MARKET SEGMENT ANALYSIS OF EV IN INDIA

▼ Problem Statement

Electric vehicles (EVs) are becoming increasingly popular worldwide as a more sustainable alternative to traditional gasoline-powered cars. In India, there has been a **growing demand** for EVs due to concerns over air pollution, rising fuel prices, and government incentives. As an Electric Vehicle Startup, it is important for us to analyze the EV market in India and come up with a feasible strategy to enter the market by targeting the segments most likely to use EVs.

Our goal is to conduct a thorough analysis of the EV market in India using segmentation analysis. We will consider various factors such as geographic, demographic, psychographic, and behavioral data to identify the most suitable location to create an early market in accordance with the **Innovation Adoption Life Cycle**. We will also analyze the available datasets to identify potential segments that are likely to adopt EVs and customize the marketing mix to target these segments. Finally, we will **estimate the potential customer base and revenue** in the early market, and identify the most optimal market segments to enter based on our research and segmentation analysis.

▼ Data Collection

Data in this report are obtained from

1. source1 : https://github.com/balajikartheek/Market-Segmentation-EV-/tree/main/Dataset
2. source2 : https://github.com/atharvakap/Market-Segmentation-EV/tree/main/Dataset
3. source3 : https://github.com/iamjasmit/Electric-Vehicle-Market-Segmentation/blob/main/ElectricCarData.csv

MetaDeta of the Datasets

1. We will begin by collecting data on the number of Electric Vehicles by state and vehicle category. The dataset provided has the following features:

- State Name: Name of Indian states and union territories
- Two Wheeler: Number of Electric Two-wheelers in the state
- Three Wheeler: Number of Electric Three-wheelers in the state
- Four Wheeler: Number of Electric Four-wheelers in the state
- Goods Vehicles: Number of Electric Goods Vehicles in the state
- Public Service Vehicle (PSV): Number of Electric PSVs in the state
- Special Category Vehicles: Number of Electric Special Category Vehicles in the state
- Ambulance/Hearses: Number of Electric Ambulance/Hearses in the state
- Construction Equipment Vehicle: Number of Electric Construction Equipment Vehicles in the state
- Other: Number of Electric Vehicles of Other categories in the state

2. We'll analyze the data on the number of charging points available in cities on high ways and express highways. The dataset provided has the following features:
    - City name: Name of an Indian city
    - Highway: Includes the Highways in India
    - Express highway: Includes the express highways in India
    - Charging stations: Includes the number of charging stations currently available in a particular city on a highway or express highway
3. Analyzing different features in the Electric Vehicles:
    - Brand

- Model
- Acceleration
- TopSpeed (in km)
- Range (in km)
- Battery_PackKwH
- Efficiency_WhKm
- FastCharge_KmH
- RapidCharge
- PowerTrain
- PlugType
- BodyStyle
- Segment
- Seats
- PriceEuro
- INR

▼ Data Preprocessing

- Importing the Datasets

```
df = pd.read_csv("Datasets/EV_India.csv")
df.head()
```

	State Name	Two Wheeler	Three Wheeler	Four Wheeler	Goods Vehicles	Public Service Vehicle	Special Category Vehicles	Ambulance/Hearses	Construction Equipment Vehicle	Other
0	Andaman and Nicobar Island	1	30.0	81	NaN	40.0	NaN	NaN	NaN	7.0
1	Arunachal Pradesh	14	NaN	5	NaN	NaN	NaN	NaN	NaN	1.0
2	Assam	721	47041.0	161	7.0	15.0	NaN	NaN	NaN	2.0
3	Bihar	5003	59079.0	114	11.0	26.0	NaN	NaN	NaN	8.0
4	Chandigarh	298	1410.0	182	NaN	40.0	NaN	NaN	NaN	1.0

```
df.columns
```

```
Index(['State Name', 'Two Wheeler', 'Three Wheeler', 'Four Wheeler',
       'Goods Vehicles', 'Public Service Vehicle', 'Special Category Vehicles',
       'Ambulance/Hearses', 'Construction Equipment Vehicle', 'Other'],
      dtype='object')
```

- filling the nan values

```
df.replace('NA', np.nan, inplace=True)
```

```
df.fillna(df.median(), inplace=True)
```

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

```
df.head()
```

1 to 5 of 5 entries Filter

index	Brand	Model	AccelSec	TopSpeed_KmH	Range_Km	Battery_Pack Kwh	Efficiency_WhKm	FastCharge_KmH	RapidCharge	PowerTrain	PlugType	BodyStyle	Segment	Seats	PriceEuro	INR
0	Tesla	Model 3 Long Range Dual Motor	4.6	233	460	70.0	161	940	Yes	AWD	Type 2 CCS	Sedan	D	5	55480	4540988.07
1	Volkswagen	ID.3 Pure	10.0	160	270	45.0	167	250	Yes	RWD	Type 2 CCS	Hatchback	C	5	30000	2455473.0
2	Polestar	2	4.7	210	400	75.0	181	620	Yes	AWD	Type 2 CCS	Liftback	D	5	56440	4619563.2
3	BMW	iX3	6.8	180	360	74.0	206	560	Yes	RWD	Type 2 CCS	SUV	D	5	68040	5569012.76
4	Honda	e	9.5	145	170	28.5	168	190	Yes	RWD	Type 2 CCS	Hatchback	B	4	32997	2700774.75

```
df.shape
```

```
(102, 16)
```

```
df.columns
```

```
Index(['Brand', 'Model', 'AccelSec', 'TopSpeed_KmH', 'Range_Km',
       'Battery_Pack Kwh', 'Efficiency_WhKm', 'FastCharge_KmH', 'RapidCharge',
       'PowerTrain', 'PlugType', 'BodyStyle', 'Segment', 'Seats', 'PriceEuro',
       'INR'],
      dtype='object')
```

```
# finding null values in the dataset
df.isnull().sum()
```

```
Brand               0
Model               0
AccelSec            0
TopSpeed_KmH        0
Range_Km            0
Battery_Pack Kwh    0
Efficiency_WhKm     0
FastCharge_KmH      0
RapidCharge         0
PowerTrain          0
PlugType            0
BodyStyle           0
Segment             0
Seats               0
PriceEuro           0
INR                 0
dtype: int64
```

- Distributing vehicle price above and below INR 4000000

```
df['CarName'] = df['Brand'] + '-' + df['Model']
df1= df.loc[df['INR'] <=4000000]
df2 = df.loc[df['INR'] >4000000]
t1 = 'less than INR 4000000'
t2 = 'more thanINR 4000000'
```

- Importing the dataset

In [10]:
```
import pandas as pd
```

In [26]:
```
df = pd.read_csv('EV_charging_points.csv', encoding='cp1252')
# pd.set_option('max_columns', None)
df.head(20)
```

Out[26]:

	Category	City/Highway	Charging Stations
0	City	Chandigarh	48
1	City	Delhi	94
2	City	Jaipur	49
3	City	B'Lore	60
4	City	Ranchi	30
5	City	Lucknow	1
6	City	Goa	30
7	City	Hyderabad	57
8	City	Agra	15
9	City	Shimla	9
10	Highway	Delhi -Chandigarh	24
11	Highway	Mum-Pune	16
12	Highway	Delhi- Jaipur- Agra	31
13	Highway	Jaipur-Delhi Highway	9
14	Expressways	Mumbai - Pune	10
15	Expressways	Ahmadabad - Vadodara	10

