Market Segmentation Analysis of Electric Vehicles Market in India

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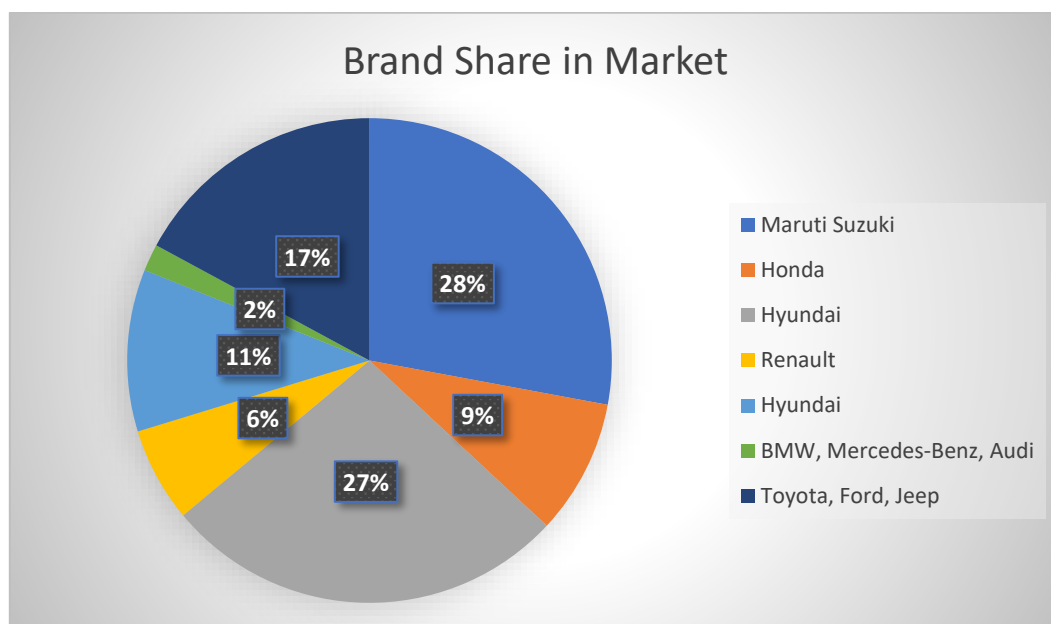Date: 26-07-2024

SAVE THE PLANET

Overview:

An electric vehicle (EV) is a type of vehicle that is driven by one or more electric motors, using energy stored in rechargeable batteries rather than conventional internal combustion engines that uses fossil fuels. EVs can include a variety of vehicle types such as cars, buses, motorcycles, scooters, and even bicycles.

It reduces greenhouse gas emissions, decreased reliance on fossil fuels, lower noise pollution.

Market Overview:

As stated earlier in India the electric vehicle industry is in nascent stages, the majority of the automobile market is dominated by petrol/diesel engine automobiles. The global supply of electric vehicles is also rising rapidly with the increase risk of climate change. It is a very good opportunity for Indian EV manufacturers to enter the market.

The majority of the share is held by Maruti Suzuki, followed by Hyundai. The pie chart below represents the present market share of all the major automobile manufacturers in India.

Brand Share in Market

- 28% Maruti Suzuki
- 9% Honda
- 27% Hyundai
- 6% Renault
- 11% Hyundai
- 2% BMW, Mercedes-Benz, Audi
- 17% Toyota, Ford, Jeep

Problem Statement:

Task is market segmentation analysis of electric vehicle in India. Based on previous data and market analysis, need to find out the appropriate electric vehicle type for a particular market segment. Various electric vehicle such as bikes, scooty, hatchbacks, sedans, SUV etc. Task is to find out what type of EV the company should produce for a particular market segment based on their Geographic, Demographic, Psychographic, and Behavioural aspects. Second task is to find out target customers in terms of age group, income group, professionality, geography of the customer.

Fermi Estimation:

Wild Guess of First problem: According to EV manufacturers two-wheeler has the highest demand in market followed by three wheelers and four wheelers.

Wild Guess of Second problem: According to the Indian automobile buying behaviour study dataset most of the customers age lies between 35 to 40 years (mid thirty to forty).

Data Collection:

Data was extracted from various website and those are easily available. Some of the website link is mentioned below.

