

Market Segmentation Analysis of Electric Vehicles Market in India

Team Members

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ABSTRACT

With the current depletion of fossil fuels and its price hike, there is a need for another energy resource to run the vehicle. The automobile sector is considering Electric Vehicle as a solution to the industry and environment in India. However, the current market penetration of EV is relatively low despite governments implementing EV policies. Through this report we will analyse the potential scope of Electric vehicle in India and the potential market segments and suitable locations that new emerging Electric Vehicles Start-ups should target in their early market stages.

BACKGROUND

All industries evolve in time and space. New industries emerge and old ones vanish with changes in technology or consumer preferences. For the last few years, the electric vehicle industry has evolved in differing contexts. In case of electric vehicles (EVs), the government plays a significant role in shaping not only the perception, but also adoption of EVs by the masses. Governments across the world are coming up with electric vehicle policy, focusing on reducing dependence on fossil fuels, meeting environmental concerns and challenges posed by rapid urbanization, enhancing employment, among others. Governments in many countries have facilitated the adoption of EVs by policy interventions such as supporting research and development, infrastructure development, and financial incentives to industry and consumers.

Over the last few years, the Indian government has started focusing on electric vehicles. Recently, the Indian government declared that it aims to have EV sales account for 30% of private cars, 70% of commercial vehicles, and 80% of two and three wheelers by 2030 as there is an immediate need to de-carbonize the transport sector. The central and state governments have both initiated policy measures to promote manufacture and adoption of EVs. To date, 15 state governments have announced EV policy for their states. Key

components of the Indian government's EV policy are making electric vehicles economically viable, developing charging/swapping infrastructure, technology advancement, and focusing on small and public vehicles to make an early impact. The EVs are also seen to contribute to economic development and employment in India. Many automobile manufacturers have recently launched EV models in two-wheeler and four-wheeler segments.

The EV industry is moving at a fast pace in most of the countries, not only in terms of evolution of technology, but also in terms of government policy and consumer expectations. Studies conducted in the EV domain in the past will become less relevant soon due to the fast-evolving nature of the industry. Many studies have been conducted in the past on the Indian automobile industry or its traditional segments, but the literature on the EV industry in India is limited and fragmented. Most of the earlier studies attempted to understand consumer sentiments toward electrical vehicles in western developed countries and China. Few studies and reports focusing on understanding electric vehicle uptake were also conducted in the context of developed nations. In the past, only a few studies were conducted explaining consumer understanding and expectations toward EVs in the Indian context. A report focusing on consumer concerns for electric vehicles and understanding the factors affecting electric vehicle uptake was missing in the Indian context. Indian policy makers and industry professionals lacked much needed insight into the EV domain. The present report aims to bridge this glaring gap. This report will help EV Startup policymakers and business professionals to understand Indian consumers' concerns, which will help them design better policies and strategies to give a big boost to EV adoption by Indian consumers.

OBJECTIVES

The specific objectives of this report are:

1. Understanding Indian consumers' concerns and behaviours related to electrical vehicles.
2. Indian Electric vehicle market segmentation using segmentation analysis and clustering to develop a feasible strategy for an EV Startup to enter the market, targeting the segments most likely to use Electric vehicles.
3. To identify the states/locations which are feasible for a new EV Startup to set up their operations in the early market.

DATA SOURCES

The data used for this study are obtain from

EVIndia.csv (<https://www.kaggle.com/datasets/kkhandekar/electric-vehicles-india>)

'Indian automobile buying behaviour study.csv'
(<https://www.kaggle.com/datasets/karivedha/indian-consumers-cars-purchasing-behaviour>)

All official data from government of India related to EV data.

(<https://data.gov.in/search?title=Electric%20Vehicles>)

The above website contains lots of datasets like a dataset which gives state-wise sales of EVs in India, another dataset which gives total number and types of EVs in India in both

Transport Vehicles and Non-Transport Vehicles. Another dataset contains the state-wise count of EVs and total number of vehicles in that state etc.

The dataset contains Electric vehicles models which are currently running in India and their specification, State wise vehicle booking count, State wise active vehicles list, Indian automobile buying behaviour study.

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

Age	Profession	Marital 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

Sl. No.	State/UT	Total Number of Invoice/Sales
34	35	Ladakh
0	1	Jammu Kashmir
1	2	Himachal Pradesh
3	4	Chandigarh
6	7	Delhi
18	19	West Bengal
28	29	Lakshadweep
16	17	Meghalaya
25	26	Andhra Pradesh
14	15	Mizoram

Data Pre-Processing

The Libraries that we have used for data pre-processing are as follows-

- 1) Numpy
- 2) Pandas
- 3) Seaborn
- 4) Matplotlib
- 5) sdv

The sdv package is used to create an artificial dataset having similar statistical properties to the original dataset that we have. This is done so because the original dataset has very few data in it.

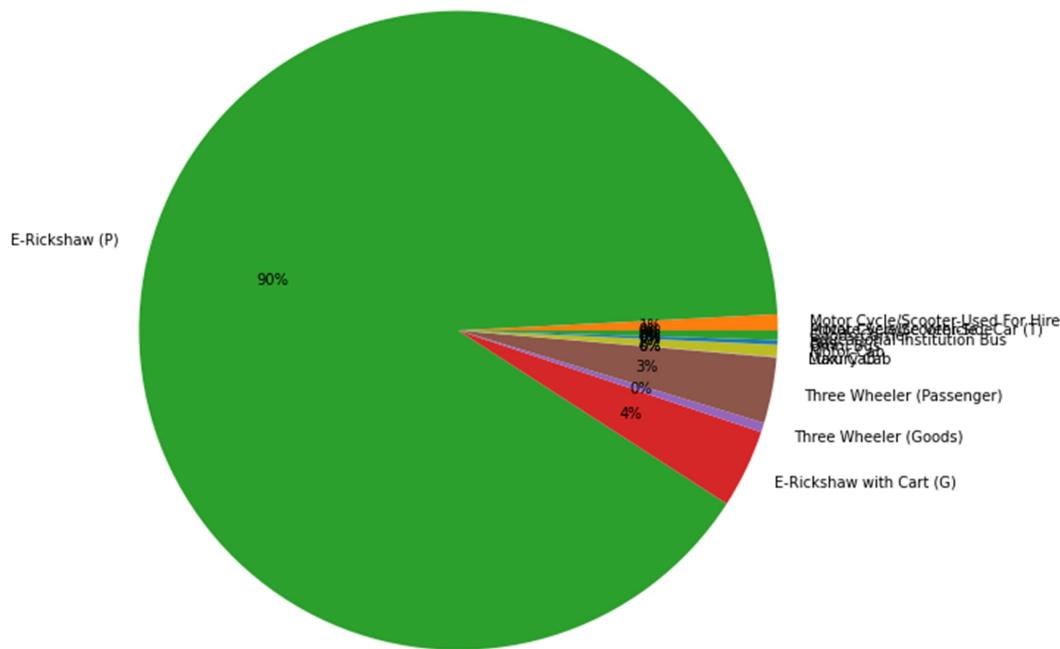
Once all these libraries were imported then we started understanding the datasets. The dataset ‘RS_Session_254_AU_2384.C.i.csv’ contains the total number of EVs registered under VAHAN4.0 based on their category and vehicle class. This dataset can be viewed as follows-