In [28]:
```
df.columns
```

Out[28]:
```
Index(['Category', 'City/Highway', 'Charging Stations'], dtype='object')
```

In [29]:
```
df.describe()
```

Out[29]:

	Charging Stations
count	40.000000
mean	102.450000
std	318.035472
min	1.000000
25%	19.000000
50%	46.000000
75%	77.000000
max	2049.000000

- Identifying the missing values and dropping dropping them:

```
In [37]: df.isna().sum()

Out[37]: Category            0
         City/Highway        0
         Charging Stations   0
         dtype: int64

In [38]: df.isna().sum()/len(df)*100

Out[38]: Category            0.0
         City/Highway        0.0
         Charging Stations   0.0
         dtype: float64

In [39]: df.dropna(axis=1)
```

▼ Exploratory Data Analysis

- Descriptive Statistics

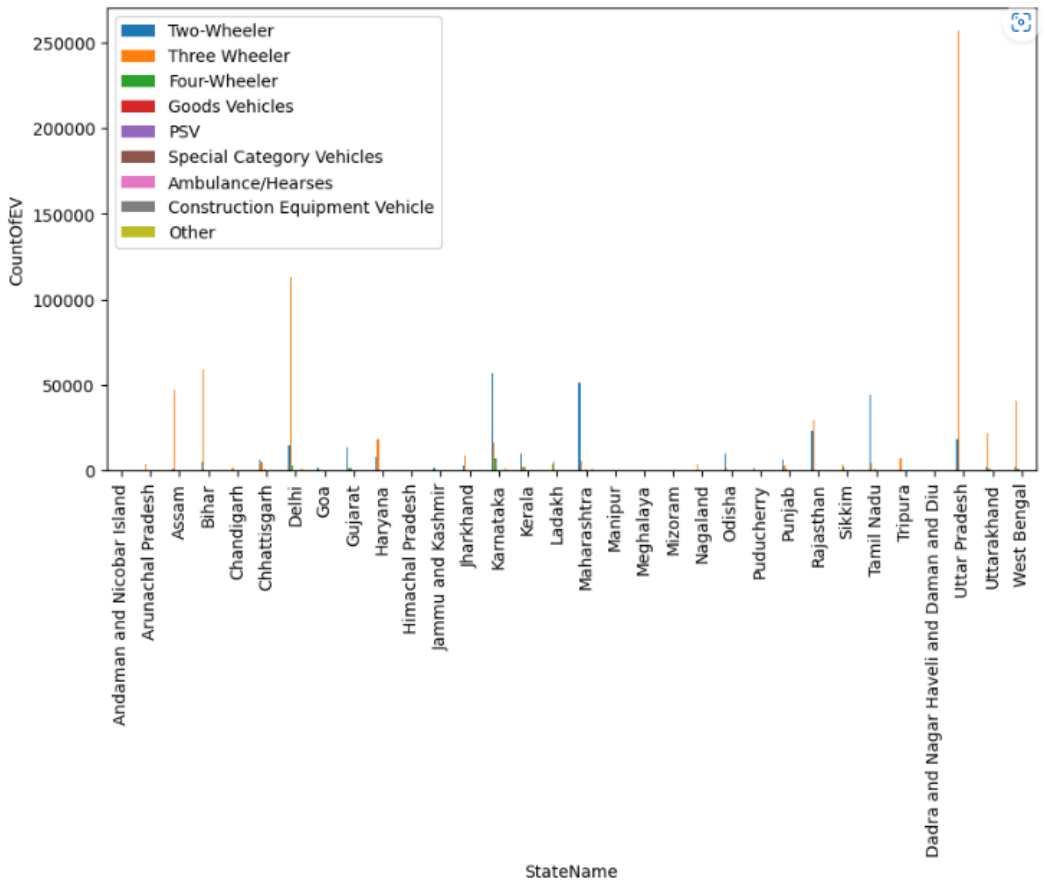
```
# Compute descriptive statistics
df.describe()
```

	Two-Wheeler	Three Wheeler	Four-Wheeler	Goods Vehicles	PSV	Special Category Vehicles	Ambulance/Hearses	Construction Equipment Vehicle	Other
count	32.000000	32.000000	32.00000	32.000000	32.000000	32.000000	32.000000	32.00000	32.000000
mean	8829.437500	20683.812500	822.96875	97.000000	71.468750	14.250000	1.031250	13.25000	140.250000
std	15027.420445	49132.494351	1661.50339	286.929237	158.902077	60.453661	0.176777	64.88501	376.276666
min	1.000000	1.000000	2.00000	1.000000	1.000000	1.000000	1.000000	1.00000	1.000000
25%	68.500000	374.000000	13.75000	5.250000	13.750000	2.000000	1.000000	1.00000	6.250000
50%	1984.500000	3674.000000	131.50000	17.000000	31.000000	2.000000	1.000000	1.00000	19.000000
75%	10306.500000	17007.250000	638.50000	31.250000	40.000000	2.000000	1.000000	1.00000	58.000000
max	56737.000000	257159.000000	7212.00000	1281.000000	851.000000	344.000000	2.000000	368.00000	1602.000000

- Bar Plot

```
df.plot(kind='bar', x='State Name', y=['Two-Wheeler', 'Three Wheeler', 'Four-Wheeler', 'Goods Vehicles', 'PSV', 'Special Categor
plt.xlabel("StateName")
plt.ylabel("CountOfEV")
```