- https://data.gov.in/
- https://medium.com/@vpsfahad/where-to-get-india-government-datasets-for-data-analytics-17bf359a5afd
- https://censusindia.gov.in/digitallibrary/Archive_home.aspx

Dataset of Electric Vehicle link:

- https://github.com/user-attachments/files/16357812/EV.Stats-1.csv
- (https://github.com/user-attachments/files/16357813/Indian.automoble.buying.behavour.study.1.0.csv)
- (https://github.com/user-attachments/files/16357817/CAR.DETAILS.FROM.CAR.DEKHO.csv)
- https://github.com/user-attachments/files/16357818/ElectricCarData_Norm.csv)
- https://github.com/user-attachments/files/16358530/Category-wise.Details.of.Sold.Electric.Vehicles.Manufactures.to.Consumers.as.on.02-08-2023.1.csv

Metadata of Indian automobile buying behaviour study 1.0:

Indian automoble
buying behavour stud

Age: age of the customers.

Profession: Profession describes that the customer is a salaried person or a business person.

Marital Status: Marital Status describes whether the customer is married or single.

Education: Education qualification of the customers.

No of Dependents: No of people dependent on the customer.

Personal loan: Any ongoing personal loan.

House Loan: Any ongoing house loan.

Wife Working: Wife is a working woman or housewife.

Salary: Salary or income of the customer.

Wife Salary: If wife is a working woman, then salary of his wife.

Total Salary: Total salary of husband(customer) and wife.

Make: Model of the car.

Price: Price of the car.

Metadata of Category-wise Details of Sold Electric Vehicles Manufactures to Consumers as on 02-08-2023:

Wheeler Type: Whether the electric vehicle is two-wheeler, three-wheeler or four-wheeler.

Total No. of Vehicle: Total no of vehicle on the particular category in Indian market upto the above-mentioned date (02-08-2023).

State Wise Count of Different Types of Vehicles:

State: Name of states.

Two Wheelers (Category L1 & L2 as per Central Motor Vehicles Rules), Two Wheelers (Category L2 (CMVR)), Two Wheelers (Max power not exceeding 250 Watts): Count of different types of two wheelers.
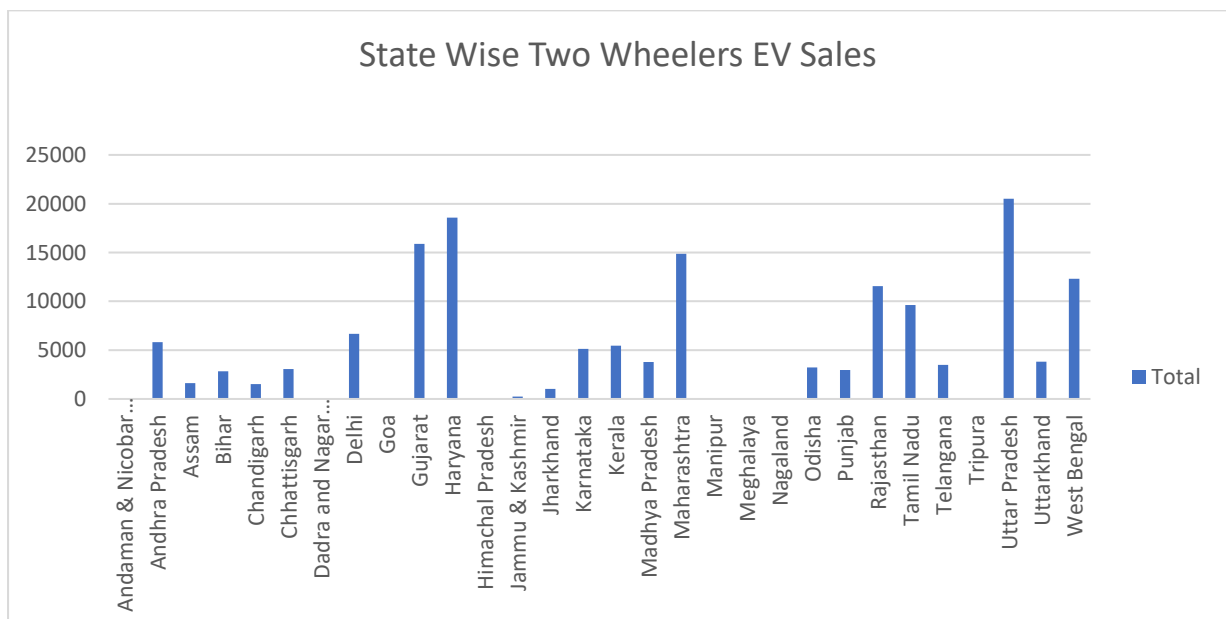
Three Wheelers (Category L5 slow speed as per CMVR), Three Wheelers (Category L5 as per CMVR): Count of different types of three wheelers.

