Electric Vehicle Market in India

Market Segmentation

By

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source: 5paisa.com

The time is right for electric cars - in fact the time is critical.

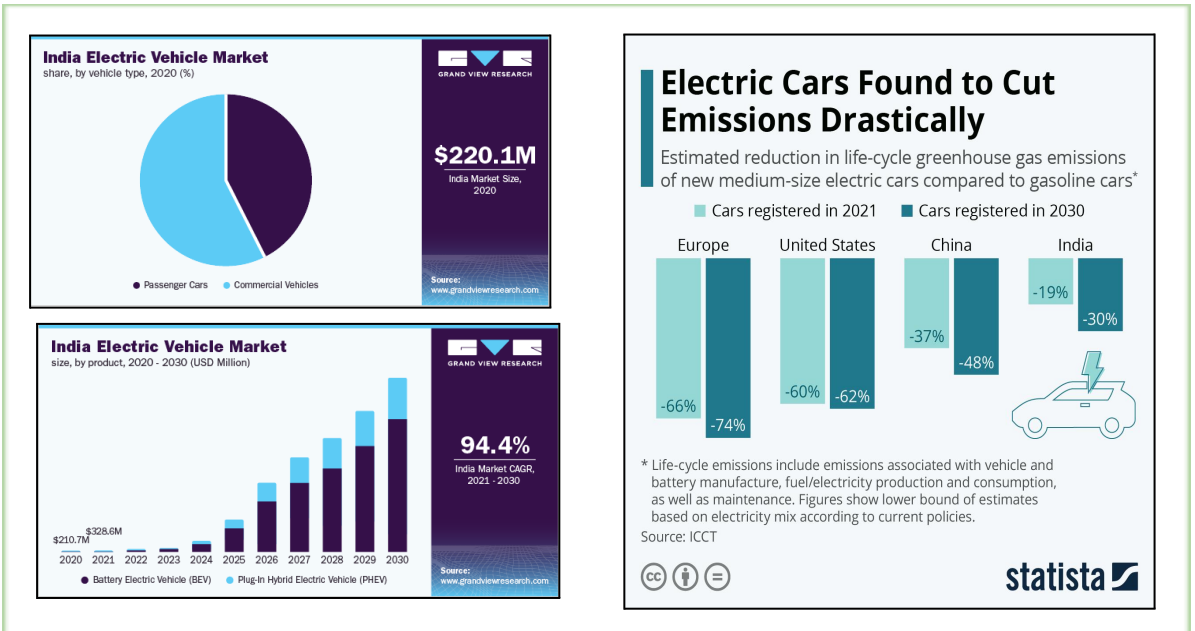
\- *Carlos Ghosn*

Abstract

The electric vehicle (EV) market in India is rapidly growing, with the Indian government promoting the adoption of EVs through various initiatives and policies. In recent years, the Indian EV market has seen significant growth in both the number of electric vehicles sold and the number of charging infrastructure facilities established. Start-ups operating in various segments of the EV industry value chain, such as manufacturing, retail, battery swapping, and software services, are disrupting the traditional structure of the automotive industry. Additionally, these startups are incorporating emerging technologies like artificial intelligence, analytics, and machine learning, giving them a technological edge over their traditional petrol or diesel counterparts.

One of the primary drivers of EV growth in India is the government's Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME) program, which aims to increase the adoption of electric vehicles and reduce carbon emissions. Under this program, the government provides incentives for the purchase of electric vehicles and the establishment of charging infrastructure. Another significant development in the Indian EV market is the emergence of several domestic EV manufacturers, such as Tata Motors, Mahindra Electric, and Hero Electric. These companies are developing affordable and efficient electric vehicles to cater to the needs of the Indian market. In addition to passenger vehicles, the Indian EV market is also seeing growth in the commercial vehicle segment, with many logistics and delivery companies adopting electric vehicles for their operations. The government has also encouraged the adoption of electric two-wheelers, which are a popular mode of transportation in India.

The following infographics shows the progress of EV market in India



source: grandviewresearch, statista

Problem Statement

This report aims to conduct a comprehensive analysis of the Electric Vehicles Market in India by employing segmentation analysis. The objective is to identify the most promising segments of the market, based on geographic, demographic, psychographic, and behavioural factors, and to devise a feasible market entry strategy accordingly. The study will focus on various segments such as region, price, charging facility, type of vehicles (e.g., 2-wheelers, 3-wheelers, 4-wheelers, etc.), retail outlets, manufacturers, body type (e.g., Hatchback, Sedan, SUV, Autorickshaw, etc.), safety features, plug types, and more. Through this analysis, we hope to provide valuable insights to businesses looking to enter the Indian Electric Vehicles Market and help them make informed decisions about their market entry strategy.

Fermi Estimation

Wild Guess: The EV market in India will grow by 50% in the next five years.
Educated Guess:
There are approximately 1.3 billion people in India. Let's assume that only 50% of them are in the target market for EVs, which would make it around 650 million. Out of this target market, let's assume that only 20% of people will be interested in buying an EV, which would make it around 130 million.
The average cost of an EV in India is around 10 lakhs. Let's assume that only 10% of people in the target market can afford to buy an EV, which would make it around 13 million people.
Let's also assume that the EV market in India is currently growing at a rate of 10% per year. In five years, it would grow by approximately 60%. However, considering the challenges in infrastructure and the cost of EVs, let's assume that growth will be slower, at 50% over the next five years.
Variables and Formulas:
Let p be the population of India.
Let *tm* be the target market for EVs.
Let *i* be the interested population for EVs.
Let *a* be the affordable population for EVs.
Let *c* be the average cost of an EV in India.
Let *g* be the growth rate of the EV market.
$tm = p * 0.5$
$i = tm * 0.2$
$a = tm * 0.1$
$g = 0.5$
Conclusion: By this analysis, we conclude that the EV market in India will grow by 50% in the next five years, and around 13 million people will be able to afford EVs.

Data Collection

The data has been collected manually, and the sources used for this process are listed below :

https://www.kaggle.com/datasets
https://data.gov.in/
https://data.worldbank.org/
https://datasetsearch.research.google.com/
https://vahan.parivahan.gov.in/vahan4dashboard/vahan/view/reportview.xhtml

Data Pre-processing

Packages/Tools used:

- Numpy
- Pandas
- SKLearn
- Matplotlib
- Seaborn
- Shapely
- Plotly.express
- Kaleido
- Kmodes.kprototypes
- geopanda

Reading the Data

```
df = pd.read_csv("behavioural_dataset.csv")
df
```

	Age	Profession	Marrital Status	Education	No of Dependents	Personal loan	Total Salary	Price
0	27	Salaried	Single	Post Graduate	0	Yes	800000	800000
1	35	Salaried	Married	Post Graduate	2	Yes	2000000	1000000
2	45	Business	Married	Graduate	4	Yes	1800000	1200000
3	41	Business	Married	Post Graduate	3	No	2200000	1200000
4	31	Salaried	Married	Post Graduate	2	Yes	2600000	1600000
...	...	...	...	...	...	...	...	...
94	27	Business	Single	Graduate	0	No	2400000	1600000
95	50	Salaried	Married	Post Graduate	3	No	5100000	1600000
96	51	Business	Married	Graduate	2	Yes	2200000	1100000
97	51	Salaried	Married	Post Graduate	2	No	4000000	1500000
98	51	Salaried	Married	Post Graduate	2	Yes	2200000	1100000

99 rows × 8 columns

```
cs_highway = pd.read_csv("CS_Highway.csv")
```

```
cs_highway
```

	Sl. No.	Highways/Expressways	Charging Stations
0	1	Mumbai - Pune Expressway	10
1	2	Surat-Mumbai Expressway	30
2	3	Mumbai - Delhi Highway	124
3	4	Mumbai - Panaji Highway	60
4	5	Mumbai - Nagpur Highway	70
5	6	Mumbai - Bengaluru Highway	100
6	7	Agra-Nagpur	80
7	8	Kolkata- Nagpur	120
8	9	Chennai- Nagpur	114
9	Total	Total	708

```
d_ka.set_index(["Vehicle_Class"])
d_ka = d_ka[["Vehicle_Class","CNG ONLY","DIESEL","ELECTRIC(BOV)","PETROL"]]
```

```
d_ka
```