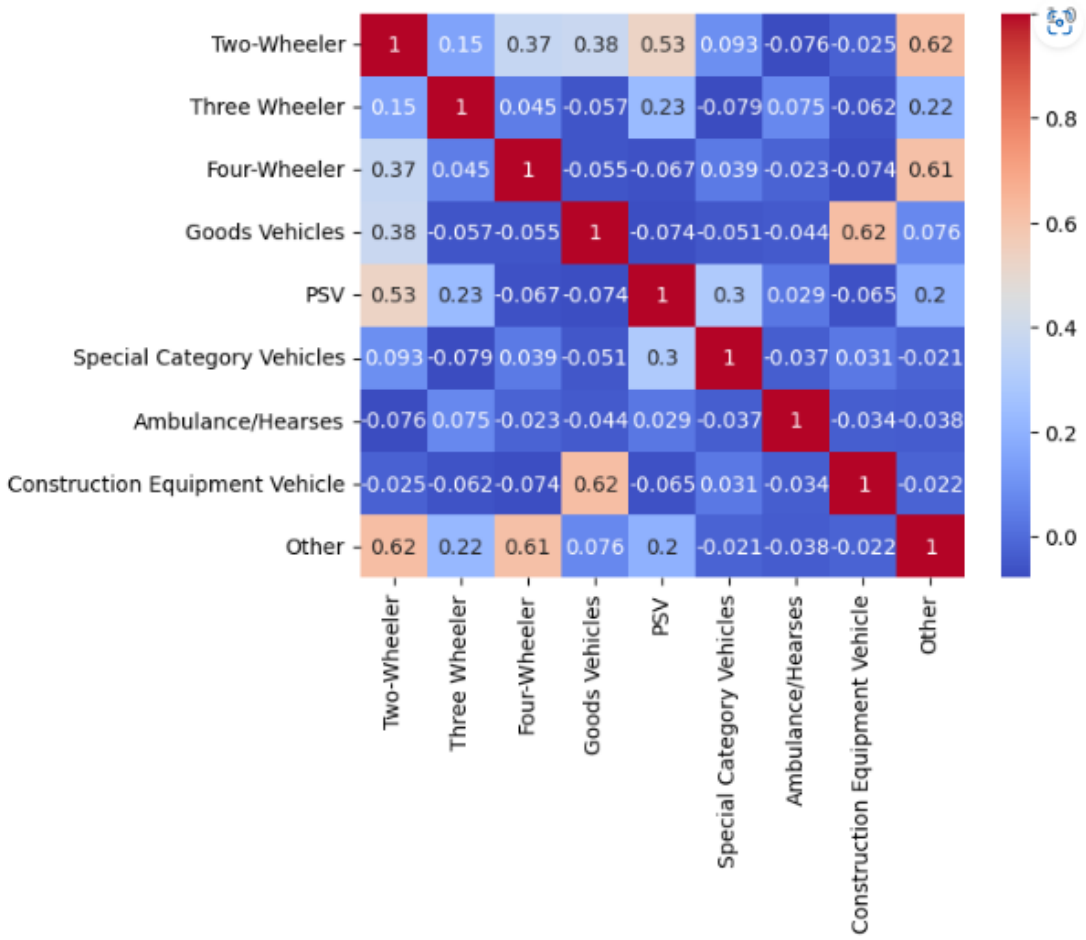
```
Text(0, 0.5, 'CountOfEV')
```



- Heatmap

```
import seaborn as sns
sns.heatmap(df.corr(), annot=True, cmap='coolwarm')
```

```
<AxesSubplot:>
```



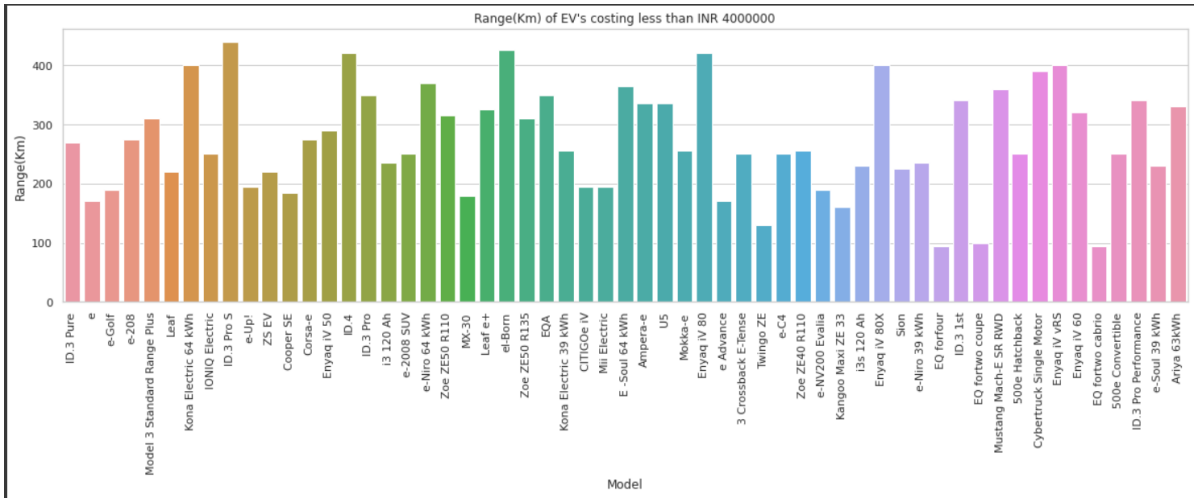
- Descriptive statistics

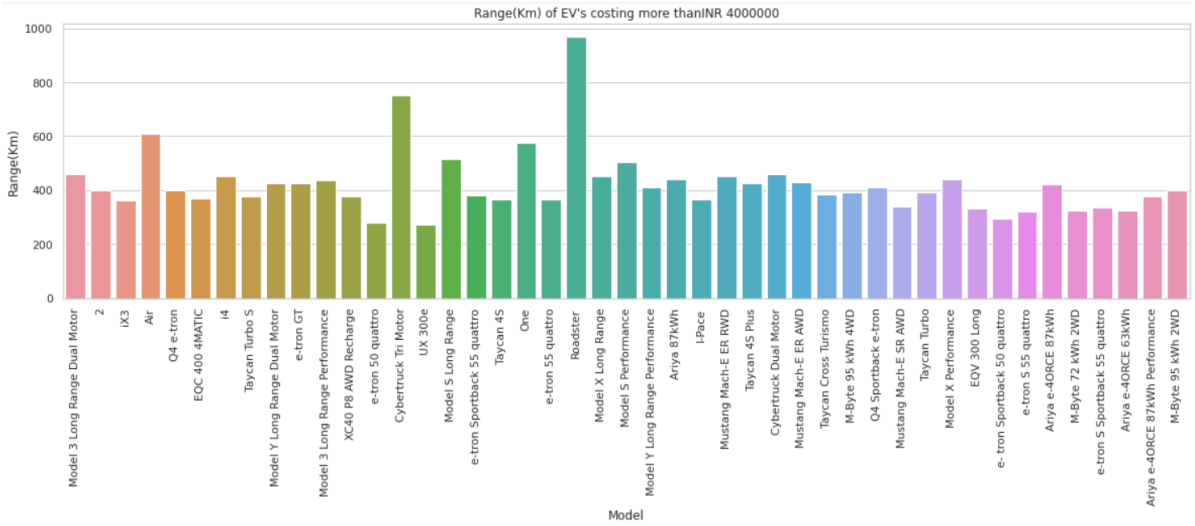
```
df.describe()
```

	AccelSec	TopSpeed_KmH	Range_Km	Battery_Pack Kwh	Efficiency_WhKm	FastCharge_KmH	Seats	PriceEuro	INR
count	102.000000	102.000000	102.000000	102.000000	102.000000	102.000000	102.000000	102.000000	1.020000e+02
mean	7.391176	179.313725	338.627451	65.415686	189.303922	435.686275	4.882353	55997.588235	4.583352e+06
std	3.031913	43.771228	126.700623	29.955782	29.679072	220.447384	0.799680	34250.724403	2.803391e+06
min	2.100000	123.000000	95.000000	16.700000	104.000000	0.000000	2.000000	20129.000000	1.647541e+06
25%	5.100000	150.000000	250.000000	43.125000	168.000000	260.000000	5.000000	34414.750000	2.816816e+06
50%	7.300000	160.000000	340.000000	64.350000	180.500000	440.000000	5.000000	45000.000000	3.683210e+06
75%	9.000000	200.000000	400.000000	83.700000	204.500000	557.500000	5.000000	65000.000000	5.320192e+06
max	22.400000	410.000000	970.000000	200.000000	273.000000	940.000000	7.000000	215000.000000	1.759756e+07