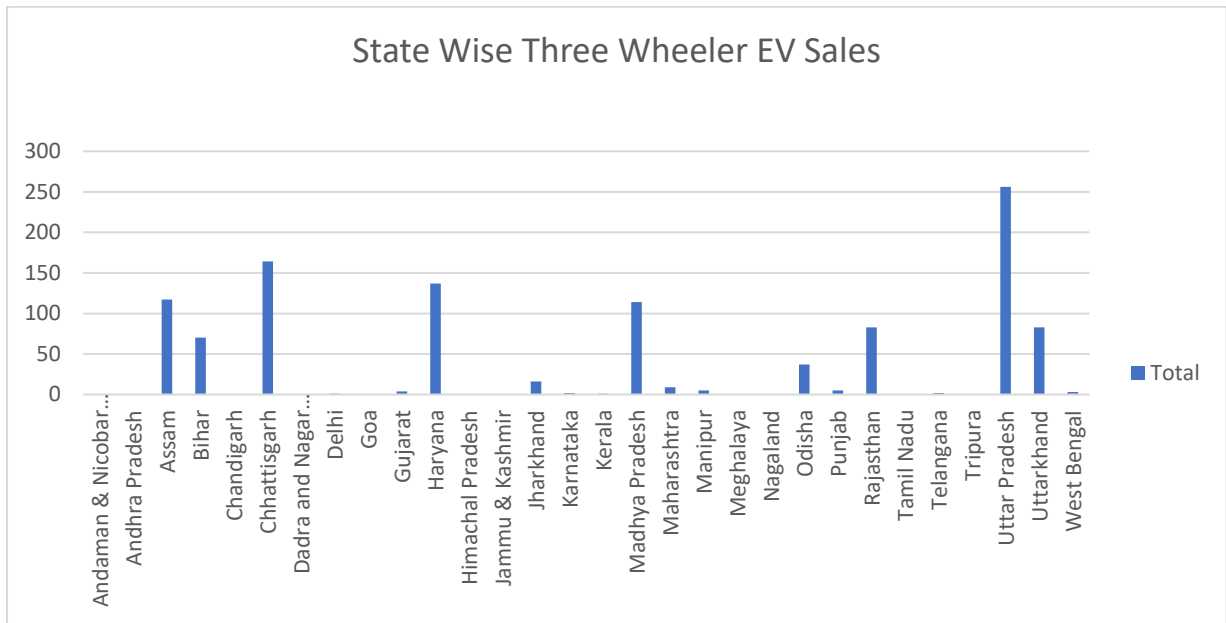Passenger Cars (Category M1 as per CMVR): Count of different types of passenger cars.

