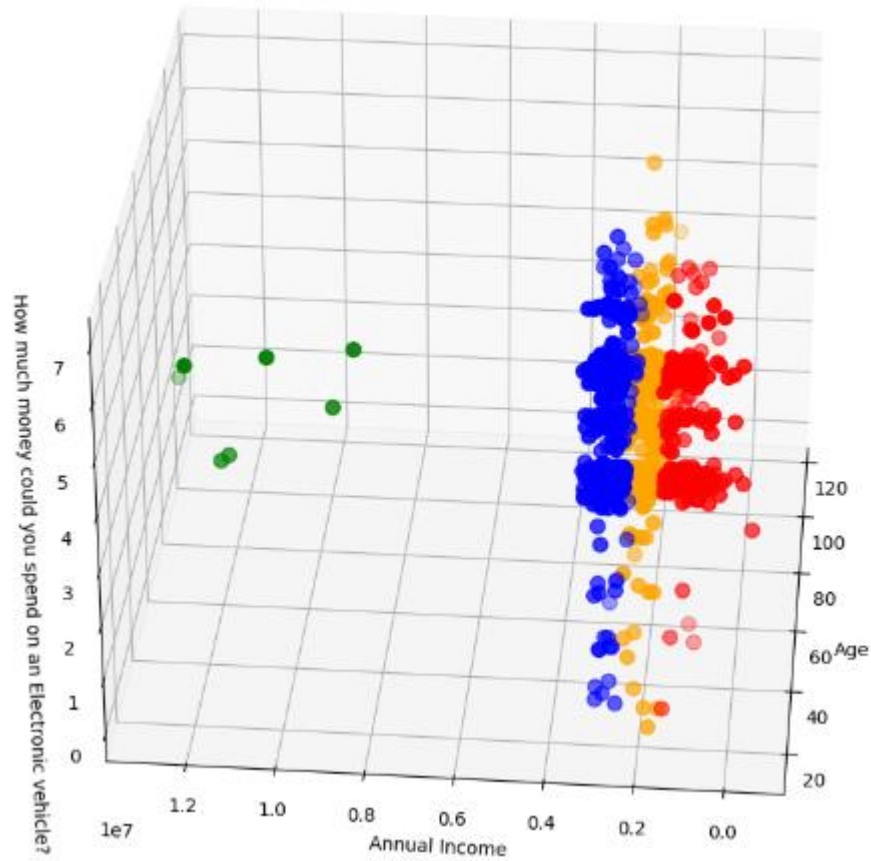
Demographic segments:
- Age -
  Target Age group of 28-31
- Income -
  Target who earns Rs. 10 lakhs to Rs. 28 lakhs per year.
- Education -
  Target Graduates.

Heatmap of Correlation:
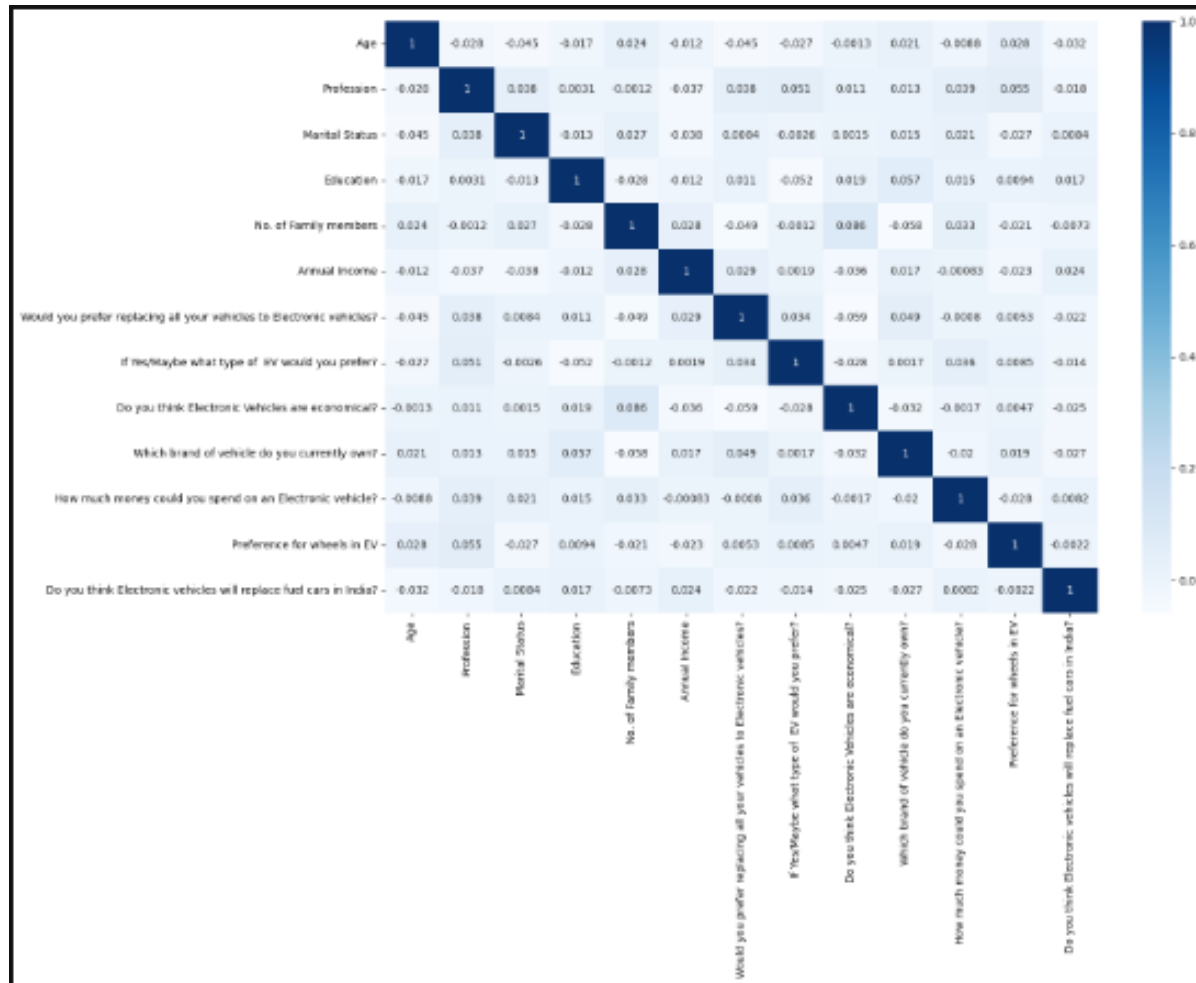
Pair Plot:
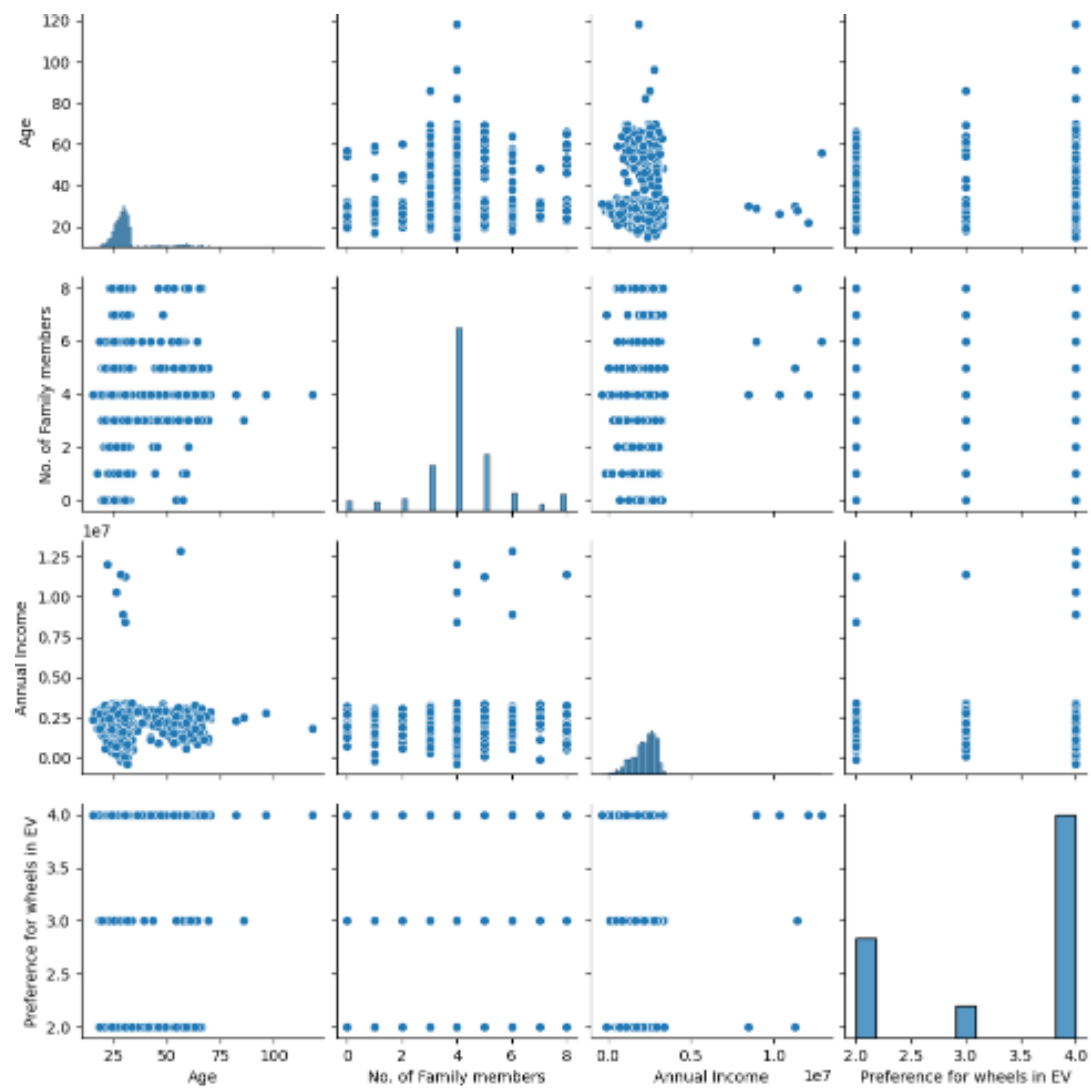
3.0 Geographic Analysis:

Location Pune, Mumbai, New Delhi, Bengaluru Considering based on Segmentation Analysis and the Infrastructures sanctioned by Govt.
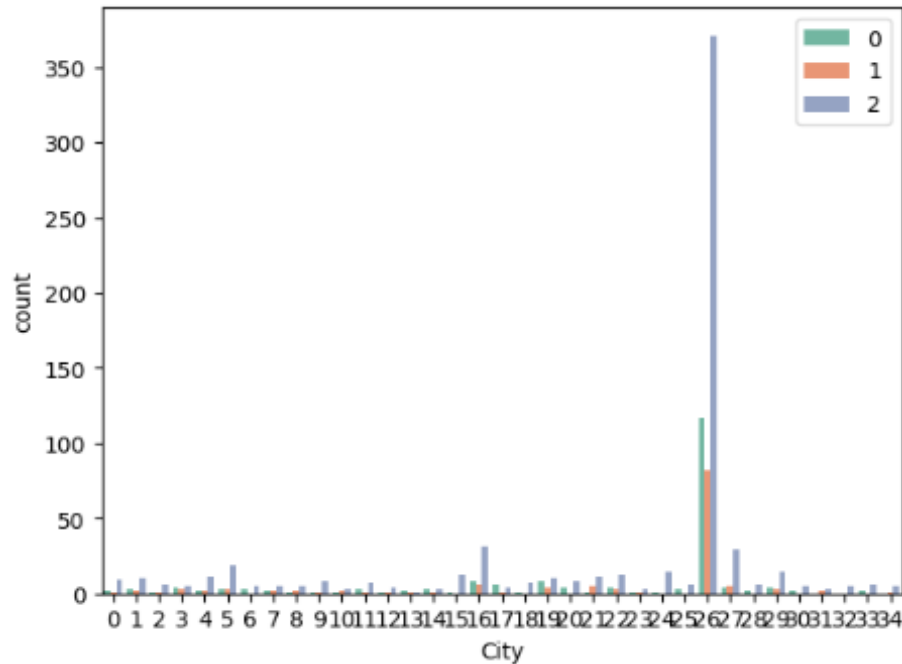
1.'Pune' and 'Mumbai' emerge as prime locations to establish an early foothold in the EV segment market.

2.'New Delhi' and 'Haldwani' warrant secondary consideration for market development.

3.'Satara' and 'Bengaluru' come next in line for strategic expansion efforts.

4.0 Segment Extraction:

4.1 K-Means Clustering:
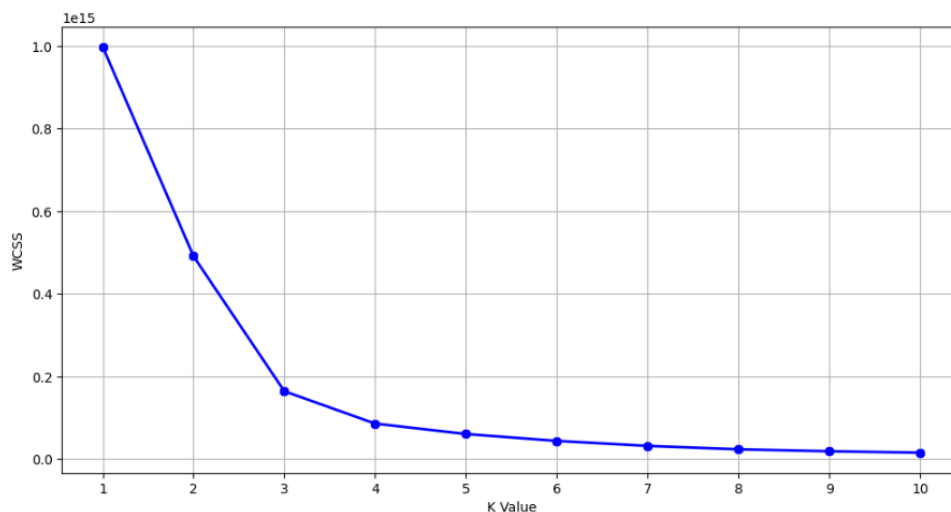
5.0 Choosing the Focus Demographic:

The younger demographic shows a keen interest in embracing new technology, particularly Electric Vehicles (EVs), driven by their awareness of environmental advantages and their desire for societal change. However, our analysis reveals that this group predominantly opts for more affordable vehicle options, posing a challenge for EV affordability. Therefore, it's recommended to focus on a segment that is both technologically inclined and financially capable of purchasing EVs, typically individuals aged between 30 to 40 years.

