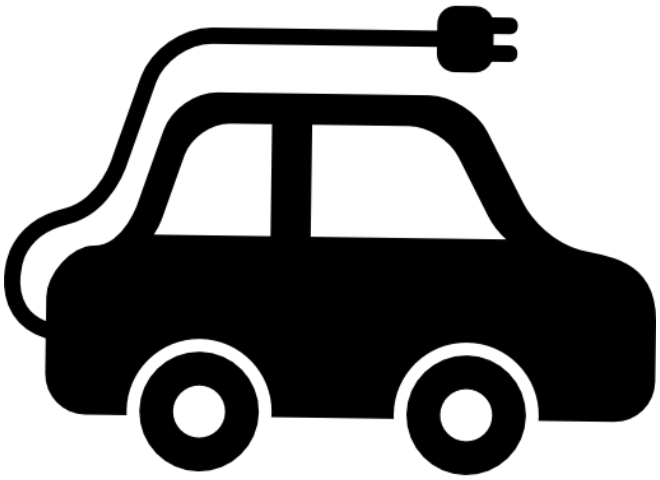
Market Segmentation

Analyzing the respective market in India using Segmentation Analysis for Electric Vehicle Startup.



By
Sheri Saket Reddy
IIITDM Kancheepuram

Github link: Find the link here.

Overview

The report delves into a comprehensive examination of the electric vehicle (EV) market in India. In recent years, the global automotive industry has witnessed a substantial shift towards sustainable and eco-friendly transportation solutions, with electric vehicles emerging as a key player in this transformation. This report focuses specifically on the Indian market, which presents a unique set of challenges and opportunities for electric vehicle startups.

Background

India, as one of the world's largest automobile markets, has been making significant strides in embracing electric mobility. With growing concerns about pollution, energy security, and climate change, the Indian government has implemented various policies and initiatives to encourage the adoption of electric vehicles. This report aims to provide valuable insights for an EV startup by analyzing the market through the lens of segmentation analysis.

Objectives:
The primary objectives of this report are as follows:

Market Understanding: To gain a deep understanding of the Indian EV market landscape, including its current status, growth trajectory, and competitive landscape.

Segmentation Analysis: To employ segmentation analysis to divide the market into distinct consumer segments based on

various factors such as demographics, psychographics, behaviors, and preferences.

Opportunity Assessment: To identify potential target segments that align with the startup's offerings and capabilities, highlighting segments with the highest growth potential.

Competitor Analysis: To analyze existing and potential competitors in the Indian EV market, understanding their strategies, strengths, and weaknesses.

Strategic Recommendations: To provide strategic recommendations for the startup based on the segmentation analysis, helping it position its products effectively and capture a larger market share.

Electric vehicles (EVs) offer numerous advantages that make them a compelling choice for both consumers and society as a whole.
These advantages span environmental, economic, and technological aspects.

Here are some of the key benefits of electric vehicles:

Environmental Benefits:

Reduced Emissions: EVs produce zero tailpipe emissions, helping to reduce air pollution and combat climate change by lowering greenhouse gas emissions.

Lower Carbon Footprint: EVs have a significantly lower carbon footprint compared to traditional internal combustion engine vehicles, especially when charged using renewable energy sources.

Noise Reduction: Electric motors are quieter than internal combustion engines, contributing to reduced noise pollution in urban environments.

Economic Benefits:

Lower Operating Costs: EVs have fewer moving parts and require less maintenance compared to traditional vehicles. There's no need for oil changes, and brake wear is reduced due to regenerative braking systems.

Lower Fuel Costs: Electricity is generally cheaper than gasoline or diesel fuel on a per-mile basis, resulting in lower fueling costs for EV owners.

Incentives and Subsidies: Many governments offer incentives such as tax credits, rebates, and reduced registration fees to promote the adoption of EVs.

Long-Term Savings: While the upfront cost of EVs may be higher, long-term savings on fuel and maintenance can offset this initial investment.

Technological Advancements:

Innovative Features: EVs often come equipped with advanced technology and features, such as regenerative braking, smart connectivity, and autonomous driving capabilities.

Energy Efficiency:

Higher Efficiency: Electric motors are inherently more efficient than internal combustion engines, converting a higher percentage of stored energy into movement.
Regenerative Braking: EVs utilize regenerative braking, which converts kinetic energy back into electricity, improving overall energy efficiency.

Energy Independence:

Reduced Reliance on Fossil Fuels: EVs reduce dependence on oil imports, enhancing energy security and reducing vulnerability to oil price fluctuations.

Quiet and Smooth Operation:

Silent Operation: Electric motors operate quietly, reducing noise pollution in urban areas. Smooth Acceleration: Electric motors provide instant torque, resulting in smooth and rapid acceleration.

MARKET OVERVIEW

The electric vehicle (EV) market in India was showing promising growth and significant potential for further development.

1. Government Initiatives and Policies:

FAME Scheme: The Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme was introduced by the Indian government to incentivize the adoption of EVs through subsidies, incentives for manufacturers, and support for charging infrastructure.

GST Reduction: The Goods and Services Tax (GST) on electric vehicles was reduced to encourage affordability and boost demand.

2. Market Growth and Adoption:

Increasing Awareness: Growing environmental concerns and increasing awareness of pollution-related issues were driving consumer interest in electric vehicles.

Two-Wheeler Dominance: The electric two-wheeler segment was particularly prominent, with several startups and established manufacturers offering electric scooters and motorcycles.

3. Key Players and Manufacturers:

Ola Electric: Ola Electric, a subsidiary of Ola Cabs, announced plans to launch electric scooters and establish a large EV manufacturing facility in India.

Ather Energy: Ather Energy gained attention for its technologically advanced electric scooters and expanding charging infrastructure.

Tata Motors: Established automakers like Tata Motors introduced electric versions of their existing models to tap into the EV market.

4. Charging Infrastructure:

Charging Networks: Charging infrastructure remained a challenge, but efforts were being made to establish public and private charging networks in urban centers.

Home Charging: Consumers were also exploring home charging solutions to address charging accessibility concerns.

5. Challenges:

Charging Infrastructure: The lack of widespread charging infrastructure outside major cities hindered the adoption of EVs in suburban and rural areas.

High Initial Cost: The upfront cost of EVs, primarily due to the cost of batteries, remained a barrier for many potential buyers.

Range Anxiety: Concerns about the driving range of EVs on a single charge and the availability of charging stations affected consumer confidence.

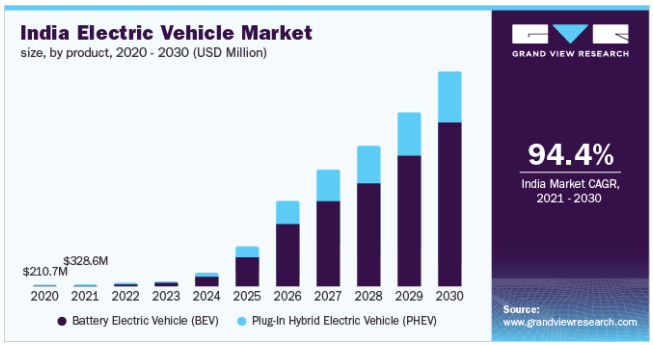
6. Future Prospects:

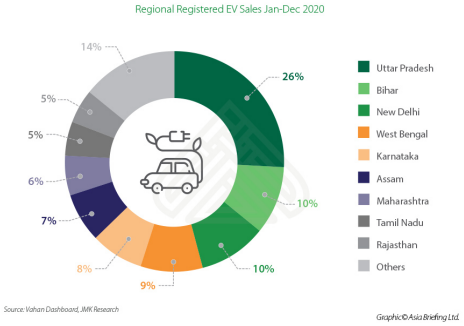
Battery Technology: Advances in battery technology were expected to lead to longer ranges, shorter charging times, and reduced costs over time.

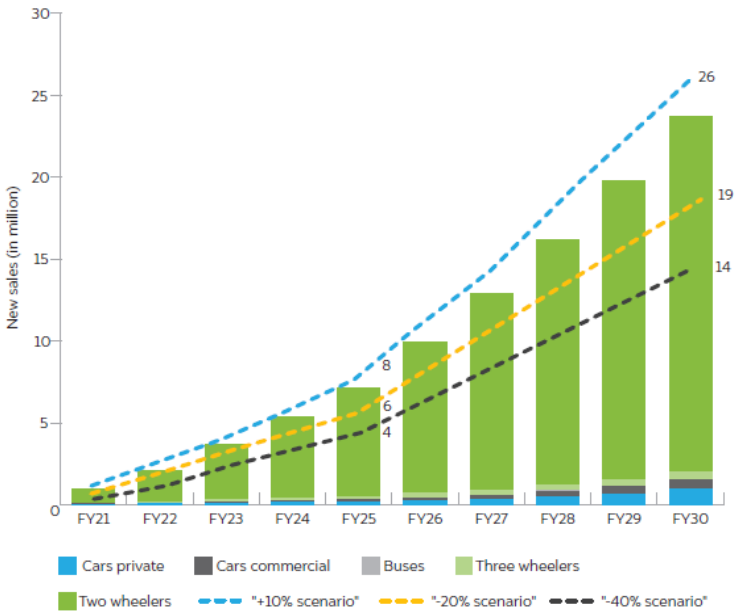
Government Support: Continued government incentives, subsidies, and policy measures were anticipated to support the growth of the EV market.