- Range of Vehicles

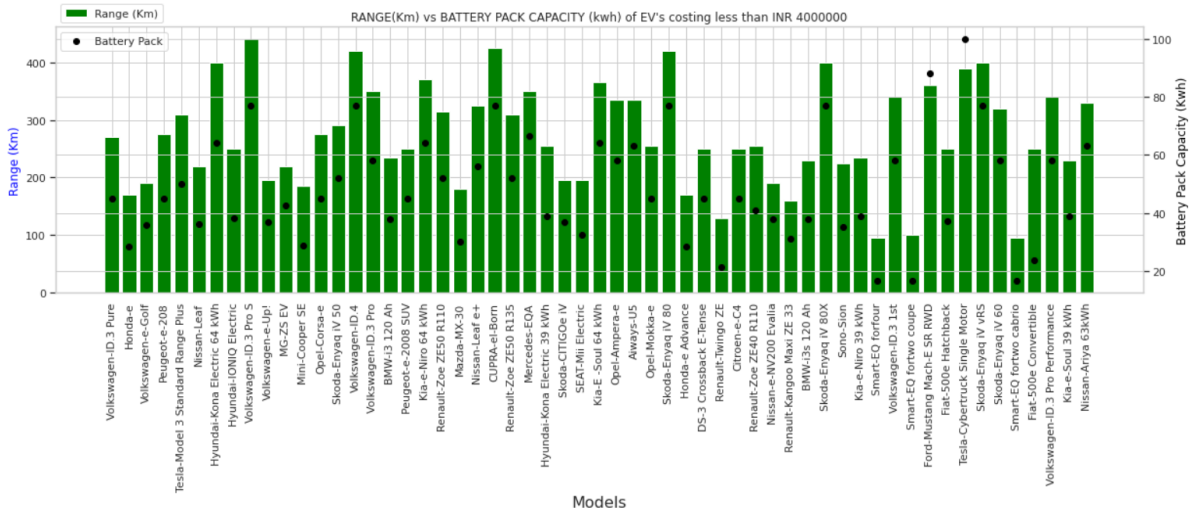
```
def range(dataframe, price):
    plt.figure(figsize=(20,5))
    sbn.set_theme(style="whitegrid")
    sbn.barplot('Model', 'Range_Km', data=dataframe)
    plt.title('''Range(Km) of EV's costing {}'''.format(price))
    plt.ylabel('Range(Km)')
    plt.xlabel('Model')
    plt.xticks(rotation = 90)
    plt.show()

range(df1, t1)
range(df2, t2)
```

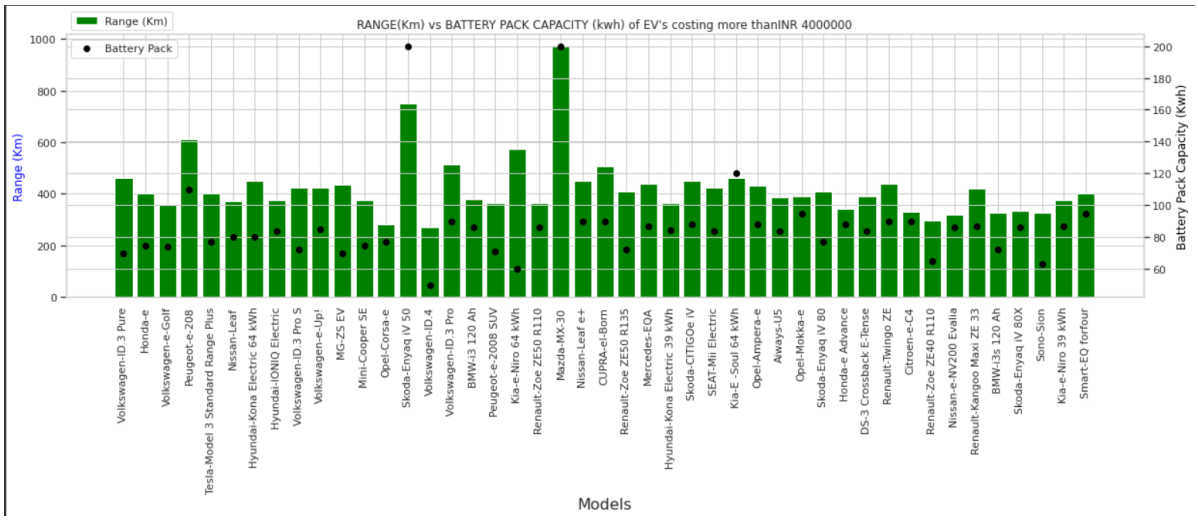




- Battery Pack

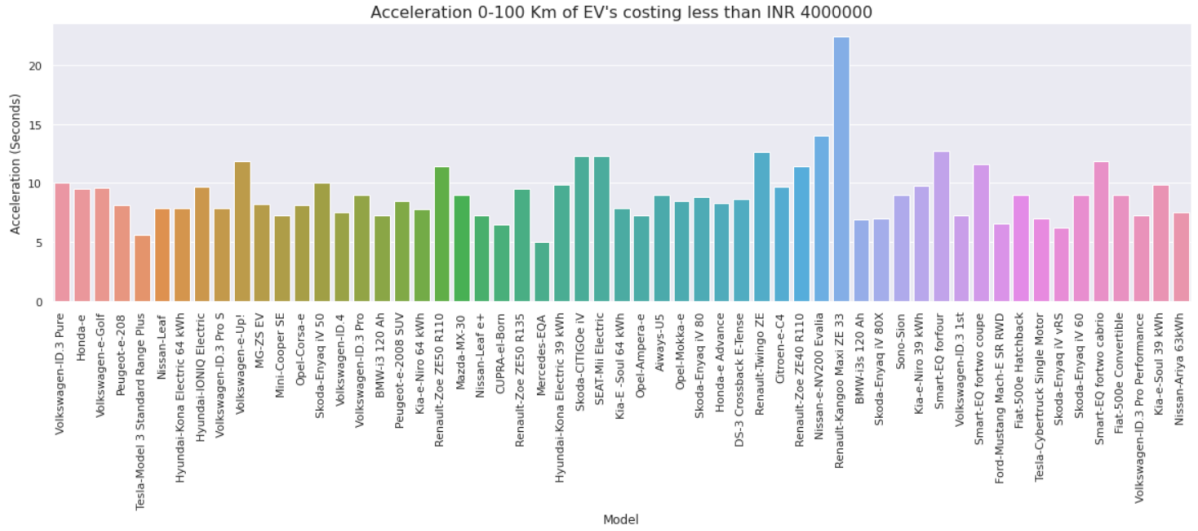
```
def battery(dataframe, text):
    fig = plt.figure(figsize=(20,5))
    a1= plt.subplot()
    a1.bar(dataframe["CarName"], dataframe["Range_Km"], label='Range (Km)', color='green')
    plt.legend(loc= "upper left", bbox_to_anchor=(0,1.105))
    a2 = a1.twinx()
    a2.scatter(dataframe["CarName"], dataframe["Battery_Pack Kwh"], label= "Battery Pack", color= 'black')
    plt.title('''RANGE(Km) vs BATTERY PACK CAPACITY (kwh) of EV's costing {}'''.format(text), fontsize=12)
    a1.set_xlabel('Models', size= 16)
    a1.set_ylabel('Range (Km)', color = 'blue')
    a2.set_ylabel('Battery Pack Capacity (Kwh)', color='black')
    plt.legend(loc='upper left', bbox_to_anchor=(0,1))
    a1.set_xticklabels(df1['CarName'], rotation = 'vertical')
    plt.show()

battery(df1, t1)
battery(df2, t2)
```