	Vehicle_Class	CNG ONLY	DIESEL	ELECTRIC(BOV)	PETROL
0	ADAPTED VEHICLE	1	543	16	39005
1	AGRICULTURAL TRACTOR	0	686442	25	3868
2	AMBULANCE	0	7864	2	3954
3	ANIMAL AMBULANCE	0	36	0	9
4	ARTICULATED VEHICLE	0	19023	0	670
...	...	...	...	...	...
65	TREE TRIMMING VEHICLE	0	25	0	0
66	VEHICLE FITTED WITH COMPRESSOR	0	1582	0	31
67	VEHICLE FITTED WITH GENERATOR	0	1038	0	21
68	VEHICLE FITTED WITH RIG	0	11199	1	110
69	X-RAY VAN	0	6	0	1

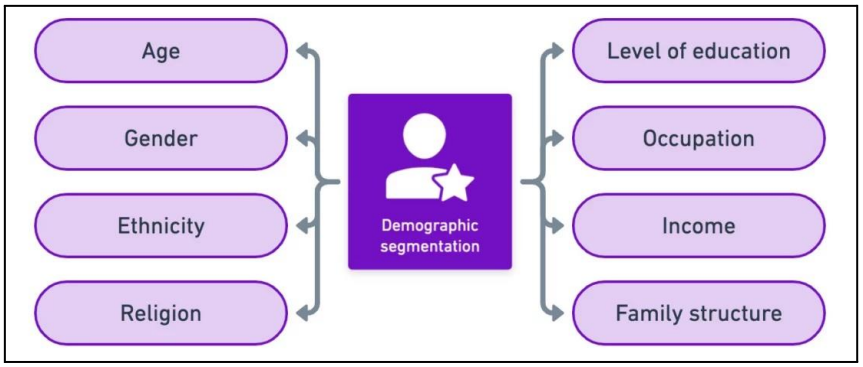
70 rows × 5 columns

Market Segmentation

Market segmentation is the process of dividing customers into subgroups based on their characteristics. There are two approaches to market segmentation - a-priori and post-hoc. The a-priori approach uses predefined characteristics to create segments, while the post-hoc approach identifies segments based on the relationship among measured variables. This study uses an a-priori approach to segment potential EV customers. The study suggests that using a blend of psychographic and socioeconomic attributes is useful in formulating sub-market strategies that satisfy specific consumer preferences. The study also recommends using perceived-benefit characteristics guided by blended psychographic and socio-economic aspects for segmenting the consumer market. Previous research has shown that psychographic characteristics are more useful than socio-demographic and economic ones in explaining environmentally-conscious consumer behaviour.

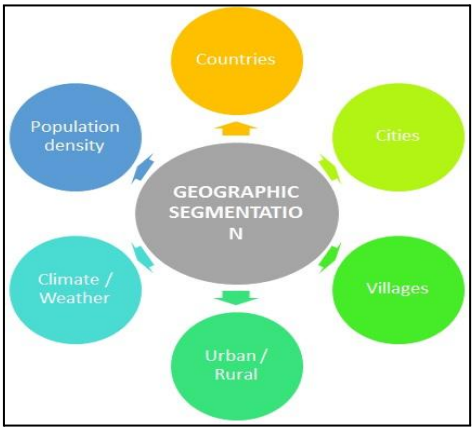
Demographic / Behavioural segmentation

Dividing the market based on factors such as age, gender, income, occupation, education, marital status, and family size.



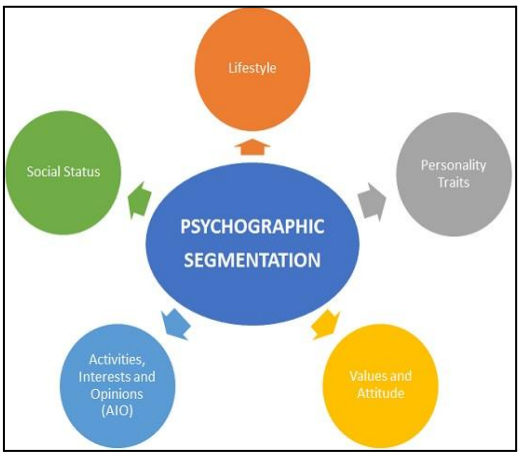
Geographic segmentation

Dividing the market based on factors such as location, climate, region, and population density.



Psychographic segmentation

Dividing the market based on factors such as personality, values, interests, attitudes, and lifestyle.



Product-based segmentation

Dividing the market based on product attributes such as features, design, quality, size, and price.

EDA and clustering

Geographical dataset

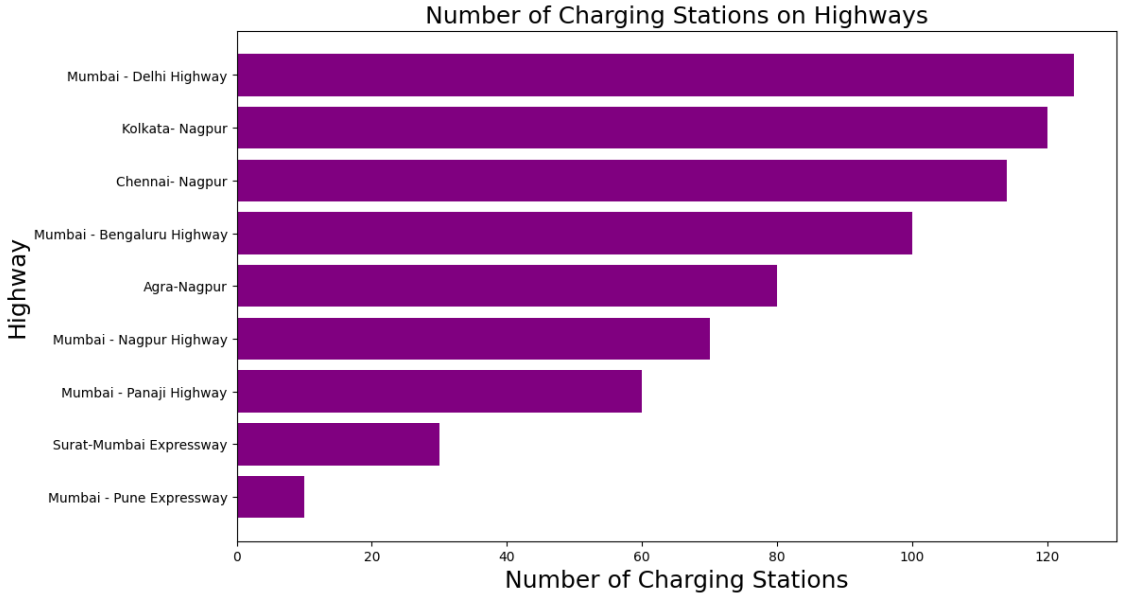
- Conducting data manipulation to extract relevant fields from the dataset.
- Creating custom functions for generating plots that group data based on specific features and provide insights.
- Eliminating features from the dataset that have little or no relevance to electric vehicles.
- Cleaning numerical data by converting string values to floating-point values.
- Combining relevant data frames to generate a visualisation of electric vehicle market insights on a map of India.

Behavioural Dataset

- Consumer characteristics, namely Age, Profession, Marital Status, Education, No. of Dependents, Car Loan, Total Salary (Combined salary in case married) are compared to the price of the purchased Electrical Vehicle.
- Clusters are formed based on inferences drawn from analysis.
- Categorical value count is compared with EV price
- Inference is drawn on clusters formed.