Market Competition: Established automakers and startups were likely to compete aggressively in the EV segment, fostering innovation and driving down costs.

Stats and Charts about EV Market in India.







Product	Market type	Body Type	Production type	FY 2021-22 Volume	Market share
Tata Nexon EV	Mass-market	SUV	Local	13,879	63%
Tata Tigor EV	Mass-market	Sedan	Local	5,227	24%
MG EZS	Mass-market	SUV	CKD	2,525	11.5%
Hyundai Kona	Mass-market	SUV	CKD	131	0.59%
Mahindra E-Verito	Mass-market	Sedan	Local	79	0.36%
Audi e-Tron	Luxury	SUV	CBU	73	0.33%
Jaguar I-Pace	Luxury	SUV	CBU	69	0.31%
Mercedes EQC	Luxury	SUV	CBU	30	0.14%
Audi e-Tron Sportback	Luxury	SUV	CBU	23	0.10%
BMW iX	Luxury	SUV	CBU	3	0.01%
				22,039	100%

Data Sources

I have collected the data from the following sites.

Kaggle: In Kaggle I found a dataset containing the attributes Vehicle Manufacturing company, Model name, Acceleration, Top speed, Fast charge, Rapid charge, Plug type, etc.

Thought the rows are limited the data is very much useful and important.

	Brand	Model	AccelSec	TopSpeed_KmH	Range_Km	Efficiency_WhKm	FastCharge_KmH	RapidCharge	PowerTrain	PlugType
0	Tesla	Model 3 Long Range Dual Motor	4.6	233	450	161	940	Yes	AWD	Type 2 CCS
1	Volkswagen	ID.3 Pure	10.0	160	270	167	250	Yes	RWD	Type 2 CCS
2	Polestar	2	4.7	210	400	181	620	Yes	AWD	Type 2 CCS
3	BMW	iX3	6.8	180	360	206	560	Yes	RWD	Type 2 CCS

Now coming to the second dataset, the dataset pertains to the purchasing behavior of Indian consumers when it comes to automobiles (cars). By analyzing the various brands and their sales trends within the dataset, we can anticipate customer preferences and create innovative products that cater to their 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

The third dataset is about each state in India and sales about the Electric vehicles line two wheelers and three wheelers. It gives total sales in each state.

	Sl. 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

Segmentation

After collecting the datasets, the analysis of collected data is performed, like checking the columns info, null values, etc.

```
df.isna().sum()
```

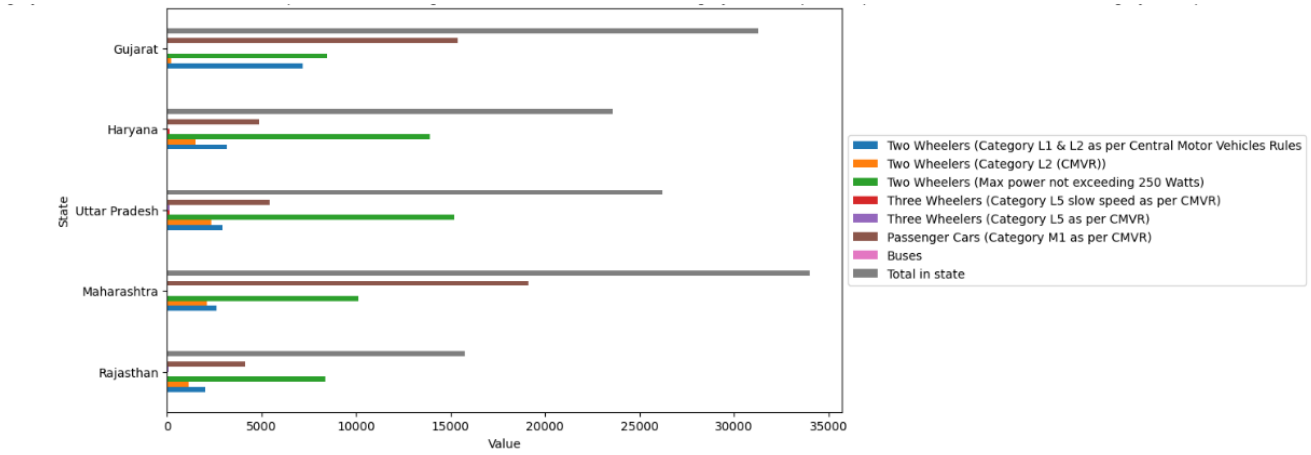
```
Brand              0
Model              0
AccelSec           0
TopSpeed_KmH       0
Range_Km           0
Efficiency_WhKm    0
FastCharge_KmH     0
RapidCharge        0
PowerTrain         0
PlugType           0
BodyStyle          0
Segment            0
Seats              0
PriceEuro          0
dtype: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

