MARKET SEGMENTATION ANALYSIS OF ELECTRIC VEHICLE MARKET

Feynn labs
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❖ OVERVIEW:

- An electric vehicle is one that operates on an electric motor instead of an internal combustion engine, which generates power by burning a mix of fuel and gases.
- Electric vehicles (EVs) are a promising technology for achieving a sustainable transport sector in the future, due to their very low to zero carbon emissions, low noise, high efficiency, and flexibility in grid operation and integration.
- It is environmental friendly. Zero exhaust emissions—EVs do not produce any exhaust emissions during operation.
- In India the current market share of EV/HEV/PHEV is around 0.1%.
- Electrical vehicle industry exhibited a rise of 11.34% in 2020 as compared to 2019.
- India is a country which imports around 70% of oil required per year.

The recent scenario of the road transportation sector can be highlighted as:

- Energy consumption   :   524 million tons of oil equivalent
- Vehicle to people ratio   :   1:56.3
- Per capita energy   :   442 kg of oil equivalent
- GHG emissions   :   1730 million tons of CO_2 equivalent
- Electric Vehicles sold   :   25000 (all) and 2000 (cars)

Market segmentation analysis is important for understanding the needs and preferences of different customer segments and developing effective marketing strategies to target those segments. Market segmentation becomes a crucial tool for evolving transportation technology such as electric vehicles (EVs) in emerging markets to explore and implement for extensive adoption.

EVs adoption is expected to grow phenomenally in near future as low emission and low operating cost vehicle, and thus, it drives a considerable amount of forthcoming academic research curiosity.

- Vehicle segmentation
- Price segmentation
- Usage segmentation
- Demographic segmentation.

❖ MARKET OVERVIEW:

Electric vehicle market segmentation:

- Vehicle type
- Power source type

The India electric vehicle market size was valued at USD 220.1 million in 2020 and is expected to expand at a compound annual growth rate (CAGR) of 94.4% from 2021 to 2030. The outbreak of the COVID-19 pandemic triggered a significant decline in the overall sales of passenger and commercial vehicles in 2020. However, the sales of electric vehicles in India remained unaffected. The post-lockdown sale of pure and hybrid electric vehicles is a prominent driving factor for the electric vehicle market in India.

The Indian Electric Vehicle Market has been impacted by the outbreak of the COVID-19 pandemic due to supply chain disruptions and halt of manufacturing units due to continuous lockdowns and travel restrictions across the country. However, the electric vehicle (EV) market is still in its nascent stage in India. It is expected to grow at a much faster rate during the forecast period due to various government initiatives and policies.

India has been recognized as one of the prominent regions in the automotive industry globally.

- India is experimenting with e-Mobility for public transport, and the country has deployed electric intercity buses across some major cities.

- FAME (Faster Adoption and Manufacturing of Hybrid & Electric Vehicles in India) India scheme with its aim of shifting toward e-mobility in the wake of growing international policy commitments and environmental challenges.
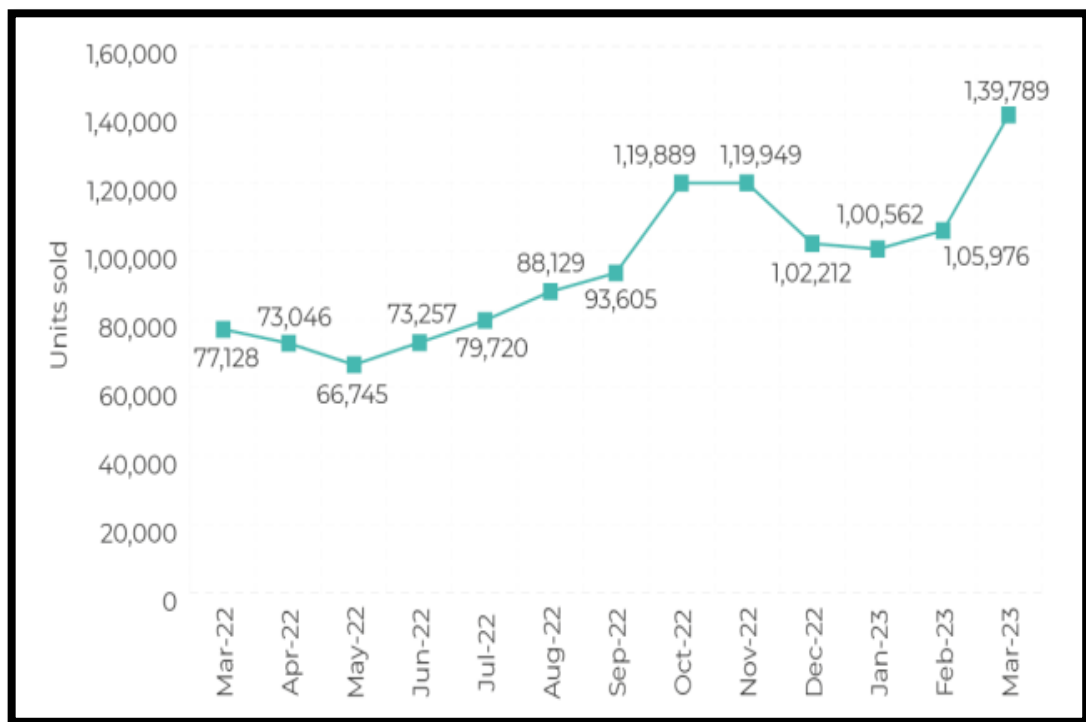

- **Some key trends in EV market include:**
  - Increased adoption of electric cars.
  - Emergence of new electric vehicle types.
  - Growing charging infrastructure.
  - Advancements of new technology in battery.

- **MARKET DYNAMICS**

The electric vehicle (EV) market is dynamic and constantly changing due to various factors, including government regulations, technological advancements, and consumer demand. Here are some of the key market dynamics in the EV industry:

- Government regulations and incentives.
- Technological advancements.
- Consumer demand.
- Competitive landscape.
- Charging infrastructure.

Overall, the electric vehicle market is dynamic and constantly evolving due to various market dynamics. These dynamics will continue to shape the industry in the coming years as more people seek sustainable transportation options and as technological advancements and government policies continue to drive growth and innovation in the EV market. In 2022-23, the scenario is shown in below :
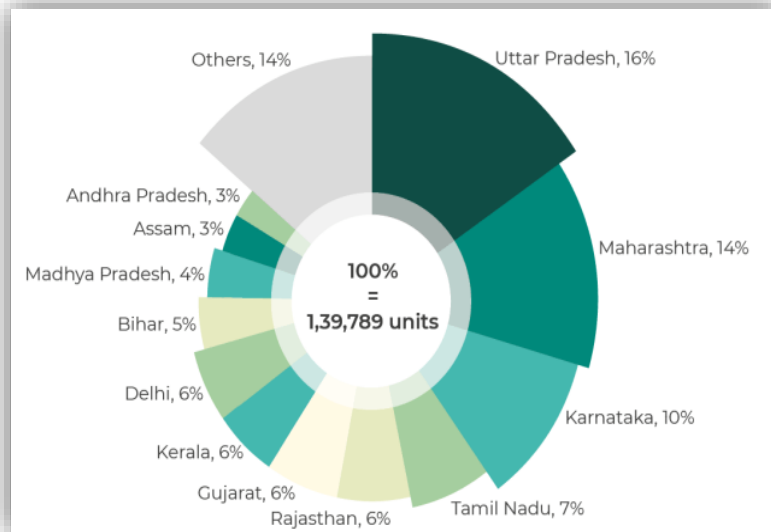
- ## GOVERNMENT INITIATIVES AND POLICIES SUPPORTING THE EV MARKET IN INDIA:

The Indian government has been taking various initiatives and policies to support the growth of the electric vehicle (EV) market in the country. Some of these initiatives and policies are:

- **FAME India Scheme:** The Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) Scheme was launched in 2015 to promote the use of electric and hybrid vehicles in the country. The scheme aims to support the development of a robust EV ecosystem in India by providing incentives and subsidies to manufacturers, buyers, and charging infrastructure providers.
- **National Electric Mobility Mission Plan (NEMMP):** The NEMMP was launched in 2013 to promote the adoption of EVs in the country and reduce dependence on fossil fuels. The plan aims to achieve 6-7 million sales of EVs by 2020 and a substantial reduction in vehicular emissions by 2030.
- **GST Reduction:** In 2019, the Indian government reduced the Goods and Services Tax (GST) on electric vehicles from 12% to 5%, making EVs more affordable for buyers.
- **Charging Infrastructure:** The government has initiated the installation of a robust charging infrastructure across the country. Under the FAME India scheme, the government is providing financial assistance to state governments, public and private organizations, and individuals for the deployment of EV charging infrastructure.

- **Battery Swapping Policy:** The government has also proposed a battery swapping policy to address the issue of range anxiety among EV users. The policy aims to promote the use of battery swapping technology, which enables EV users to exchange discharged batteries with fully charged ones at designated swapping stations.
- **Incentives for Manufacturing:** The Indian government is providing various incentives and benefits to EV manufacturers to promote domestic manufacturing and reduce the cost of EVs. The incentives include exemption from customs duty on EV components, reduction in corporate tax rates, and the establishment of special economic zones (SEZs) for EV manufacturing.

Overall, these initiatives and policies are aimed at creating a favorable environment for the growth of the EV market in India and achieving the country's ambitious target of having a 100% electric vehicle fleet by 2030.

- ## MARKET CHALLENGES:

Despite the various initiatives and policies taken by the Indian government to support the growth of the electric vehicle (EV) market in the country, there are several challenges that the industry is facing. Some of the significant challenges in the EV market in India are:

1. **High upfront cost:** One of the major challenges in the EV market is the high upfront cost of EVs compared to conventional vehicles. EVs require expensive battery technology, which makes the initial purchase cost of EVs higher than traditional vehicles. Although government incentives and subsidies have helped reduce the cost of EVs, they still remain comparatively expensive.
2. **Lack of charging infrastructure:** The availability of charging infrastructure is critical for the widespread adoption of EVs. Currently, the charging infrastructure in India is inadequate, with a limited number of charging stations available. This has created range anxiety among EV users and is hindering the adoption of EVs.
3. **Limited EV models:** The availability of a limited number of EV models in the Indian market is also a challenge. The majority of EV models available in India are in the two-wheeler and three-wheeler segments, while there are relatively few options in the four-wheeler segment.
4. **Lack of public awareness:** There is a lack of awareness among the public about the benefits of EVs, which is hindering the adoption of EVs in India. Many people are still unaware of the cost savings and environmental benefits associated with EVs.
5. **Battery technology:** The battery technology used in EVs is still evolving, and the range and charging time of batteries remain limited. The development of new battery technologies, such as solid-state batteries, could address these challenges, but their commercial availability is still some time away.