Different Types of Analysis Based on EV Sales data
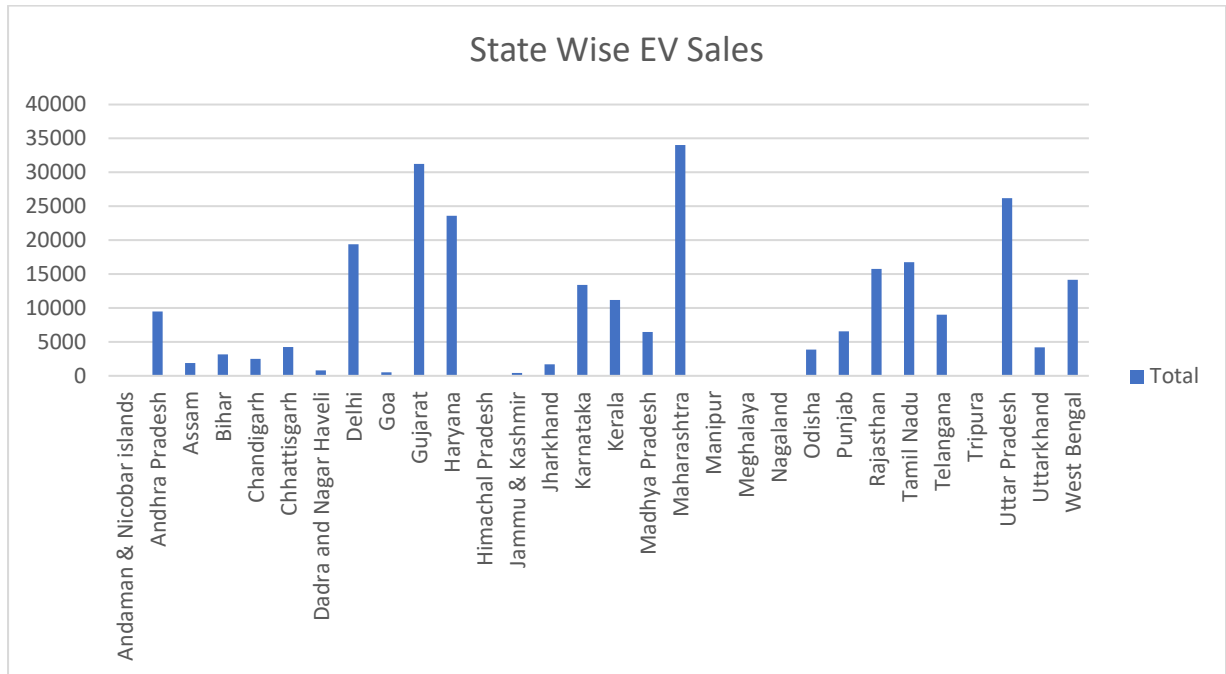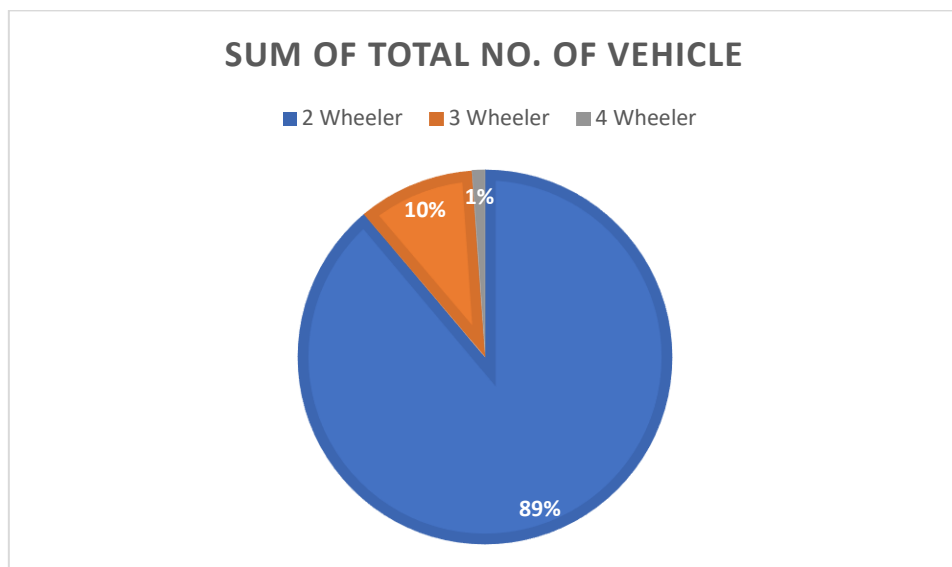

State wise sales data of electric vehicle
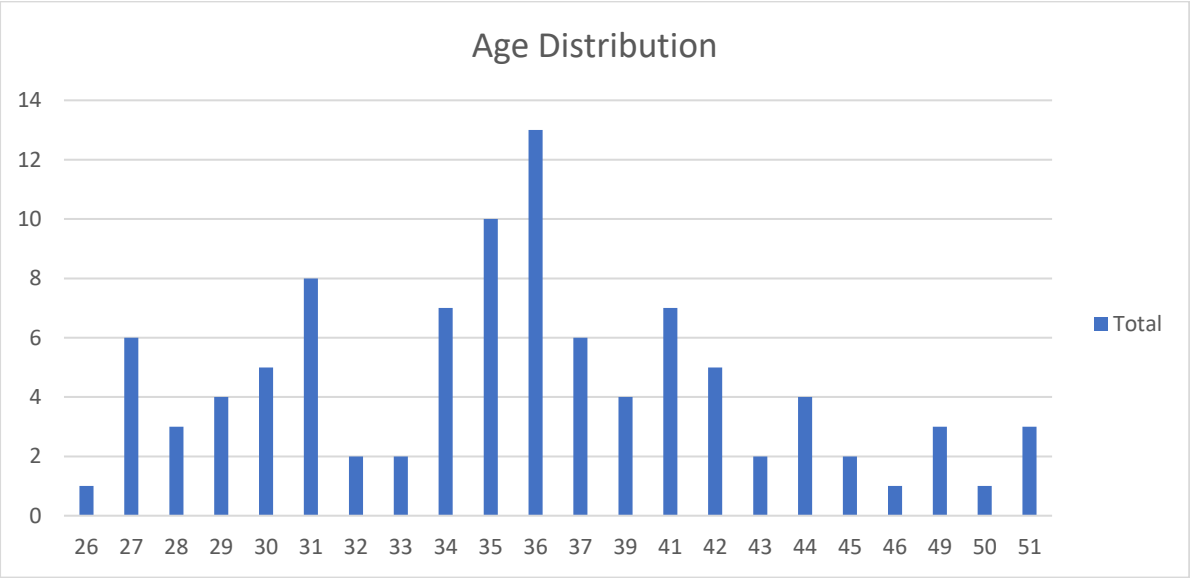