Geographical Segmentation: Visualization and insights

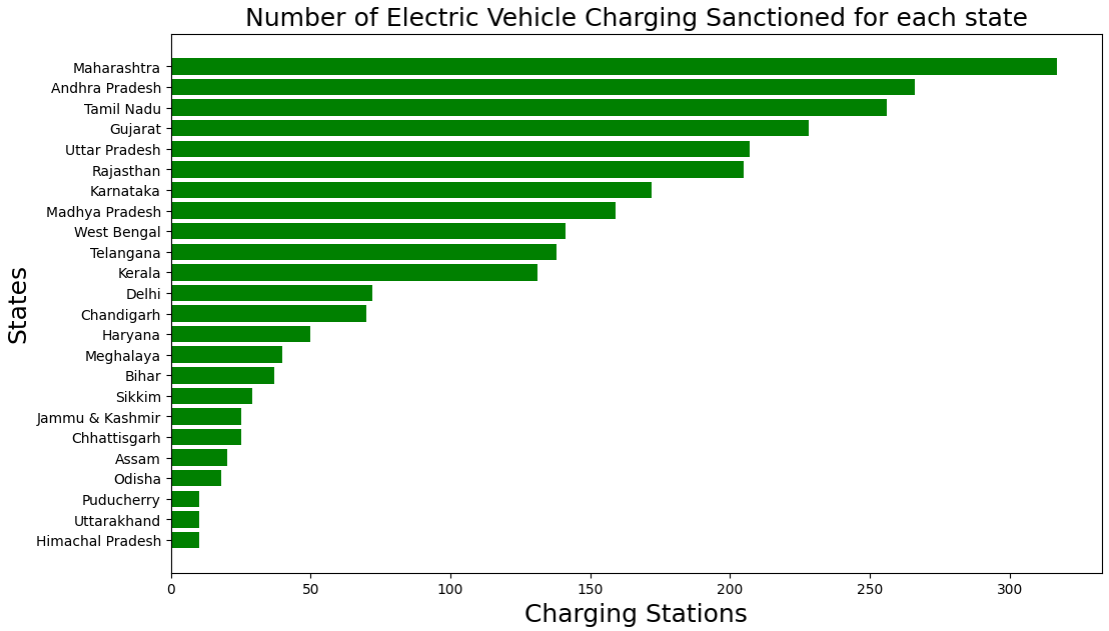
Charging stations on Indian Highways



Based on the above plot, the following states could serve as baseline targets when it comes to geographic segmentation.

- Maharashtra.
- Delhi.
- West Bengal.
- Karnataka.
- Gujarat

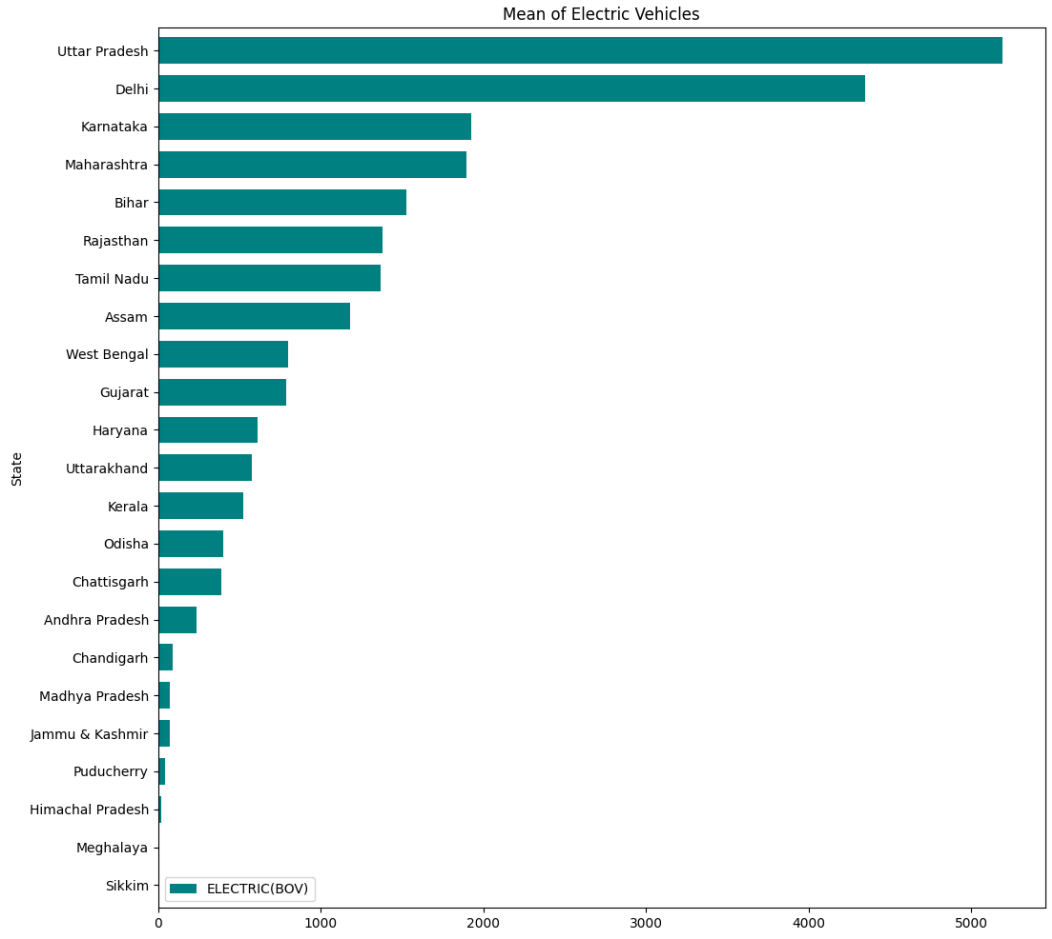
Sanctioned Charging Stations State-wise



States to target based on charging stations sanctioned:

- Maharashtra
- Andhra Pradesh
- Tamil Nadu
- Gujarat
- Uttar Pradesh
- Rajasthan
- Karnataka

Vehicle wise fuel data state-wise



After conducting analysis of the number of charging stations in various states and highways, we have identified the most promising states to enter the EV market. This aligns with our earlier baseline states that we had established. We can now move on to the next phase of geographic segmentation and focus on targeting specific types of vehicles.

To determine the most promising vehicle types, we have analysed the existing number of E-vehicles being used across different states. Based on this analysis, we have identified six states that show the most promise. Our focus will be on targeting these states and capturing a significant share of the EV market.

We are excited to move forward with this strategy and believe that it will position us for long-term success in the EV industry.

The below mentioned states are best to enter our EV vehicle in the market:

- Uttar Pradesh
- Delhi
- Karnataka
- Maharashtra
- Tamil Nadu
- Bihar
- Rajasthan

Vehicle Class wise fuel data on Uttar Pradesh state

Uttar Pradesh

```
1  up = pd.read_excel("type_UP.xlsx")
2  up = up[["Vehicle_Class","CNG ONLY","DIESEL","ELECTRIC(BOV)","PETROL"]].sort_values(by=["ELECTRIC(BOV)"],ascending=False)
3  up = up.head(10)
4  up
```

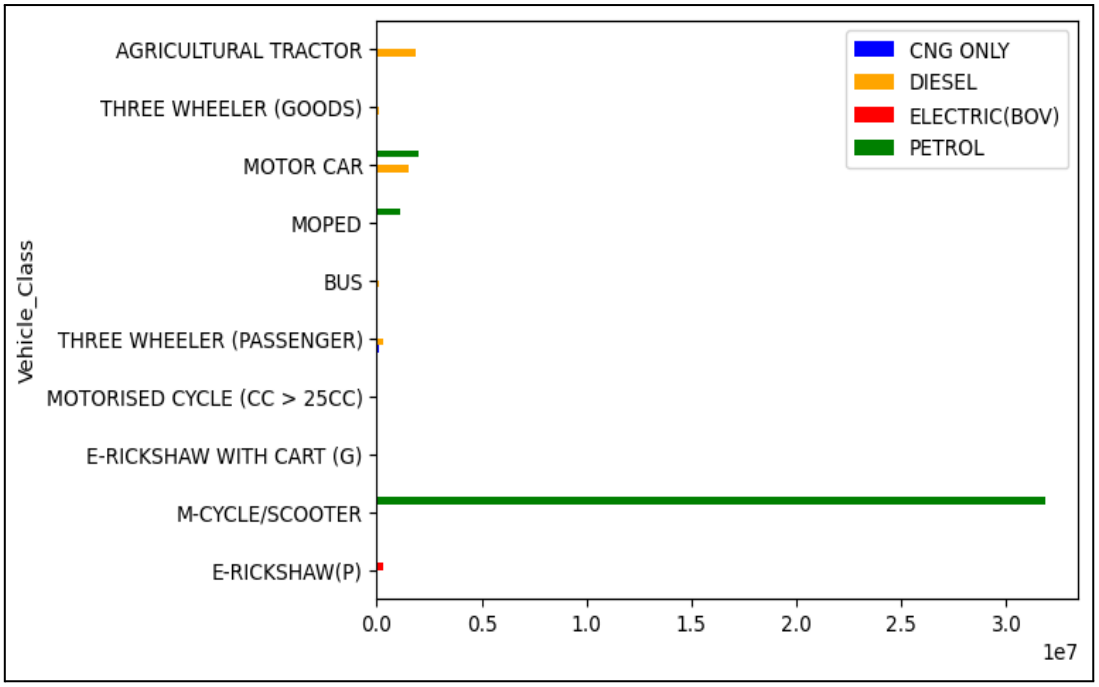
Python

	Vehicle_Class	CNG ONLY	DIESEL	ELECTRIC(BOV)	PETROL
19	E-RICKSHAW(P)	11	45	320515	5
32	M-CYCLE/SCOOTER	65	11593	28717	31845948
20	E-RICKSHAW WITH CART (G)	2	51	9273	1
44	MOTORISED CYCLE (CC > 25CC)	0	3	1491	65798
55	THREE WHEELER (PASSENGER)	74001	297699	1410	24915
9	BUS	13484	93406	576	83
38	MOPED	1	213	555	1125365
40	MOTOR CAR	2169	1500358	483	1993210
54	THREE WHEELER (GOODS)	10613	86192	354	5293
1	AGRICULTURAL TRACTOR	11	1844663	94	2740

```
1  up.plot.barh(x = 'Vehicle_Class', color=("blue", "orange", "red", "green"))
```

