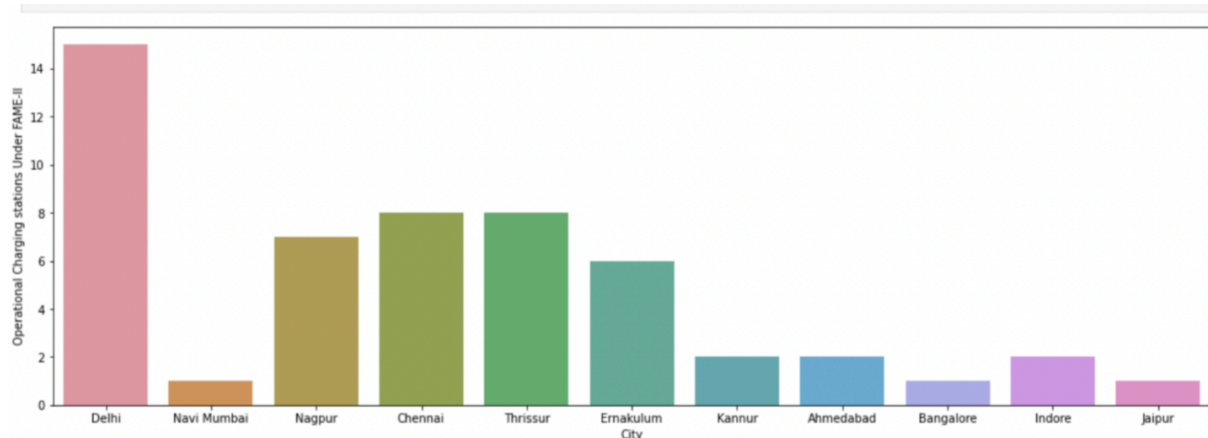# NAME : ANKIT KUMAR YADAV
EV MARKET

**Visualize the Current Availability of the Charging Stations for EVs in India**

Interim Conclusion for Charging Station Availability with respect to FAME 2 Government of India

1) First observation, only limited number of charging station is available in india as of 2023

2) Delhi being capital has more number of charging station as compared to other metro cities

3) South Indian metro cities have balanced number, but still many cities are missing from south india

4) Mumbai being the economic capital of india have only 1 charging station in Navi Mumbai(private charging stations not counted or being missed)

Final Conclusion:

a)In order to make the public comfortable with Electric Vehicle Environmnet, Infrastructure development will play the key role in EV market

b)charging stations are only available in metro cities currently. other small cities and towns should also needed to be included.

Visualise number of operation electric vehicles in the states of India
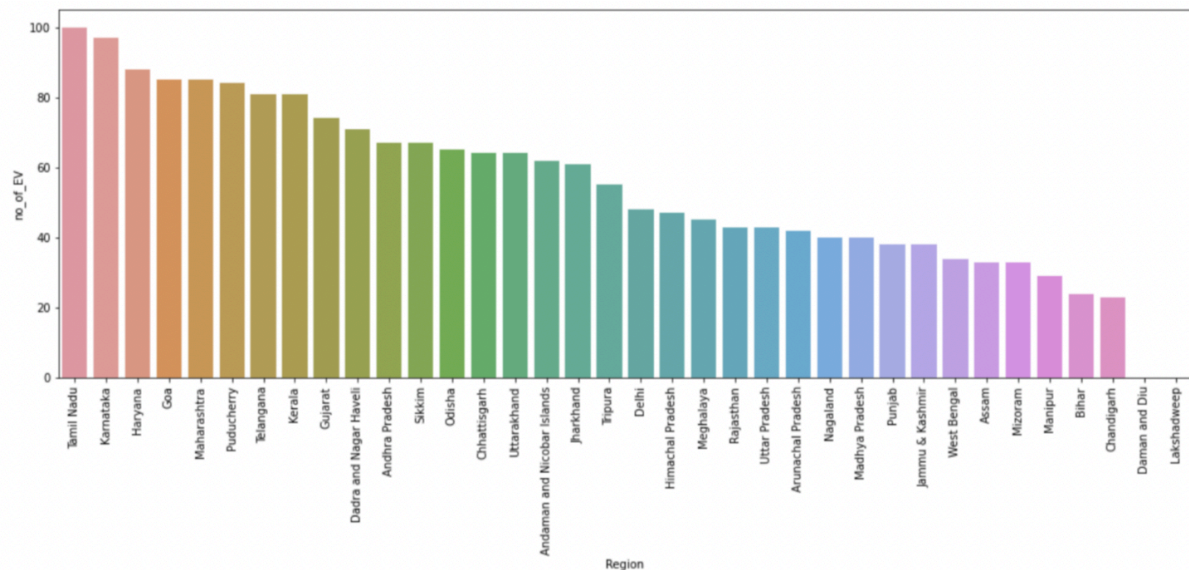
Sorted and Paraphrased Interim Conclusion on Operational Electric Vehicles in Indian States