State wise sales data of two-wheeler electric vehicle

State wise sales data of three-wheeler electric vehicle

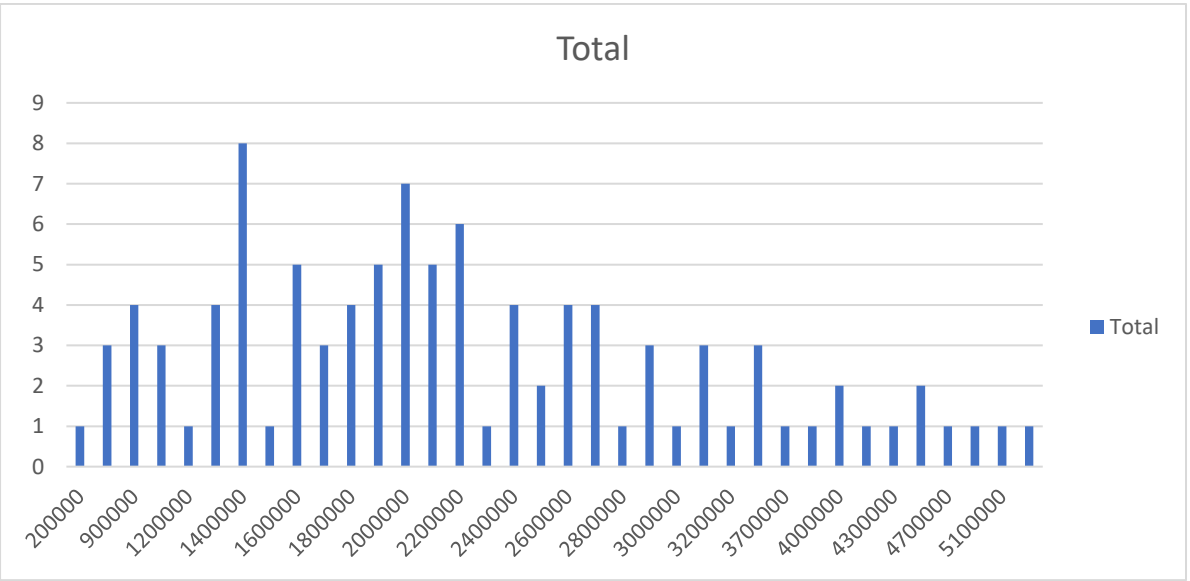| Row Labels	Sum of Total No. of Vehicle
2 Wheeler	775753
3 Wheeler	87570
4 Wheeler	9597