Sl. No.	Category	Vehicle Class	Total Registered on VAHAN 4.0
0	1 Transport Vehicles	Motor Cycle/Scooter-SideCar (T)	8
1	2 Transport Vehicles	Motor Cycle/Scooter-Used For Hire	4468
2	3 Transport Vehicles	E-Rickshaw (P)	495781
3	4 Transport Vehicles	E-Rickshaw with Cart (G)	21871
4	5 Transport Vehicles	Three Wheeler (Goods)	2630
5	6 Transport Vehicles	Three Wheeler (Passenger)	18268
6	7 Transport Vehicles	Luxury Cab	70
7	8 Transport Vehicles	Maxi Cab	158
8	9 Transport Vehicles	Motor Cab	3267
9	10 Transport Vehicles	Omni Bus	65
10	11 Transport Vehicles	Bus	1298
11	12 Transport Vehicles	Educational Institution Bus	9
12	13 Transport Vehicles	Goods Carrier	2591
13	14 Transport Vehicles	Private Service Vehicle	7
14	Grand Total Transport Vehicles	Grand Total	550491
15	1 Non-Transport Vehicles	M-Cycle/Scooter	135691
16	2 Non-Transport Vehicles	M-Cycle/Scooter-With Side Car	121
17	3 Non-Transport Vehicles	Motorised Cycle (CC > 25cc)	4246
18	4 Non-Transport Vehicles	Moped	13001
19	5 Non-Transport Vehicles	Motor Car	15700
20	6 Non-Transport Vehicles	Adapted Vehicle	62
21	7 Non-Transport Vehicles	Three Wheeler (Personal)	300
22	8 Non-Transport Vehicles	Omni Bus (Private Use)	14
23	9 Non-Transport Vehicles	Private Service Vehicle (Individual Use)	11
24	10 Non-Transport Vehicles	Construction Equipment Vehicle	489
25	11 Non-Transport Vehicles	Fork Lift	334
26	Grand Total Non-Transport Vehicles	Grand Total	169969

This dataset can be better understood by the help of various visualisations. The pie chart visualization of the dataset helped us to understand about the percentage of different vehicles

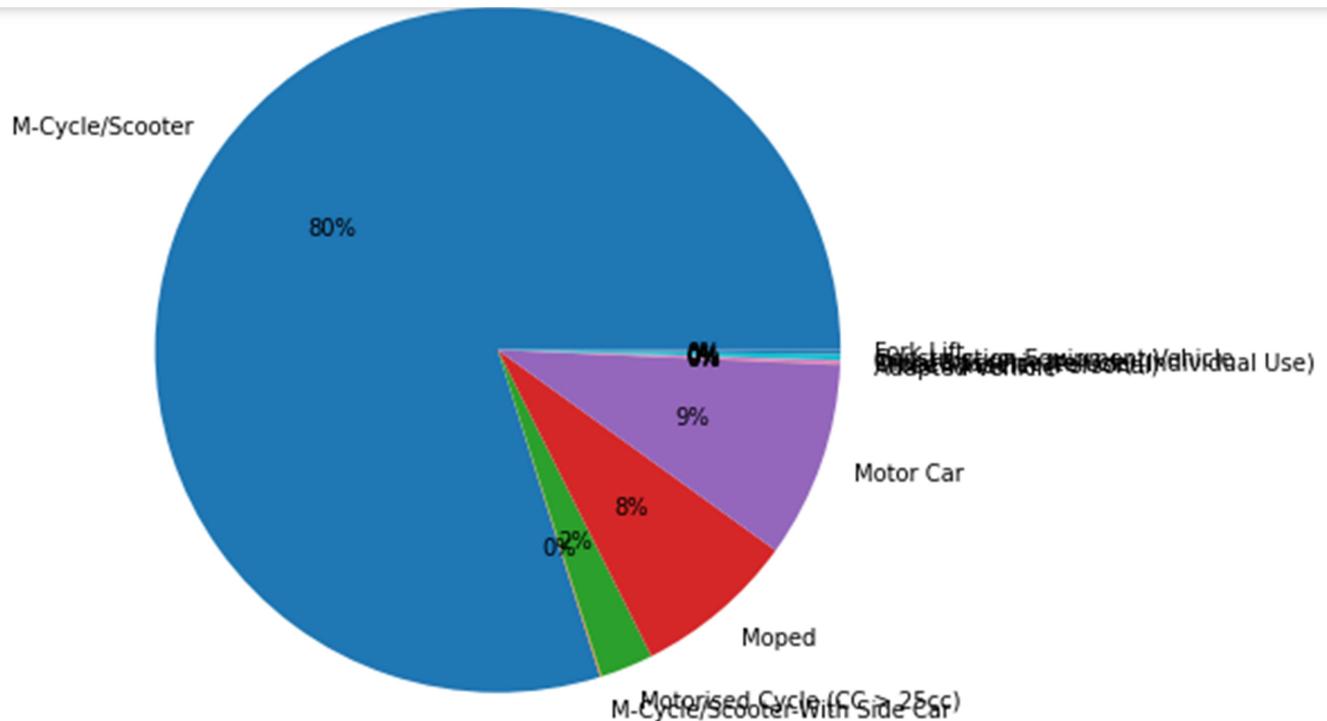
under the Transport Vehicles as well as the Non-Transport Vehicles Category. The pie charts are given below-

Transport Vehicles



From the above pie chart it is clear that for all the EVs registered under Transport Vehicles about 90% of the registrations belongs to E-Rickshaws.