```
[4] df.describe()
```

	AccelSec	TopSpeed_KmH	Range_Km	Efficiency_WhKm	Seats	PriceEuro
count	103.000000	103.000000	103.000000	103.000000	103.000000	103.000000
mean	7.396117	179.194175	338.786408	189.165049	4.883495	55811.563107
std	3.017430	43.573030	126.014444	29.566839	0.795834	34134.665280
min	2.100000	123.000000	95.000000	104.000000	2.000000	20129.000000
25%	5.100000	150.000000	250.000000	168.000000	5.000000	34429.500000
50%	7.300000	160.000000	340.000000	180.000000	5.000000	45000.000000
75%	9.000000	200.000000	400.000000	203.000000	5.000000	65000.000000
max	22.400000	410.000000	970.000000	273.000000	7.000000	215000.000000

	Age	No of Dependents	Salary	Wife Salary	Total Salary	Price
count	99.000000	99.000000	9.900000e+01	9.900000e+01	9.900000e+01	9.900000e+01
mean	36.313131	2.181818	1.736364e+06	5.343434e+05	2.270707e+06	1.194040e+06
std	6.246054	1.335265	6.736217e+05	6.054450e+05	1.050777e+06	4.376955e+05
min	26.000000	0.000000	2.000000e+05	0.000000e+00	2.000000e+05	1.100000e+05
25%	31.000000	2.000000	1.300000e+06	0.000000e+00	1.550000e+06	8.000000e+05
50%	36.000000	2.000000	1.600000e+06	5.000000e+05	2.100000e+06	1.200000e+06
75%	41.000000	3.000000	2.200000e+06	9.000000e+05	2.700000e+06	1.500000e+06
max	51.000000	4.000000	3.800000e+06	2.100000e+06	5.200000e+06	3.000000e+06

Now a small analysis is done, from the data collected from Indian states, we will see each column i.e. type of vehicle sold in the given Indian states.