Urban residents, who benefit from advanced infrastructure and possess knowledge about technology and its advantages, are inclined towards EV adoption. Additionally, married individuals with dependents are more inclined towards vehicle ownership, presenting another viable target audience.

It's noteworthy that the average salary of vehicle buyers is approximately 30 lakhs, with most purchases falling within the 10-20 lakh range for automobiles and lower for two-wheelers. These considerations are pivotal in shaping our strategy moving forward.

6.0 Tailoring the Market Blend:

Determining prices for our products requires a blend of art and science. It begins with a thorough grasp of production costs, followed by adjustments based on product features, chosen pricing strategies, customer responsiveness to pricing, their values, and other pertinent factors. The Marketing Mix framework aids in comprehending the value our product or service delivers to customers, facilitating the creation of a compelling product offering. It supports the formulation, development, and implementation of impactful marketing strategies. Ultimately, it assists in assessing the suitability of our product or service for our target customers.

> **PRODUCT**

The choice of product would naturally vary depending on the EV Startup, but after thorough analysis, we've determined that entering India's market with two-wheelers is optimal. This decision is informed by the fact that two-wheelers dominate the automobile market share in the country. Given their cost-effectiveness and the existing infrastructure, they are a popular choice among consumers. Additionally, exploring public transport vehicles is another avenue worth

considering. Government policies favor the transition of public transport to electric engines, making it a promising market segment for the EV Startup to explore.

➢ PRICE

The affordability factor significantly impacts the proliferation of Electric Vehicles (EVs). It's crucial to bear in mind that for the company's product to resonate with consumers, it must be economically viable both in terms of initial purchase and ongoing maintenance costs. Ideally, the product should be priced between 10 to 20 lakhs INR, as this price range aligns with the preferences of the majority of potential buyers.

➢ PLACE

Consideration of infrastructure is crucial when developing and launching any product. It's advisable to focus on major urban centers in the country, as these areas typically boast infrastructure conducive to the adoption of Electric Vehicles (EVs).

Moreover, urban dwellers, often more educated about environmental issues, are more inclined to purchase EVs due to their awareness of the associated ecological benefits. Our geographic analysis has identified the top states that offer promising markets for various types of vehicles.

➢ PROMOTION

Promotion strategies vary based on the product. The most effective approach is to enlighten consumers about the advantages of EVs, HEVs, and PHEVs compared to traditional fuel-based vehicles. If the Startup introduces an affordable product, it's imperative to promote it extensively.

III. Parag Mahendrakumar Buch

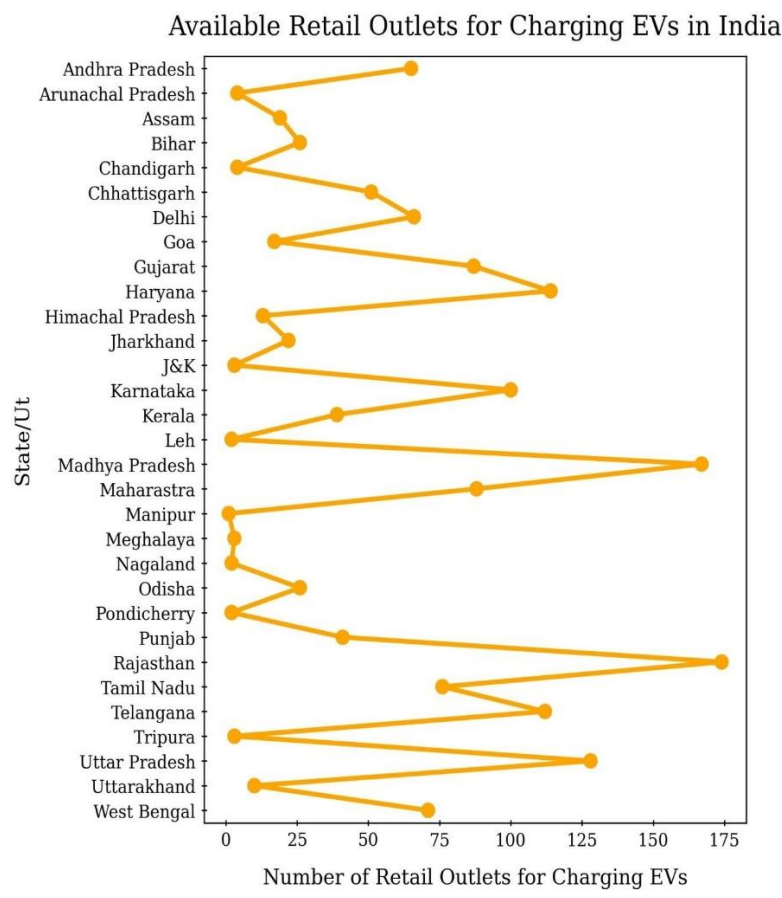## 1.0 Data Visualization:

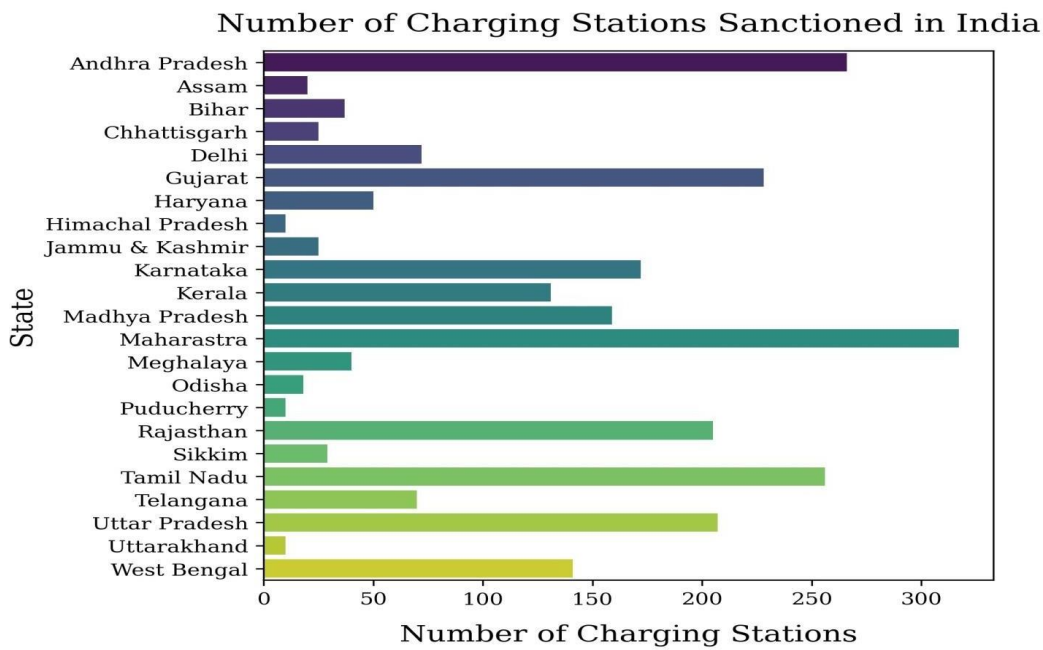**Number of 2-wheeler EVs in India**
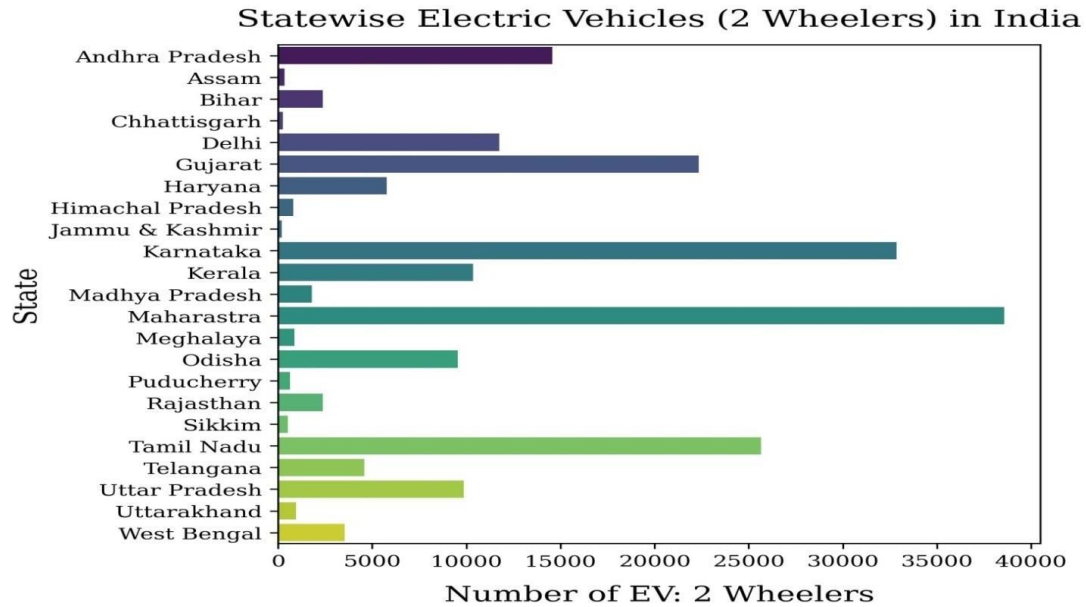
Number of 3-wheeler EVs in India
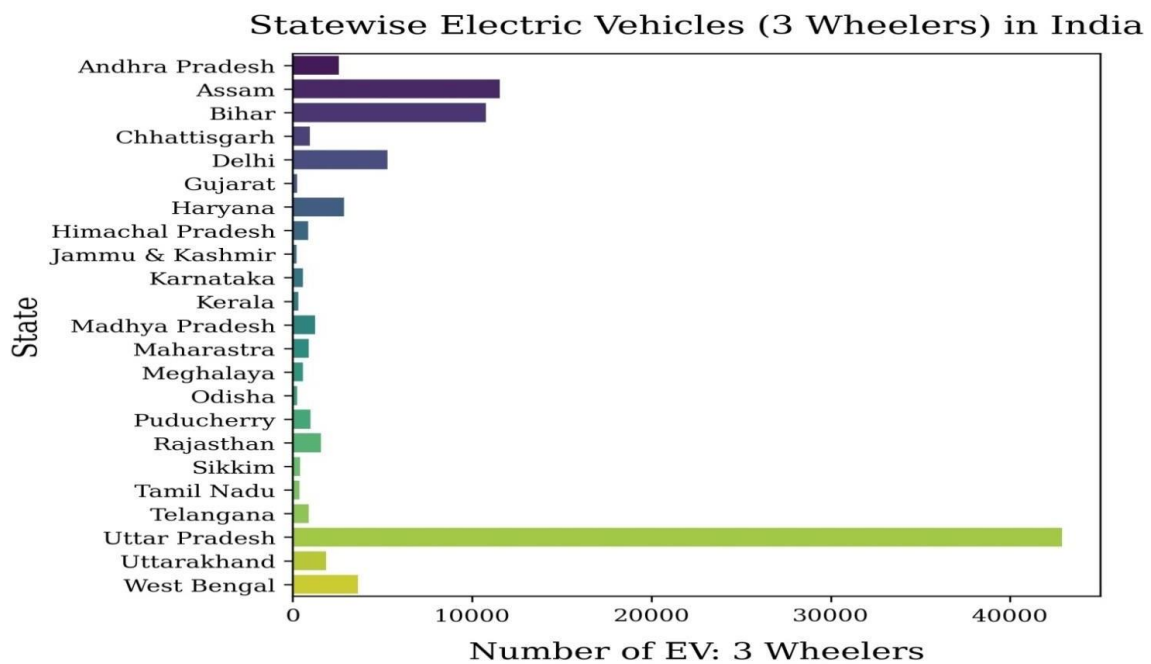
Number of 4-wheeler EVs in India

Statewise Electric Vehicles (4 Wheelers) in India
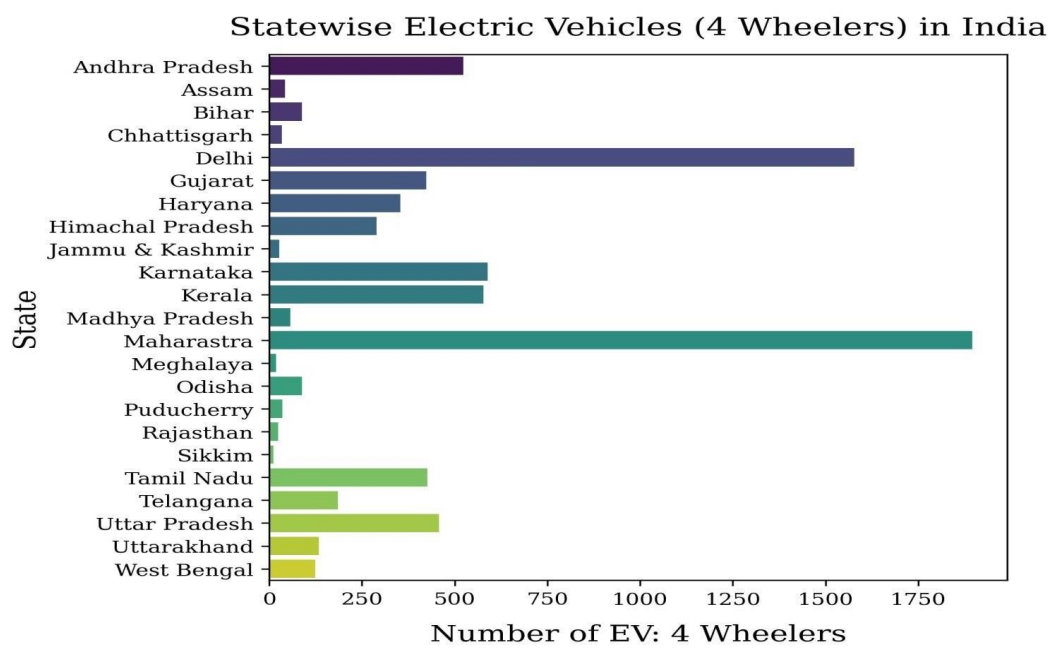
Retail outlets in India for charging EVs