Python

```
<Axes: ylabel='Vehicle_Class'>
```

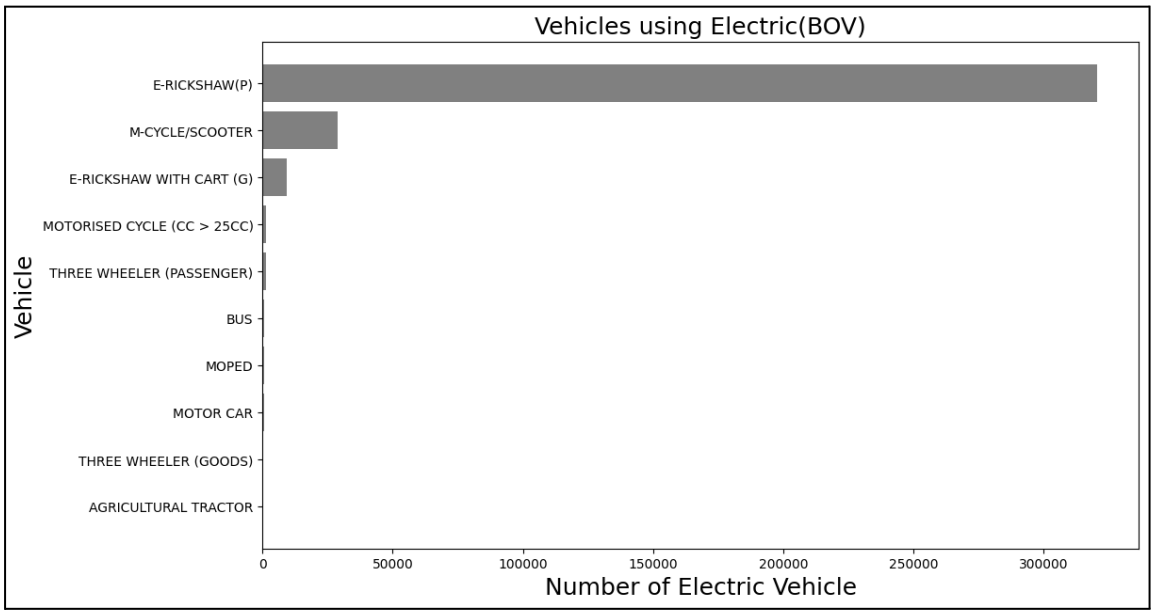


By analyzing the different types of fuels used by vehicles in Uttar Pradesh, we have gained valuable insights into the current state of the market

Furthermore, we have also conducted an analysis of the types of vehicles that currently use electric vehicles (battery-operated vehicles). This analysis has allowed us to narrow our focus and target specific vehicle types that show the most promise for the EV market.

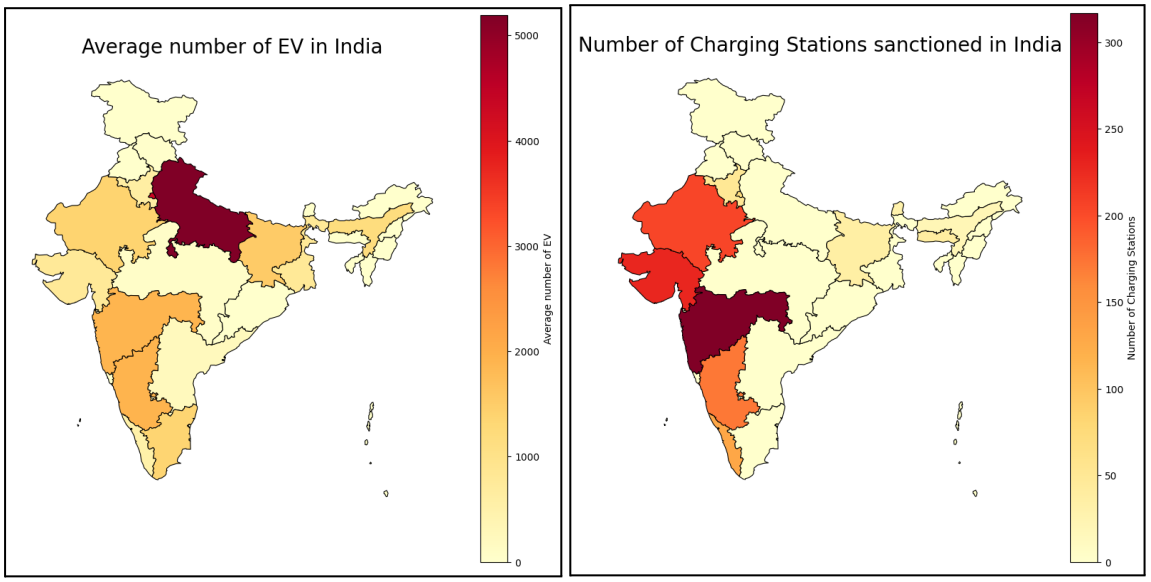
By honing in on these vehicle types, we can develop EV models that are tailored to the needs of consumers in Uttar Pradesh. This will enable us to capture a significant share of the market and position ourselves for long-term success in the EV industry.

Vehicles in Uttar Pradesh using EVs:

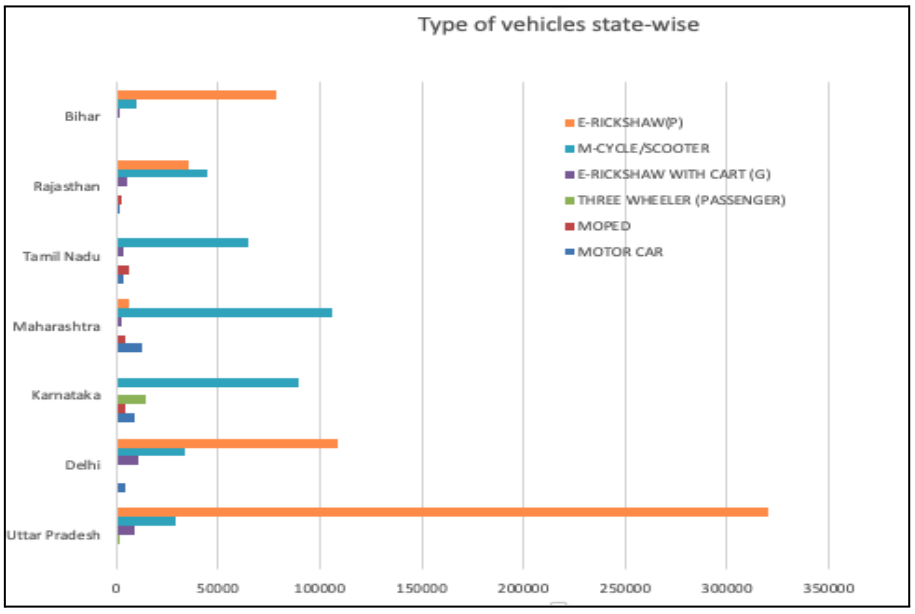


We can see that when it comes to Battery operated vehicles for Uttar Pradesh, E-rickshaw (Passenger), Motor-Cycle / Scooter and 3 Wheeler (Passenger) are the vehicle spaces which should be considered.

Selection of segments:



The above maps, constructed with the help of geopandas and shapely provide a final and insightful representation of the Number of Charging Stations and the EV (Battery operated vehicle) used across India.