It can be seen are total sales are pretty high in the states Maharashtra, Gujarat, and Uttar Pradesh.

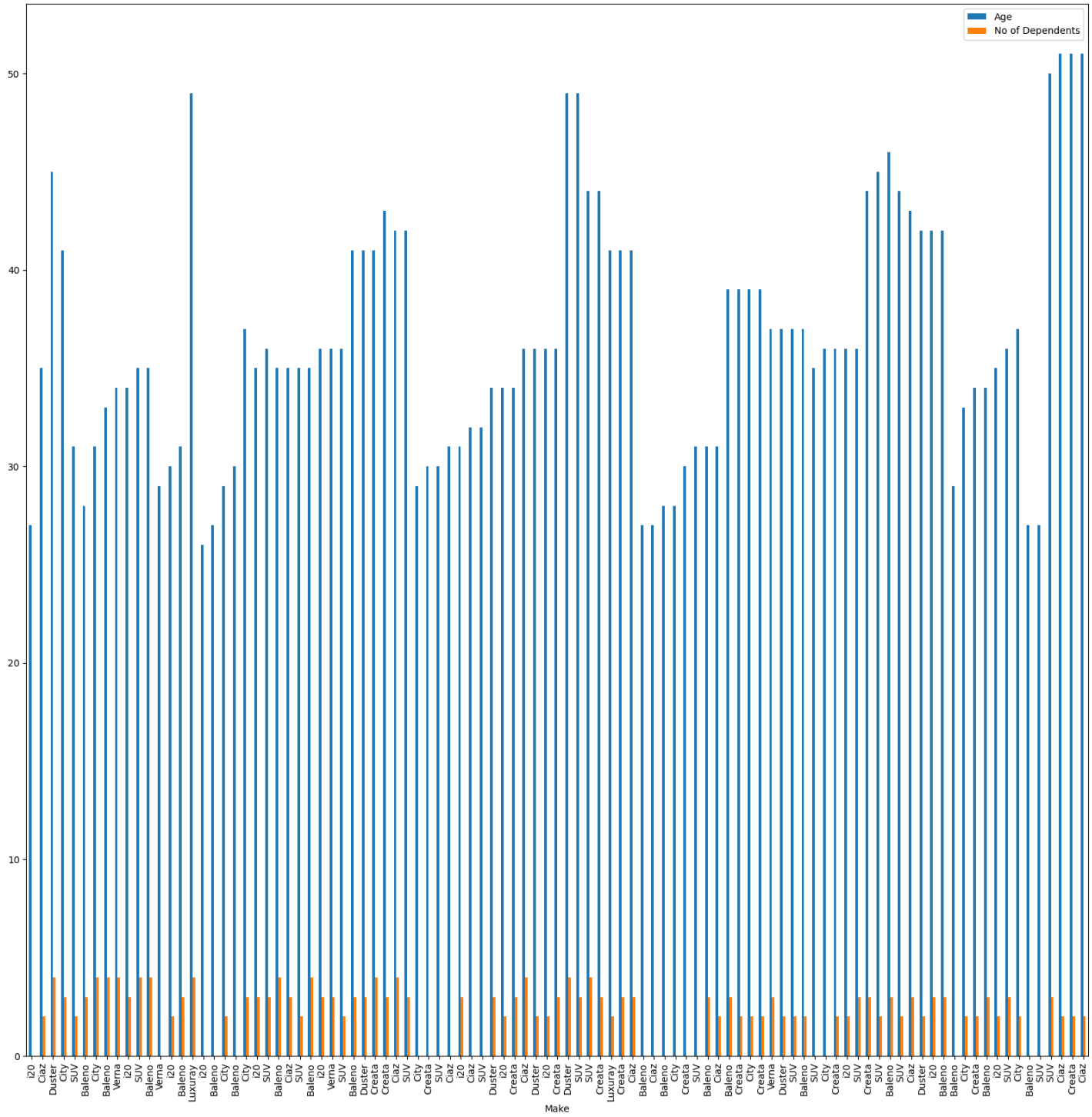
Passenger cars are high for Gujarat and Maharashtra.

Two wheelers not exceeding 250 watts is high in Haryana and Uttar Pradesh.

L1 and L2 category two wheelers are heavy in Gujarat.

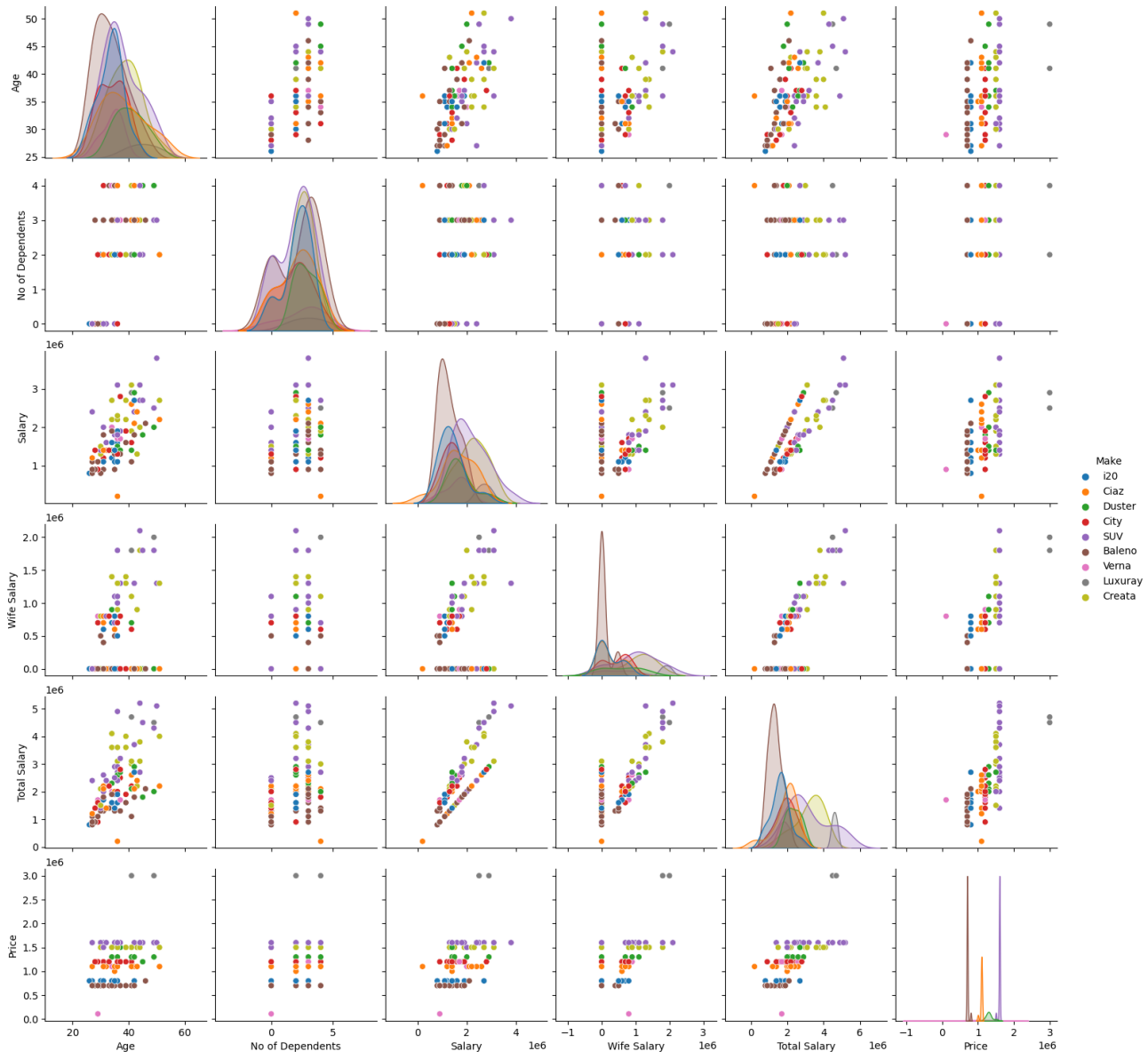
L2 (CMVR) are high in Uttar Pradesh.

Now another such analysis is done for second dataset, the attributes “**Age**” and “**No. of dependents**” (Family members) are taken into account.

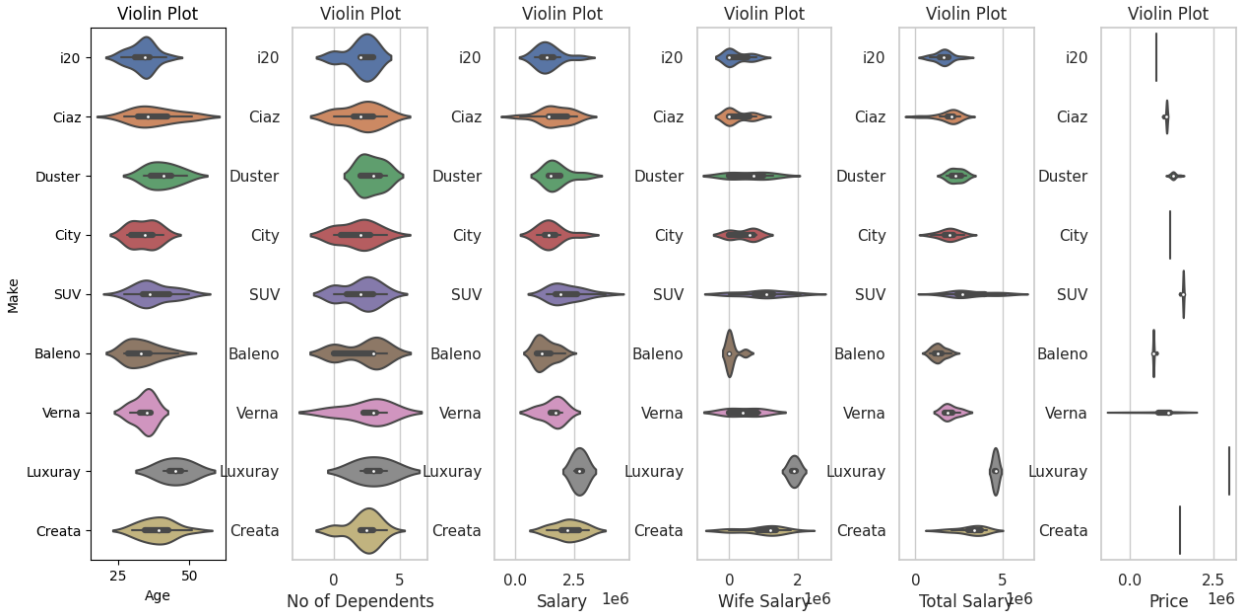


From the above plot we can understand that Younger customers go for cheaper cars.

Now various cars are taken and pair plot is performed.



Similarly violin plot is performed.



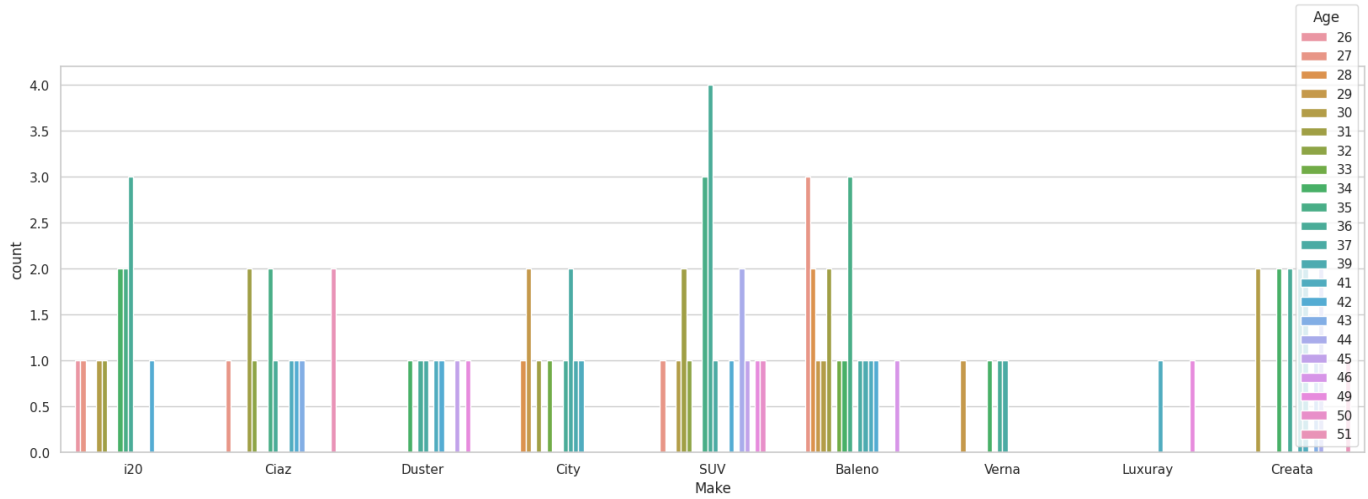
Younger customers go for cheaper cars.

As the family size increases the customer goes for cars with more space like SUVs, Creata, etc.

Coming to the Salary, it is directly proportional to the expensiveness range of the car. Here the salary is total salary, wife's salary also plays a role.

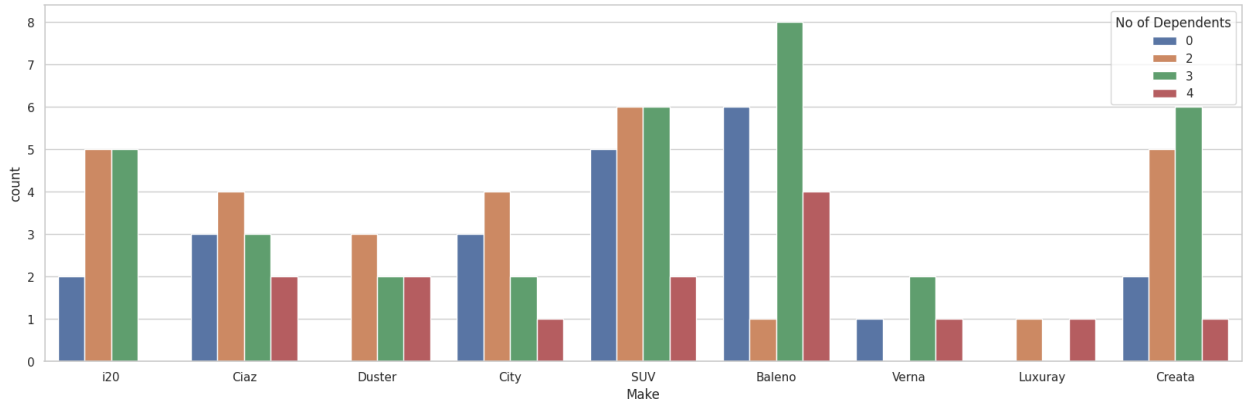
Now let us briefly dig analyze the data.

Let us plot the Vehicle purchased and consumer's age.



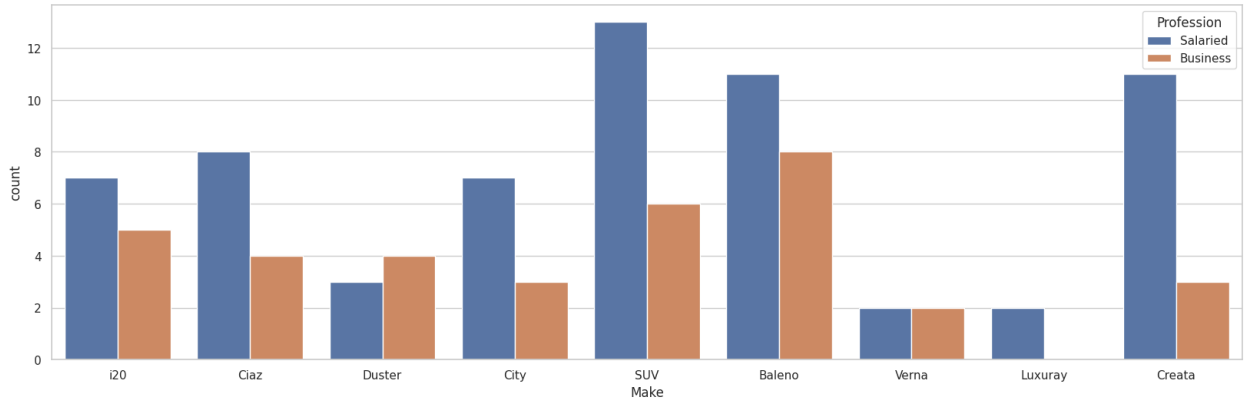
Now we have to understand the majority of our electrical vehicle consumers are also going to be between 30 and 40 years of age.

Now a plot between No. of dependents and Car purchased.



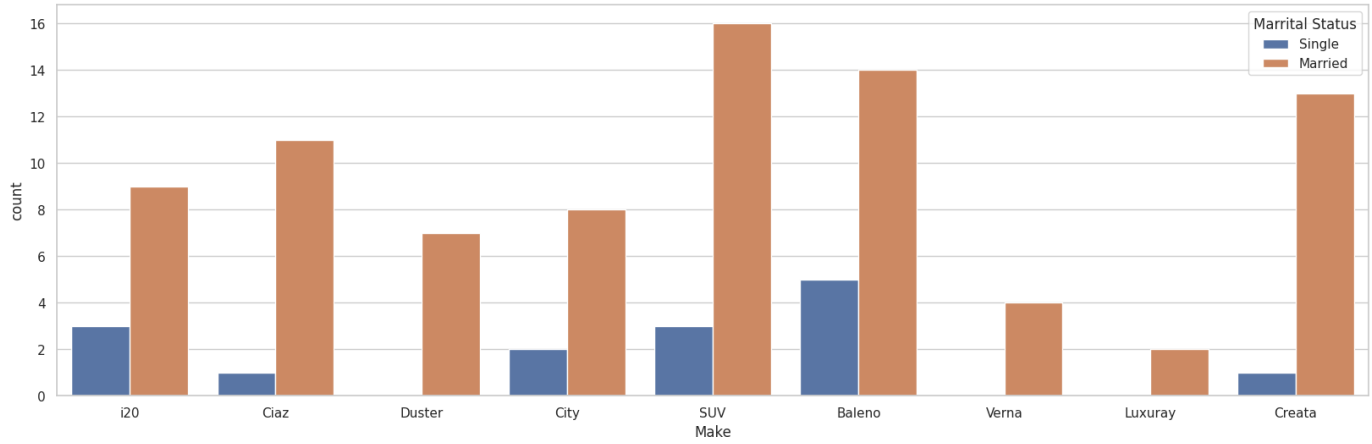