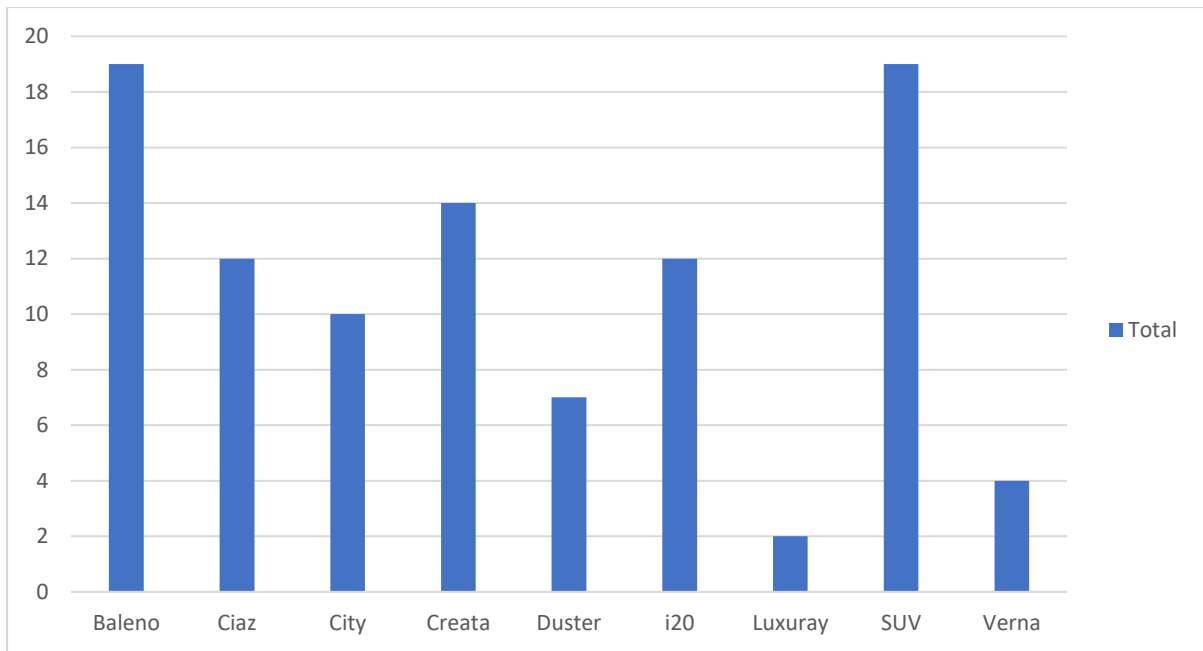Vehicle type wise sum of total no of Vehicle
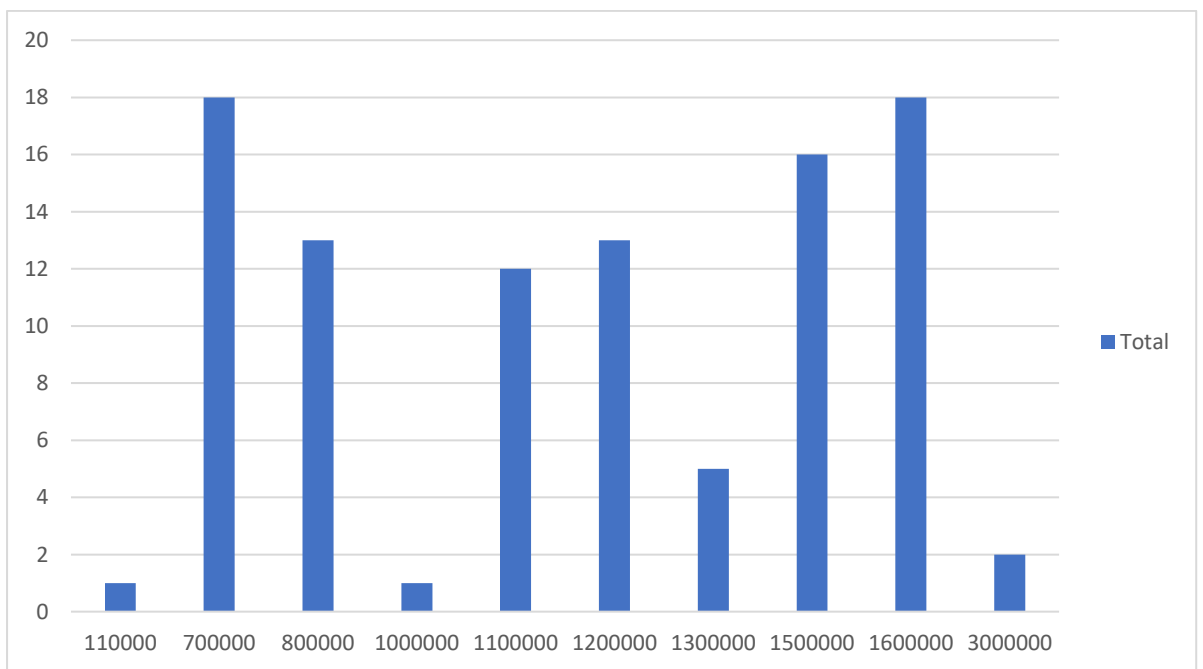
Behavioural analysis of customers for EV