Insights after geographic segmentation to consider

- Based on the Number of sanctioned charging stations, people are more likely to opt for EV vehicles due to its convenience. States to focus are:

Maharashtra, Andhra Pradesh, Tamil Nadu, Gujarat,Uttar Pradesh, Rajasthan, Karnataka.

- Based on the average number of EV present in India, and charging stations in highways, States to focus are:
  Uttar Pradesh, Maharashtra, Karnataka, Gujarat, Tamil Nadu, Bihar.
- The common names from both the insights are important to target sales of our EV.It is evident that states having lower temperatures are less likely to adopt EVs compared to above mentioned states.
- Based on the type of vehicle predominant in states, Vehicle to focus are: ***Motor-Cycle/scooter, Car, Moped, E-Rickshaw.***

Apart from this, the startup needs to keep informed about

- Government guidelines related to EV rules and regulations state-wise.
- Also, the sentiment of the population towards EV vehicles. For instance, the EV vehicle when it comes to personal usage is not bound to social status. But for Rickshaw to be made electric, proper communications need to be made to the public as auto drivers aren't economically independent, are reluctant to adopt new means of transport because of fear of their current vehicle being obsolete. Some steps include:
- With coordination from government and support to those segments can be fruitful in introducing the rickshaw to the market.
- Creating awareness state-wise through celebrities like cricket players, artists to the public about EV vehicle advantages.

Demographic / Behavioural segmentation of EV customer

Description of dataset

```
1  df.describe()
```

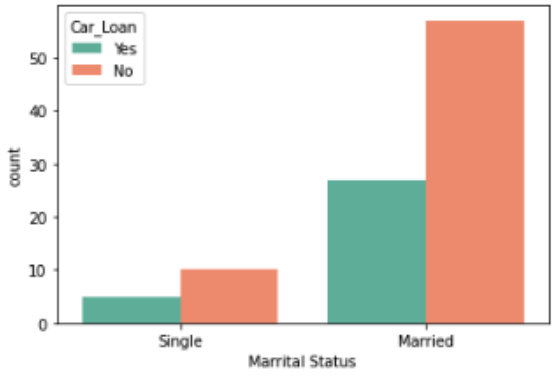
	Age	No of Dependents	Total Salary	Price
count	99.000000	99.000000	9.900000e+01	9.900000e+01
mean	36.313131	2.181818	2.270707e+06	1.194040e+06
std	6.246054	1.335265	1.050777e+06	4.376955e+05
min	26.000000	0.000000	2.000000e+05	1.100000e+05
25%	31.000000	2.000000	1.550000e+06	8.000000e+05
50%	36.000000	2.000000	2.100000e+06	1.200000e+06
75%	41.000000	3.000000	2.700000e+06	1.500000e+06
max	51.000000	4.000000	5.200000e+06	3.000000e+06

Here we observe that the maximum age of the person who bought an EV car is 51 and the mean of such ages is 36.31 years. Maximum salary of the person who bought the car is 5200000 while minimum salary is 2000000 and the average of the salary is 2270707.

Visualisation of customer based on marital status

```
# Plotting the Car loan status with respect to Marital Status
sns.countplot(x ='Marrital Status', hue = 'Car_Loan',  data = df, palette = 'Set2')
plt.show()
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f38408e3f40>
```




```
import math
a =(df['Marrital Status'].value_counts()['Married'])/((df['Marrital Status'].value_counts()['Married'])+(df['Marrital Status'].value_counts()['Single']))*100
print(math.floor(a),'%')
```

```
84 %
```

According to the depicted graph, married couples appear to be more inclined towards buying electric vehicles (EVs) compared to single individuals. The analysis shows that nearly 84% of EV buyers are married, indicating that the current EV market is primarily focused on catering to families. Although there are options that may appeal to single individuals, this group encompasses a more diverse range of preferences, making it challenging to target them specifically.

Car Loan ratio:

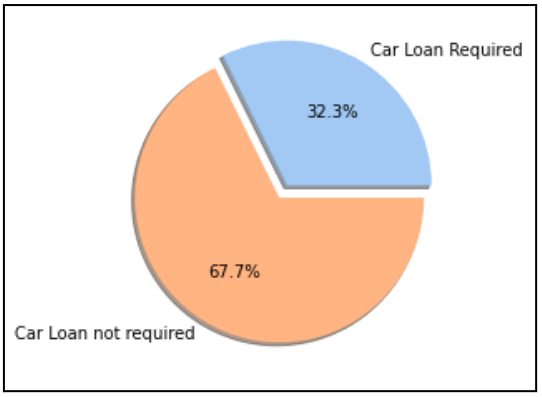
```
#Getting labels and data
labels = ['Car Loan Required','Car Loan not required']
Loan_status = [df.query('Car_Loan == "Yes"').Car_Loan.count(),df.query('Car_Loan == "No"').Car_Loan.count()]

# declaring exploding pie
explode = [0.1, 0]
# define Seaborn color palette to use
palette_color = sns.color_palette('pastel')

# plotting data on chart
plt.pie(Loan_status, labels=labels, colors=palette_color, shadow = "True",
        explode=explode, autopct='%1.1f%%')

# displaying chart
plt.show()
```

Python

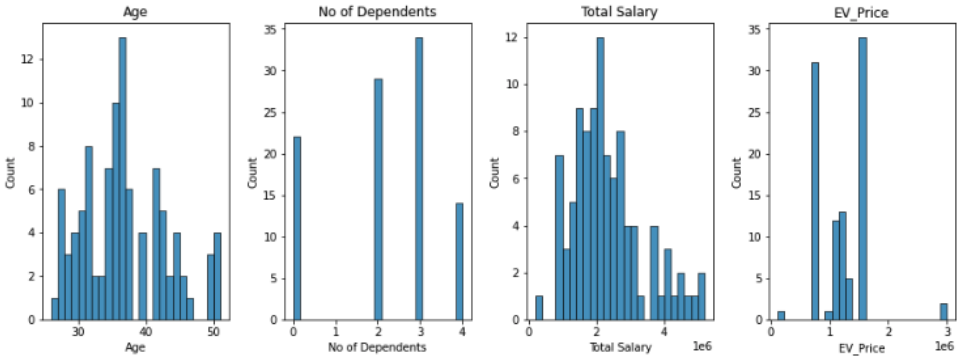


67.7% of the total person who bought EV car do not need car loan

Frequency of customers against Age, No of Dependents, Total Salary and EV_price.

```
plt.figure(1, figsize=(15,5))
n=0
for x in ['Age', 'No of Dependents' ,'Total Salary'  ,'EV_Price']:
  n += 1
  plt.subplot(1,4,n)
  plt.subplots_adjust(hspace=0.3, wspace=0.3)
  sns.histplot(df[x], bins= 25)
  plt.title(f'{x}')
plt.show()
```

Python



- The age group of 30 to 40 years old appears to have made the highest number of car purchases.
- Individuals with four family members seem to be less interested in buying cars.
- People with a medium-level salary appear to have a higher tendency to purchase EV cars.
- EV cars with a medium price range seem to be in higher demand and are being sold more frequently.

KModes Clustering

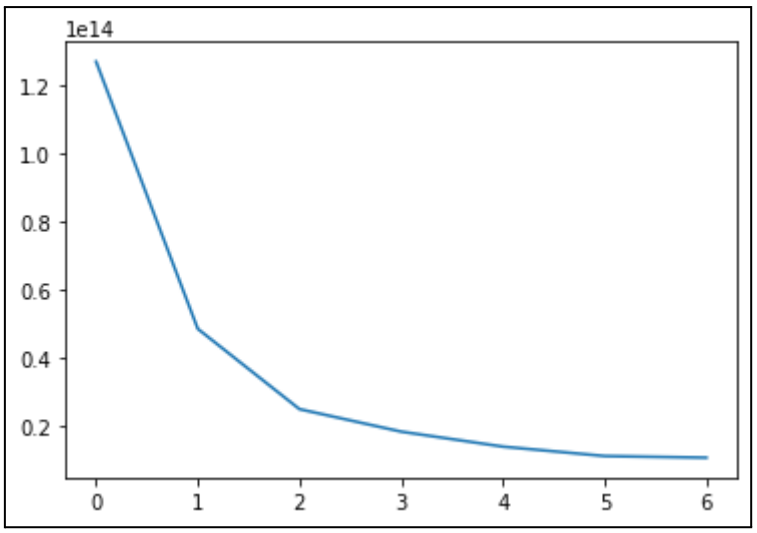
KModes clustering is an unsupervised Machine Learning technique designed for clustering categorical variables.
Unlike KMeans, which uses mathematical measures (distance) to cluster continuous data, KModes uses dissimilarities between data points, as we cannot calculate distances for categorical data.
The dissimilarities are determined based on the total number of mismatches between the data points. Moreover, while KMeans uses Means to update the centroids, KModes uses Modes for cluster centers.
Additionally, in each iteration, KModes applies a frequency-based method to update the Mode. These modifications make KModes more suitable for clustering high-dimensional categorical data than KMeans, which requires the conversion of categorical data into numerical form and may not provide accurate results for such data.