Overall, addressing these challenges is crucial for the growth of the EV market in India, and the government and industry need to work together to overcome these challenges and promote the adoption of EVs in the country.

- **COMPETITIVE LANDSCAPE:**

The competitive landscape of the electric vehicle (EV) market in India is evolving rapidly with the entry of new players and the expansion of existing ones. Some of the major players in the Indian EV market are:

- **Tata Motors:** Tata Motors is one of the largest automotive manufacturers in India and has a significant presence in the EV market. The company currently offers a range of electric cars and commercial vehicles, including the Tata Nexon EV and the Tata Tigor EV.
- **Mahindra & Mahindra:** Mahindra & Mahindra is another leading player in the Indian EV market, with a strong presence in the electric four-wheeler segment. The company offers a range of electric cars and commercial vehicles, including the Mahindra e2oPlus and the Mahindra eVerito.
- **Hero Electric:** Hero Electric is a leading player in the electric two-wheeler segment in India. The company offers a range of electric scooters and bikes, including the Hero Optima and the Hero Flash.
- **Ather Energy:** Ather Energy is a Bangalore-based start-up that is rapidly gaining traction in the Indian EV market. The company offers two electric scooters, the Ather 450X and the Ather 450 Plus, which are known for their performance and technology.
- **Ola Electric:** Ola Electric is a subsidiary of ride-hailing giant Ola and is focused on developing electric mobility solutions in India. The company recently announced plans to set up a mega EV manufacturing plant in Tamil Nadu, which is expected to be one of the world's largest EV manufacturing facilities.
- **MG Motors:** MG Motors is a British carmaker that has made significant inroads into the Indian EV market with the launch of the MG ZS EV. The company plans to expand its EV line up in India with the launch of more electric cars in the coming years.

Overall, the competitive landscape of the Indian EV market is becoming increasingly crowded with the entry of new players and the expansion of existing ones. With the government's support and incentives, the market is expected to grow rapidly in the coming years, and competition is likely to intensify further.

- **PROBLEM STATEMENT:**

You are a team working under an Electric Vehicle Startup. The Startup is still deciding in which vehicle/customer space it will be develop its EVs.

You have to analyse the Electric Vehicle market in India using Segmentation analysis and come up with a feasible strategy to enter the market, targeting the segments most likely to use Electric vehicles. (CUSTOMER/VEHICLE/B2B) SEGMENTS: Apart from Geographic, Demographic, Psychographic, Behavioural segments, teams can consider different CATEGORY of Segments for the Segmentation Tasks, based on AVAILABILITY OF DATA. Market Segmentation comes with wide scope of possibility and Segments created can change based on different datasets collected.

✓ SOLUTION APPROACH:

Here is breakdown of problem statement with Fermi Estimation:

1. **Electric Vehicle Market Analysis in India:**
- Estimate the current size of the EV market in India (e.g. number of EVs sold, revenue generated)
- Estimate the growth rate of the EV market in India (e.g. percentage increase in number of EVs sold per year)
- Estimate the market share of different types of EVs (e.g. cars, two-wheelers, buses, trucks)

2. **Segmentation Analysis:**
- Determine the relevant segmentation categories based on the available data (e.g. geographic, demographic, psychographic, behavioural, B2B)
- Estimate the size and growth rate of each segment (e.g. number of potential customers in each segment, percentage increase in segment size per year)
- Estimate the willingness to pay for different types of EVs based on each segment's income level and purchasing power.

3. **Feasible Strategy:**
- Identify the most promising segments for the startup to target based on the segmentation analysis
- Determine the most appropriate type of EV to develop based on the targeted segments' needs and preferences (e.g. car, two-wheeler, bus, truck)
- Estimate the investment required to develop and market the chosen type of EV
- Estimate the potential revenue and profit for the startup based on the chosen strategy.

Overall, the Fermi estimation would involve making reasonable assumptions and estimates based on available data to arrive at a feasible strategy for the electric vehicle startup to enter the market and target the most promising customer/vehicle/B2B segments in India.

• ASSUMPTIONS:

1. **Availability of data:** Assumption that sufficient data is available for conducting the segmentation analysis and determining the most promising customer/vehicle/B2B segments to target.
2. **Competitor analysis:** Assumption that a competitor analysis has been conducted to understand the current landscape of the EV market in India and identify potential gaps or opportunities for the startup.
3. **Cost estimation:** Assumption that a cost estimation has been done to determine the investment required for developing and marketing the chosen type of EV, and that the startup has access to the necessary funds or can secure funding.

4. **Government policies:** Assumption that the government policies related to the EV industry will remain stable or favorable, and that any potential changes will not have a significant impact on the feasibility of the startup's strategy.
5. **Technological advancements**: Assumption that the technology required for developing the chosen type of EV is currently available or can be developed within a reasonable timeframe.
6. **Customer acceptance:** Assumption that customers in the targeted segments will be willing to adopt and use EVs, and that any potential barriers to adoption can be addressed through marketing or other strategies.

• DATA COLLECTION:

1. **EV market data:** This dataset include information about the region of the EV market in world, mode of Ev's, powertrain of Ev's, and the market value of Ev's.
2. **General vehicle type data:** This dataset has information about number of two, three, four-wheeler vehicles and distribution of them in Indian states.
3. **Vehicle market data:** This dataset include information about the overall vehicle market in India, including the most popular brands and models, as well as demographic and psychographic data about their customers.
4. **Charging stations data:** This dataset includes information about the State, City, Address, Latitude, Longitude, Type of electric vehicle in India.
5. **Vehicle statistics in cities:** This dataset include information about the electrical and non-electric vehicles in india also include the information about state name wise electrical vehicle present in the different states.

Using these datasets, we use Fermi estimation to break down the problem statement and determine which factors are most relevant for their analysis, such as which cities have the highest demand for EVs, which demographic groups are most likely to purchase EVs, and which types of vehicles are most suitable for the Indian market.

• DATA SOURCES:

We have considered multiple datasets for the analysis.

1. **Ev Market Data :**

https://www.iea.org/data-and-statistics/data-product/global-ev-outlook-2022#global-ev-data-explorer

2. **General Vehicle Type Data :**

https://electricvehicles.in/electric-vehicles-sales-report-in-india-2018/

3. **Vehicle Market Data :**

https://www.kaggle.com/datasets/karivedha/indian-consumers-cars-purchasing-behaviour?select=Indian+automoble+buying+behaviour+study+1.0.csv

4. **Charging Stations Data :**

5. Vehicle Statistics In Cities:

https://pib.gov.in/PressReleasePage.aspx?PRID=1842704

● **General Vehicle Type Data:**

We have taken the EV States dataset which has information about the spread of EV vehicles in Indian States. The dataset contains 10 columns with 30 rows and has numerical values. The

	SI. No	State	Two Wheelers (Category L1 & L2 as per Central Motor Vehicles Rules	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 in state
0	1	Meghalaya	0	0	0	0	0	6	0	6
1	2	Nagaland	0	20	3	0	0	1	0	24
2	3	Manipur	16	8	11	0	5	12	0	52
3	4	Tripura	28	9	36	0	0	8	0	81
4	5	Andaman & Nicobar islands	0	0	0	0	0	82	0	82
5	6	Himachal Pradesh	0	0	0	0	0	98	0	98
6	7	Jammu & Kashmir	2	76	152	0	0	208	0	438
7	8	Goa	0	0	0	0	0	513	1	514
8	9	Dadra and Nagar Haveli	4	0	9	0	0	803	0	816
9	10	Jharkhand	75	228	736	9	7	655	0	1710
10	11	Assam	463	138	1006	0	117	151	0	1875

SI.NO. column is dropped since it adds no value to the dataset. Checking upon, it has no null values and has unique values in each column. The dataset includes Two wheelers, Three Wheelers, Cars, Buses of EV vehicles. Since the column names are quite big, we are renaming the column names L1_L2, L2, L2_250W, L5_slow, L5, M1, B1. We didn't apply encoding since the attributes are already in numerical values.

● Plot for the relationship between the total number of vehicles and the states

Total Number of Vehicles in Each State
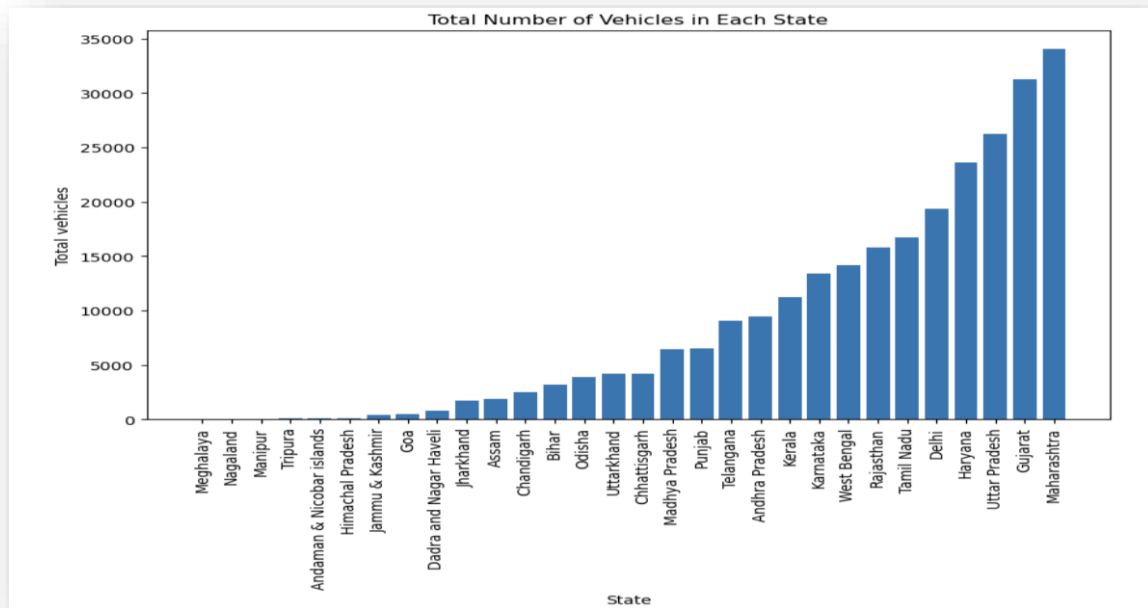
Observation: Checking the relation between total number of vehicles and state using bar plot, we can come to the conclusion that Bigger the state is, Higher the number of EV Vehicles, i.e. Maharashtra, Gujarat, Uttar Pradesh, Haryana, etc.