Available Retail Outlets for Charging EVs in India

Number of charging stations sanctioned by Government of India

Number of Charging Stations Sanctioned in India

Choices for the number of seats for EVs in India

Available Electric Vehicles of Different Number of Seats in India
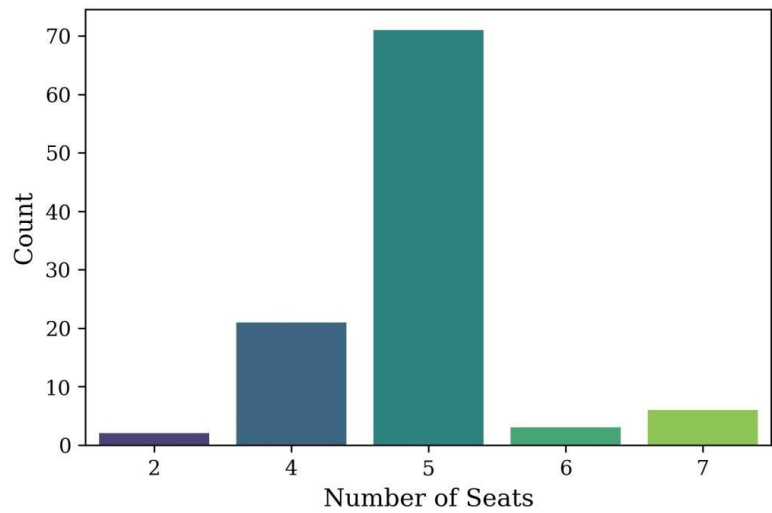
Top EV manufacturing brands in India

Number of EV Models Manufactured by a Brand
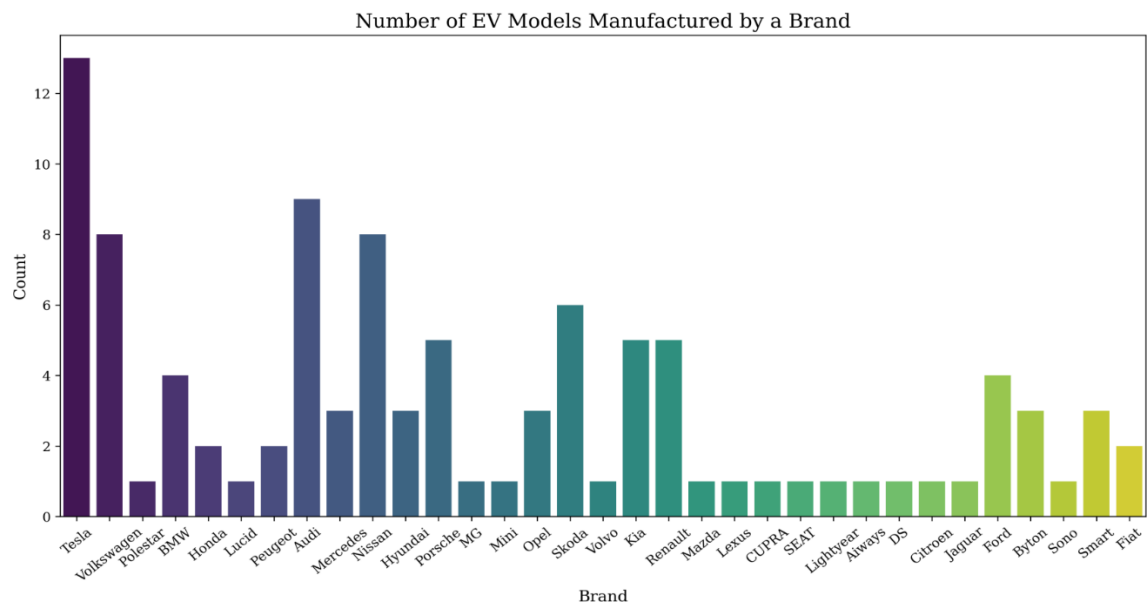
Types of EV plugs available in India

Available Plug Types of EVs in India
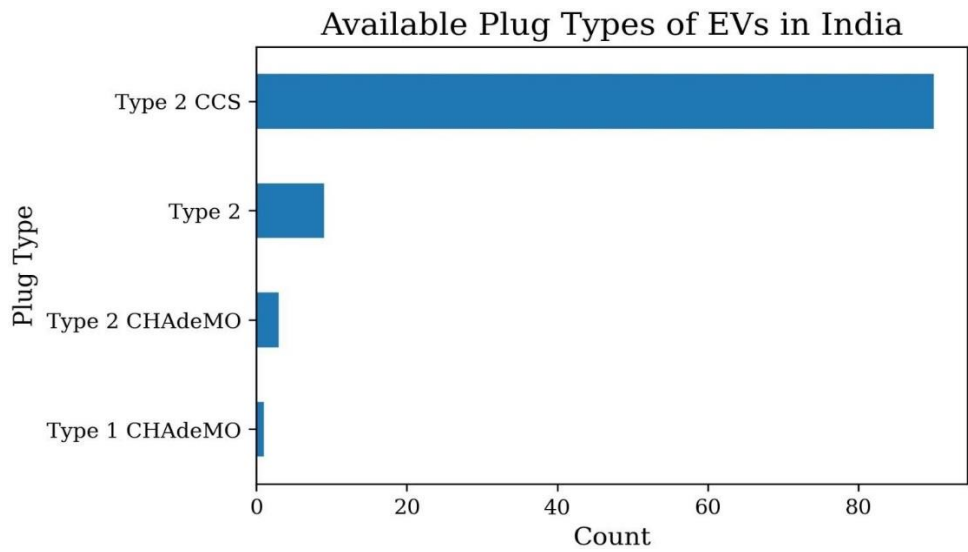
Body types of EVs in India

Electric Vehicles of Different Body Types in India
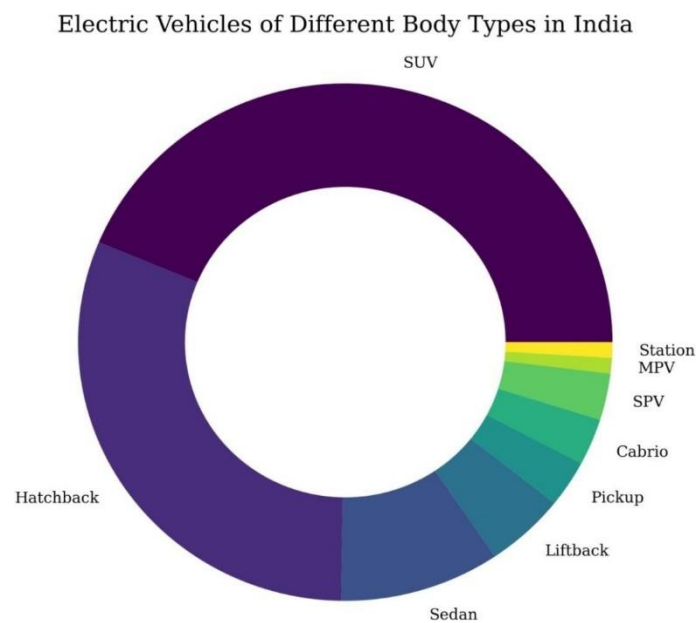
Price comparison of different brands of EVs in India