Finding optimal number of clusters for Kmodes

```python
cost = []
for num_clusters in list(range(1,8)):
    kproto = KPrototypes(n_clusters=num_clusters, init='Cao')
    kproto.fit_predict(cluster_data, categorical=[1,2,3,5])
    cost.append(kproto.cost_)

plt.plot(cost)
plt.show()
```

Python



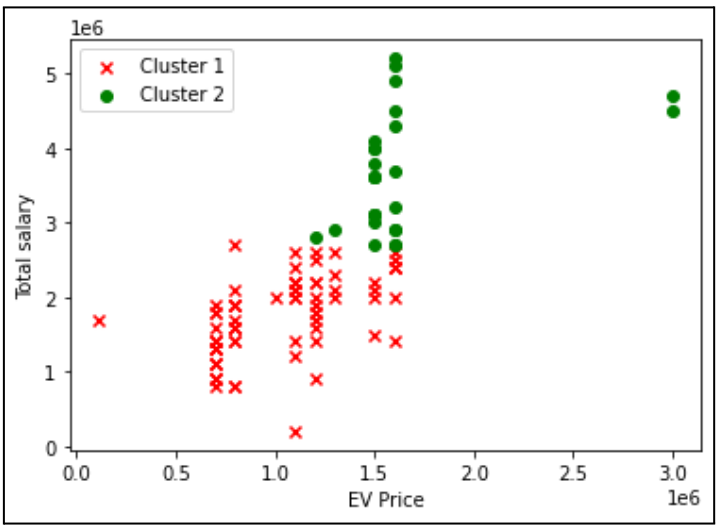
There is bending in the line at point 2. Hence the number of clusters formed is 2 for better visualisation.

Plotting the effect of EV_price and salary on clusters

```python
plt.scatter(Cluster_0.EV_Price, Cluster_0['Total Salary'],color='red', marker = 'x', label = 'Cluster 1')
plt.scatter(Cluster_1.EV_Price, Cluster_1['Total Salary'],color='green', label = 'Cluster 2')
plt.legend(loc="upper left")

plt.xlabel('EV Price')
plt.ylabel('Total salary')
plt.show()
```

Python

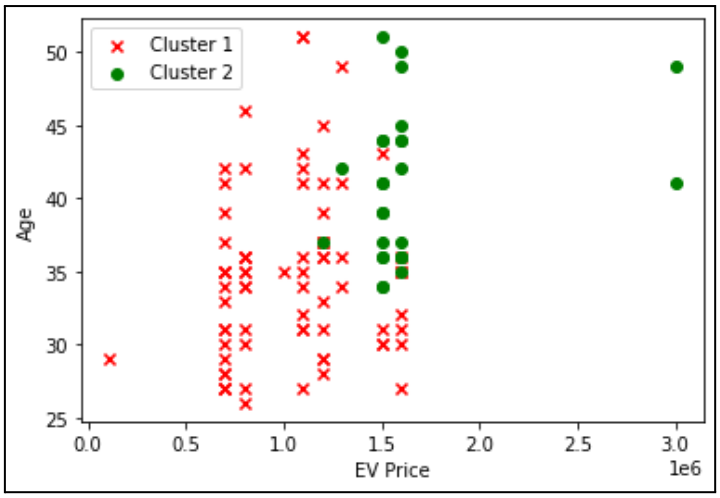


Based on this scatter plot, Total Salary appears to be a reliable indicator of cluster formation.

- Cluster 1 comprises individuals with a total salary ranging from 200,000 to 2,700,000 rupees, which corresponds to a base EV price range of 1.1 L to 16 L. This suggests that Cluster 2 consumers are more likely to opt for baseline models and budget-friendly EV options.
- On the other hand, Cluster 2 consists of individuals with a total salary ranging from 2,700,000 to 5,200,000 rupees, which corresponds to a base EV price range of 12 L to 30 L. This indicates that Cluster 2 represents a wealthier market segment capable of purchasing premium EVs.

Overall, the scatter plot shows that Total Salary is a useful factor in distinguishing between these two clusters of EV buyers.

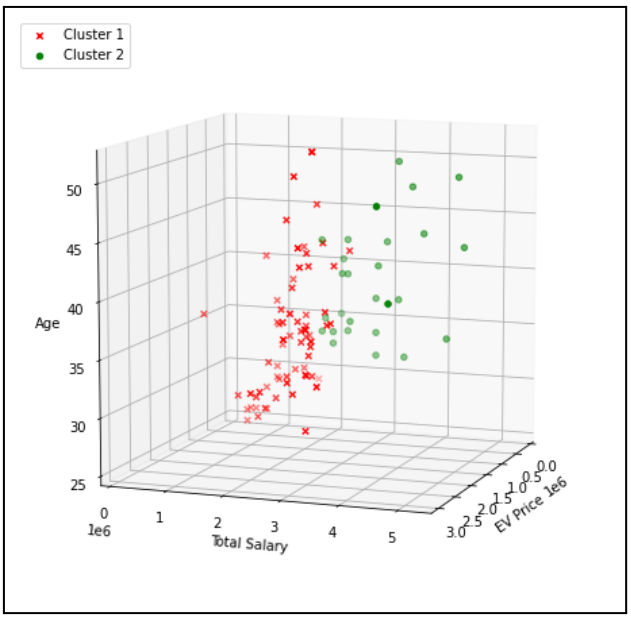
Plotting the effect of EV_price and age on clusters



This scatter plot displays the distribution of clusters based on Age and EV Price. The data indicates that Age is not a significant factor in cluster formation, as there is no clear separation between the clusters. While the majority of the data falls within the 25-45 age range, it does not distinctly distinguish the clusters.

- Cluster 1 encompasses individuals with ages ranging from 25 to 50 years old, with the majority falling within the 25-43 age range.
- In contrast, Cluster 2 consists of individuals between the ages of 33 and 50.

Clusters based on EV_price, Salary, Age



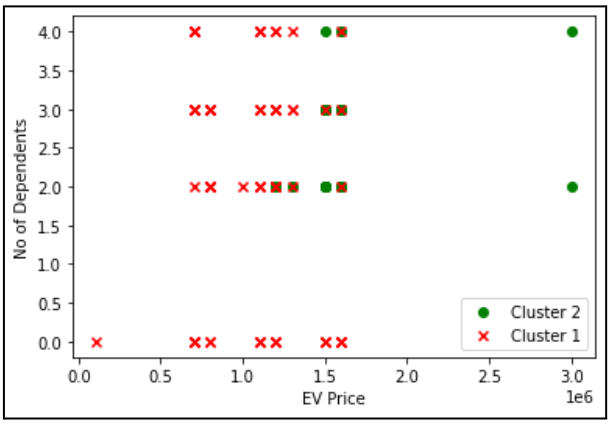
The insights obtained from the 3D Scatter Plot are a synthesis of the findings from the previous two plots. The data still indicates that Total Salary is a more influential factor in EV purchases than Age. Therefore, no additional inferences can be made beyond those previously established.

Clusters based on EV_price, and number of dependents in family

```
plt.scatter(Cluster_1.EV_Price, Cluster_1['No of Dependents'],color='green', label = 'Cluster 2')
plt.scatter(Cluster_0.EV_Price, Cluster_0['No of Dependents'],color='red', marker = 'x', label = 'Cluster 1')
plt.legend(loc="lower right")

plt.xlabel('EV Price')
plt.ylabel('No of Dependents')
plt.show()
```

Python



This analysis provides further insights into the current family-oriented EV market:

- Consumers with 0 dependents are inclined towards budget-friendly options, with individuals or couples having a maximum salary of 20 L. All data points fall within Cluster 2, which is the budget-friendly option.
- The data is insufficient for consumers with 1 dependent, so no inferences can be made.
- Consumers with 2 or 3 dependents make up the majority of the total distribution, and there is an equal distribution of data points among the clusters.
- Consumers with 4 dependents are a smaller portion of the market compared to those with 2 or 3 dependents. While no concrete conclusions can be drawn, it seems that a majority of this market segment is similar to Cluster 2.