Age distribution of customers
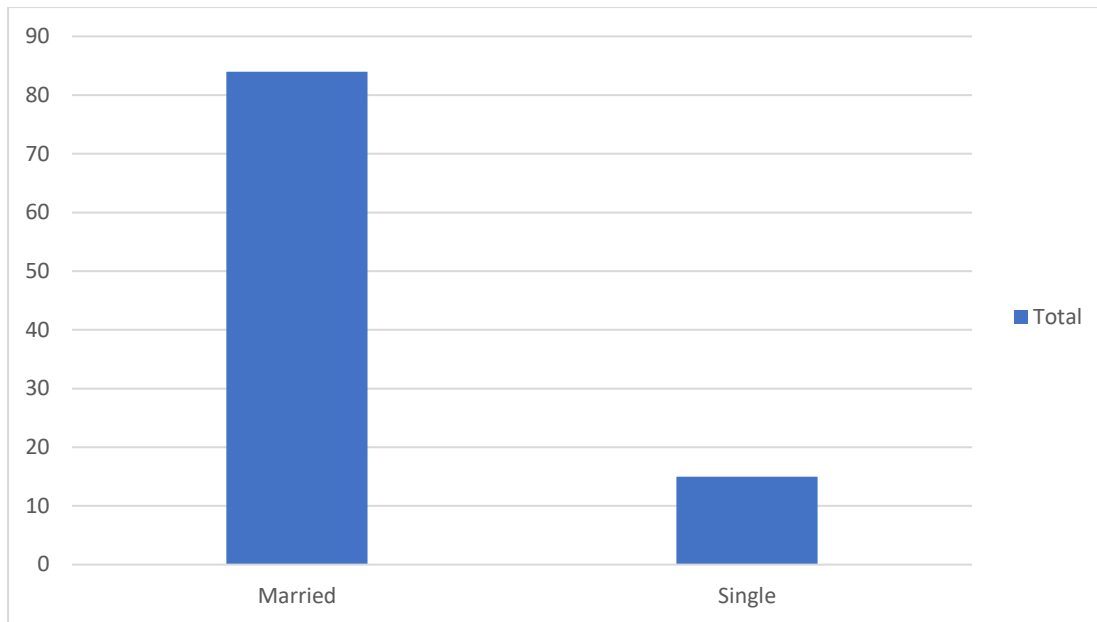

Customer behaviour based on salary

Demand of Model

Price Distribution Behaviour

Ratio of Married and Unmarried Customers

K-Means Clustering:

K-means is a clustering algorithm, used in unsupervised learning. It aims to partition a given dataset into a specified number of clusters, where each datapoint belongs to a cluster with the nearest mean. The main objective is to minimized the variance within each cluster.

It can be defined as the task of identifying subgroups in the data such that data points in the same subgroup (cluster) are very similar while data points in different clusters are very different. We try to find homogeneous subgroups within the data such that data points in each cluster are as similar.

Application:

Market segmentation: Grouping customers based on purchasing behaviour.

K-means Algorithm:

1. Specify no of K, which is no of clusters.

2. Initialize centroids randomly.

3. Assign each data point to the nearest cluster.

4. Recalculate the centroids as the mean of all data points assigned to each cluster.

5. Repeat the assignment and update steps until the centroids no longer change significantly or a predefined number of iterations is reached.

Machine Learning Model:

Here K-means clustering method will be used as a machine learning model. It will help in market segmentation. In this project we need to find the proper market to launch an electric vehicle and we also need to find which type of EV has the height market share. K-means clustering model is the appropriate model to identify the market segment.

Data Pre-processing:

- Here OneHotEncoder will be applied to convert all the categorical values to the numerical values.
- StandardScaler method will be used to scale the dataset.

```python
y=data['Price']
X=data.drop(['Price','Make'],axis=1)
```

```python
from sklearn.preprocessing import StandardScaler, OneHotEncoder, OrdinalEncoder, MinMaxScaler
from sklearn.compose import ColumnTransformer
from sklearn.pipeline import Pipeline
```

```python
my_list=[('ohe',OneHotEncoder(handle_unknown='ignore',sparse_output=False),
        ['Profession','Marrital Status','Education','Personal loan','House Loan','Wife Working'])]
ct1=ColumnTransformer(transformers=my_list, remainder='passthrough',verbose_feature_names_out=False).set_output(transform='pandas')
```

```python
steps=[('ct1',ct1),
        ('std',StandardScaler())]
pipe=Pipeline(steps=steps)
transformed_X_train=pipe.fit_transform(X)
```

```python
k_range = range(1,10)
#sum of squared error
sse = []
for k in k_range:
    km = KMeans(n_clusters=k)
    km.fit(transformed_X_train)
    sse.append(km.inertia_)
plt.title('The Elbow Point Graph')
plt.xlabel('K')
plt.ylabel('sse')
plt.plot(k_range,sse)
```