As the dataset contains large column names, it is difficult to use such large column names in the data pre-processing and also in other steps. To avoid such difficulty, the column names are renamed as below

```python
df = df.rename(columns={'Two Wheelers (Category L1 & L2 as per Central Motor Vehicles Rules': 'L1_L2',
                        'Two Wheelers (Category L2 (CMVR))': 'L2',
                        'Two Wheelers (Max power not exceeding 250 Watts)': 'L2_250W',
                        'Three Wheelers (Category L5 slow speed as per CMVR)': 'L5_slow',
                        'Three Wheelers (Category L5 as per CMVR)': 'L5',
                        'Passenger Cars (Category M1 as per CMVR)': 'M1',
                        'Buses': 'B1',
                        'Total in state':'total'})
df
```

|	State	L1_L2	L2	L2_250W	L5_slow	L5	M1	B1	total
0	Meghalaya	0	0	0	0	0	6	0	6
1	Nagaland	0	20	3	0	0	1	0	24
2	Manipur	16	8	11	0	5	12	0	52
3	Tripura	28	9	36	0	0	8	0	81
4	Andaman & Nicobar islands	0	0	0	0	0	82	0	82
5	Himachal Pradesh	0	0	0	0	0	98	0	98
6	Jammu & Kashmir	2	76	152	0	0	208	0	438

- Plot for the relationship of percentage of each vehicle in the country
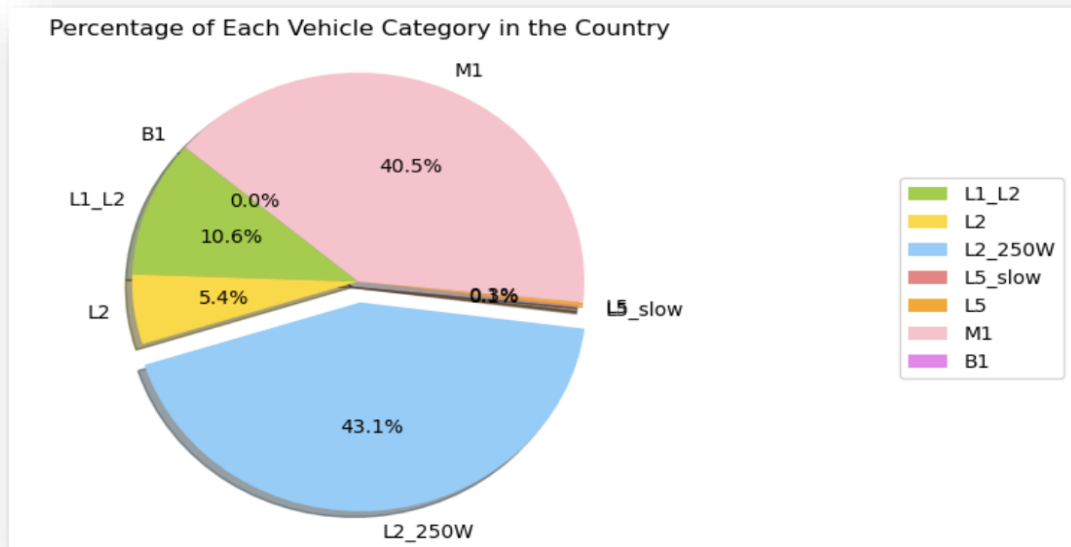
Observation: Now, checking how much percentage holds for two, three and four wheelers, it can be stated that the two wheelers (max power not exceeding 250 watts) contribute more 43% of the Electric Vehicles in the category and second place comes for passenger car contributes more than 40% of the Electric Vehicles. Note that, Three Wheelers (Category L5 slow speed as per CMVR) and Buses contribute the minimum percentage of Electric Vehicles in the category (i.e. less than 0.5%).
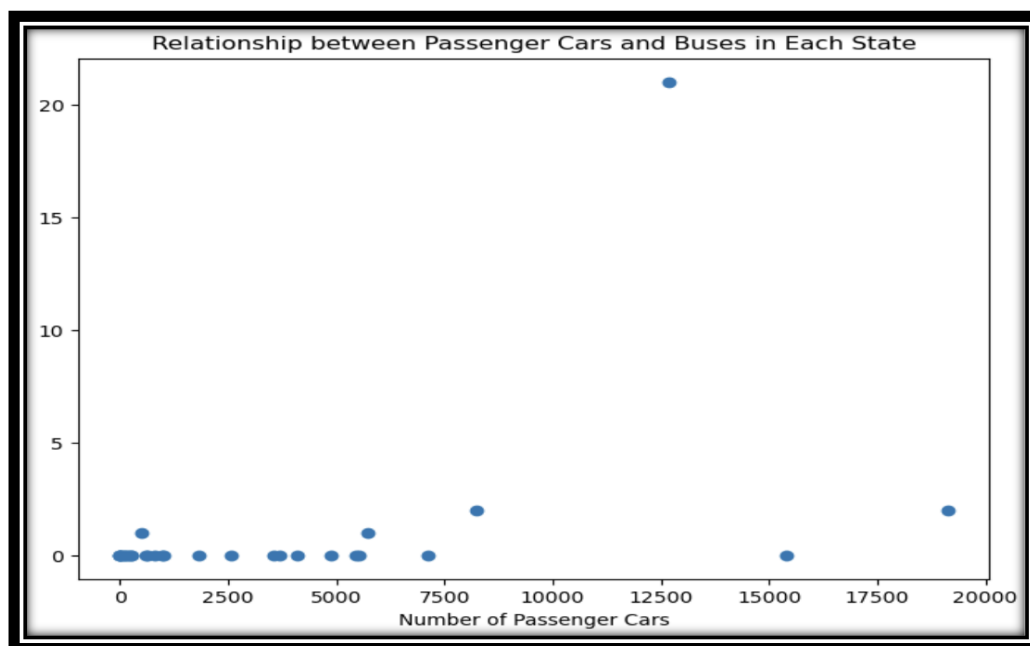
● Plot for the relationship between the Passenger Cars and Buses
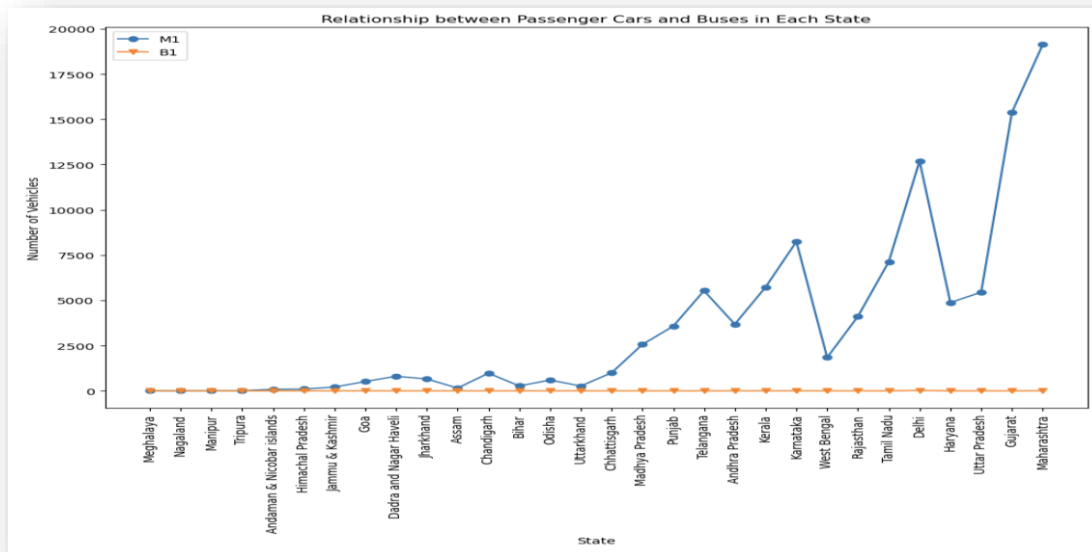
Observation: We can also check the relationship between Passenger Cars and Buses to check how people use public transport and how they prefer cars more than buses. The below plots show the distribution and usage of cars and buses by the people in each state.

● Plot for correlation between all vehicles
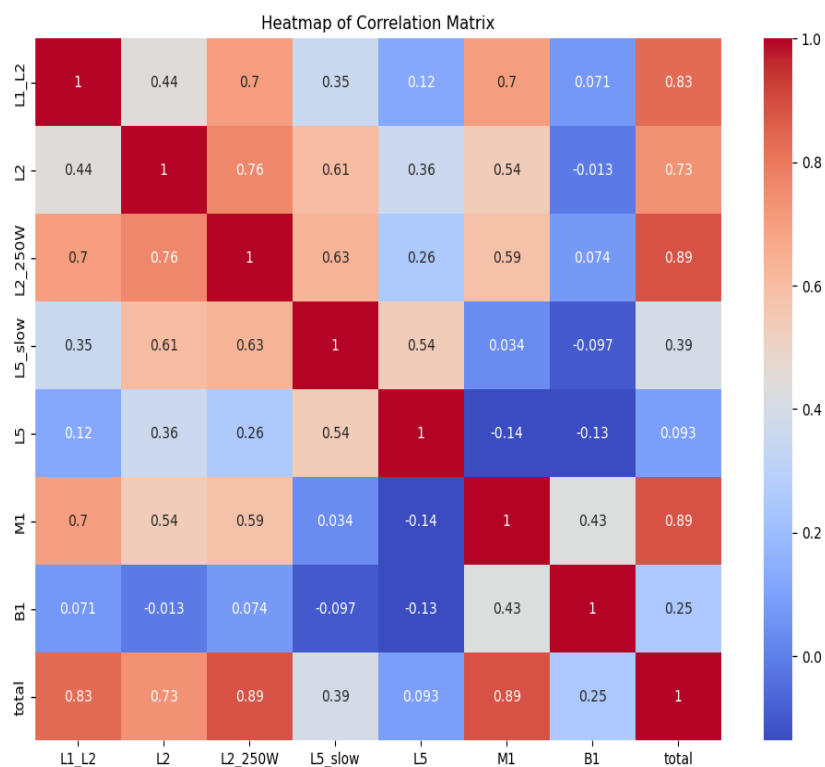
Observation: This heatmap shows the overall distribution and correlation between all the vehicles in each state.