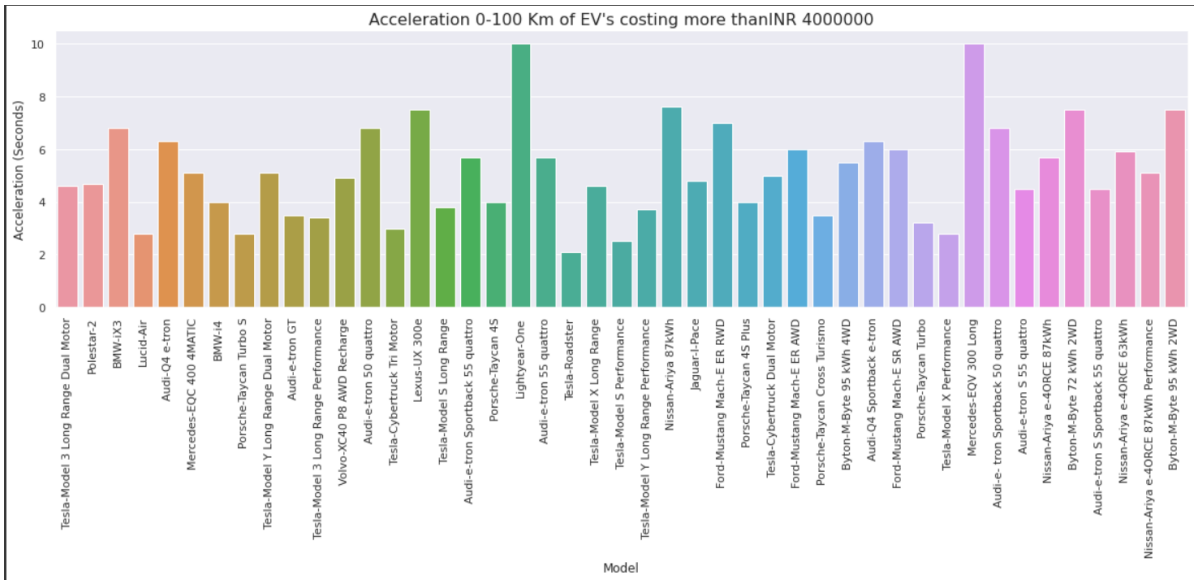




- Acceleration

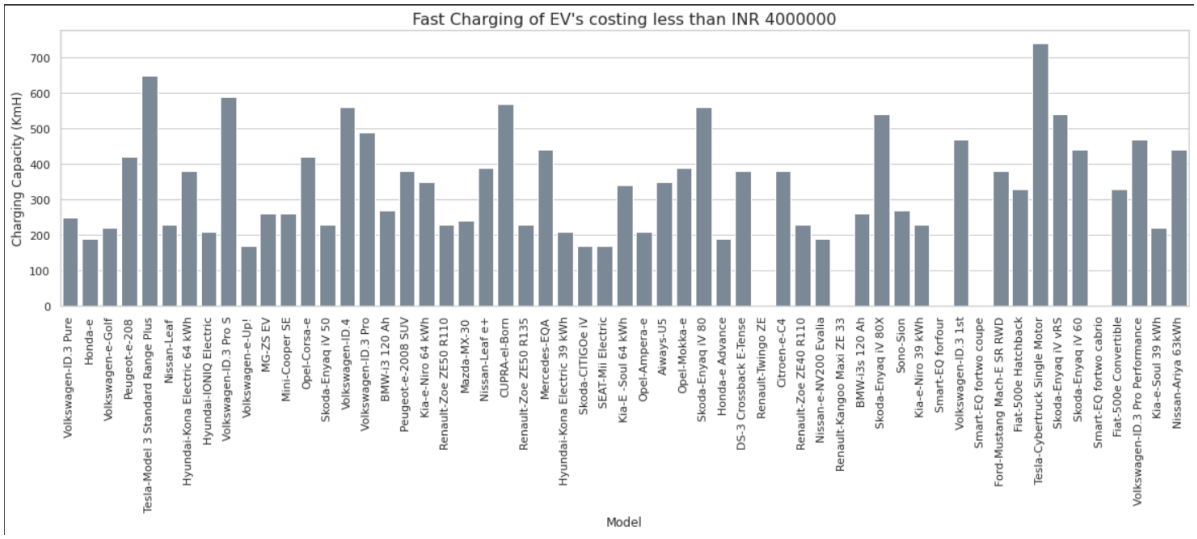
```
def acc(dataframe, text):
    plt.figure(figsize=(20,5))
    sbn.set_theme(style="darkgrid")
    sbn.barplot('CarName', 'AccelSec', data=dataframe)
    plt.title('''Acceleration 0-100 Km of EV's costing {}'''.format(text), fontsize=16)
    plt.ylabel('Acceleration (Seconds)')
    plt.xlabel('Model')
    plt.xticks(rotation = 90)
    plt.show()

acc(df1,t1)
acc(df2,t2)
```

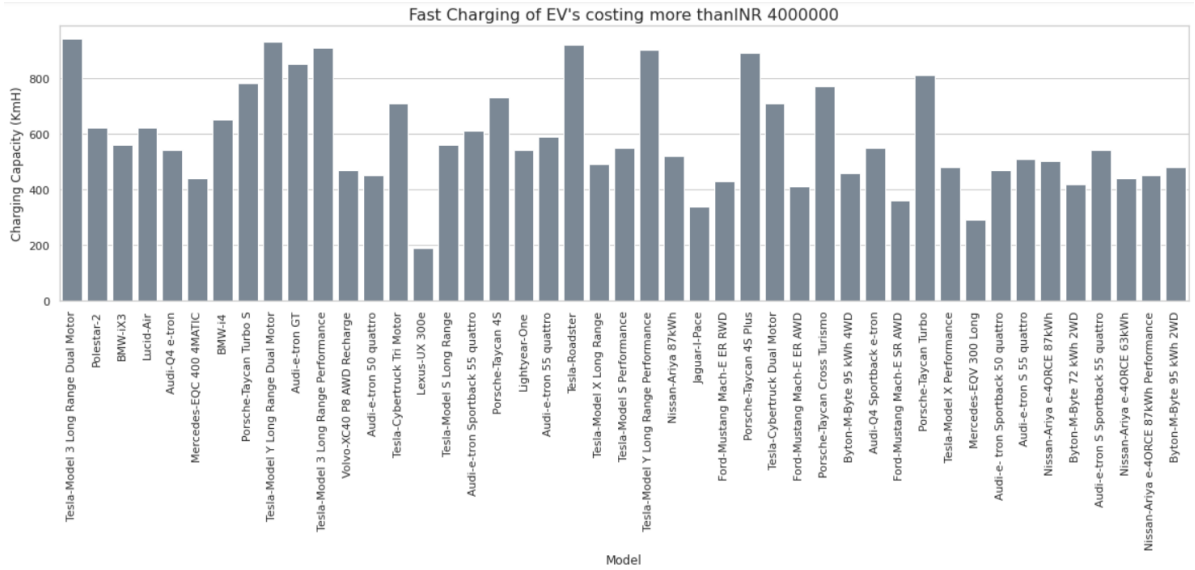




- Fast charging vehicles

```
def fastcharge(dataframe, price):
    plt.figure(figsize=(20, 5))
    sbn.set_theme(style="whitegrid")
    sbn.barplot('CarName', 'FastCharge_KmH', data=dataframe, color = 'lightslategrey')
    plt.title('''Fast Charging of EV's costing {}'''.format(price), fontsize = 16)
    plt.ylabel('Charging Capacity (KmH)')
    plt.xlabel('Model')
    plt.xticks(rotation=90)
    plt.show()

fastcharge(df1, t1)
fastcharge(df2, t2)
```