The Elbow Point Graph
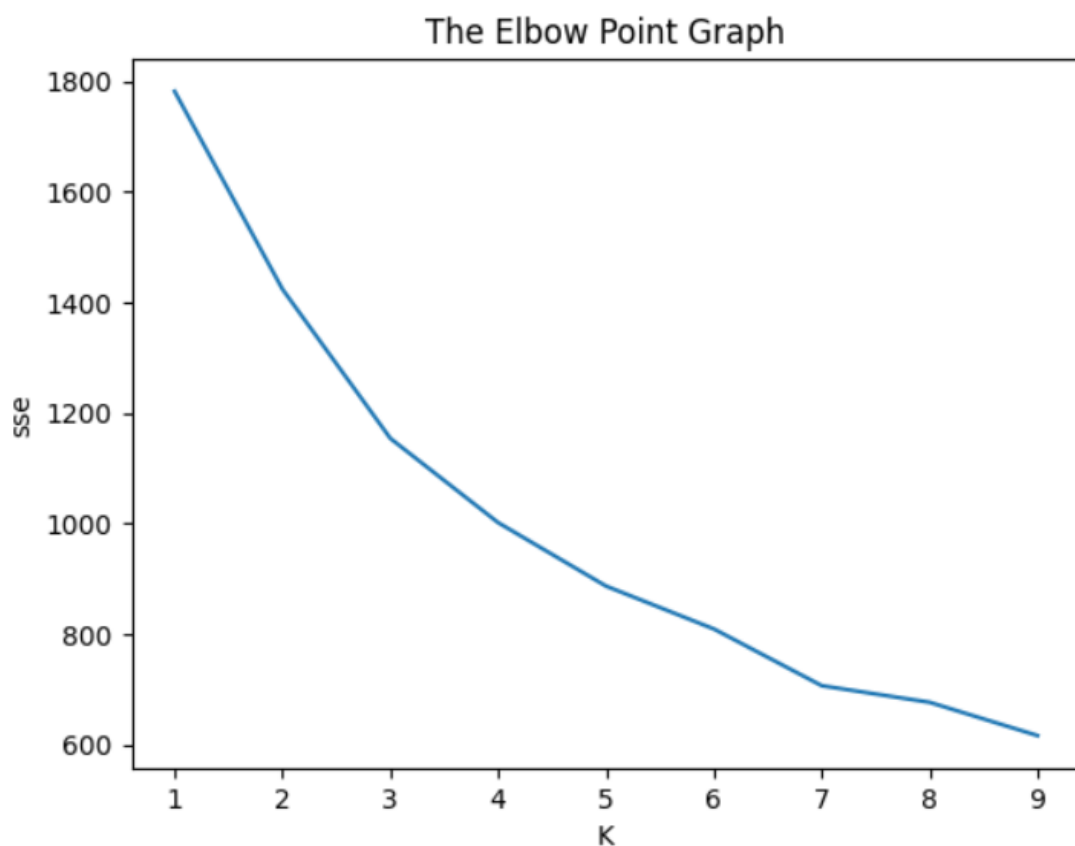
We get the number of clusters as 5.

Top 4 variables which can be used to create most optimal Market Segments for EV Market Domain:

- ➢ Age
- ➢ Total Salary
- ➢ Price
- ➢ Make (Model)

Target Segment:

- ➢ Two wheelers have the height demand in Electric Vehicle market.
- ➢ Most of the Electric Vehicle customers' age lies between mid-thirty to forty.
- ➢ 7 lakhs to 16 lakhs price range of the vehicle have the highest demand in EV market.
- ➢ The company should start their business from Metro Cities in India. Cities like Mumbai, Delhi, Bengaluru, Hyderabad. Then after considerable business expand to other cities of the same state of the Metro Cities.