1) South India

- **Tamil Nadu and Karnataka** lead in the number of operational electric vehicles, including both EV bikes and cars, with growing demand.
- Other states like **Puducherry, Telangana, Kerala, Andhra Pradesh, and Tripura** also show relatively high numbers with increasing demand.

2) West India

- **Goa and Maharashtra** have the highest number of operational EVs with a noticeable increase in demand.
- **Gujarat and Dadra and Nagar Haveli** experienced a slow start, but demand is gradually rising.

3) North India

- **Haryana** has one of the highest numbers of operational EVs, with the fastest-growing demand in the entire North India region.
- **Delhi**, despite being the capital with the highest number of charging stations, had a slow start and a gradual increase in demand.

- Other northern states like **Uttarakhand** show relatively good numbers.
- **Himachal Pradesh, Rajasthan, Uttar Pradesh, Punjab, and Jammu & Kashmir** have had a slower start.

4) East India

- **Andaman & Nicobar, Odisha, and Jharkhand** have the highest operational EVs in the East India region.
- States like **Bihar and West Bengal** have seen a slow start and comparatively lower demand.

5) Central India

- **Chhattisgarh** has a good number of operational EVs.
- **Madhya Pradesh** has experienced a slow start in EV adoption, with low demand growth.

6) North East India

- Despite having less EV charging infrastructure, North East India is showing promising growth in EV adoption.
- **Sikkim** has surpassed Central India in terms of operational EV numbers.
- States like **Meghalaya and Nagaland** have competitive numbers considering the region's underdeveloped charging infrastructure.
- **Assam, Mizoram, and Manipur** have had a slow start.

7) Daman and Diu and Lakshadweep

- Data was missing for these regions, so null values were replaced with zeros.

Final Interim Conclusion:

1. **South India** is the backbone of EV demand, being a tech hub with numerous charging stations and the presence of major car brands' manufacturing plants and headquarters.
2. **Delhi** has the highest number of charging stations but relatively low EV popularity.
3. **North East India** is gaining EV popularity despite limited infrastructure.

4. Other regions, especially **North, West, East, and Central India**, have balanced numbers and competitive demand.
5. Survey information was not available for **Daman and Diu and Lakshadweep**, so these regions were not thoroughly analyzed.

Next Steps:

Now that we've reviewed the current state of charging infrastructure and the number of operational electric vehicles in various regions of India, let's delve into the analysis of why non-electric vehicles remain popular. We will explore the reasons and the extent of fossil fuel vehicle popularity in India.
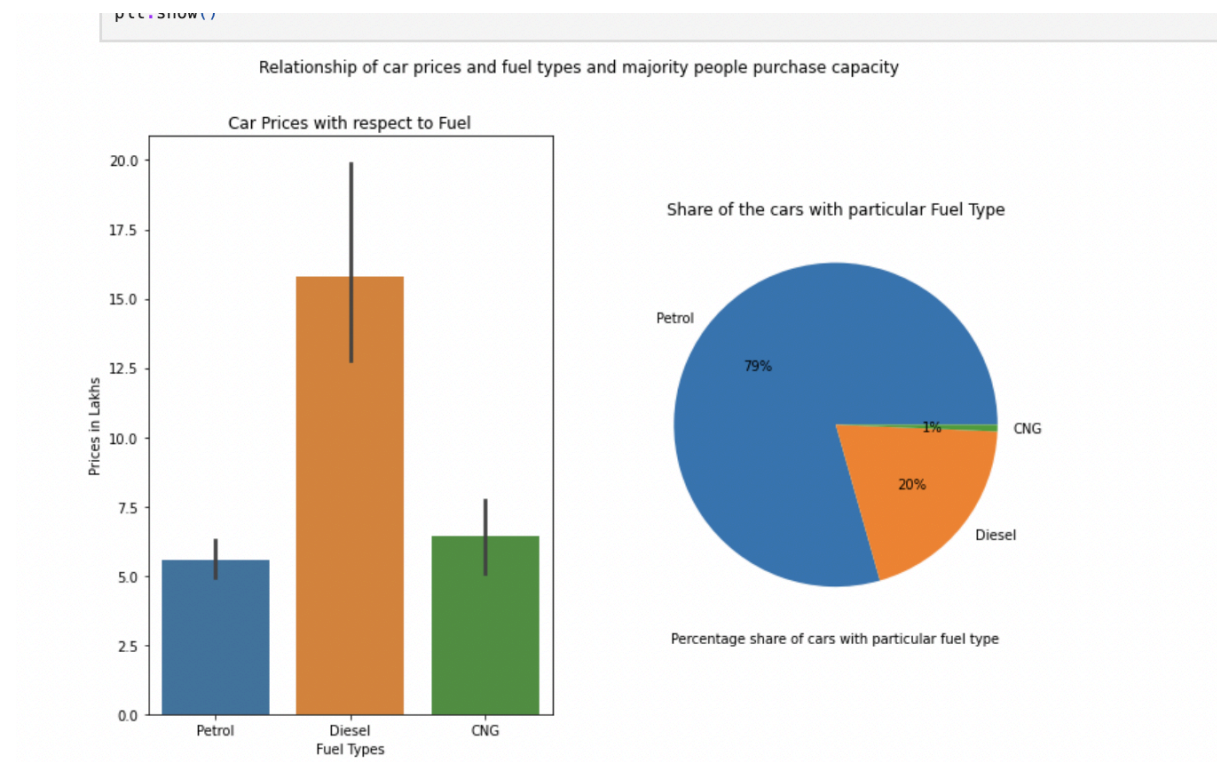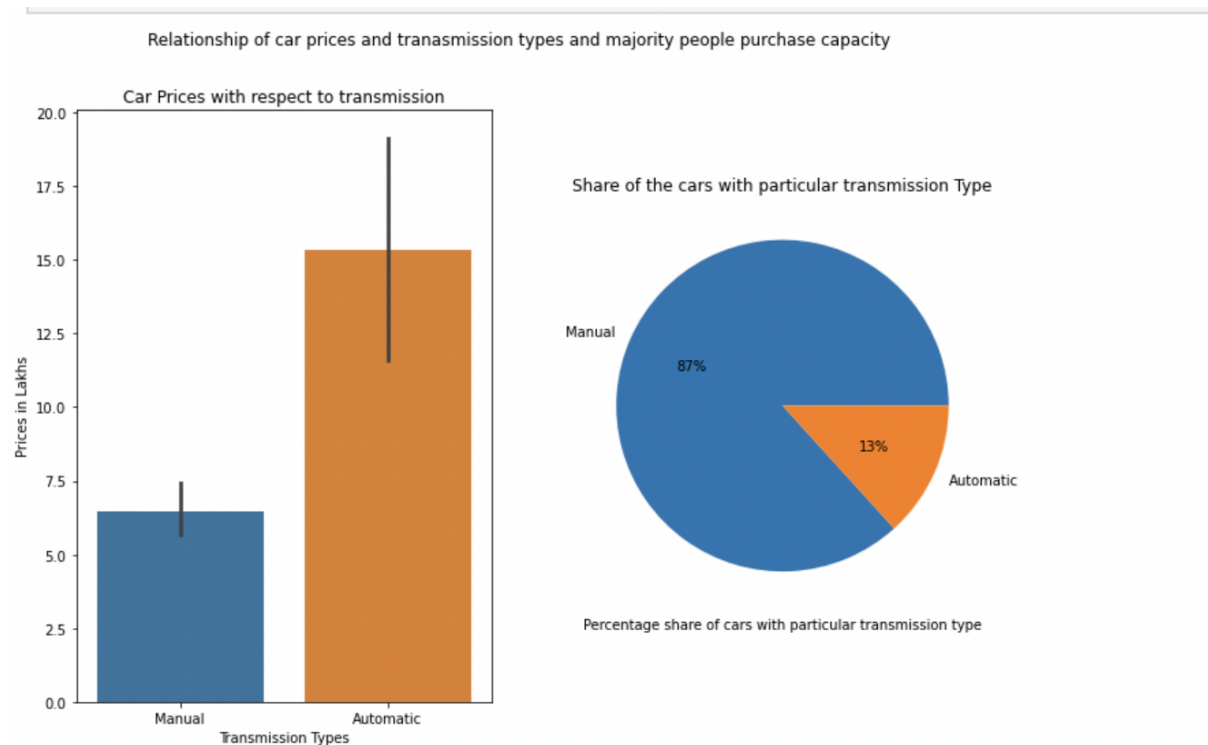