Selection and insights from clusters:

Cluster 1:

- The total salary of this segment falls between 27,00,000 and 52,00,000 rupees.
- The EV price range for this segment is between 12 L to 30 L.
- The age range lies between 25 to 50.
- This segment represents a wealthier market capable of purchasing premium EVs.

Cluster 2:

- The total salary of this segment falls between 2,00,000 and 27,00,000 rupees.
- The EV price range for this segment is between 1.1 L to 16 L.
- The age range lies between 33 to 50.

- This segment represents a market that is more inclined towards baseline models and budget-friendly EV options.

Insights from Demographic / Behavioural segmentation

- The age range of people who bought EV cars is between 51 and the mean age is 36.31. The maximum salary of buyers is 5200000, the minimum salary is 2000000 and the average salary is 2270707.
- Majority of single or married individuals do not require car loans to purchase EV cars.
- Around 67.7% of people who bought EV cars did not require car loans.
- Most EV cars are purchased by individuals aged between 30 and 40.
- Families with four members are less interested in buying cars.
- Individuals with a moderate salary level are more likely to buy EV cars.
- EV cars with medium price range are popular among buyers.

Vehicle Specification Segmentation:

```
1  ev_cars = pd.read_csv('EVIndia.csv')
```

Python

```
1  ev_cars.head()
```

Python

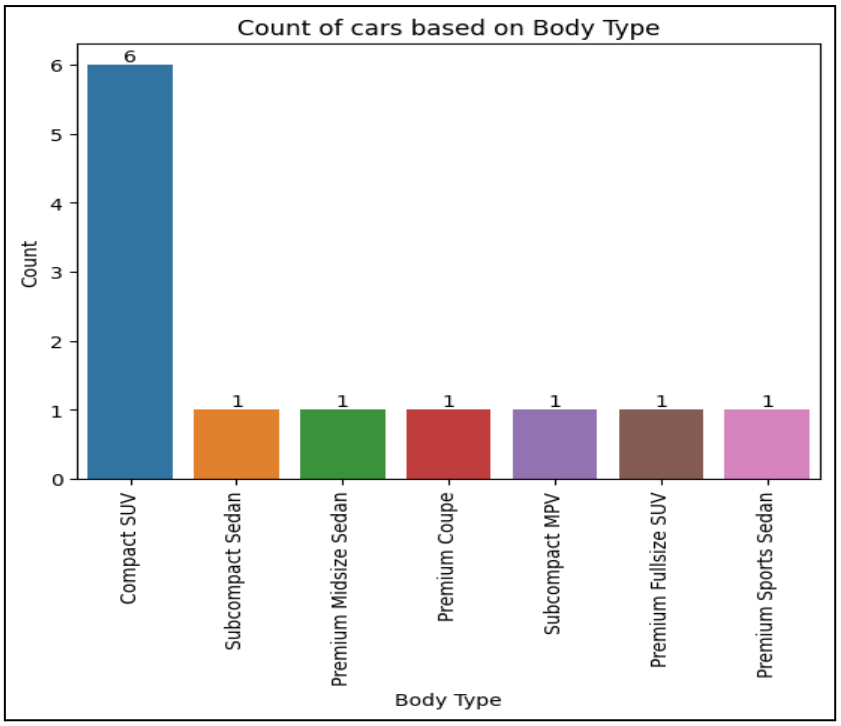
	Car	Style	Range	Transmission	VehicleType	PriceRange	Capacity	BootSpace	BaseModel	TopModel
0	Tata Nexon EV	Compact SUV	312 Km/Full Charge	Automatic	Electric	₹ 13.99 - 17.4 L	5 Seater	350 L	XM	Dark XZ Plus LUX
1	Tata Tigor EV	Subcompact Sedan	306 Km/Full Charge	Automatic	Electric	₹ 12.49 - 13.64 L	5 Seater	316 L	XE	XZ Plus Dual Tone
2	Tata Nexon EV Max	Compact SUV	437 Km/Full Charge	Automatic	Electric	₹ 17.74 - 19.24 L	5 Seater	350 L	XZ Plus 3.3 kW	XZ Plus Lux 7.2 kW
3	MG ZS EV	Compact SUV	419 Km/Full Charge	Automatic	Electric	₹ 21.99 - 25.88 L	5 Seater	448 L	Excite	Exclusive
4	Hyundai Kona Electric	Compact SUV	452 Km/Full Charge	Automatic	Electric	₹ 23.79 - 23.98 L	5 Seater	na	Premium Dual Tone	HSE

```
1  ev_cars.describe()
```

Python

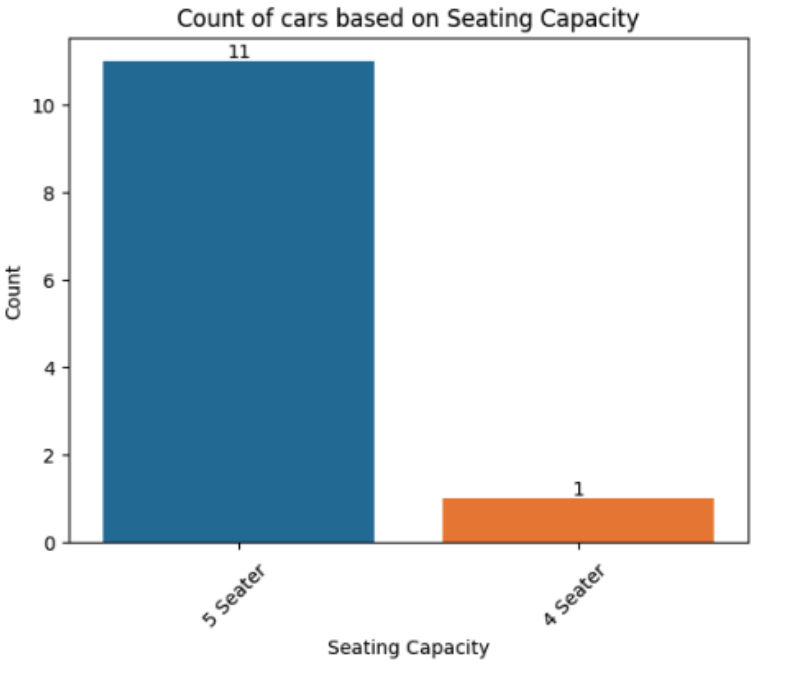
	Car	Style	Range	Transmission	VehicleType	PriceRange	Capacity	BootSpace	BaseModel	TopModel
count	12	12	12	12	12	12	12	12	12	12
unique	12	7	12	1	1	12	2	8	9	7
top	Audi E-Tron	Compact SUV	312 Km/Full Charge	Automatic	Electric	₹ 21.99 - 25.88 L	5 Seater	na	na	na
freq	1	6	1	12	12	1	11	4	4	6

Visualisations:

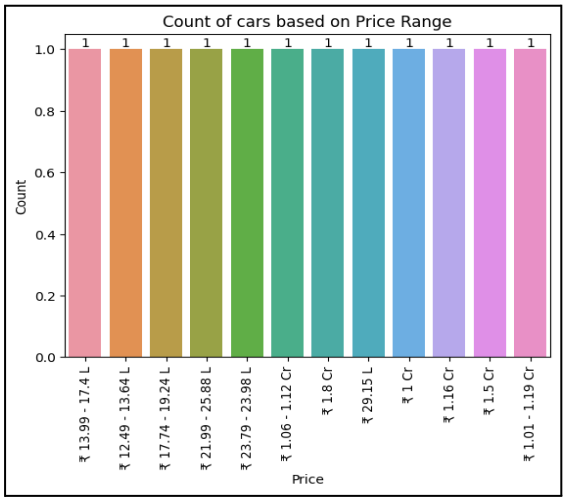


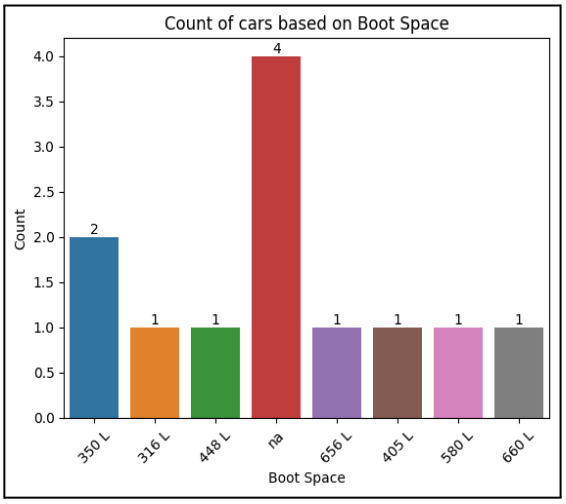
There are more car variants in Compact SUVs compared to other body types.

```
ax = sns.countplot(data=ev_cars, x='Capacity')
plt.title("Count of cars based on Seating Capacity")
plt.xlabel("Seating Capacity")
plt.xticks(rotation=45)
plt.ylabel("Count")
for label in ax.containers:
    ax.bar_label(label)
plt.show()
```



Most EVs in India have `5 seats`. Therefore, if a company launches a new EV with more seats, it can be profitable for that company.