Most of the time no. of dependents are 3 and the frequent they go for us Baleno or SUV type cars.

Relation between consumers profession and the vehicles they tend to purchase.



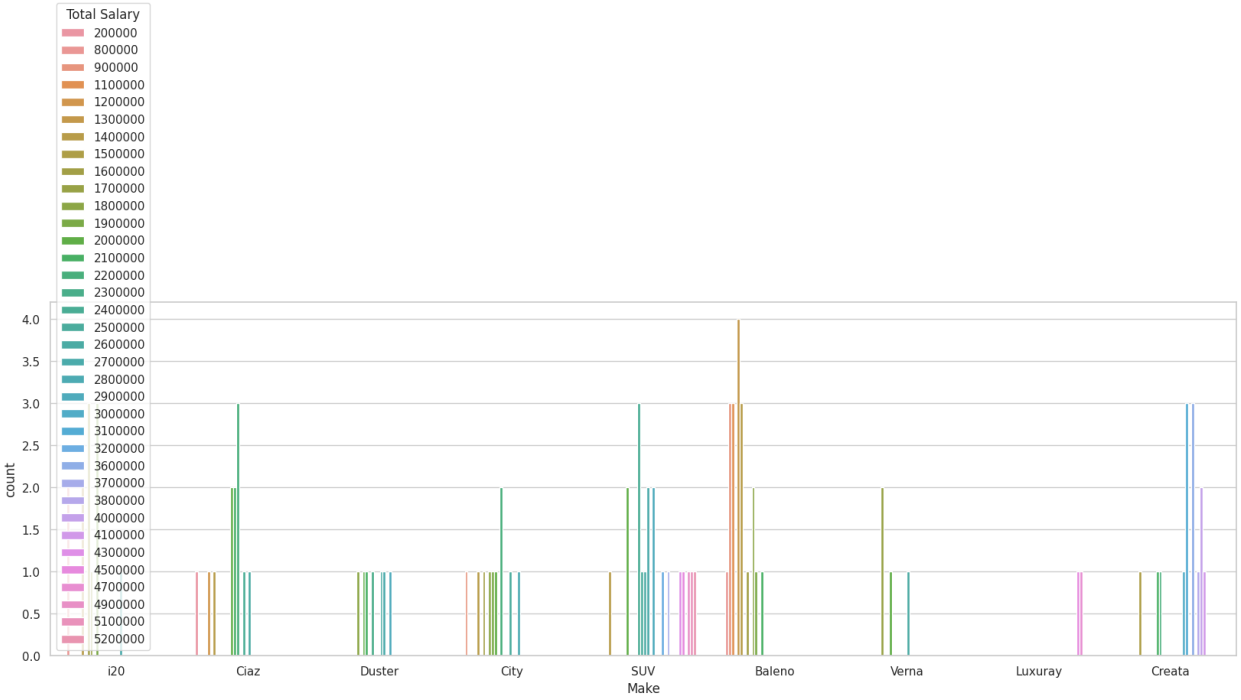
Now Salaried people will be the more potential customers.

Relation between consumer's marital status and the vehicles they purchase.



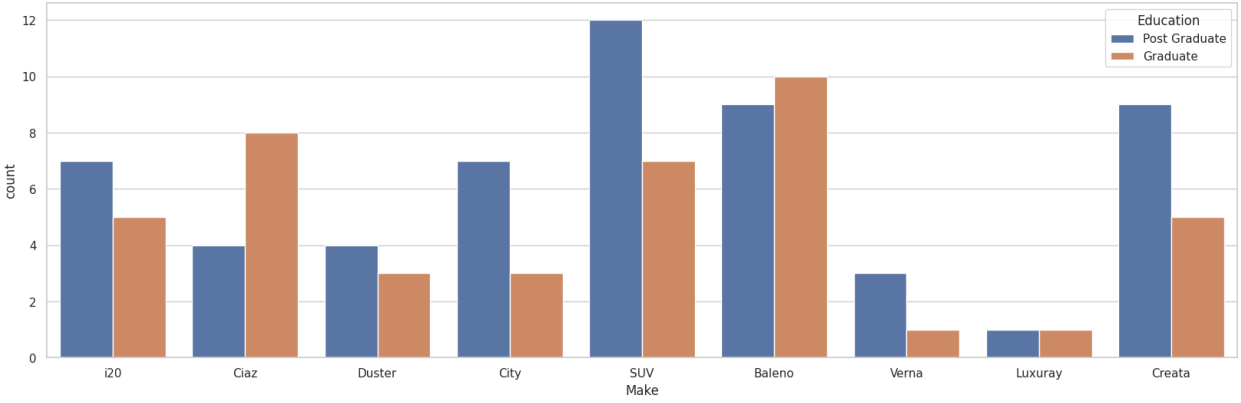
Married people tend to buy more cars then single people. If the customer is single they tend to buy car features closer to i20, SUV, Baleno.

Relation between consumers total salary and the vehicles they purchase.



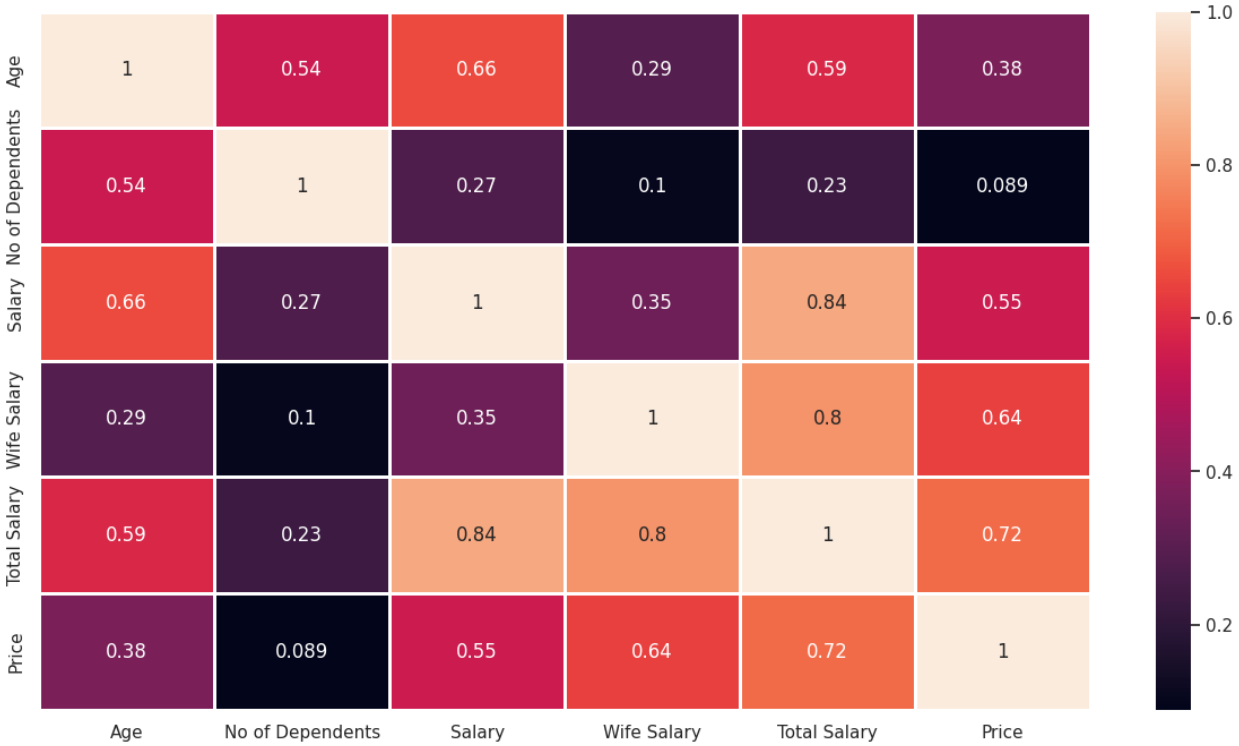
From the above plot we can analyse that salary is directly proportional to type of Electric vehicle a person tends to buy.

Relation between consumers education and the vehicles they purchase.

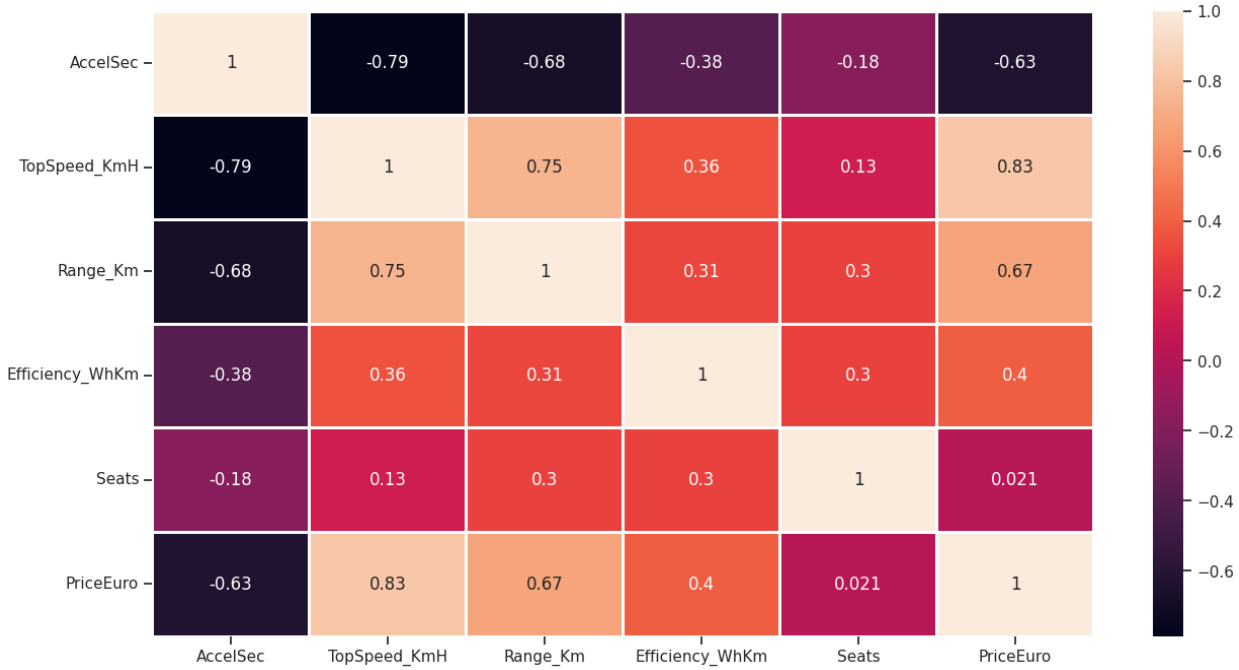


We can understand that both graduates and undergraduates tend to buy a vehicle in similar way Post Graduates have a small edge.

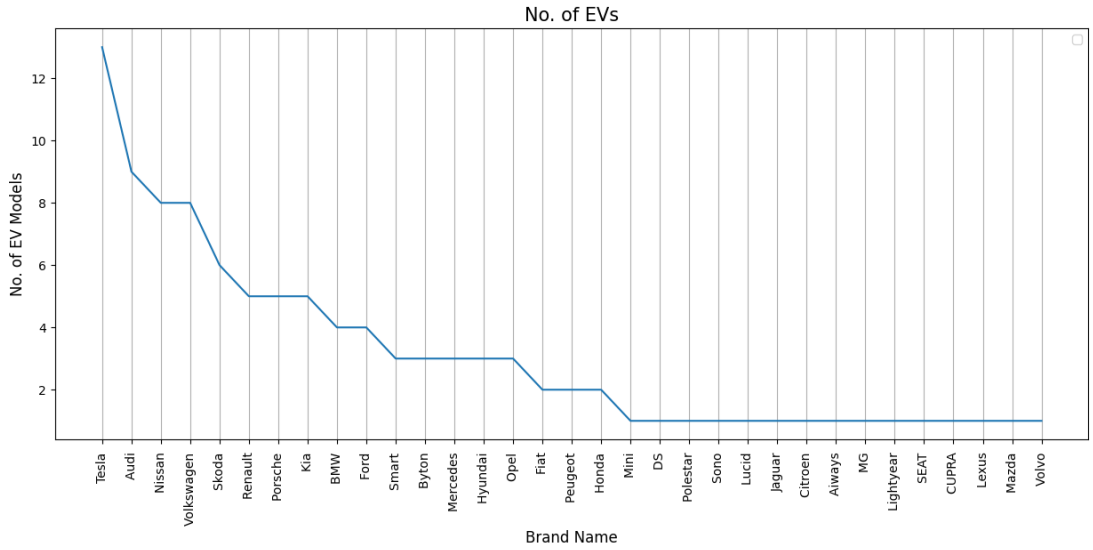
Now we have to exactly see what and how attributes are affecting, for this we have to perform a correlation plot.



Similarly let us draw another correlation plot for the first dataset.

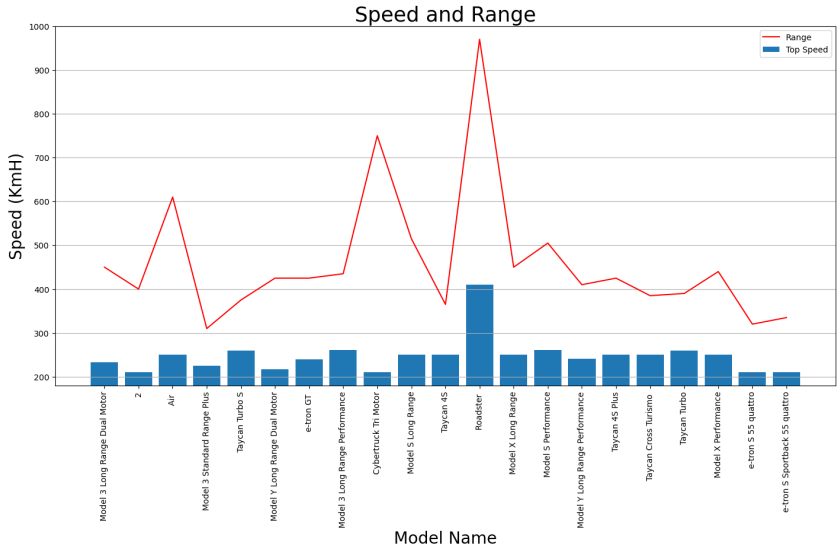


Now let us see which **company's cars are sold more** in the market, they are also going to be the biggest competitor.



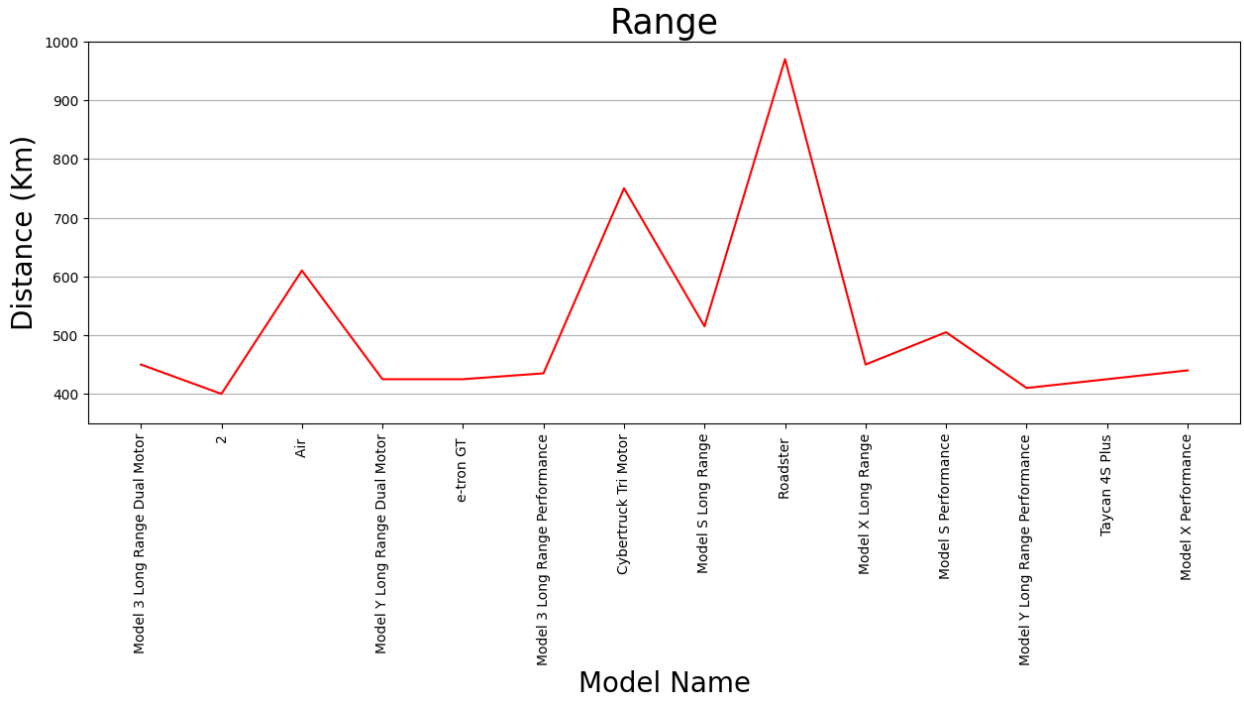