Visualization Summary:

1. **Bar Charts**:
   ○ Petrol cars are cheaper than CNG and diesel cars.
   ○ Diesel cars are the most expensive compared to both petrol and CNG cars.
2. **Pie Chart**:
   ○ **Petrol cars** dominate the market with 79% share due to their lower cost.
   ○ **Diesel cars** hold 20% of the market, valued for their high performance and durability, despite being more expensive.

○ **CNG cars** have the lowest popularity, as they lack in performance and engine durability, appealing primarily for their fuel economy.

Observations:

1. **Price Sensitivity**: Most people choose petrol cars due to their affordability.
2. **Performance and Durability**: Diesel cars are preferred by those seeking high performance and low maintenance.
3. **Fuel Economy**: CNG cars attract a smaller segment focused on fuel savings.

Relationship of car prices and tranasmission types and majority people purchase capacity

Visualization Summary:

1. **Bar Charts**:
   ○ Automatic transmission cars are more expensive than manual ones due to higher maintenance costs and initial price.
   ○ Manual cars are cheaper and have lower maintenance costs.
2. **Pie Charts**:
   ○ Manual transmission cars are the most popular, favored for their low maintenance and durability.
   ○ Automatic transmission cars are growing in popularity despite higher costs.

Observations:

1. Manual transmissions are popular due to habit, affordability, and lower maintenance costs.

2. Automatic transmissions, though expensive, are gaining popularity because of their features and convenience.
3. Consumers are willing to pay more for vehicles if they offer significant features and luxury, though price remains a key concern.

Interim Conclusion:

1. Vehicle price, maintenance, and durability are critical factors for consumers.
2. While low maintenance and durability are important, vehicle pricing must be carefully considered.

Next Steps:

● We've observed a public preference for economical vehicles, analyzed EV infrastructure, and examined EV popularity across India.
● Next, we will explore what makes EVs a better choice than fossil fuel vehicles.
● A market segmentation analysis on public reviews of electric vehicles will be conducted using machine learning techniques.
● We will also analyze popular cars currently available in the market.