Non Transport Vehicles



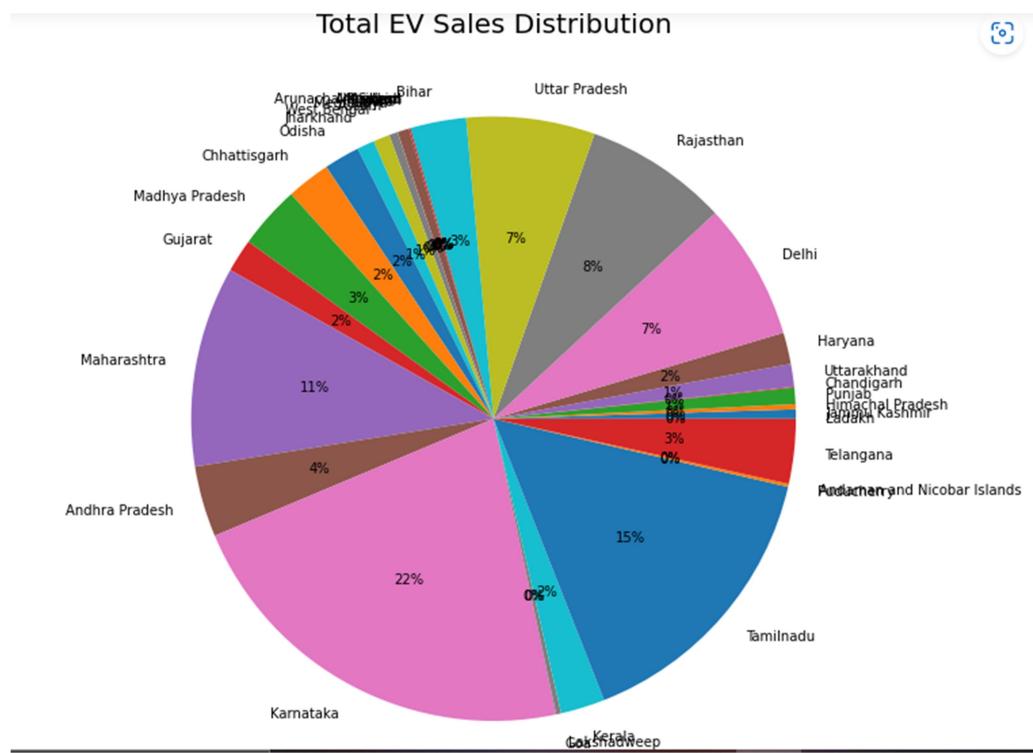
From the above pie chart it can be clearly seen that from the non-transport vehicles M-Cycle / Scooter has had most EV registrations(80%) followed by Motor Car(9%), Moped(8%) etc.

The above data suggests that the startup company should look towards manufacturing E-Rickshaws if it wants to manufacture Transport Vehicles or it should start manufacturing E-Scooters / Electric Cars if it wants to enter the market of manufacturing Non-Transport Vehicles.

The Dataset 697 contains the Sales of EVs across different states. It can be viewed as follows-

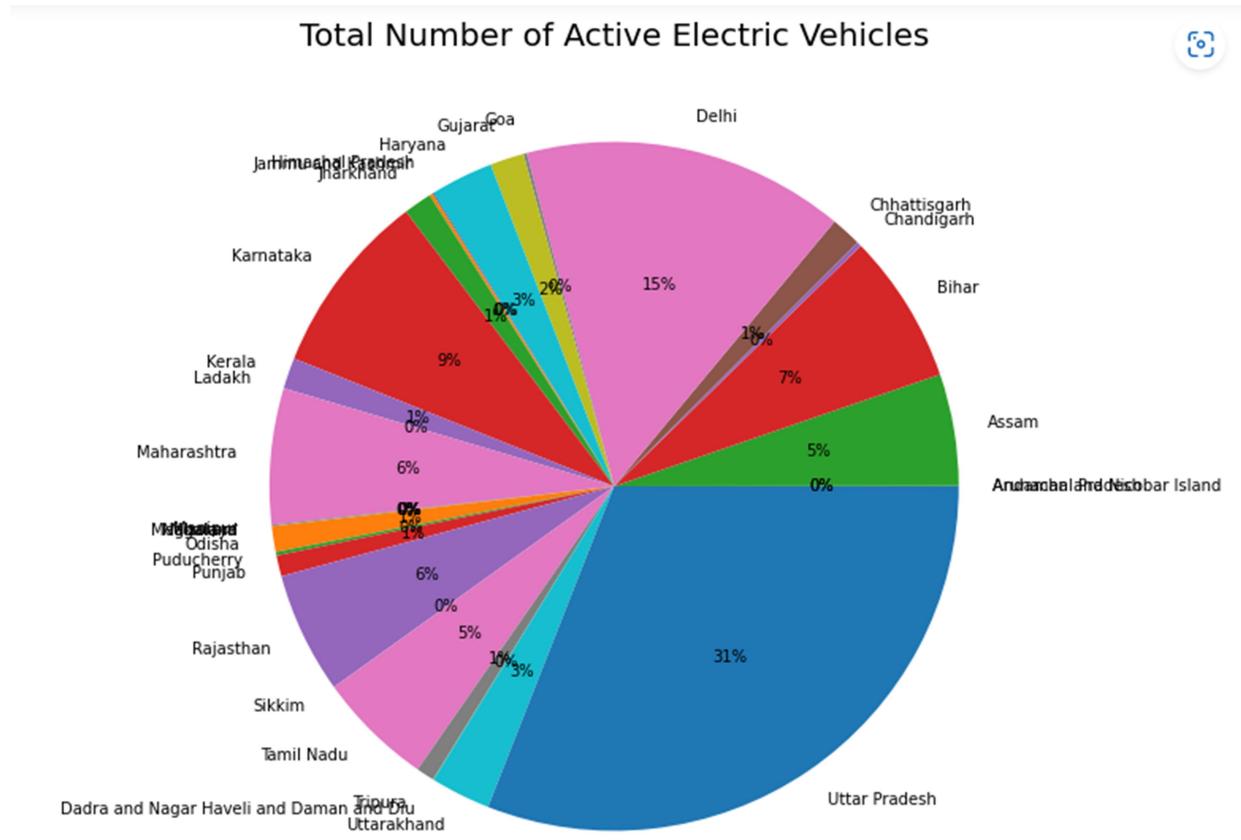
Sl. No.		State/UT	Total Number of Invoice/Sales
32	33	Andaman and Nicobar Islands	2
33	34	Telangana	3031
34	35	Ladakh	0
35	36	The Dadra and Nagar Haveli and Daman and Diu	27
36	Total	Total	87659

The visualization of this dataset gave a lot of information related to the use and sale of EVs across states in India. This information is given below in terms of pie charts as follows –



The above pie chart shows the distribution of the Sales of Electric Vehicles statewise across the country. It can clearly be seen that Karnataka has the highest amount of sales in EV Vehicles recently followed by Tamil-Nadu, Maharashtra etc. This data has helped us to understand in which state has there been higher amount of sales of Electric Vehicles as compared to others.