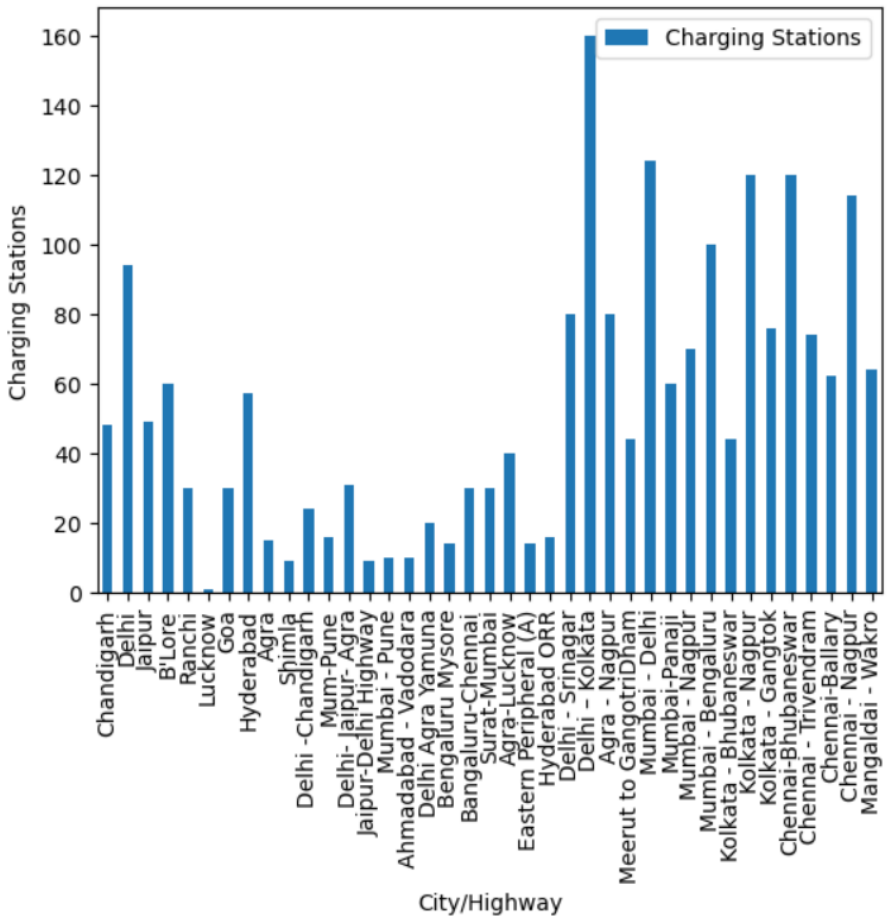


- Exploratory data analysis of the charging points data:

```
In [50]: import matplotlib.pyplot as plt
         df.drop(df.tail(1).index,inplace=True)
```

```
In [51]: df.plot(kind='bar', x='City/Highway', y='Charging Stations')
         plt.xlabel('City/Highway')
         plt.ylabel('Charging Stations')
```

```
Out[51]: Text(0, 0.5, 'Charging Stations')
```



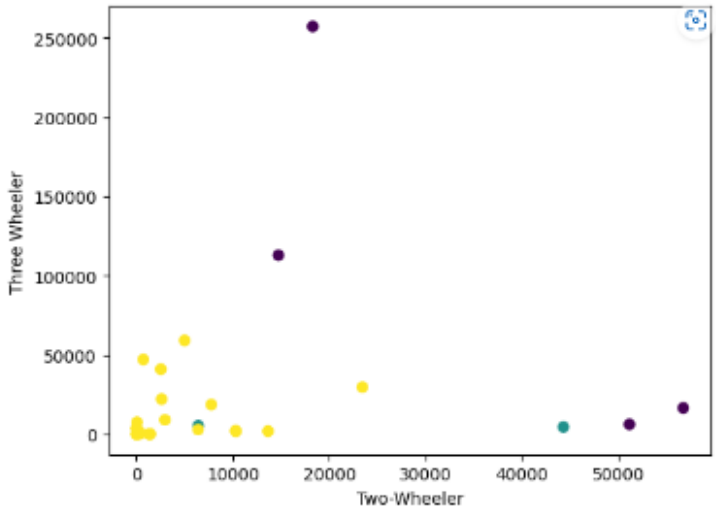
▼ Segment Extraction

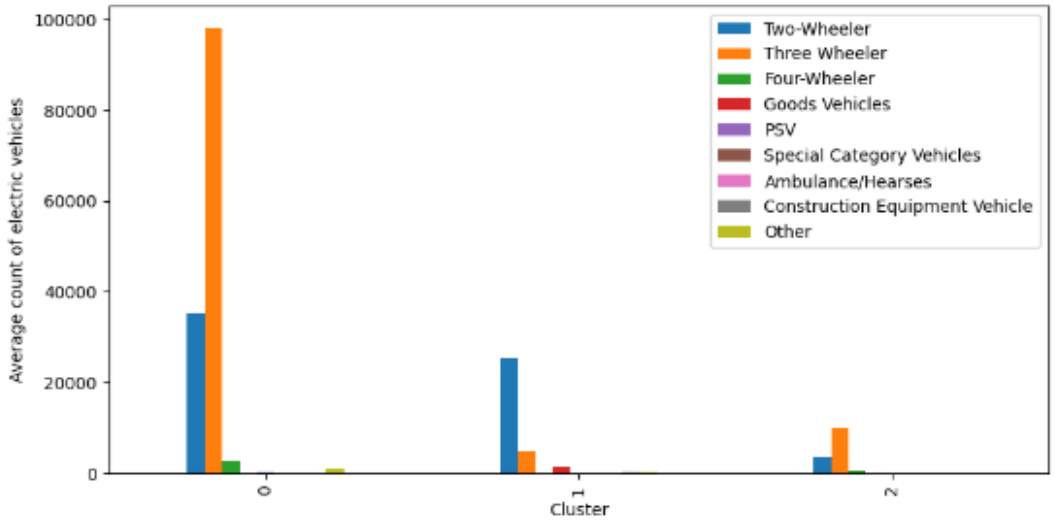
To achieve this goal, various ML techniques can be used for segment extraction. For instance, clustering algorithms such as K-Means can be used to group the states into clusters based on the number of electric vehicles in each category. This will enable the identification of states with similar electric vehicle adoption patterns.