Results from principal components analysis indicate that the three components 'Performance','Fuel Economy' and 'Value for Money' capture about more than 50% of the information contained in the segmentation variables
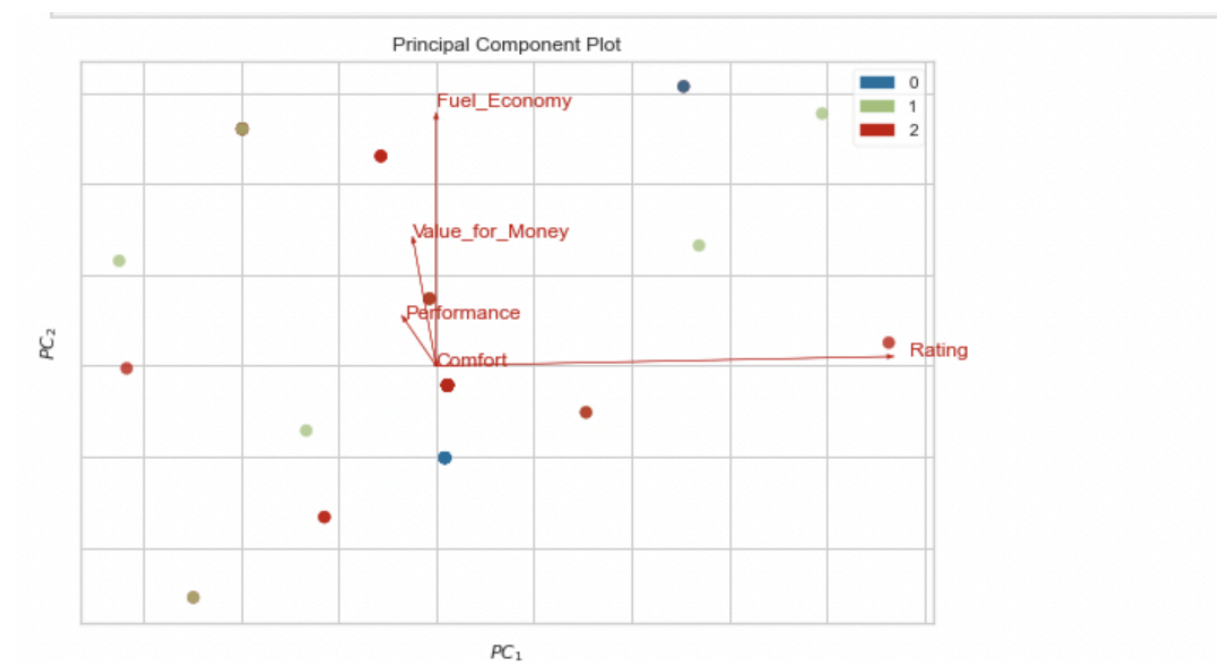
Visual Plot

PC1 and PC2 are the 2 components captured the highest of information contained in segmentation variables

The above principal component Plot shows clearly:

1) According to first principal component (PC1), we assess the fact that value for money, the performance and the Fuel economy feature of the EV has similar percentage and closest positive ratings