- **Vehicle Market Data:**

Indian automobile buying behaviour study 1.0.csv: This dataset Indian Consumers Automobiles (Cars) buying behaviour. By observing different brands and their sales pattern, we can predict customer demand and bring up new products that would reach customer satisfaction.

|	Age	Profession	Marrital Status	Education	No of Dependents	Personal loan	House Loan	Wife Working	Salary	Wife Salary	Total Salary	Make	Price
0	27	Salaried	Single	Post Graduate	0	Yes	No	No	800000	0	800000	i20	800000
1	35	Salaried	Married	Post Graduate	2	Yes	Yes	Yes	1400000	600000	2000000	Ciaz	1000000
2	45	Business	Married	Graduate	4	Yes	Yes	No	1800000	0	1800000	Duster	1200000
3	41	Business	Married	Post Graduate	3	No	No	Yes	1600000	600000	2200000	City	1200000
4	31	Salaried	Married	Post Graduate	2	Yes	No	Yes	1800000	800000	2600000	SUV	1600000

- **DEMOGRAPHIC ANALYSIS:**

We will visualize the dataset to gain knowledge on customer preferences on different vehicles.

- Plot for Relationship between consumers age and the vehicles they purchase
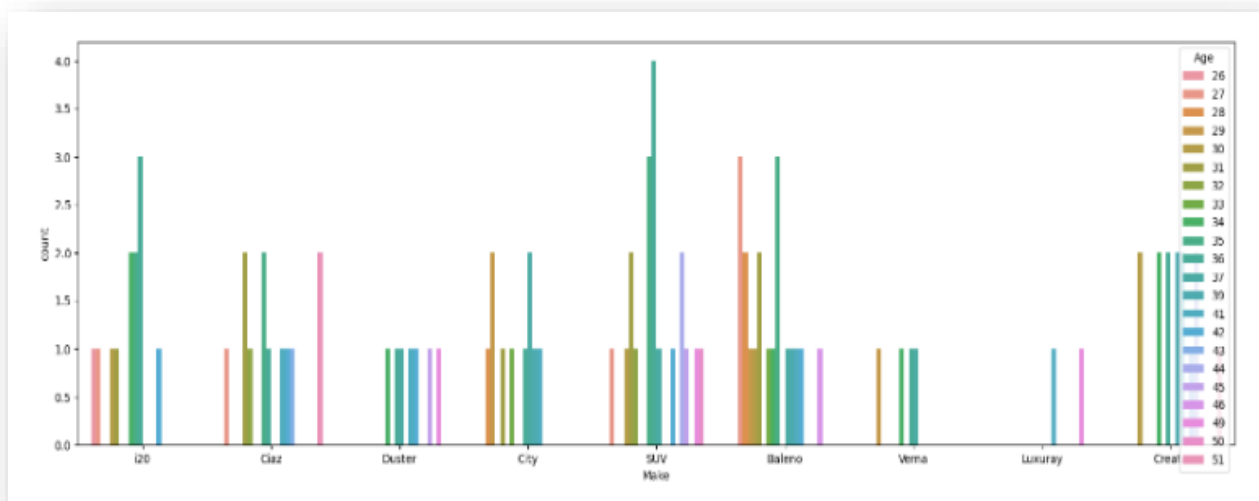

Observation: People in their 30s including early 40s and late 20s tend to buy electric vehicle comparatively than others.

- Plot for Relation between consumers total salary and the vehicles they purchase
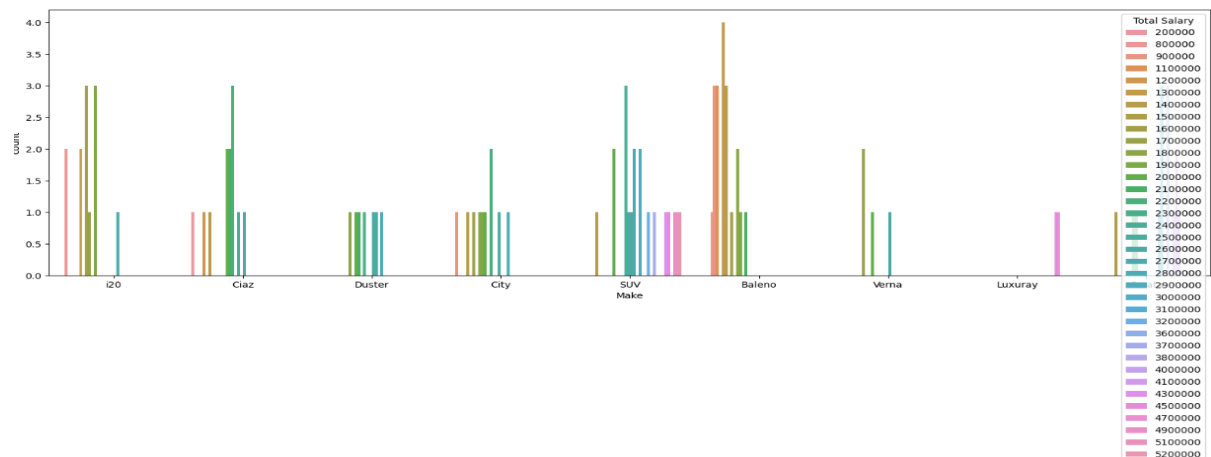

Observation: From the above plot we can analyse that salary is directly proportional to type of Electric vehicle a person tends to buy.

- Plot the Relation between consumer's marital status and the vehicles they purchase.
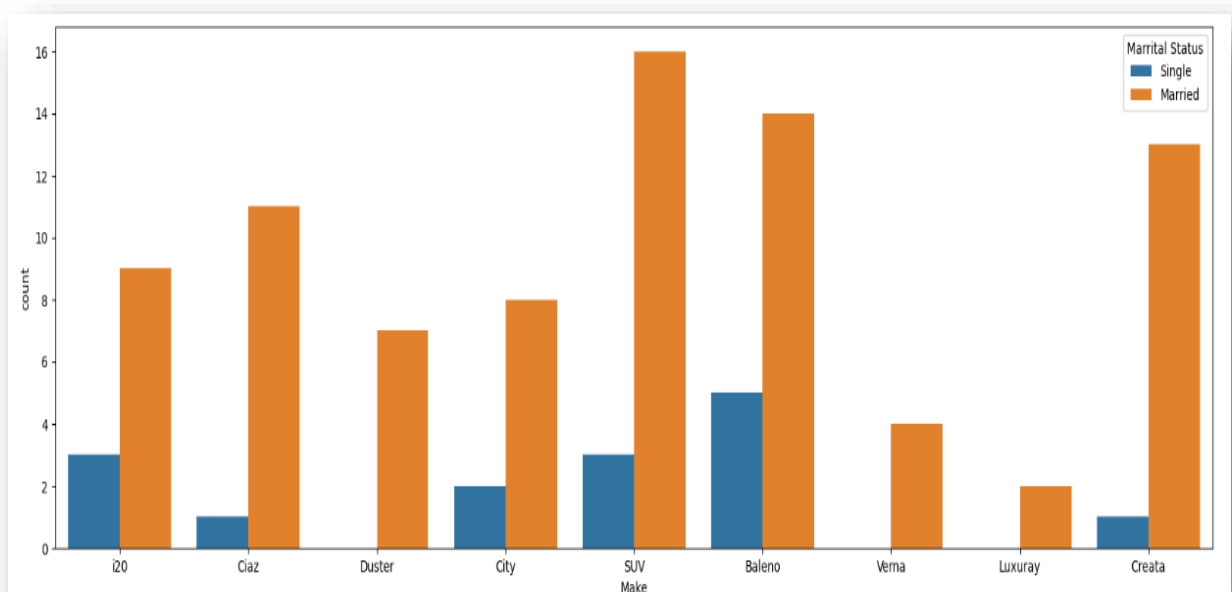
Observation: According to the data it is notable that the married persons are more likely to purchase an electric vehicle when compared to a single person.

- Plot for Relation between consumers' Profession and the vehicles they purchase.
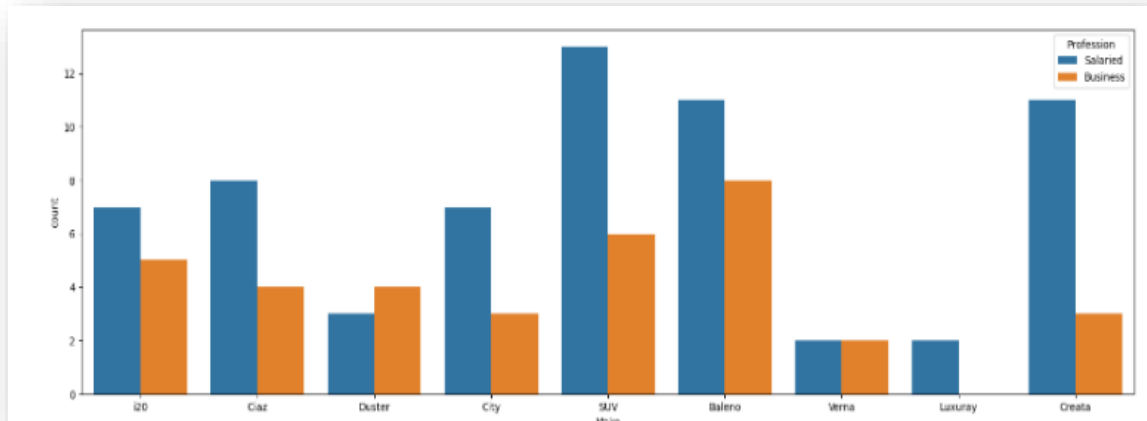
Observation: Here it is notable that the salaried profession purchase EV more likely than Business profession.