Also we have visualized another dataset which tells us the percentages of EV distributed across each state as of December 2021.



From the above pie chart it can be clearly seen the Most number of EVs present in the country is in Uttar Pradesh followed by Delhi, Karnataka, Maharashtra etc.

After analyzing both the above pie charts it is felt these states will be a more suitable place for an EV startup to start its operations because it has significant percent of Electric Vehicles and also its EV sales has been very high in the recent times. Hence it is felt that starting the startup operations from Karnataka will help the startup company build a strong base in the Indian EV market.

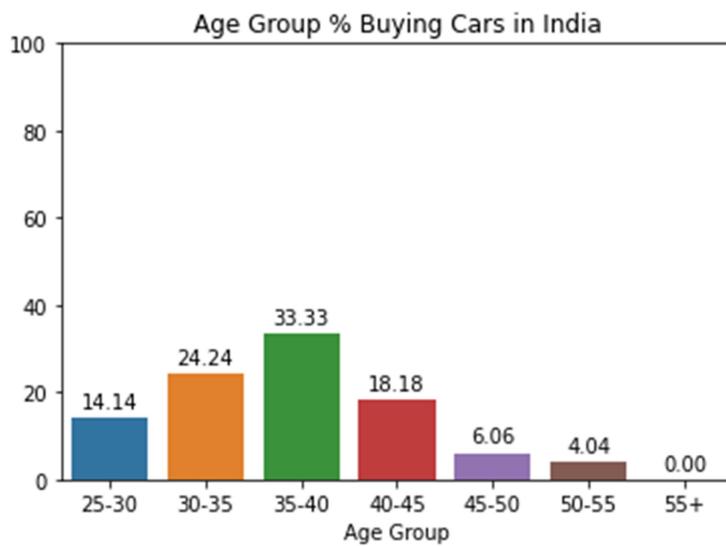
Once the geographical location for the opening up of the startup has been decided it is important to understand the Car Buying Behaviour of the Indian Consumers. It will help the startup to target the correct segment and thereby start manufacturing of the correct type of vehicle in order to attract their target consumers. The first look of the dataset is as follows –

	Age	Profession	Marital 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

This dataset has no missing values as shown below –

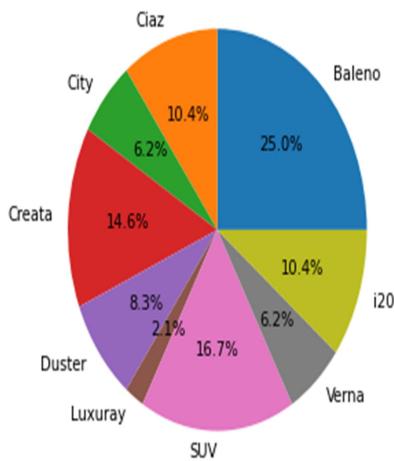
```
ds7.isnull().any()
index          False
Age            False
Profession     False
Marital Status False
Education      False
No of Dependents False
Personal loan  False
House Loan    False
Wife Working   False
Salary         False
Wife Salary    False
Total Salary   False
Make           False
Price          False
dtype: bool
```

The visualization of the dataset will help to provide a lot of useful information related to the dataset. It can allow us to analyse the Car Buying Behaviour of the Indian Consumers and hence make lots of inferences from it. Hence the visualization of the dataset containing Indian Consumer's Car Buying Behaviour is as follows –

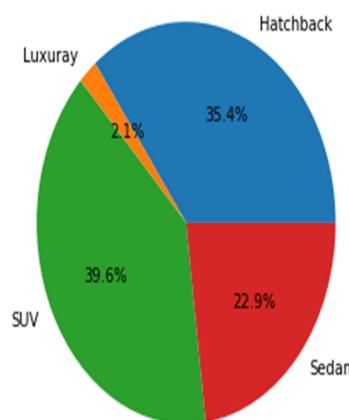


The above bar graph shows that the maximum people who are buying cars in India lie in the Age-Groups of 30 – 45 years. Hence targeting this age group seems to be a good option for the Company.

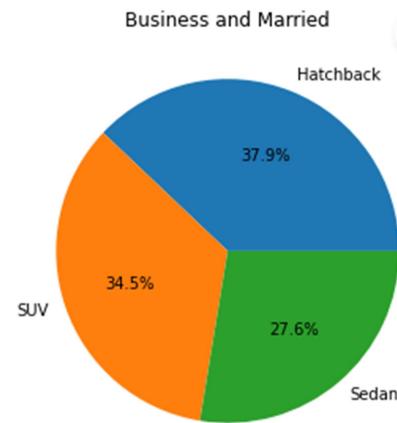
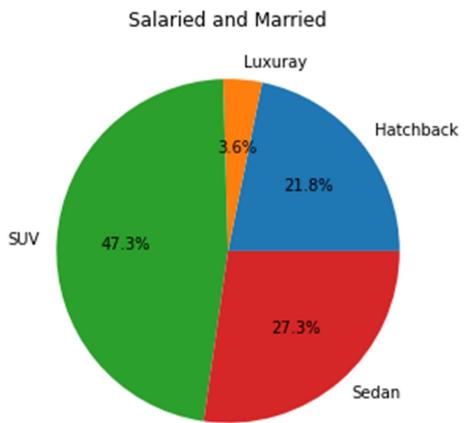
Married and No.of.Dependents>=3 'Car Make' chart



Married and No.of.Dependents>=3 'Car Type' chart

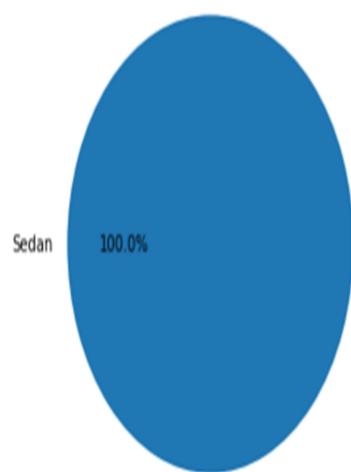


The above pie chart shows that for Married People who has number of dependents more than 3 people tend to buy SUV more than other Car types. This will give an idea to the Company that it will be a good idea to start manufacturing an Electric SUV in order to target these people.