2) Overall rating is at the attrative coordinate according to both the principal componants (PC1 and PC2)
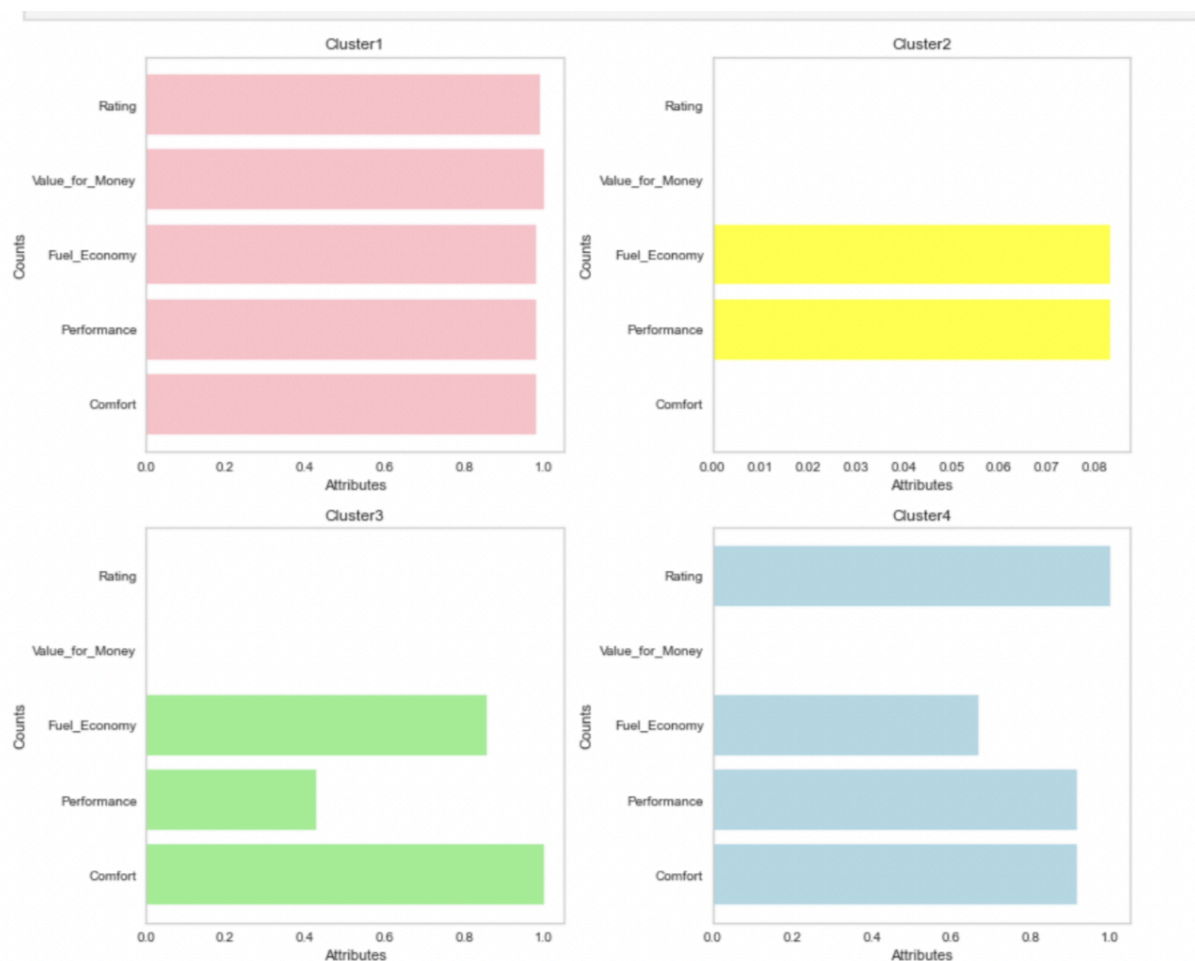
1) The barplot plots the percentage of respondents within each segment who associate each perception for EV.

2) Marker variables are coloured differently for each segment.

3) All other variables are whited out

X - Segment Number and Y - Sentiments
segment number
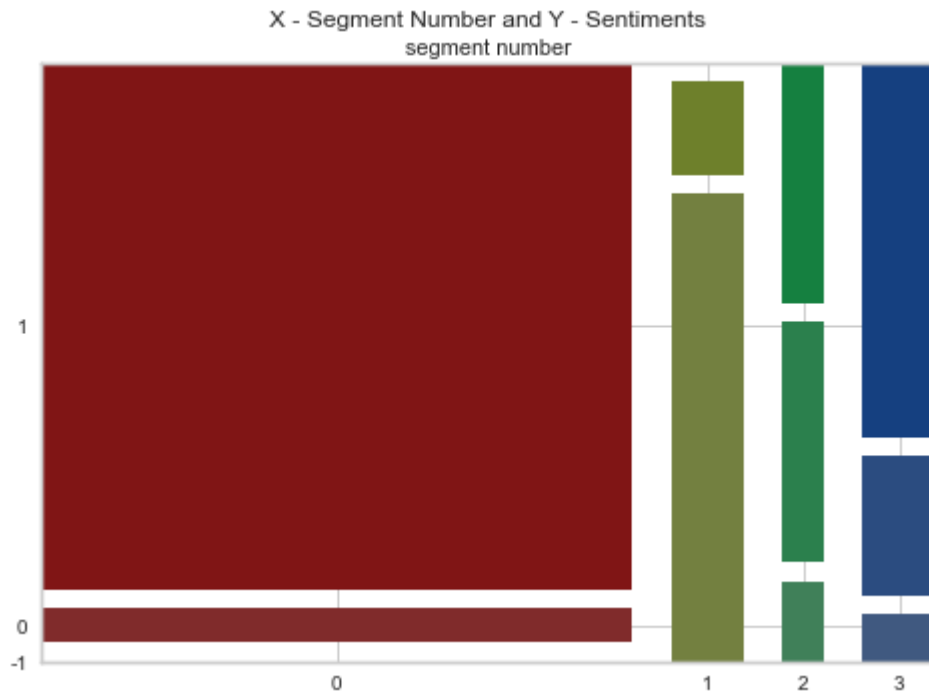
Mosaic plot remarks