Insights from Vehicle Specification segmentation

- The observation of the prevalent body type of electric vehicles in India suggests that there may be potential competition for a company if it chooses to produce EVs in the same compact SUV category. However, it is possible for a company to establish a monopoly in the market by manufacturing EVs in other categories, such as hatchbacks or premium hatchbacks.
- From this dataset, the price range does not give much information. It is worth noting that a majority of the EVs in India have a seating capacity of 5 seats. Thus, a company that introduces an EV with a higher seating capacity could potentially reap profits.
- As per the Boot Space graph, it is evident that there is a dearth of EVs in the 0L - 300L range, with most of the available EVs having a boot space capacity in the range of 400L - 600L.

Marketing Mix

The marketing mix comprises a series of tactics used by a company to promote its brand or product in the market. It typically consists of four elements, commonly referred to as the 4Ps: Price, Product, Place, and Promotion. Each of these factors plays a crucial role in the success of a company's marketing strategy.

Source: lumenlearning

- **Price** refers to the monetary value assigned to a product, which depends on various factors such as the targeted market segment, the company's financial ability, the customers' purchasing power, and supply-demand dynamics.
- **Product** pertains to the actual service or product being offered and its ability to meet a minimum level of performance required to satisfy customers.
- **Place** involves the point of sale, which aims to capture customers' attention and make it convenient for them to purchase the product. A well-planned distribution strategy can greatly influence the success of a retail business, as location is often key.
- **Promotion** encompasses all activities undertaken to create awareness and generate interest in the product or service. This can include advertising, word of mouth, press coverage, incentives, trade awards, consumer schemes, direct marketing, and contests.

The four elements of the marketing mix are interrelated and impact one another. An effective marketing plan requires a thorough understanding of the market, extensive research, and consultation with various stakeholders such as customers, trade partners, and manufacturers. When executed well, the marketing mix can propel a company to great success.

Customising the Marketing Mix

Product:

The EV market in India is dominated by compact SUVs and hatchbacks. However, there are also electric sedans and premium SUVs available in the market. Companies like Hyundai, Tata Motors, and MG Motor offer various EV models with different features, such as fast charging, connected car technology, and advanced safety features. For example, the Hyundai Kona Electric comes with a range of 452 km, fast charging capability, and advanced safety features. With the market diversified demand for different preferences, our startup needs to have a set of

products to serve all types of customers. Based on our research,existing vehicles using EV (BOV), target these vehicle spaces:
E-Rickshaw
motor-Cycle
Moped
Car with 5 seaters or more*(data is insufficient)*

Place:

In India, the EV market is still at a nascent stage, and the infrastructure for EV charging is not yet well developed. Companies like Tata Motors and MG Motor have partnered with various entities to set up charging stations across the country. Moreover, they are also setting up their dealerships in various cities to provide a better buying experience for customers. For example, Tata Motors has partnered with Tata Power to set up a wide network of charging stations, and MG Motor has partnered with Fortum Charge & Drive India to set up 5 superfast charging stations in five cities.
For our product, we have to be informed about Government guidelines related to EV rules and regulations state-wise. We have to target states where charging stations are more/ or Govt and other entities collaborate to establish more convenient infrastructure.
From our research, based on the Number of sanctioned charging stations, people are more likely to opt for EV vehicles due to its convenience. States to focus are:
Maharashtra, Andhra Pradesh, Tamil Nadu, Gujarat,Uttar Pradesh, Rajasthan, Karnataka.
Based on the average number of EV present in India, and charging stations in highways, States to focus are:
Uttar Pradesh, Maharashtra, Karnataka, Gujarat, Tamil Nadu, Bihar.
The common names from both the insights are important to target sales of our EV. They are:
Uttar Pradesh, Delhi*(It's the capital; viable to enter here too)****, Maharashtra, Karnataka, Rajasthan, Gujarat, Tamil Nadu***
It is evident that states having lower temperatures are less likely to adopt EVs compared to above mentioned states.

Price:

A company's price strategy is influenced by factors such as competition, segment, geography, and demand. A flexible pricing strategy can be used to adjust to changes in market conditions and competitors. Two common pricing strategies are

- market-oriented pricing and
- value-based pricing.

Market-oriented pricing sets prices based on the prevailing market rates, while value-based pricing sets prices based on the perceived or actual value of the product. Companies may use value-based pricing for high-end or more expensive

products. Additionally, offering financing options at low-interest rates can help companies increase sales and profitability.
From our research,

- Most EV cars are purchased by individuals aged between 30 and 40.
- Families with four members are less interested in buying cars.
- Individuals with a moderate salary level are more likely to buy EV cars.
- EV cars with medium price range are popular among buyers.

The startup needs to focus only on market-oriented pricing strategy where a certain group of customers get attracted.

Promotion:

To promote their EVs, companies in India use various marketing channels, such as advertising, social media, events, and sponsorships. For example, Tata Motors launched the Nexon EV with a TV commercial campaign featuring actor Milind Soman. Similarly, MG Motor launched the ZS EV with an online booking campaign and tied up with various celebrities to promote the brand. Moreover, companies also participate in events like Auto Expo to showcase their products and create buzz in the market.
A company like Toyota utilises various promotional tactics to market their products. They make use of traditional media platforms like newspapers, billboards, and television, as well as digital platforms like social media and websites.
Toyota also employs personal selling, where sales personnel directly promote products to potential buyers, and they use celebrities as brand ambassadors to create brand recall for customers. Additionally, they have implemented initiatives to reduce greenhouse gas emissions, which they promote to the public to enhance their public relations. Toyota's promotional strategy encompasses activities like personal selling, advertising, public relations, sales promotion, and direct selling.
We have to focus on:

- Also, the sentiment of the population towards EV vehicles. For instance, the EV vehicle when it comes to personal usage is not bound to social status. But for Rickshaw to be made electric, proper communications need to be made to the public as auto drivers aren't economically independent, and are reluctant to adopt new means of transport because of fear of their current vehicle being obsolete. Some steps include:
- With coordination from government and support to those segments can be fruitful in introducing the rickshaw to the market.
- Creating awareness state-wise through celebrities like cricket players, artists to the public about EV vehicle advantages.

References

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2. "India Electric Vehicle Market - Size, Share, COVID-19 Impact & Forecasts up to 2028" by ResearchAndMarkets.com, available at: https://www.researchandmarkets.com/reports/5717214/india-electric-vehicle-market-size-share
3. "BloombergNEF’s global EV outlook 2021: Commercial vehicles" by BloombergNEF, available at: https://www.bloomberg.com/professional/blog/bloombergnefs-global-ev-outlook-2021-commercial-vehicles/
4. “Descriptive Marketing Mix of Toyota with 4Ps Explained” by IIDE, available at: https://iide.co/case-studies/marketing-mix-of-toyota/
5. "Market Segmentation Analysis: Understanding It, Doing It, and Making It Useful" by Sara Dolnicar, Bettina Grün, Friedrich Leisch
6. Government website (Number of Charging Stations)
7. Vahan Parivahan (Vehicle class wise fuel usage data)

Github Links:

- https://github.com/ManjuKannavalli/EV-market-segmentation_Team-Avinash.git
  - Avinash Budige
  - Manjunath Kannavalli
  - Nishanth Nair
  - Raksha Pophare