- Plot for Relation between consumers' Education and the vehicles they purchase.
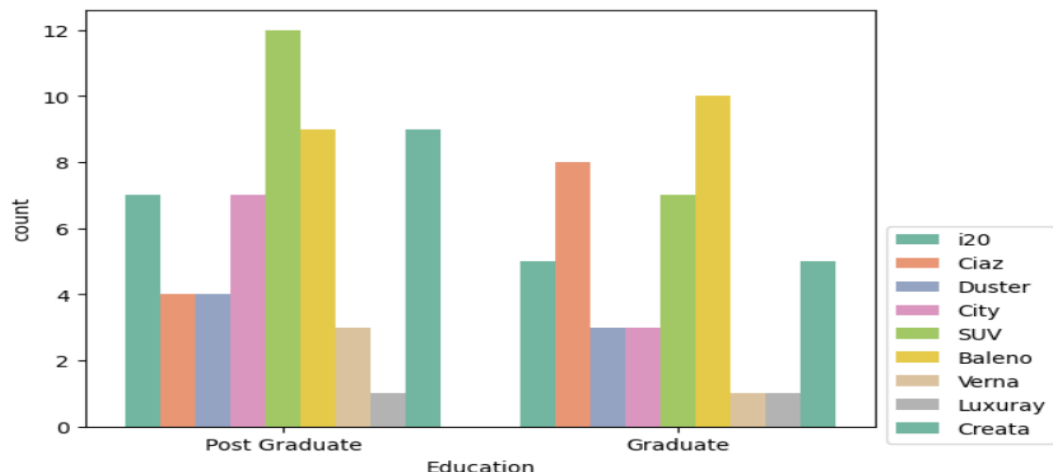
Observation: According to data given Both graduates and post-graduates have equal probability of buying electric vehicles.

We will visualize the dataset to gain knowledge on customer preferences.

Observations:

- Age: Younger consumers buy cheaper cars.
- Number of dependents: More dependents make consumers buy cars with more seats, so they prefer SUVs.
- Salary: If you fit the normal salary chart with the price chart, you'll notice that the average violin salary chart corresponds to the price of the car, which is a very direct relationship.
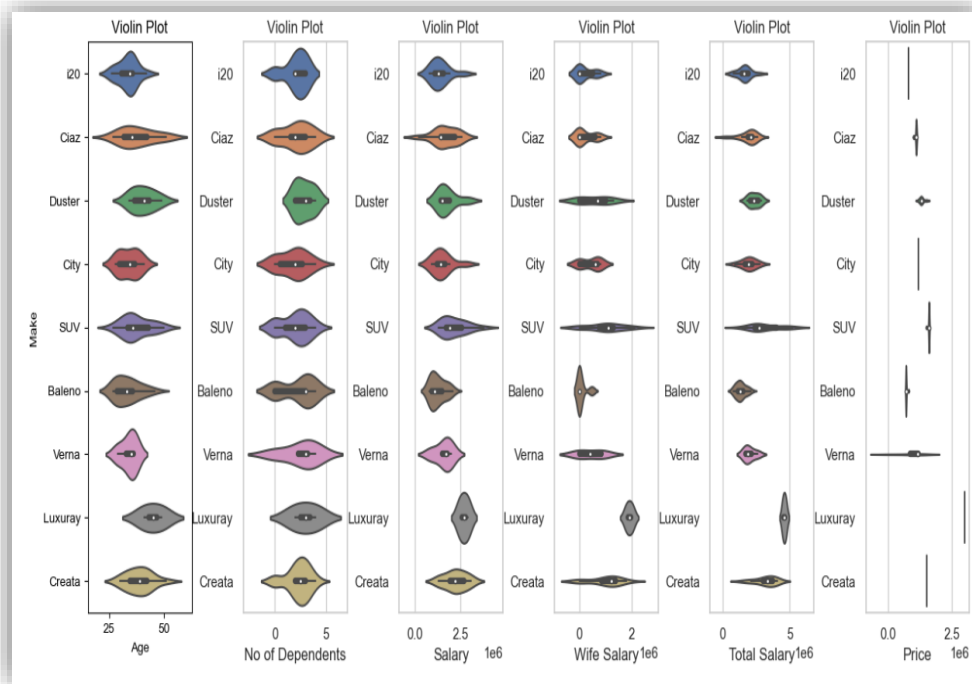
- **CORRELATION PLOT:**

This correlation plot can clearly convey the attributes that affects the buying preference of any person.
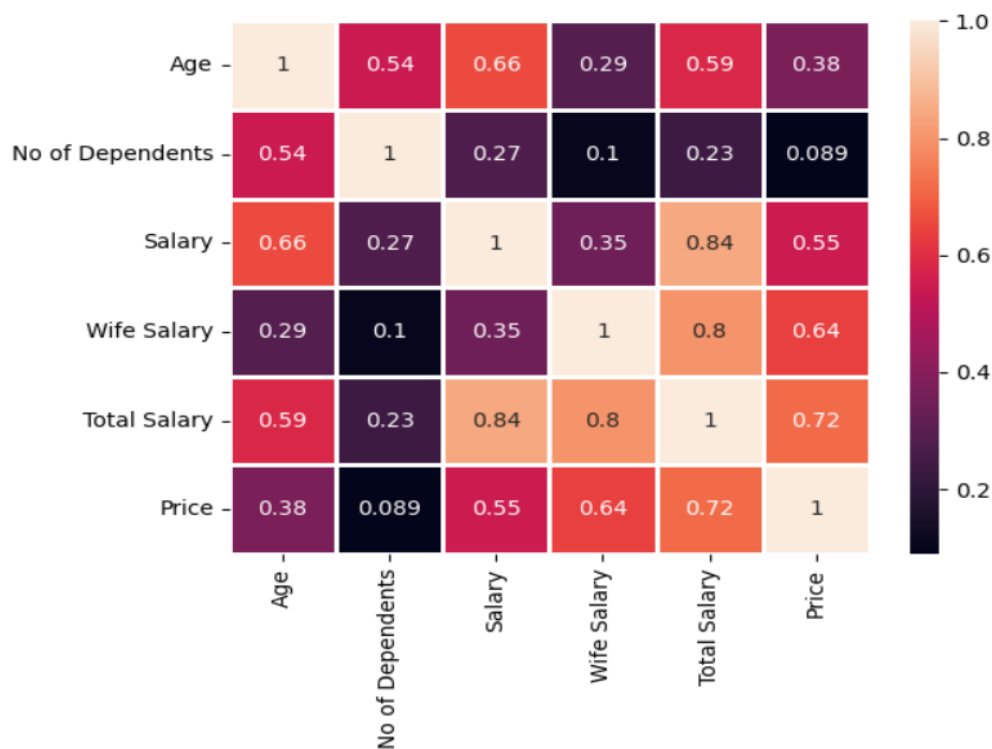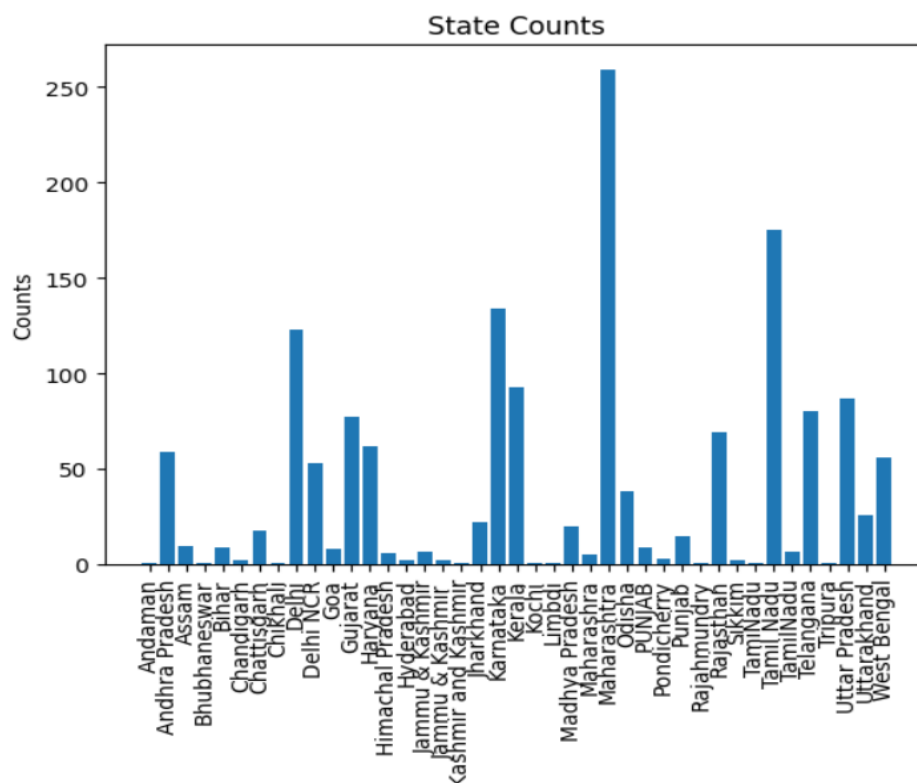
- **CHARGING STATIONS DATA IN INDIA:**

  Charging stations dataset: This includes State, City, Address, Latitude, Longitude, Type of electric vehicle in India.

```
[ ] dataset.head()
```

|	name	Area	city	address	lattitude	longitude	type
0	Neelkanth Star DC Charging Station	Haryana	Gurugram	Neelkanth Star Karnal, NH 44, Gharunda, Kutail...	29.6019	76.9803	12.0
1	Galleria DC Charging Station	Haryana	Gurugram	DLF Phase IV, Sector 28, Gurugram, Haryana 122022	28.4673	77.0818	12.0
2	Highway Xpress (Jaipur-Delhi) DC charging station	Rajasthan	Behror	Jaipur to Delhi Road, Behror Midway, Behror, R...	27.8751	76.2760	12.0
3	Food Carnival DC Charging Station	Uttar Pradesh	Khatauli	Fun and Food Carnival, NH 58, Khatauli Bypass,...	29.3105	77.7218	12.0
4	Food Carnival AC Charging Station	Uttar Pradesh	Khatauli	NH 58, Khatauli Bypass, Bhainsi, Uttar Pradesh...	29.3105	77.7218	12.0

- Here we have obtained the bar plot by taking a dataset regarding to the charging stations in India.
- The below bar plot shows the relation between number of charging stations and areas in which they are located according to the dataset.


From the above plot, we can make analysis on which area will be preferred to start a electric vehicle market by observing at number of charging stations in that particular area.