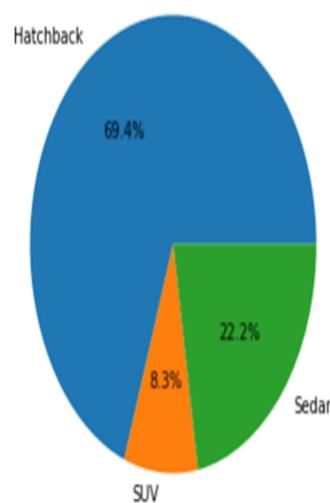


The above pie chart shows that for Consumers who are salaried and marries about half of them tend to buy an SUV whereas about 35% of the consumers who are married and have their own Business also tend to buy SUV as well.

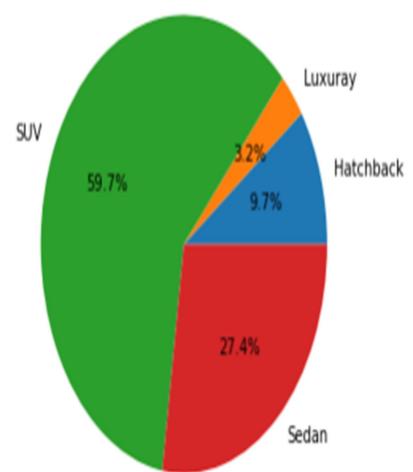
Financial Status='Low' Car Buying Behaviour



Financial Status='Middle' Car Buying Behaviour



Financial Status='High' Car Buying Behaviour



The above pie charts compare the Financial Status of the Indian Consumers. It shows that all those people whose financial status is low end up buying Sedan car type as it is affordable for them. Whereas the consumers whose Financial status is Middle Class tend to buy Hatchback car type more as compared to an SUV or a Sedan. On the other hand the consumers whose Financial Status is high tend to buy SUV more often than Sedan or Hatchback. Hence the Financial Status of a consumer greatly affects their choice of Car. The company can use this information to target consumers of a particular target segment and then can make Electric Car of the particular type which can woo its target consumers.

After doing all these data visualizations it becomes very important to convert the categorical data into numerical data so that it can be further used for the Segmentation purposes. Hence

to convert the categorical data into numeric data dictionaries were used in which the keys were the categorical values and the values were their corresponding numerical values. Once such dictionaries were created they were mapped into the dataset so that the dataset can be converted from categorical values to numerical values.

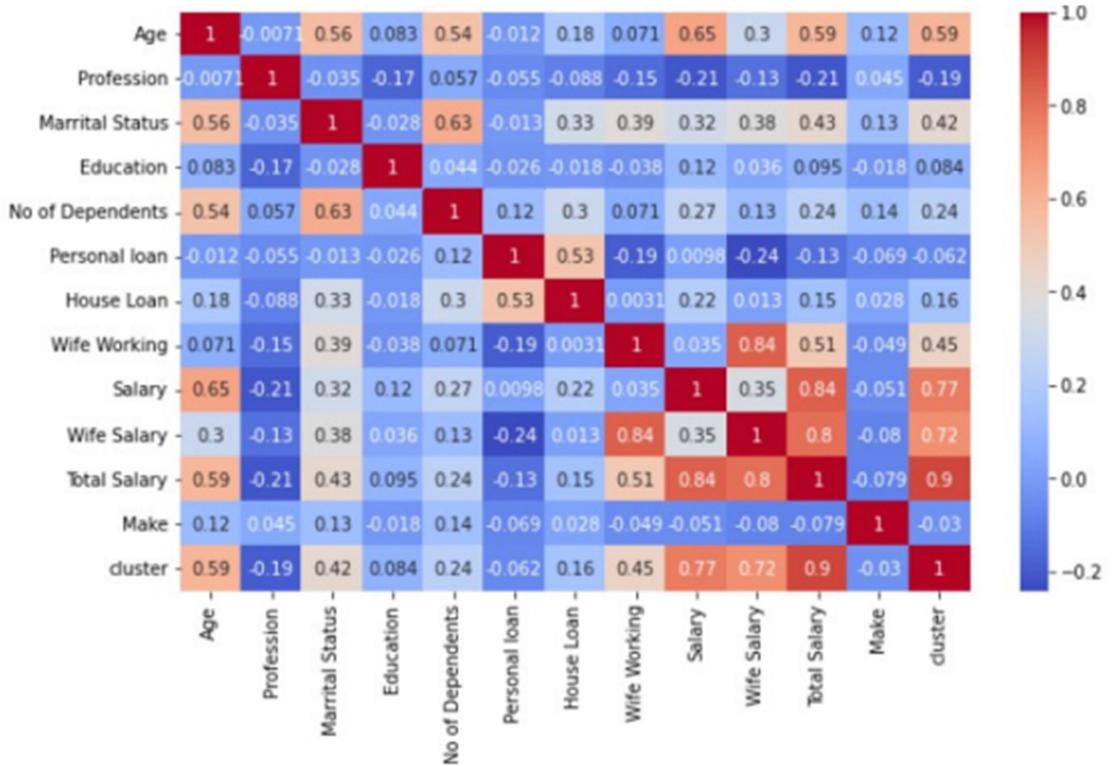
Columns having categorical values are being converted into integers by using the below mentioned transformations.

- Column 'Profession' has two values, 'Salaried' and 'Business', change it to '0' and '1'.
- Column 'Marital Status' has two values, 'Married' and 'Single', change it to '1' and '0'.
- Column 'Education' has two values, 'Post Graduate' and 'Graduate', change it to '1' and '0'.
- Column 'Personal loan' has two values, 'Yes' and 'No', change it to '1' and '0'.
- Column 'House Loan' has two values, 'Yes' and 'No', change it to '1' and '0'.
- Column 'Wife Working' has three values, 'Yes', 'No' and 'm'. There is only one row which has 'm' as 'Wife Working', we are not sure if that refers to 'Yes' or 'No', so better to delete that row.
- Column 'Make' has these nine values, 'SUV', 'Baleno', 'Creatra', 'i20', 'Ciaz', 'City', 'Duster', 'Verna' and 'Luxuary', change them to '0', '1', '2', '3', '4', '5', '6', '7', '8' and '9' respectively.