1) Members of segment 1 (depicted in the first column) expresses most positive responses of EVs the top left boxes being coloured in red.

2) In stark contrast, members of segment 2 expresses Negative Thoughts (as indicated by the pale green bar boxes).

3) segment 3 provides info about people expressing balanced responses (as indicated by dark green color)

4) segment 4 have majority of positive responses (as indicated by dark blue color)

Final Observation:

In the figure above, the frequency of driving EVs is on the x-axis, and sentiments are on the y-axis.

1. Market Segments 1 are in the most attractive quadrant. These segments show strong positive sentiments towards EVs and actively recommend them to others. Their feedback is crucial and should be prioritized.
2. Market Segments 3 and 4 also have positive sentiments but drive EVs less frequently. Their feedback is important for improving EVs and needs special attention.

3. Market Segment 2 is in the least attractive position, with members showing negative attitudes toward EVs, making them less appealing as a target market.

Interim Conclusion:

1. Most people have positive sentiments and reviews about EVs, especially after trying them.
2. Segment 1, representing short drives, is particularly enthusiastic, indicating that a good test drive experience can lead to higher EV adoption.
3. EV popularity is growing, especially with new, more affordable models entering the market.

Summary of Analysis:

1. Government Charging Infrastructure: Availability across India.
2. EV Popularity: Across various regions in India.
3. Non-Electric Vehicles: Analyzed based on prices, fuel types, and transmission.
4. Consumer Behavior: Segmentation analysis showed a tendency to switch from traditional vehicles to EVs based on reviews and recommendations.

Next Steps for Competing EVs:

1. Affordability: The upcoming EV must be within the budget of the majority of the Indian public.
2. Features: Consumers desire advanced features, as shown in segmentation analysis.
3. Fuel Economy: A good driving range is essential.
4. Performance: High performance is crucial, as seen in the comparison between petrol and diesel cars.

To address these issues, let's create a DataFrame that includes a general range of price, battery capacity, drive range, power, and charging time for the upcoming EV.