- **GEOGRAPHIC ANALYSIS:**

As of January 23, 2023, India had 5,254 public electric vehicle (EV) charging stations, to cater to a total of 20.65 lakh EVs. There is vehicle to grid(V2G) technology opportunity for electric vehicle charging stations.
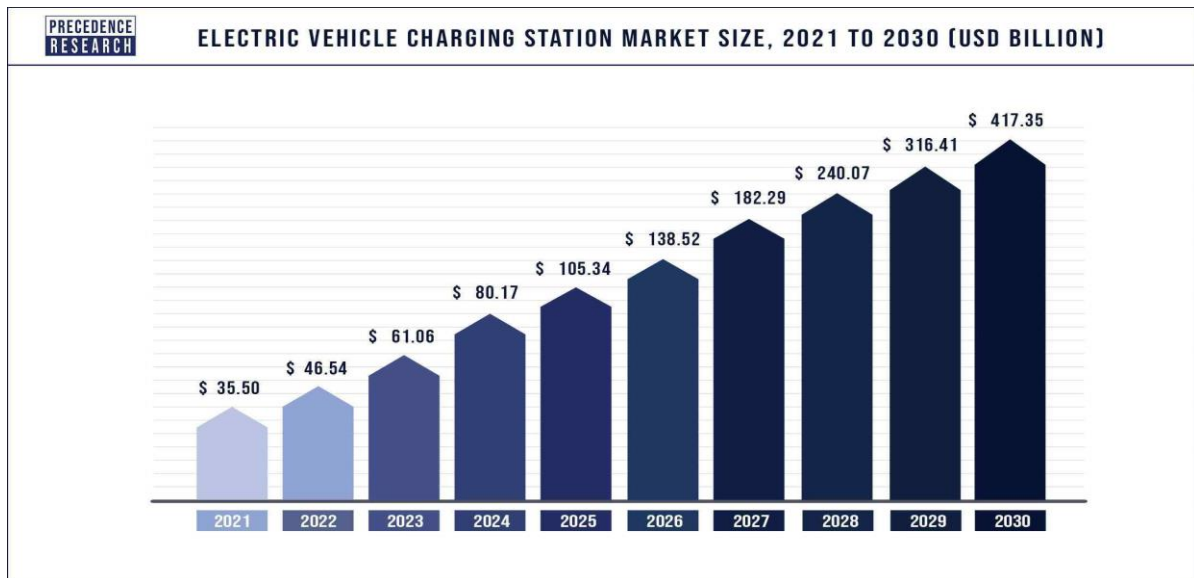
From the above plot we can see how the market for charging stations is increasing year by year, and given an approximation till the year 2030 from present scenario.
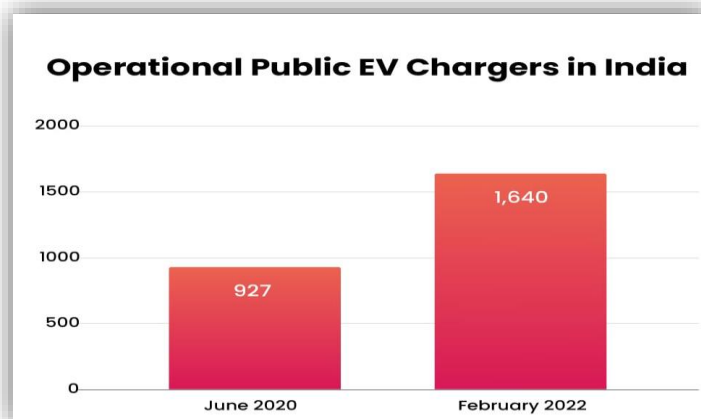
From the above plot, we can see that there is considerable increment in charging stations in India from the year 2020 to 2022.

- **Vehicle Statistics In India :**

EV_India.csv : This dataset include information about the electrical and non-electric vehicles in india also include the information about state name wise electrical vehicle present in the different states.

```
In [21]: df.head()
Out[21]:
```

	Sr. No.	State Name	Total Electric Vehicle	Total Non-Electric Vehicle	Total
0	1	Andaman & Nicobar Island	162	1,46,945	1,47,107
1	2	Andra Pradesh	NaN	NaN	NaN
2	3	Arunachal Pradesh	20	2,52,965	2,52,985
3	4	Assam	64766	46,77,053	47,41,819
4	5	Bihar	83335	1,04,07,078	1,04,90,413

- **Electric Vehicles by geographic Segments :**

- **Electric Vehicles By Income :**
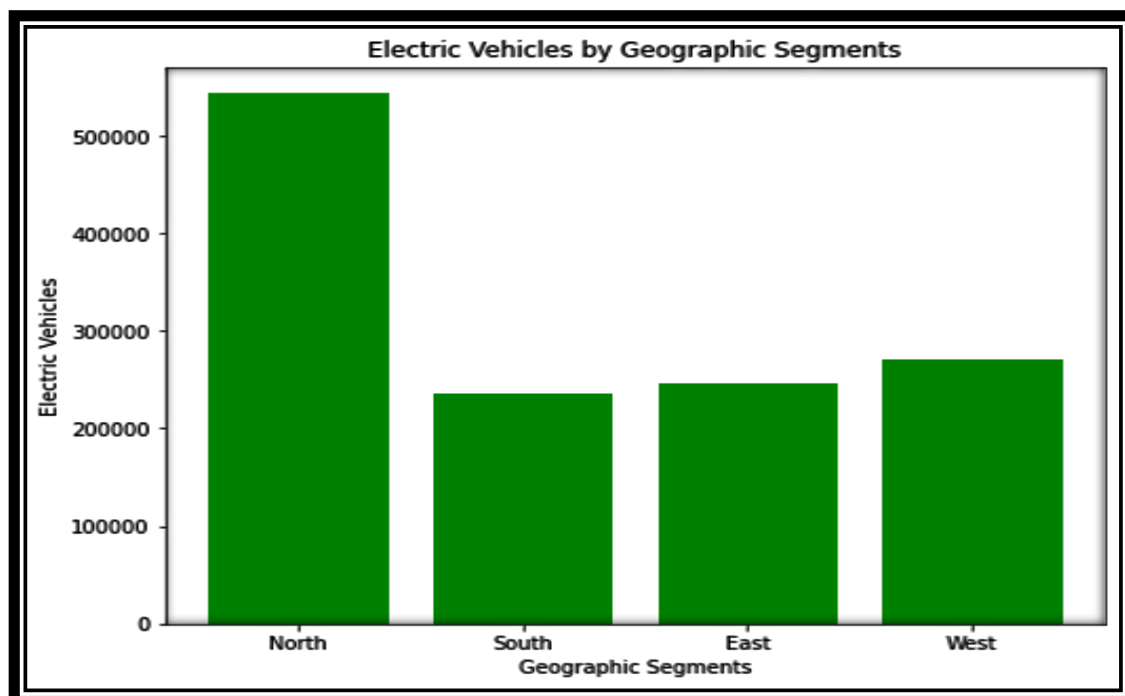
Electric Vehicles by Income
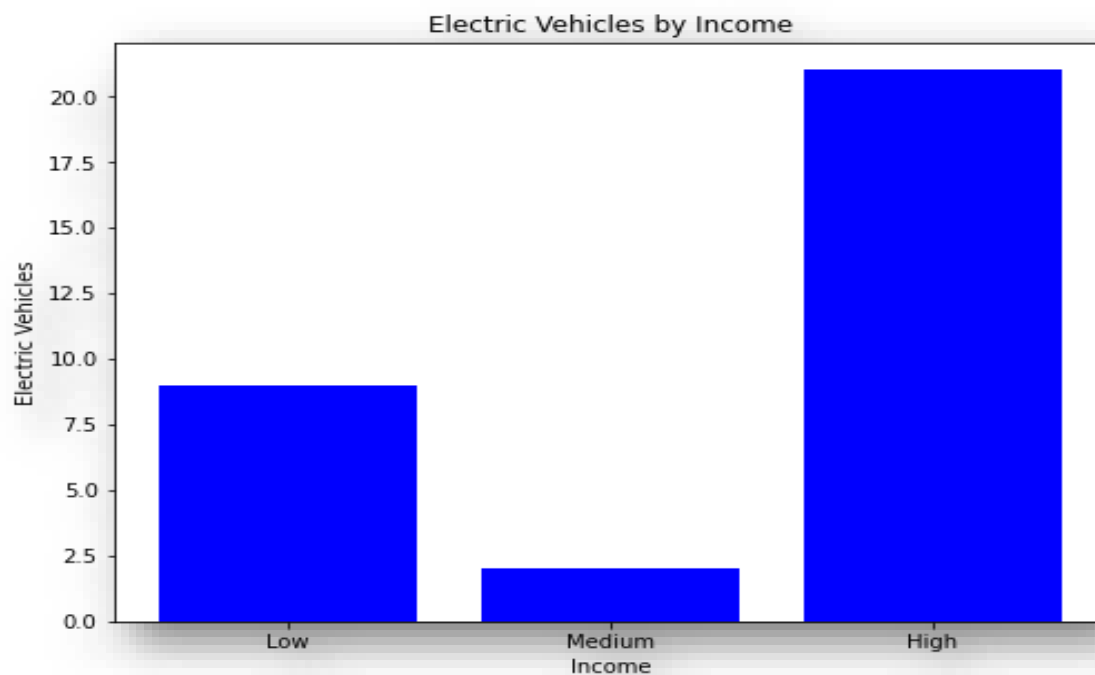
- **Target Segmentation :**

```python
In [66]: # Target Potential Segments based on Geographic and Demographic Segments
         target_segments = []
         for segment, states in geographic_segments.items():
             count = df[df['State Name'].isin(states)]['Total Electric Vehicle'].sum()
             if count >= 5000:
                 target_segments.append(segment)

         for segment, subsegments in demographic_segments.items():
             if '30-45' in subsegments:
                 if subsegments['30-45'] >= 2000:
                     target_segments.append(f"Age 30-45 {segment}")

         print("\nTarget Potential Segments:")
         for segment in target_segments:
             print(segment)


         Target Potential Segments:
         North
         South
         East
         West
```
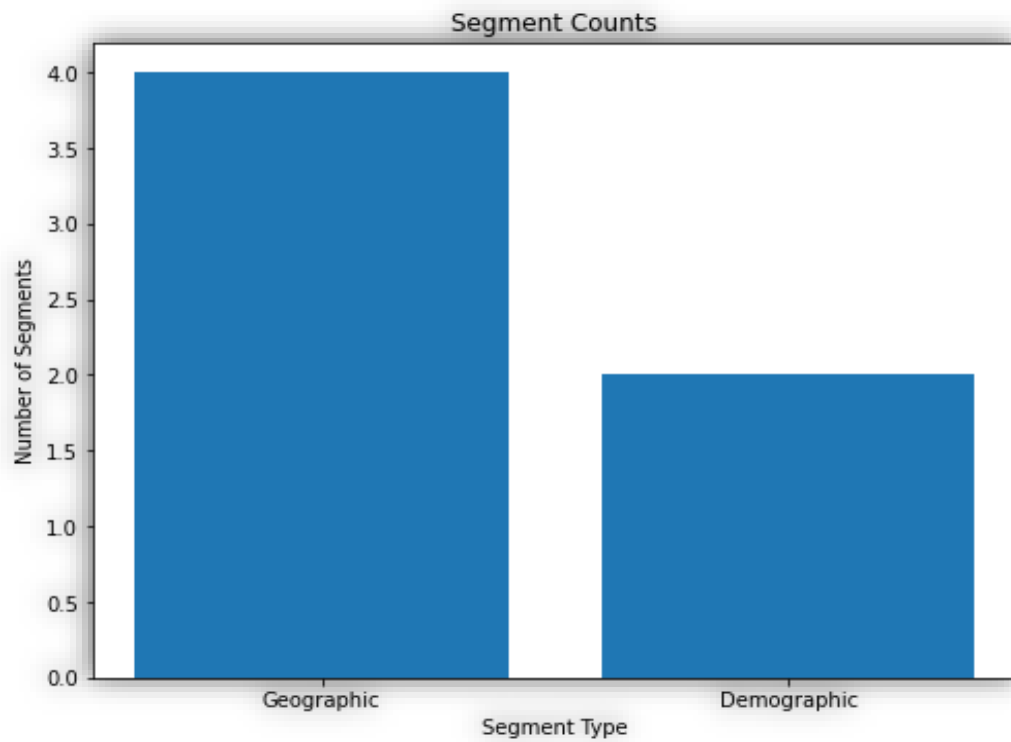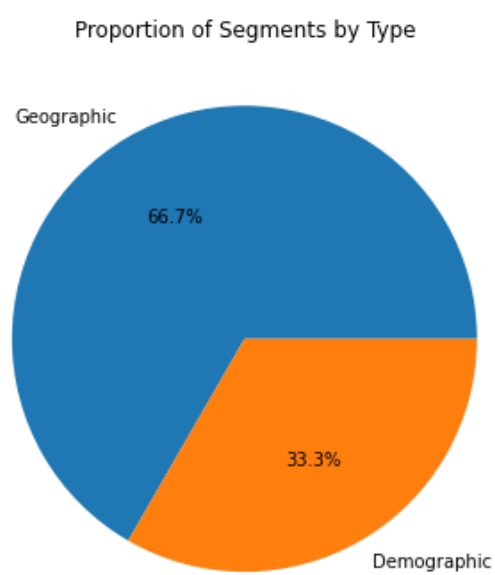
- **Target Segment Countplot :**