Price Comparison
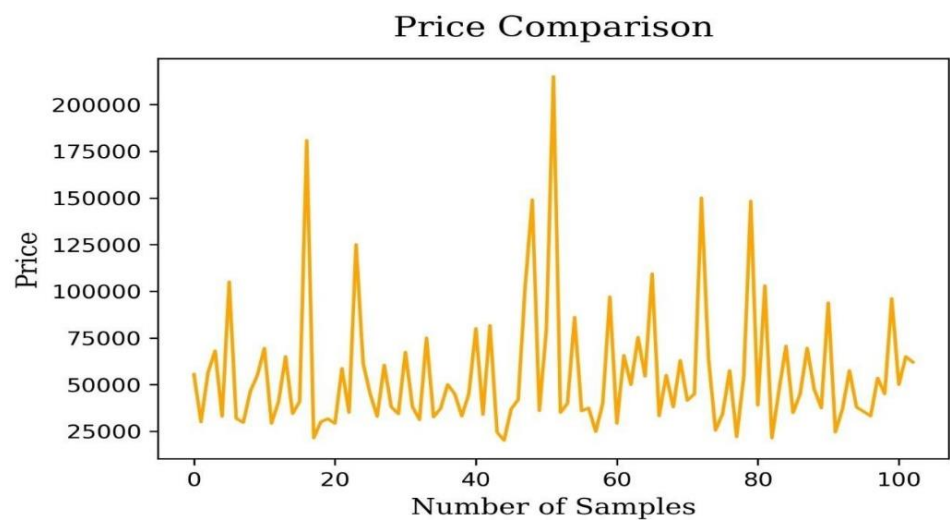
Comparison of different brands of EVs based on acceleration

Accleration of EVs in India

Comparison of different brands of EVs based on speed
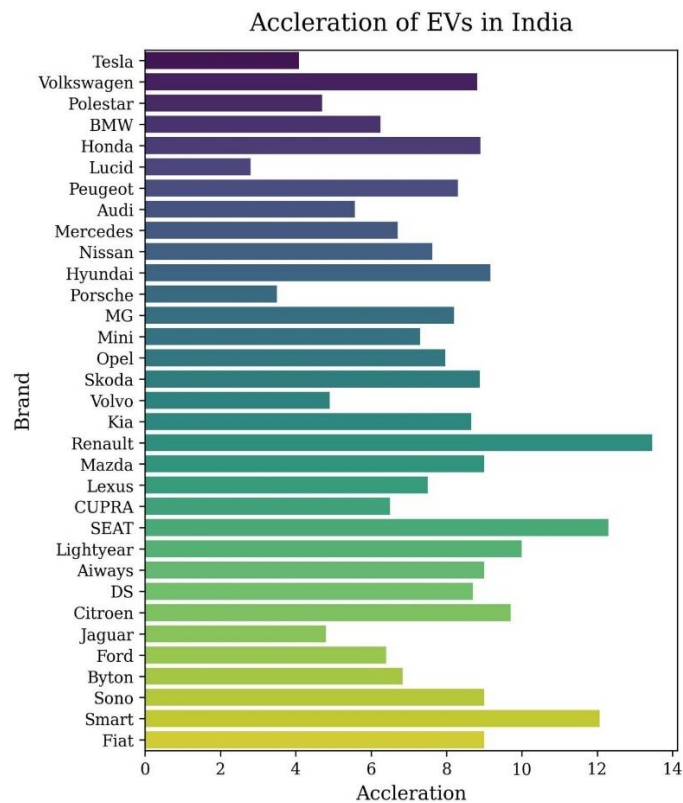
Brand-wise Speed Comparison of EVs in India
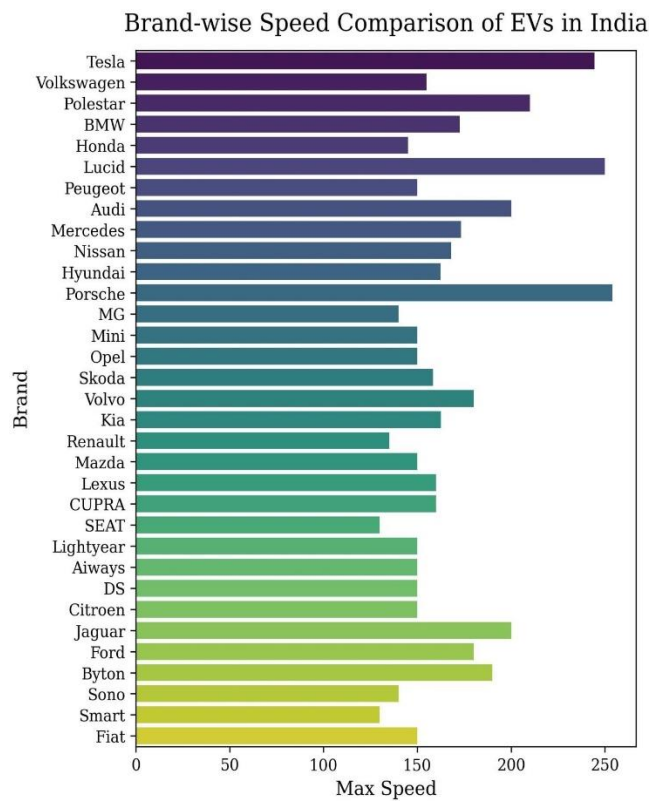
EV Segments in India

Electric Vehicles of Different Segments in India
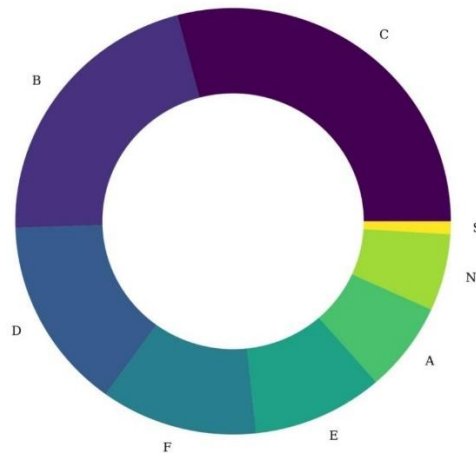
Correlation Matrix

Correlation Matrix

	AccelSec	TopSpeed_KmH	Range_Km	Efficiency_WhKm	FastCharge_KmH	Seats	PriceEuro
AccelSec	1.00	-0.79	-0.68	-0.38	-0.73	-0.18	-0.63
TopSpeed_KmH	-0.79	1.00	0.75	0.36	0.79	0.13	0.83
Range_Km	-0.68	0.75	1.00	0.31	0.72	0.30	0.67
Efficiency_WhKm	-0.38	0.36	0.31	1.00	0.32	0.30	0.40
FastCharge_KmH	-0.73	0.79	0.72	0.32	1.00	0.19	0.67
Seats	-0.18	0.13	0.30	0.30	0.19	1.00	0.02
PriceEuro	-0.63	0.83	0.67	0.40	0.67	0.02	1.00

2.0 Segmentation Approaches:

2.1 K-Means Clustering:

K-Means Clustering is an unsupervised learning algorithm whose job is to group the unlabeled dataset into different clusters where each datapoint belongs to only one cluster. Here, K is the number of clusters that need to be created in the process. The algorithm finds its applicability into a variety of use cases including market segmentation, image segmentation, image compression, document clustering etc. The below image is the results of clustering on one of ourdatasets.