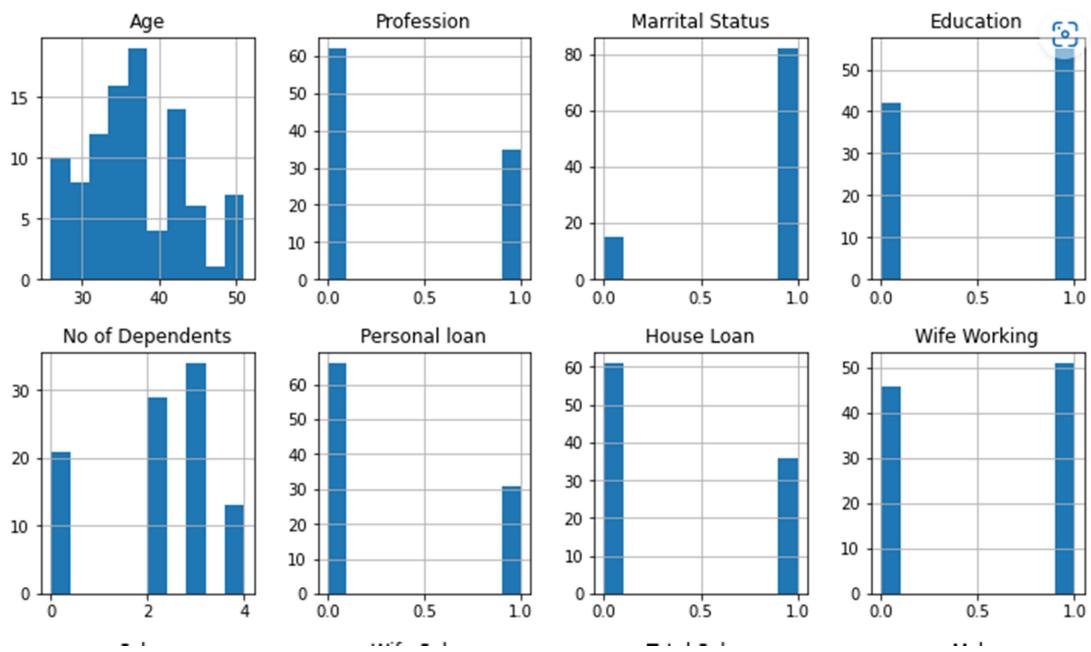
```
dict_Make = { "SUV" : 0, "Baleno" : 1, "Creatra" : 2, "i20" : 3, "Ciaz" : 4, "City" : 5, "Duster" : 6, "Verna" : 7, "Luxuary" : 8}
df_beh["Make"] = df_beh["Make"].map(dict_Make)
```

Once all the categorical data were converted into numerical data the data types of the features got changed.

```
: df_beh.dtypes
: Age           int64
: Profession   int64
: Marrital_Status int64
: Education    int64
: No of Dependents int64
: Personal_loan int64
: House_Loan   int64
: Wife_Working int64
: Salary        int64
: Wife_Salary   int64
: Total_Salary  int64
: Make          int64
: Price         int64
: Car_Type      object
: Financial_Status object
: Financial_Condition object
: dtype: object
```



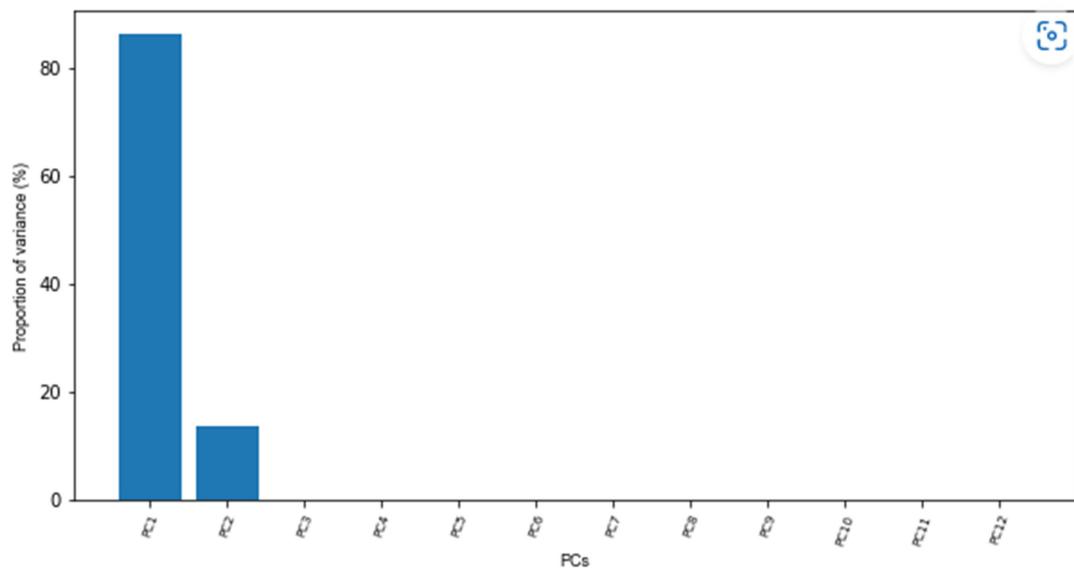
Then the histograms of the data were drawn as below –