- **Proportion Of Electric Vehicle Segmentation Plot :**

EV MARKET DATA :

IEA-EV-data.csv: This dataset includes information about the region of the EV market in world, mode of Ev's, powertrain of Ev's, and the market value of Ev's.

```
In [162]: df1.head()

Out[162]:
            region  category    parameter            mode  powertrain  year                    unit                 value
     3021   India   Historical  EV sales share       Cars  EV          2010                    percent              0.021000
     3022   India   Historical  EV stock share       Cars  EV          2010                    percent              0.005200
     3023   India   Historical  Oil displacement Mbd Cars  EV          2010  Milion barrels per day               0.000015
     3024   India   Historical  Oil displacement Mlge Cars EV          2010  Milion litres gasoline equivalent    0.860000
     3025   India   Historical  Oil displacement Mbd Cars  EV          2011  Milion barrels per day               0.000030
```

Here, below graph shows the relationship between modes of Ev and powertrain of Ev's :
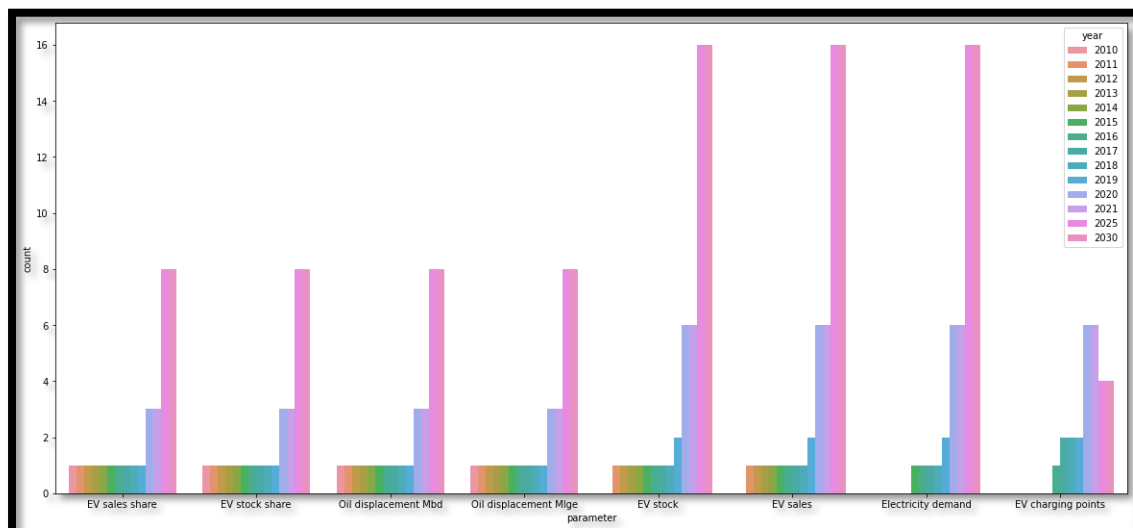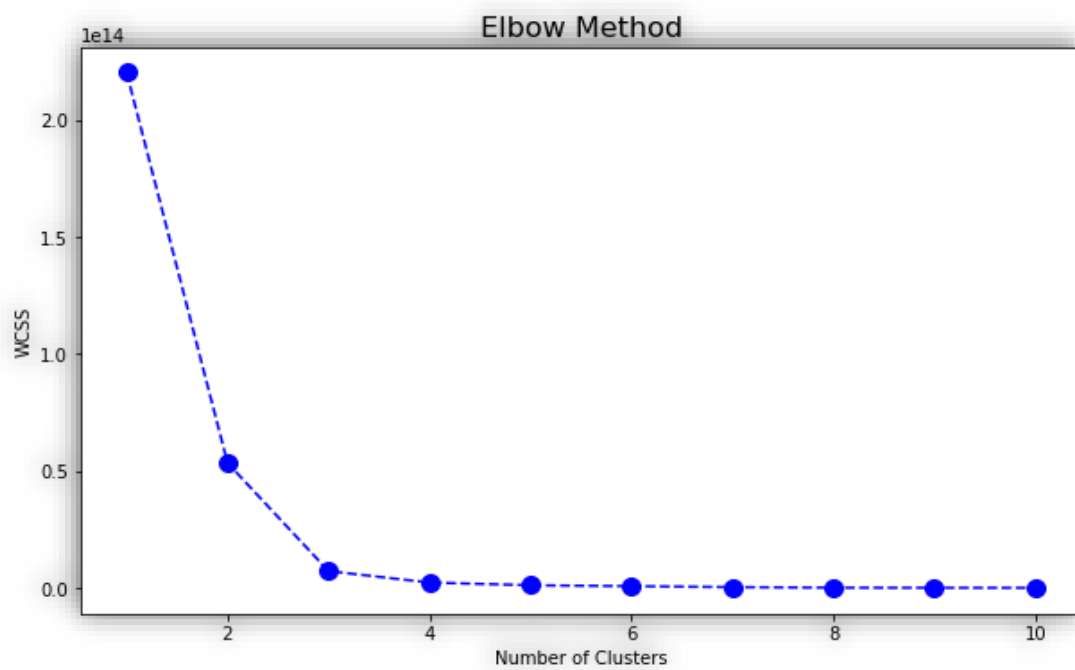