K- Means Custering

```
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler


features = ['Two-Wheeler', 'Three Wheeler', 'Four-Wheeler', 'Goods Vehicles', 'PSV', 'Special Category Vehicles', 'Ambulance/Hear

scaler = StandardScaler()
X = scaler.fit_transform(df[features].values)


kmeans = KMeans(n_clusters=3, random_state=42)
kmeans.fit(X)


df['Cluster'] = kmeans.labels_


print(df['Cluster'].value_counts())


plt.scatter(df['Two-Wheeler'], df['Three Wheeler'], c=df['Cluster'])
plt.xlabel('Two-Wheeler')
plt.ylabel('Three Wheeler')
plt.show()


df.groupby('Cluster')[features].mean().plot(kind='bar', figsize=(10,5))
plt.xlabel('Cluster')
plt.ylabel('Average count of electric vehicles')
plt.show()
```

```
2    26
0     4
1     2
Name: Cluster, dtype: int64
```





▼ Profiling and describing potential segments

For instance, a segment of young, tech-guy, and environmentally conscious customers may prefer electric two-wheelers. They may be interested in purchasing eco-friendly products, have a high disposable income, and be located in urban areas. Understanding these characteristics can help businesses tailor their marketing strategy to target this segment effectively.

▼ Selection of target segment

▼ Analyzing Market Segments (Inference)

- Analyzing state-wise

```
for col in df.columns[1:]:
    if col != 'Grand Total':
        print(f"State with highest {col}: {df.loc[df[col].idxmax(), 'State Name']}")
```

```
State with highest Two-Wheeler: Karnataka
State with highest Three Wheeler: Uttar Pradesh
State with highest Four-Wheeler: Karnataka
State with highest Goods Vehicles: Tamil Nadu
State with highest PSV: Maharashtra
State with highest Special Category Vehicles: Gujarat
State with highest Ambulance/Hearses: West Bengal
State with highest Construction Equipment Vehicle: Chhattisgarh
State with highest Other: Delhi
```

- Popular Category of Vehicle in the city are:

```python
# Identify the category of vehicles that is the most popular in each state
for state in df['State Name']:
    state_data = df.loc[df['State Name']==state].iloc[:,1:]
    if 'Grand Total' in state_data.columns:
        state_data = state_data.drop('Grand Total', axis=1)
    max_value = state_data.max().max()
    for col in state_data.columns:
        if state_data.loc[state_data[col]==max_value, col].any():
            print(f"Most popular category of vehicle in {state}: {col}")
```

```
Most popular category of vehicle in Andaman and Nicobar Island: Four-Wheeler
Most popular category of vehicle in Arunachal Pradesh: Three Wheeler
Most popular category of vehicle in Assam: Three Wheeler
Most popular category of vehicle in Bihar: Three Wheeler
Most popular category of vehicle in Chandigarh: Three Wheeler
Most popular category of vehicle in Chhattisgarh: Two-Wheeler
Most popular category of vehicle in Delhi: Three Wheeler
Most popular category of vehicle in Goa: Two-Wheeler
Most popular category of vehicle in Gujarat: Two-Wheeler
Most popular category of vehicle in Haryana: Three Wheeler
Most popular category of vehicle in Himachal Pradesh: Two-Wheeler
Most popular category of vehicle in Jammu and Kashmir: Two-Wheeler
Most popular category of vehicle in Jharkhand: Three Wheeler
Most popular category of vehicle in Karnataka: Two-Wheeler
Most popular category of vehicle in Kerala: Two-Wheeler
Most popular category of vehicle in Ladakh: Four-Wheeler
Most popular category of vehicle in Maharashtra: Two-Wheeler
Most popular category of vehicle in Manipur: Three Wheeler
Most popular category of vehicle in Meghalaya: PSV
Most popular category of vehicle in Mizoram: Two-Wheeler
Most popular category of vehicle in Nagaland: Three Wheeler
Most popular category of vehicle in Odisha: Two-Wheeler
Most popular category of vehicle in Puducherry: Two-Wheeler
Most popular category of vehicle in Punjab: Two-Wheeler
Most popular category of vehicle in Rajasthan: Three Wheeler
Most popular category of vehicle in Sikkim: Three Wheeler
Most popular category of vehicle in Tamil Nadu: Two-Wheeler
Most popular category of vehicle in Tripura: Three Wheeler
Most popular category of vehicle in Dadra and Nagar Haveli and Daman and Diu: Four-Wheeler
Most popular category of vehicle in Uttar Pradesh: Three Wheeler
Most popular category of vehicle in Uttarakhand: Three Wheeler
Most popular category of vehicle in West Bengal: Three Wheeler
```

- Vehicles to buy under INR 40,00000 with max range(Km)

```
top_range_1 = df1.sort_values(by= 'Range_Km', ascending= False)
print(top_range_1[['CarName', 'Range_Km', 'Battery_Pack Kwh', 'INR', 'RapidCharge']])
```

	CarName	Range_Km	Battery_Pack Kwh	INR	\
15	Volkswagen-ID.3 Pro S	440	77.0	3350574.76	
37	CUPRA-el-Born	425	77.0	3683209.50	
53	Skoda-Enyaq iV 80	420	77.0	3273964.00	
25	Volkswagen-ID.4	420	77.0	3683209.50	
88	Skoda-Enyaq iV vRS	400	77.0	3887832.25	
12	Hyundai-Kona Electric 64 kWh	400	64.0	3339034.04	
71	Skoda-Enyaq iV 80X	400	77.0	3683209.50	
86	Tesla-Cybertruck Single Motor	390	100.0	3683209.50	
31	Kia-e-Niro 64 kWh	370	64.0	3118859.96	
45	Kia-E -Soul 64 kWh	365	64.0	3015075.30	
83	Ford-Mustang Mach-E SR RWD	360	88.0	3838722.79	
39	Mercedes-EQA	350	66.5	3683209.50	
26	Volkswagen-ID.3 Pro	350	58.0	2701020.30	
94	Volkswagen-ID.3 Pro Performance	340	58.0	2911781.73	
80	Volkswagen-ID.3 1st	340	58.0	3191050.86	
49	Aiways-U5	335	63.0	2951233.00	
46	Opel-Ampera-e	335	58.0	3429968.39	
97	Nissan-Ariya 63kWh	330	63.0	3683209.50	
35	Nissan-Leaf e+	325	56.0	3047814.94	
89	Skoda-Enyaq iV 60	320	58.0	3069341.25	
32	Renault-Zoe ZE50 R110	315	52.0	2552382.33	
38	Renault-Zoe ZE50 R135	310	52.0	2711906.23	
8	Tesla-Model 3 Standard Range Plus	310	50.0	3796161.26	

- Vehicles with best acceleration under INR 40,00000

```
acceleration = df1.sort_values(by= 'AccelSec')
print(acceleration[['CarName','AccelSec','Range_Km','Battery_Pack Kwh','INR']])
```