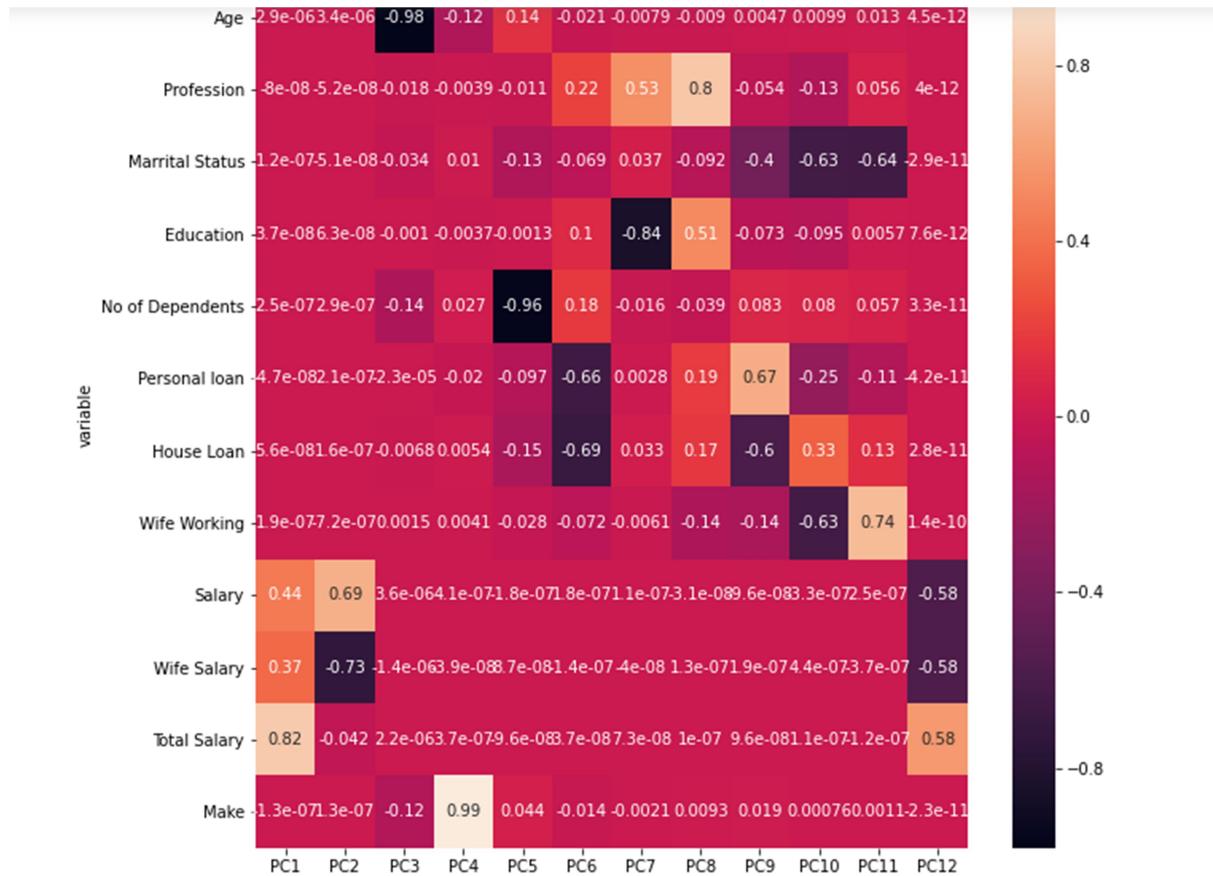
Once the histogram was plotted then the Principal Component Analysis(PCA) of the dataset was done. The PCA is a statistical process which converts a set of Correlated features into a set of linearly uncorrelated features with the help of Orthogonal Transformation. These new Transformed Features are called Principal Components. This process reduces the dimensions of the dataset and makes it cost-effective to carry out clustering operations.

The Principal Components of the Indian Consumer Car Buying Behaviour dataset is as follows –



From the above bar chart it can be clearly seen that the first 2 Principal Components themselves account for 100% of the variance in the data.

Also the heatmap between the original variables and the principal components can be shown as follows –



From the above heatmap it can be inferred that for the first principal component Salary, Wife Salary and Total Salary are the original variables which are highly correlated with it and similarly for other principal components as well.

Segment Extraction(K-Means Methods)

Now for the extraction of the segments the K-Means algorithm has been used. K-Means algorithm is an unsupervised learning algorithm which is used to solve clustering problems in ML. It allows us to cluster the dataset into K number of group in a convenient way. The number K either must be known in advance or it must be found out using the elbow method. This algorithm allows us to identify segments of groups in an unlabeled dataset without the need for any training. The main aim of the algorithm is to divide the dataset into k number of segments in such a way that there is minimum sum of distance between a data point and its corresponding segment.

First in order to extract the segments it is important to know the correct number of segments in the data. The correct number of segments can be known by using a method called elbow methods. The elbow method help us to choose the optimum value of k by fitting the model with a range of k values. The sum of squares of distances also called the epsilon or the cost function of the K-means algorithm is used to find the elbow. The epsilon is expected to decrease with increasing value of k. The value of k after which the value of epsilon decreases

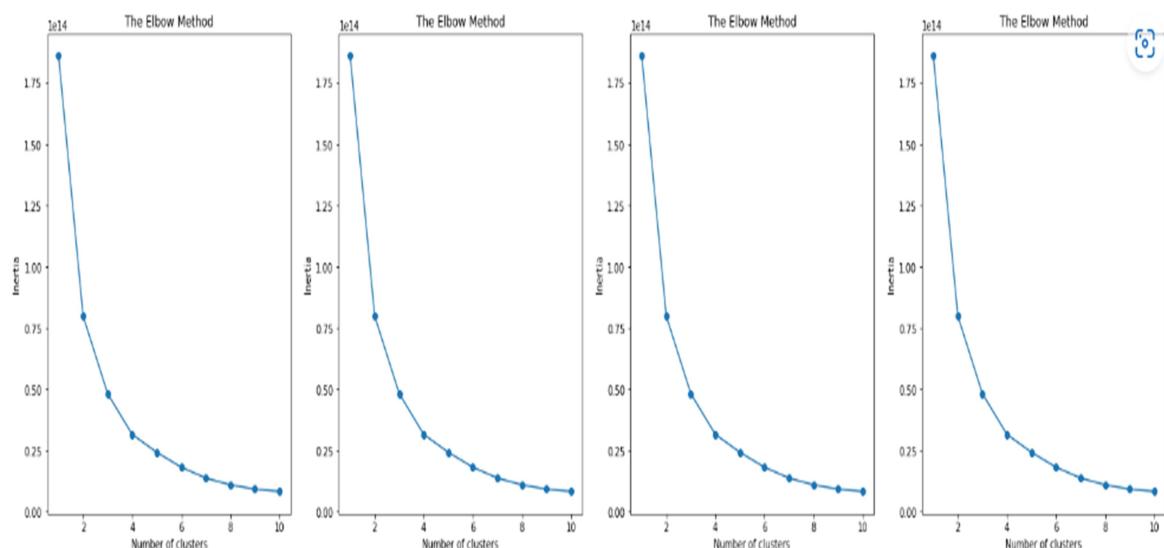
very less is considered to be the optimum value of k. In our dataset we performed the elbow method 10 times to get the average value of k.