K-Means Clustering Results

2.2 Elbow Method:
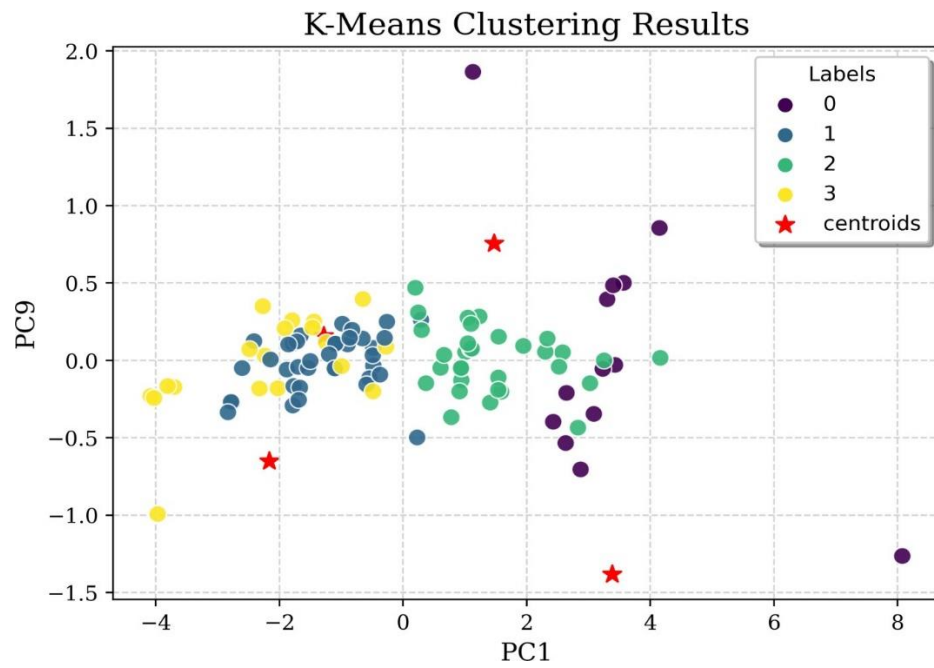
Plot of the Elbow Method
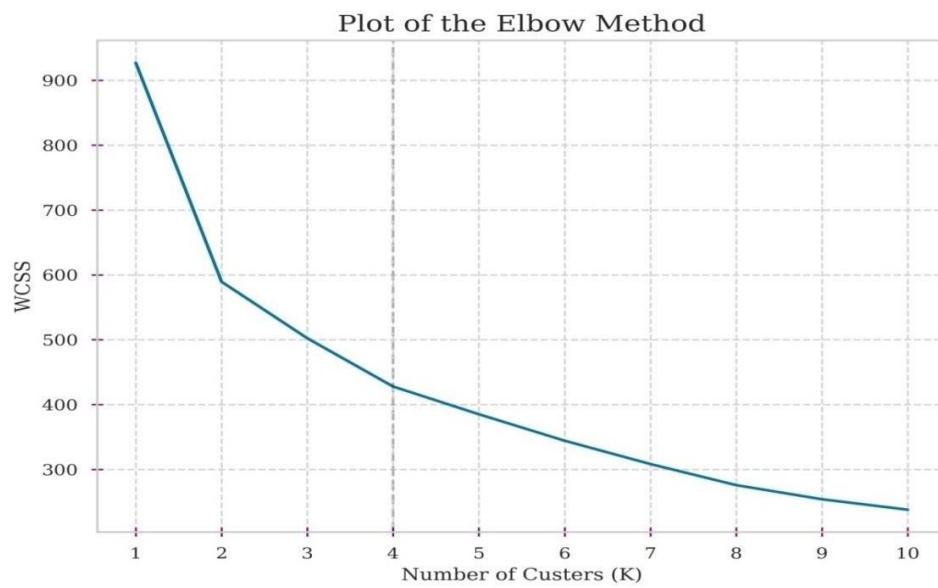
IV. Kavita Lamani

1.0 Data visualization:

Two Wheelers (Category L1 & L2 as per Central Motor Vehicles Rules) in Each State:

1. L1 & L2 Categories:

- These are specific categories defined under the Central Motor Vehicles Rules (CMVR) for two-wheeled vehicles.
- They likely represent different classes or types of two-wheelers based on characteristics such as engine displacement, vehicle weight, or design specifications.

2. Central Motor Vehicles Rules (CMVR):

- CMVR is a set of regulations established by the Indian government to govern various aspects of motor vehicles, including their manufacture, registration, operation, and safety standards.
- Vehicles falling under the "Two Wheelers (Category L1 & L2)" classification must adhere to the specific regulations and standards outlined in the CMVR pertaining to their respective categories.
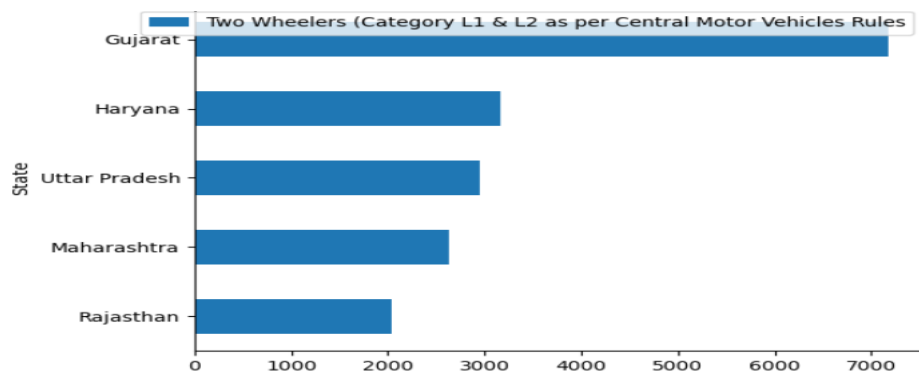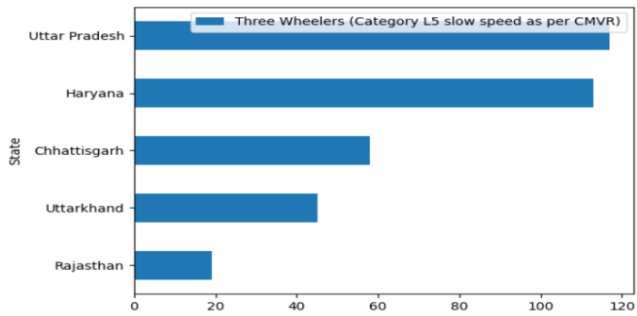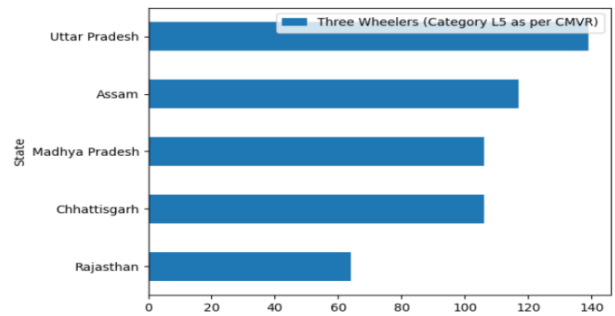