There are more no. of models available at Tesla, Audi, Nissan, Volkswagen and skoda so that we can say they have enough experince and updated EV's comparatively.

Vehicle model Vs Top speed.



There are much of models speed above 200kmH and subsequently with the range.

Model Vs Distance Range.



Models having range higher than 400Km with speed above 200KmH.

Now Let us use Elbow method to find number of clusters.

The elbow method is a technique used in clustering analysis, particularly in K-means clustering, to determine the optimal number of clusters for a given dataset. It involves plotting the sum of squared distances between data points and their assigned cluster centers, as the number of clusters increases. The point at which the plot resembles an "elbow" is considered a good indication of the appropriate number of clusters.

In simpler terms, the elbow method helps us find the balance between having too few clusters (resulting in poor separation of data) and having too many clusters (leading to overfitting and complex patterns). The "elbow point" on the plot represents a point where adding more clusters doesn't significantly reduce the sum of squared distances, indicating that additional clusters might not capture much more meaningful information.

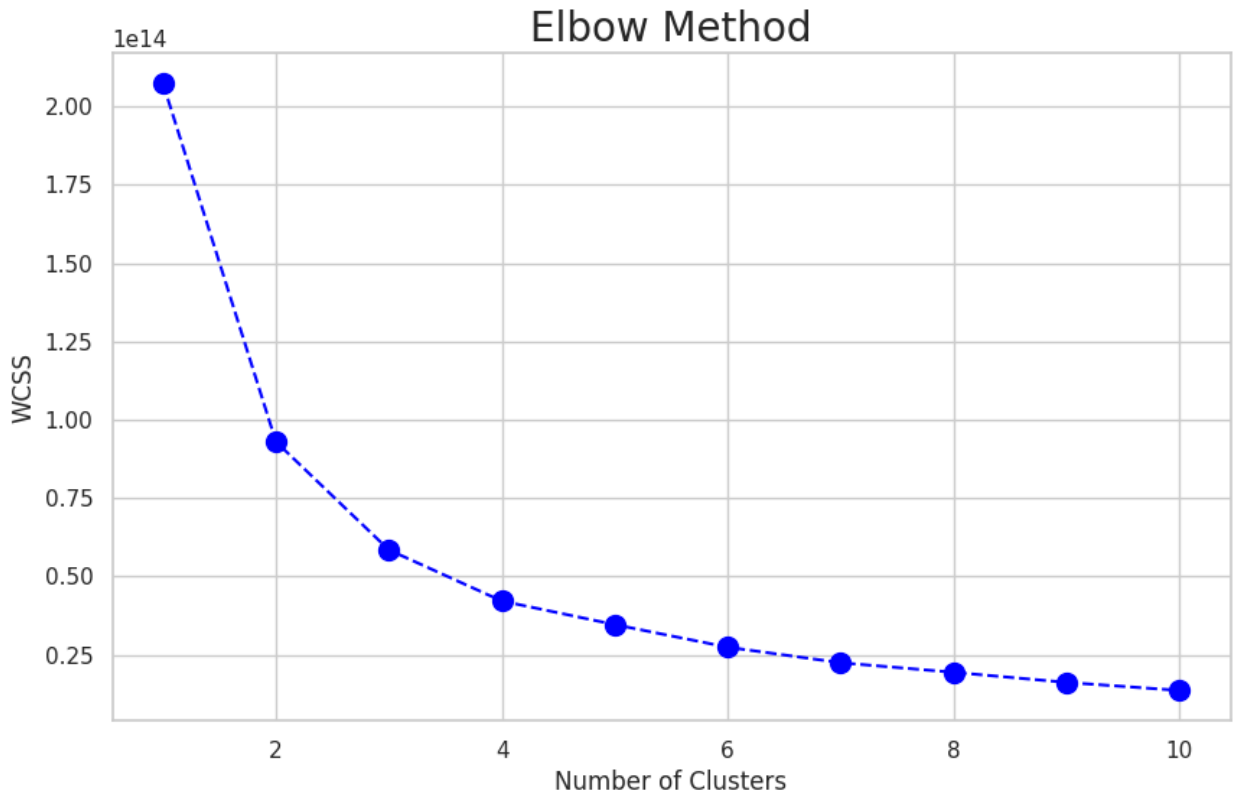
By observing the elbow point, analysts can make informed decisions about how many clusters to use in their clustering analysis, thereby helping to segment the data in a meaningful way.