Here, below graph shows the relation between parameters of the Ev and year :
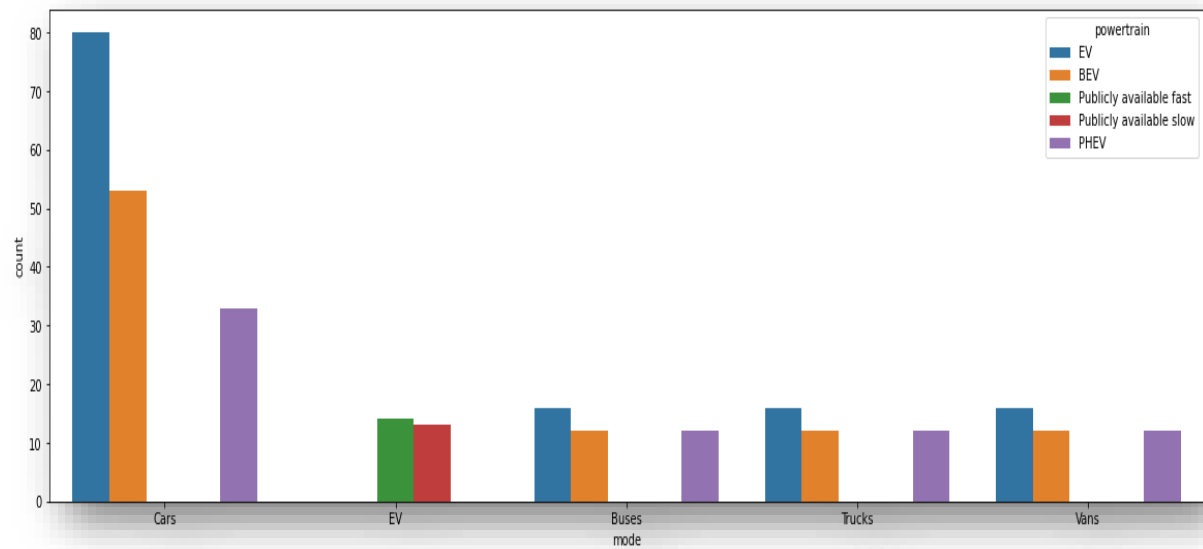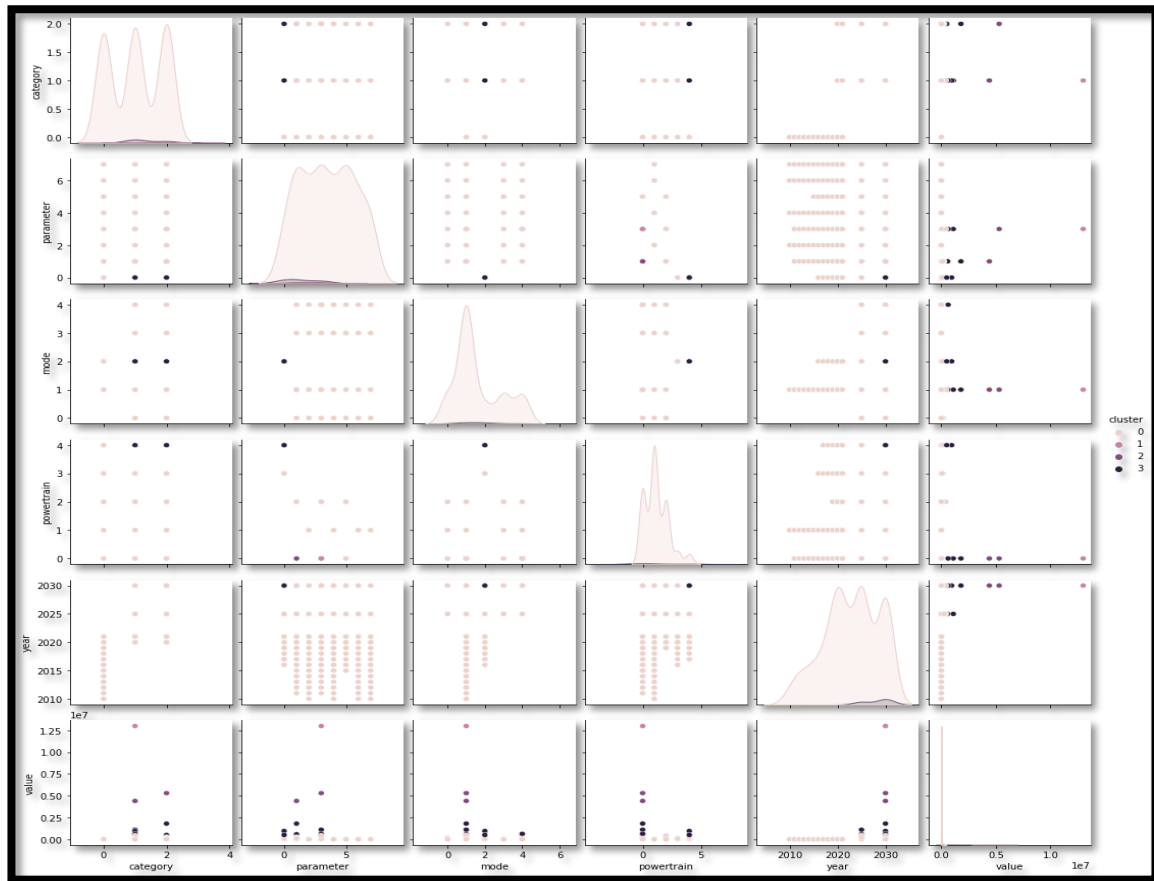
From this graph, we can interpret that the parameters of the Ev or Ev market should be highest in demand in year 2030.

Optimal number of clusters using Elbow method:

Analysis of clusters by describing the segments:

Selection of target segments:

```
In [146]: # Select the most promising target segments based on their potential value
          target_segments = df2.groupby(['category','mode', 'powertrain', 'year']).agg({'value': 'sum'})
          target_segments = target_segments.sort_values(by='value', ascending=False)
          print(target_segments)
```

```
                                           value
category mode powertrain year
1        1    0          2030  1.742800e+07
2        1    0          2030  7.112000e+06
1        1    0          2025  1.682600e+06
         2    4          2030  9.500000e+05
         4    0          2030  8.425000e+05
2        1    0          2025  6.710000e+05
1        1    2          2030  5.313000e+05
2        2    4          2030  5.000000e+05
         4    0          2030  3.320000e+05
1        2    4          2025  2.600000e+05
         0    0          2030  2.350000e+05
2        0    0          2030  1.877000e+05
         1    2          2030  1.602500e+05
1        2    3          2030  1.500000e+05
2        2    4          2025  1.200000e+05
1        1    2          2025  9.516000e+04
2        2    3          2030  8.000000e+04
```

Customizing market mix result of EV market in India:

```
Marketing mix for 0:
Product: Affordable electric car rental
Price: $50 per day
Promotion: Social media ads targeting young professionals in urban areas
Sales: 1000
Revenue: 50000
Marketing mix for 1:
Product: Premium electric van leasing
Price: $1000 per month per vehicle
Promotion: Email marketing and cold calling to businesses in urban areas
Sales: 50
Revenue: 50000
Marketing mix for 2:
Product: Luxury electric car rental
Price: $300 per day
Promotion: Social media ads targeting affluent travelers
Sales: 100
Revenue: 30000
Marketing mix for 3:
Product: Luxury electric car rental
Price: $300 per day
Promotion: Social media ads targeting affluent travelers
Sales: 100
Revenue: 30000
Marketing mix for 4:
Product: Luxury electric car rental
Price: $300 per day
Promotion: Social media ads targeting affluent travelers
Sales: 100
Revenue: 30000
Marketing mix for 5:
Product: Luxury electric car rental
Price: $300 per day
Promotion: Social media ads targeting affluent travelers
Sales: 100
Revenue: 30000
```

Tracking and Analysing market mix:

```python
In [151]: # Tracking and analyzing ad campaign effectiveness

          # Define a function to calculate engagement rate
          def calculate_engagement_rate(clicks, impressions):
              return clicks / impressions

          # Define a function to calculate conversion rate
          def calculate_conversion_rate(conversions, clicks):
              return conversions / clicks

          # Set up tracking variables
          total_impressions = 10000
          total_clicks = 1000
          total_conversions = 100

          # Calculate engagement rate and conversion rate
          engagement_rate = calculate_engagement_rate(total_clicks, total_impressions)
          conversion_rate = calculate_conversion_rate(total_conversions, total_clicks)

          # Print results
          print(f"Engagement rate: {engagement_rate}")
          print(f"Conversion rate: {conversion_rate}")

          # Evaluate campaign effectiveness and make adjustments as necessary
          if engagement_rate < 0.05:
              print("Engagement rate is low. Consider adjusting ad targeting or creative.")
          elif conversion_rate < 0.01:
              print("Conversion rate is low. Consider adjusting landing page or offer.")
          else:
              print("Campaign is performing well. Keep monitoring and optimizing.")

          Engagement rate: 0.1
          Conversion rate: 0.1
          Campaign is performing well. Keep monitoring and optimizing.
```

Interpretation:

we get the effective result for the target segments and campaign is performing well so we can create social media ads and run them for each target segment, determine ad copy based on category and powertrain type, Determine ad image and URL based on region and powertrain type, Run social media ads and track results, Print results for each target segment.

```
                                    ad_copy  \
0  Attention business owners! Switch to electric ...
1  Experience the future of driving with our affo...
2  Experience the future of driving with our affo...
3  Attention business owners! Switch to electric ...
4    Drive in style with our luxury hybrid vehicles.
5    Drive in style with our luxury hybrid vehicles.

                  ad_image                    ad_url  engagement_rate  \
0   Cars_Electric_West.jpg   Cars_Electric_West.com             0.05
1  Trucks_Electric_East.jpg  Trucks_Electric_East.com             0.05
2  Buses_Electric_West.jpg   Buses_Electric_West.com             0.05
3     Cars_Hybrid_East.jpg     Cars_Hybrid_East.com             0.05
4   Trucks_Hybrid_West.jpg   Trucks_Hybrid_West.com             0.05
5    Buses_Hybrid_East.jpg    Buses_Hybrid_East.com             0.05

   conversion_rate
0            0.01
1            0.01
2            0.01
3            0.01
4            0.01
5            0.01
```

IMPORTANCE OF MARKETING MIX

It helps understand what our product or service can offer to our customers and helps plan a successful product offering. Helps with planning, developing, and executing effective marketing strategies. Help determine whether your product or service is suitable for your customers.

• **Product**: Since the company is starting with EVs, the product should manage all the concerns that have been mentioned.

• **Price:** Price will largely depend on service parts and battery cost, i.e., whether company sources them locally or imports them.

• **Place**: Through the analysis we have seen that southern states are the best suitable for the company to register initial high sales.

• **Promotion**: Promotion can be based on the analysis. More offers and promotions can be given to the segments that are more valuable to the company. New start up should focus on the range and affordability of the e-vehicle

Conclusion:

Market segmentation analysis can be very beneficial for an EV market startup in a number of ways:

1. **Targeted advertising:** By identifying the specific characteristics of your target audience, you can create targeted advertising campaigns that are more likely to resonate with potential customers. This can lead to more effective advertising and higher conversion rates.
2. **Product development:** Market segmentation analysis can also help inform product development decisions. By understanding the specific needs and preferences of different customer segments, you can create products that are better tailored to their needs.
3. **Competitive advantage:** By leveraging market segmentation analysis, you can gain a competitive advantage over other EV market startups that are not using this approach. This can help you stand out in a crowded market and increase your chances of success.

Overall, market segmentation analysis can help an EV market startup to better understand its target audience, create more effective advertising campaigns, develop products that are better tailored to customer needs, and gain a competitive advantage in the marketplace.

GITHUB LINKS:

Lahari Shastri - https://github.com/LahariShastri/EV-Market-Segment-Anlaysis

Rayudu Mounika - https://github.com/mourayu/Mcdonalds.git

Pawar Mayur Dattatray – https://github.com/mayurpawar24/Ev-Market-Data-Market-Segmentation-Analysis

Krisi UmangKumar Doshi - https://github.com/KrisiDoshi/Market-Segmentation-Analysis-On-Ev-Statistics-In-India

Rajesh Kannan - https://github.com/rajesh-chaitanyaa/EV_Market_Segment_Analysis

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