Two Wheelers (Category L2 (CMVR))
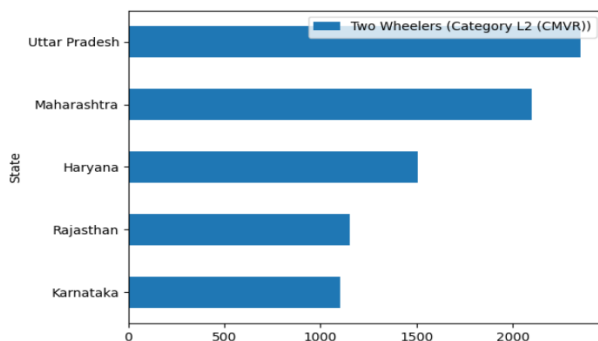
Two Wheelers (Max power not exceeding 250 Watts)
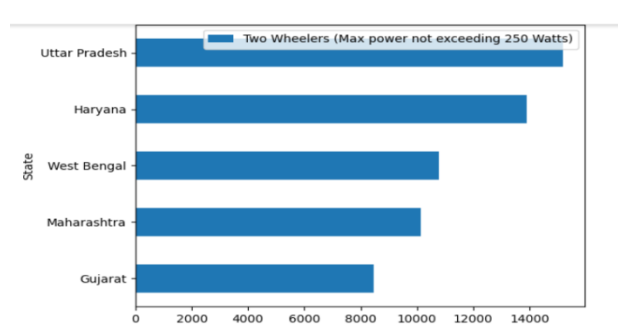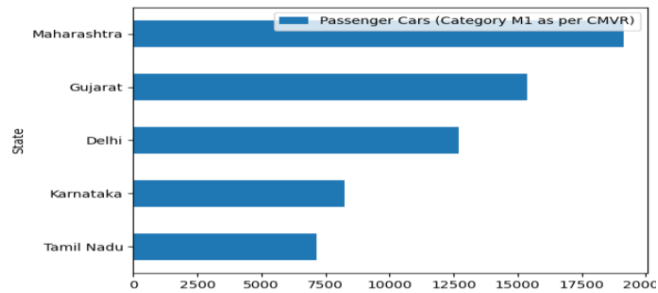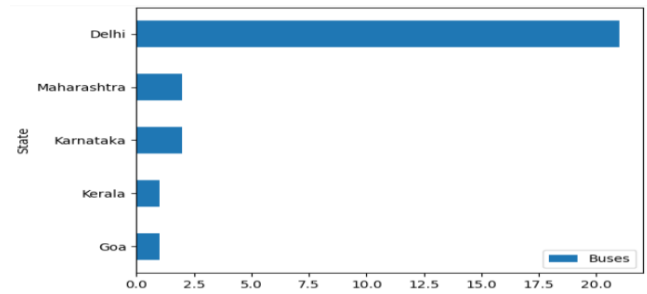
Three Wheelers (Category L5 slow speed as per CMVR)
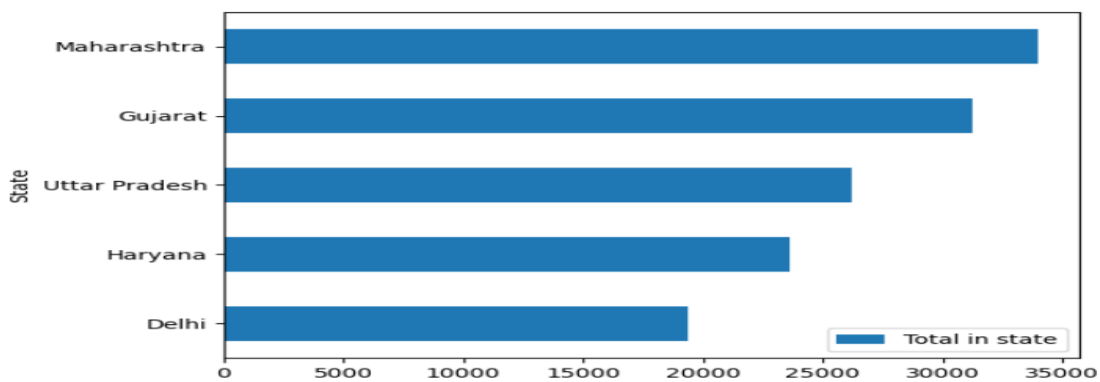

Three Wheelers (Category L5 as per CMVR)
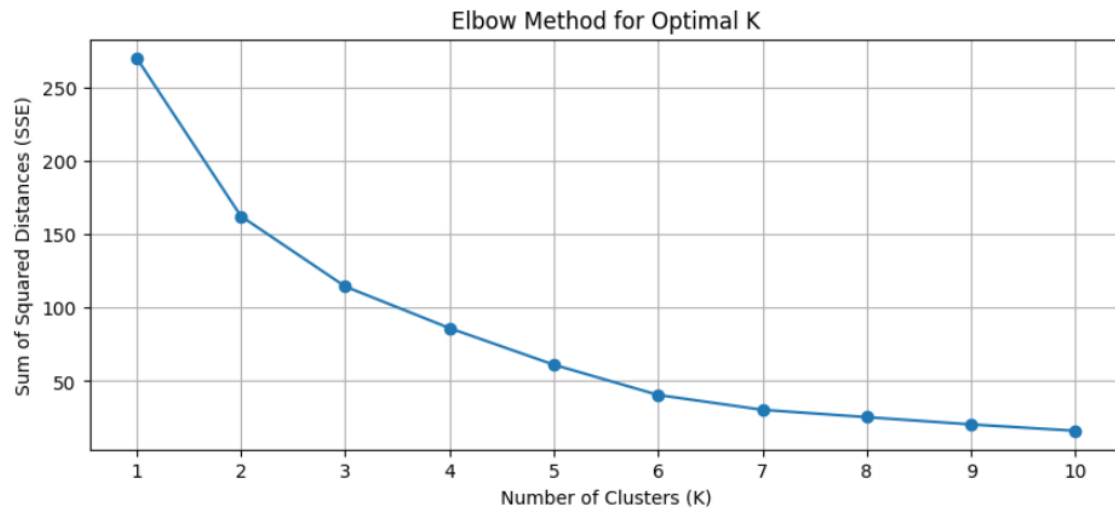

Passenger Cars (Category M1 as per CMVR)

Buses

Total Vehicle in Each State

2.0 Segmentation Approach:

2.1 Elbow Method:

Elbow Method for Optimal K

GitHub Links:

1. **Samiksha Band**
   https://github.com/Samikshaband/EV-market-segmentation

2. **Bhawana Jirapure**
   https://github.com/Jbhawana/fennyLabs_EV-market-project

3. **Parag Buch**
   https://github.com/paragbuch/Feynn_lab_Project/blob/main/EV_MARKET_INDIA_SEGMENTATION.ipynb

4. **Kavita Lamani**

   https://github.com/kavita07lamani/Electric-Vehicle-Indian-Market-Segmentation-