```
wcss=[]
for i in range(1,11):
    #preventing random initialization: 'init=k-means++'
    kmeans= KMeans(n_clusters=i, init='k-means++', random_state=42)
    kmeans.fit(obj_df)
    wcss.append(kmeans.inertia_)
```

Now let us plot the result.

```
plt.figure(figsize=(10,6))
plt.plot(range(1,11),wcss,color='blue', linestyle='dashed', marker='o',
         markersize=10)
plt.title('Elbow Method', size=20)
plt.xlabel('Number of Clusters')
plt.ylabel('WCSS')
plt.show()
```

Elbow Method:



The elbow point is located between 2 and 4, so the optimal number of clusters are going to be 3.

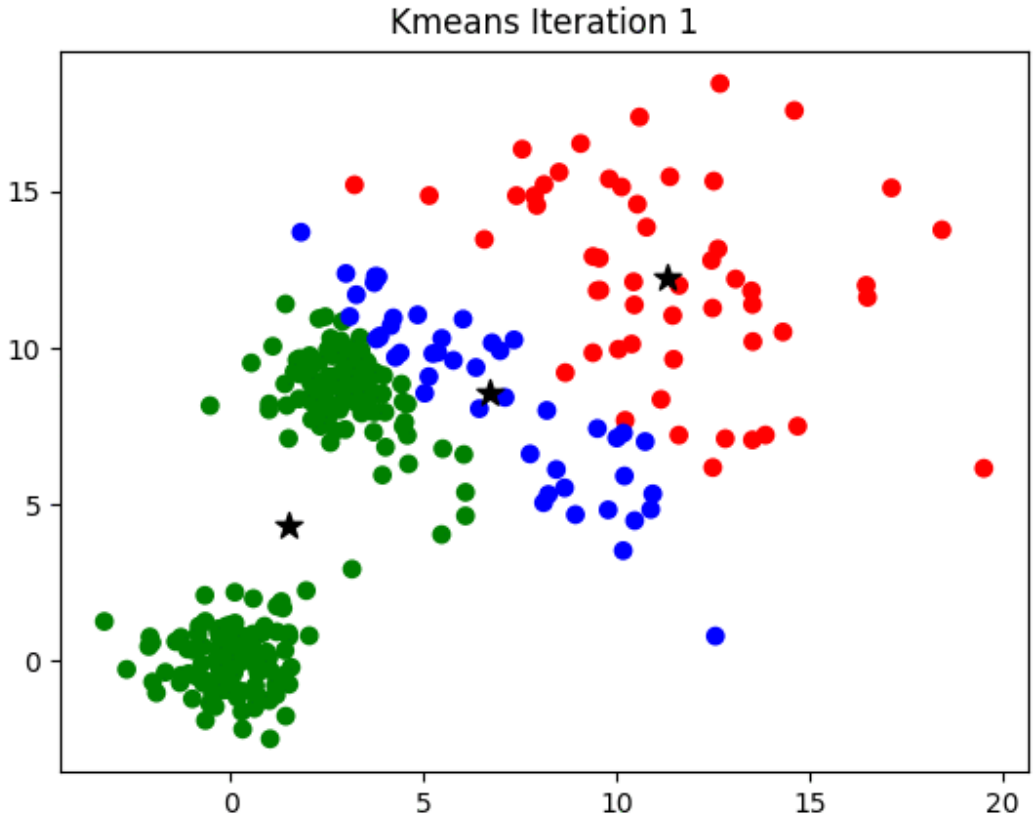
Using K-means Clustering we have done the clustering.