Relationship of car prices and fuel types and majority people purchase capacity
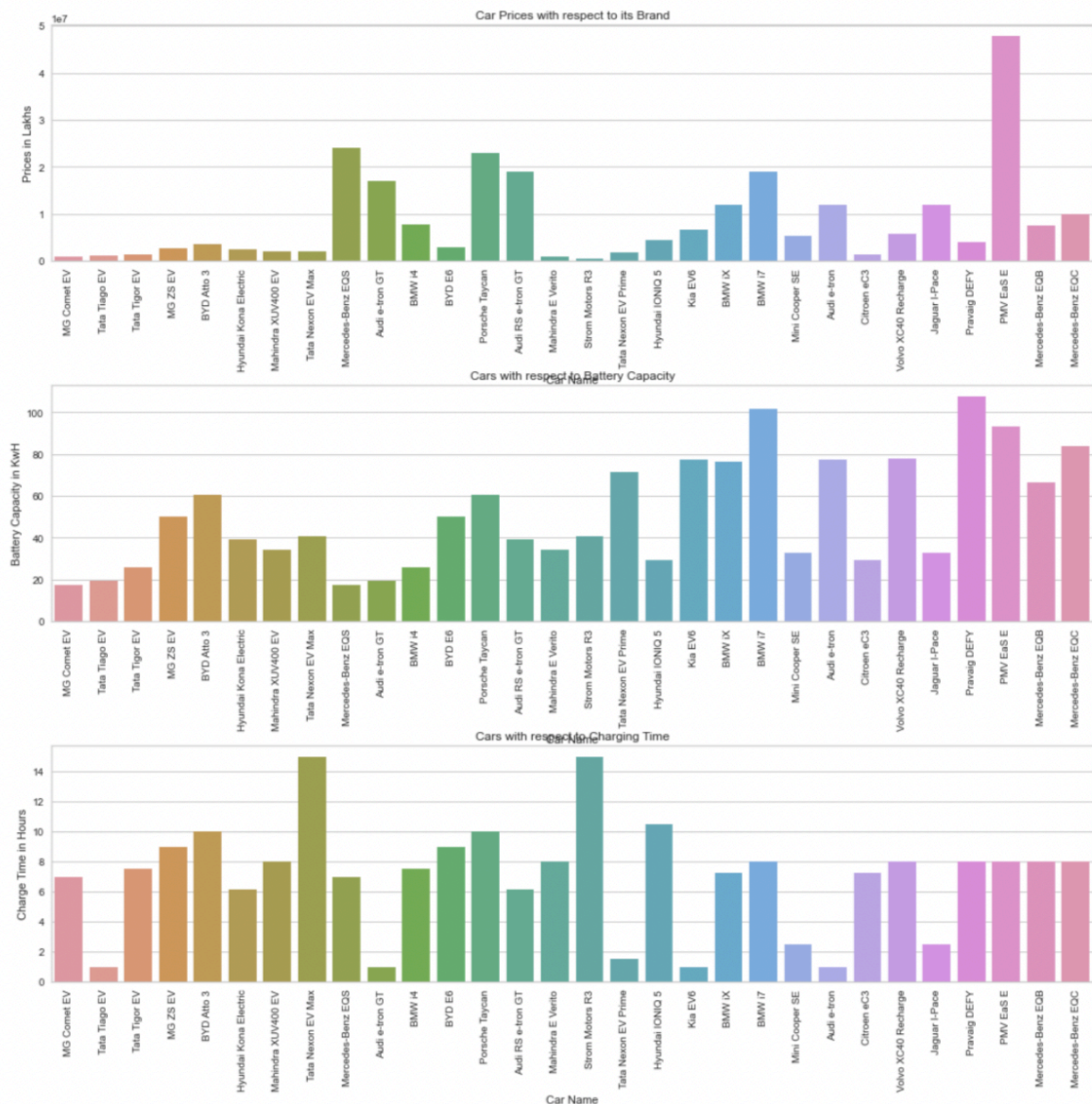
Final Conclusion:

Geographic and Demographic Analysis:

1. **South India**: Technologically advanced with strong charging infrastructure and EV popularity. Competing here will be challenging due to established big brands.
2. **North East India**: Growing popularity, especially in Sikkim, makes it a promising market for our EVs.

3. **East and Central India**: These regions are suitable for expansion once our EVs gain popularity.

Psychographic and Behavioral Analysis:

1. **Positive Sentiment**: Market segmentation shows that 3 out of 4 people have a positive attitude toward EVs. Those who take a test drive are likely to buy, and regular users recommend them to others.
2. **Key Considerations**: Competitive pricing, more features, and strong performance are essential, as consumers favor low-priced, low-maintenance vehicles.

Startup Strategy:

1. **E-Bikes**: Target East Indian states like Bihar and West Bengal, and Central India (e.g., Madhya Pradesh) with affordable, feature-rich E-bikes.
2. **E-Cars**: Focus on North East and Central India first, then expand to East India after building brand recognition.
3. **North India**: Not recommended due to low EV adoption despite good infrastructure.
4. **South India**: Reserved for future expansion due to intense competition from international brands.