	CarName	AccelSec	Range_Km	Battery_Pack Kwh	\
39	Mercedes-EQA	5.0	350	66.5	
8	Tesla-Model 3 Standard Range Plus	5.6	310	50.0	
88	Skoda-Enyaq iV vRS	6.2	400	77.0	
37	CUPRA-el-Born	6.5	425	77.0	
83	Ford-Mustang Mach-E SR RWD	6.6	360	88.0	
70	BMW-i3s 120 Ah	6.9	230	37.9	
86	Tesla-Cybertruck Single Motor	7.0	390	100.0	
71	Skoda-Enyaq iV 80X	7.0	400	77.0	
35	Nissan-Leaf e+	7.3	325	56.0	
19	Mini-Cooper SE	7.3	185	28.9	
28	BMW-i3 120 Ah	7.3	235	37.9	
80	Volkswagen-ID.3 1st	7.3	340	58.0	
94	Volkswagen-ID.3 Pro Performance	7.3	340	58.0	
46	Opel-Ampera-e	7.3	335	58.0	
25	Volkswagen-ID.4	7.5	420	77.0	
97	Nissan-Ariya 63kWh	7.5	330	63.0	
31	Kia-e-Niro 64 kWh	7.8	370	64.0	
45	Kia-E -Soul 64 kWh	7.9	365	64.0	
15	Volkswagen-ID.3 Pro S	7.9	440	77.0	
12	Hyundai-Kona Electric 64 kWh	7.9	400	64.0	
11	Nissan-Leaf	7.9	220	36.0	
20	Opel-Corsa-e	8.1	275	45.0	
7	Peugeot-e-208	8.1	275	45.0	
18	MG-ZS EV	8.2	220	42.5	

- Vehicles with Maximum Efficiency

```
efficiency = df.sort_values(by = 'Efficiency_WhKm')
print(efficiency[['CarName', 'Efficiency_WhKm', 'Range_Km', 'PowerTrain', 'Battery_Pack Kwh', 'INR']])
```

```
                            CarName  Efficiency_WhKm  Range_Km PowerTrain  \
48                      Lightyear-One              104       575        AWD
14              Hyundai-IONIQ Electric              153       250        FWD
8    Tesla-Model 3 Standard Range Plus              153       310        RWD
41        Hyundai-Kona Electric 39 kWh              154       255        FWD
74                           Sono-Sion              156       225        FWD
..                                 ...              ...       ...        ...
98  Audi-e-tron S Sportback 55 quattro              258       335        AWD
67         Tesla-Cybertruck Dual Motor              261       460        AWD
33          Tesla-Cybertruck Tri Motor              267       750        AWD
90            Audi-e-tron S 55 quattro              270       320        AWD
84               Mercedes-EQV 300 Long              273       330        FWD

    Battery_Pack Kwh          INR
48              60.0  12195515.90
14              38.3   2820438.14
8               50.0   3796161.26
41              39.0   2780495.78
74              35.0   2087152.05
..               ...          ...
98              86.5   7861606.06
67             120.0   4501700.50
33             200.0   6138682.50
90              86.5   7677445.58
84              90.0   5781083.78
```

▼ Customizing the Marketing Mix

- **Product:**
  Based on the research conducted, it is evident that two-wheelers are the most popular category of vehicles in many states, including Karnataka, Kerala, Tamil Nadu, Maharashtra, and Odisha. Therefore, offering a range of two-wheeler options, such as electric scooters and motorcycles, can attract customers in these states. In states where four-wheelers are popular, such as Ladakh and Dadra and Nagar Haveli and Daman and Diu, offering a range of affordable yet high-quality four-wheelers can be beneficial.
- Based on analysis of the data of the number of charging stations available in the cities or highways and express highways it is evident that the more the charging stations are available the more is the possibility of expanding the EV market in that area. According to the data the most charging stations are available on Delhi-Kolkata highway and Delhi itself has the most charging

points available. So starting to expand the EV market from Delhi itself would be beneficial.

- **Price**:
  Pricing is a crucial aspect of any marketing strategy. When customizing the marketing mix, it is essential to consider the target market's price sensitivity. For example, customers in Chhattisgarh prefer two-wheelers; offering them at affordable prices can attract a significant customer base. Similarly, the price range for goods vehicles in Tamil Nadu, where it is the most popular category, can be set competitively to capture a large market share.
- Pricing must vary according to availability of the charging stations in the particular area. The reagion which already has lesser number of charging stations indicates that EV market is less popular so the pricing should be less to gain the market.

- **Promotion**:
  Promotion involves communicating the value proposition of the product to the target market. Based on the most popular category of vehicles in each state, promotion can be customized to suit the preferences of the target market. For instance, social media promotion can be used to target the younger population in states where two-wheelers are popular. In contrast, traditional advertising mediums such as newspapers and billboards can be used to reach older customers in states where four-wheelers are preferred.
- The areas where the Charging points are lesser in number indicates the less popularity of EV market. Promoting the brand, the benefits of using EVs should be done in such areas to gain the market.

Place:

- The distribution channel for the product can be customized based on the popular category of vehicles in each state. For example, in states where two-wheelers are preferred, partnering with local dealers and distributors can help in increasing the availability of the product. On the other hand, in states where

four-wheelers are popular, tie-ups with car dealerships can be beneficial in reaching out to the target market.

- Introducing charging points where ever necessary at reasonable cost to the customers will encourage them to buy more EVs and thus the market will grow. Such areas should be focused with priority .

▼ for Business Markets)Potential customer base in the early market, thereby calculating the potential sale (profit) in the early market (Potential Customer Base * Your Target Price Range = Potential Profit).

- Calculating based on the popular category of vehicles in each state. For instance, the potential customer base for two-wheelers can be high in states like Karnataka, Kerala, Tamil Nadu, Maharashtra, and Odisha. Therefore, the market research and segmentation can be customized to target these states, which can result in a high potential sale/profit.
- @Jasmit Singh
- The less number of charging stations discourage customers to stick to petrol/diesel based vehicles as the charging stations are less in number the sell of EVs will also be less. Introducing the charging stations where they are necessary will increase in sell. For example in Luckhnow there’s only one charging station, introducing more will encourage customers to at least try out EVs as charging stations are available in their area.

▼ The MOST OPTIMAL MARKET SEGMENTS to open in the market as per your Market Research and Segmentation

Based on the market research and segmentation, it is recommended to focus on the following optimal market segments for the most popular categories of vehicles in each state:

- Two-Wheeler market segment in Karnataka, Kerala, Tamil Nadu, Maharashtra, Odisha, Goa, Meghalaya, Mizoram, Jammu and Kashmir, and Manipur.

- Three-Wheeler market segment in Uttar Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Delhi, Haryana, Jharkhand, Rajasthan, Sikkim, Tripura, and Uttarakhand.
- Four-Wheeler market segment in Ladakh, Dadra and Nagar Haveli and Daman and Diu.
- Goods Vehicle market segment in Tamil Nadu.
- PSV market segment ian Meghalaya.
- Special Category Vehicle market segment in Gujarat.
- Ambulance/Hearse market segment in West Bengal.
- Construction Equipment Vehicle market segment in Chhattisgarh.
- Other market segment in Delhi.

- The highest market growth possibilities are in areas like Delhi, Kolkata, Mumbai, Nagpur where people already use EVs and where there is availability of charging stations nearby.
- Once a strong market in established then it can be expanded through nearby towns and cities

Links to the Notebook: (GitHub)

Balaji Kartheek	https://github.com/balajikartheek/Market-Segmentation-EV-/blob/main/EvMarket.ipynb
Atharv	https://github.com/atharvakap/Market-Segmentation-EV
Jasmit singh	https://github.com/iamjasmit/Electric-Vehicle-Market-Segmentation