```
kmeans = KMeans(n_clusters = 3, init = "k-means++", random_state = 42)
y_kmeans = kmeans.fit_predict(obj_df)
y_kmeans
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` w
  warnings.warn(
array([2, 1, 2, 1, 1, 2, 2, 2, 1, 2, 1, 2, 2, 2, 2, 0, 2, 2, 2, 2, 1, 2,
       1, 2, 1, 1, 2, 2, 1, 1, 2, 1, 1, 1, 1, 0, 2, 1, 2, 1, 2, 2, 1, 1,
       2, 0, 2, 1, 2, 1, 1, 0, 1, 0, 0, 1, 1, 2, 2, 2, 2, 2, 1, 2, 1, 2,
       0, 1, 0, 2, 1, 1, 2, 1, 1, 0, 2, 1, 1, 0, 1, 0, 1, 1, 1, 2, 2, 1,
       0, 2, 2, 0, 1, 2, 1, 0, 1, 0, 1], dtype=int32)
```

What is K-means Clustering?

K-means clustering is a method that groups similar data points into clusters. It works by iteratively adjusting cluster centers to minimize distances between points and centers. This helps in organizing data based on similarities, which is useful for tasks like customer segmentation or image compression.



Now Let us add this cluster column to our dataset.

```
df['cluster']=y_kmeans
df.head()
```

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

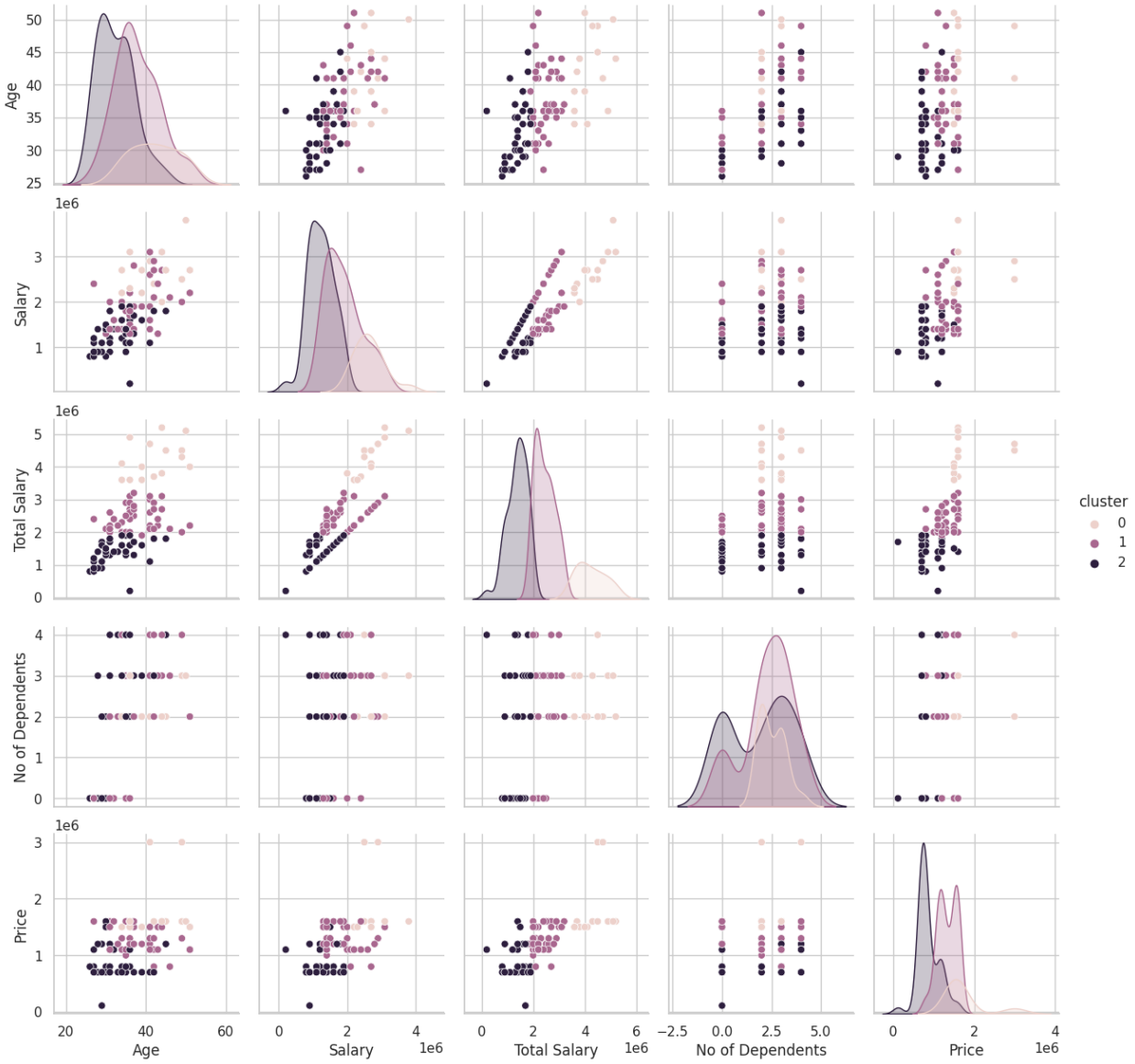
The final Customer Segmentation.

The most effecting attributes include:

- Age
- Salary
- Total Salary
- Total no. of dependents
- Price

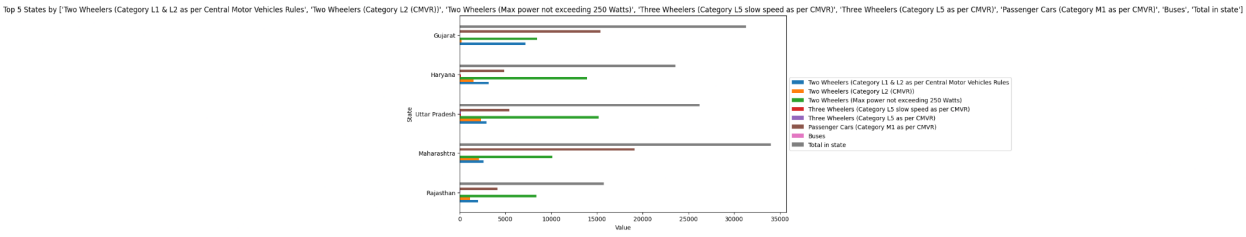
And the optimal number of clusters we achieved is three.

So, we are going to plot a pairplot withabove attributes and hue as clusters we obtained from “K-means Clustering.”

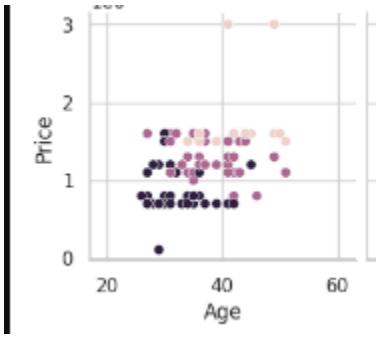

Age
Salary
Total Salary
No of Dependents
Price
1e6
cluster
0
1
2

Target Segment.

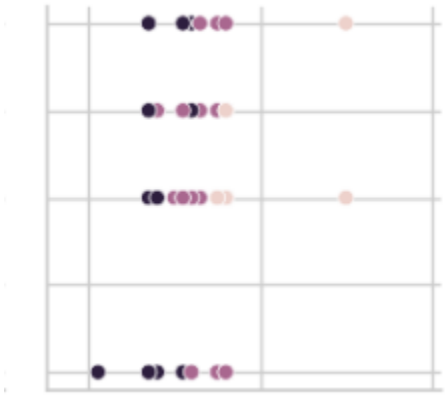
The market is very high in the states like Maharashtra, Uttar Pradesh, Haryana, etc. Targeting the customers from these states will be profitable.



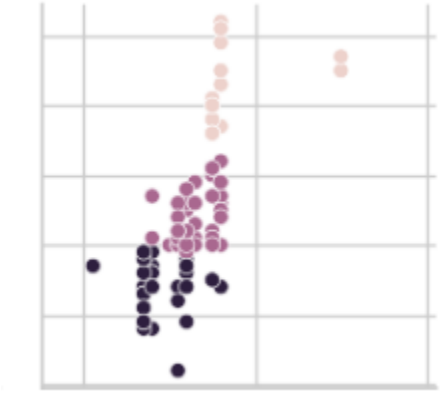
Then coming to the age, most of the customers who purchase the cars are between 30 and 40 years of age.



Coming to the model types, the consumers would go for bigger models if their no. of dependents are high.



And coming to the Salary, the higher income people tend to buy more expensive cars alongside more common cars. Lower income people tend to buy cheaper cars.



The company should pay significant attention to various aspects of their vehicles, particularly emphasizing Performance, Range, and service cost. This is crucial because consumers typically purchase cars with a long-term perspective. Concerns related to range, service expenses, and battery safety are prevalent, as mentioned earlier. If the company can effectively address these concerns, it would instill confidence in customers, leading to the establishment of trust and ultimately fostering business growth.

Marketing Mix

We want to sell electric cars to different types of people. Our cars will be designed for different needs and preferences, and we'll make sure they're affordable and valuable. We'll tell people about the good things our cars do for the environment and how advanced they are. We'll put charging stations in convenient places. You can choose how your car looks and works. We'll teach you about electric cars and ease your worries about how far they can go. If anything goes wrong, we'll fix it. Our main focus is making sure our cars are good for the planet, which is important to many people.


Thank
you!