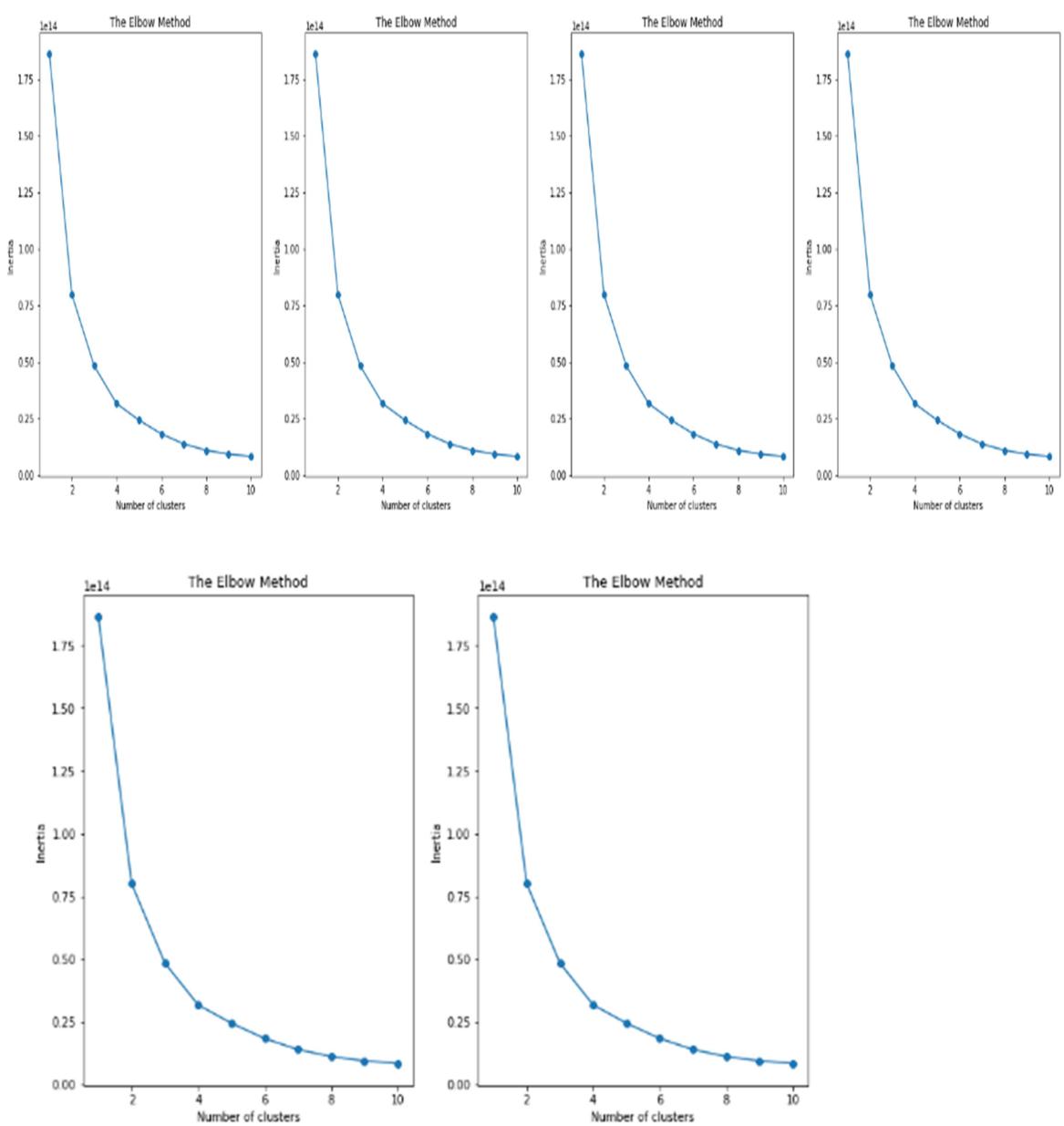
The code for elbow method is as follows –

```
In [86]: from sklearn.cluster import KMeans
# Get the inertia values for number of clusters varying from 1 to 10
for j in range(1,11):
    inertia = []
    for i in range(1, 11):
        kmeans = KMeans(n_clusters = i, init = 'k-means++', max_iter = 300, n_init = 10, random_state = 0)
        kmeans.fit(data_beh)
        inertia.append(kmeans.inertia_)

    # Plot the inertia values for these clusters to choose the appropriate number of clusters
    plt.subplot(3,4,j)
    plt.plot(range(1, 11), inertia,marker = "8")
    plt.title('The Elbow Method')
    plt.xlabel('Number of clusters')
    plt.ylabel('Inertia')
plt.show()
```

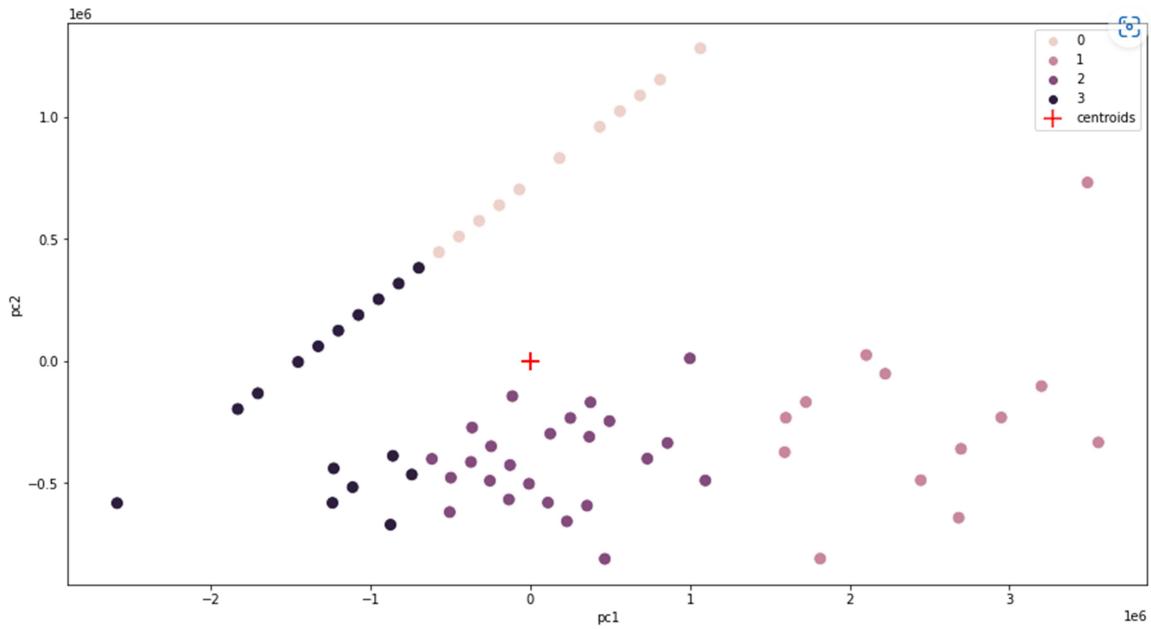
The graphs showing the decrease in the value of epsilon are as follows –





So from observing all the 10 graphs it can be concluded that the optimum number of clusters will be 4.

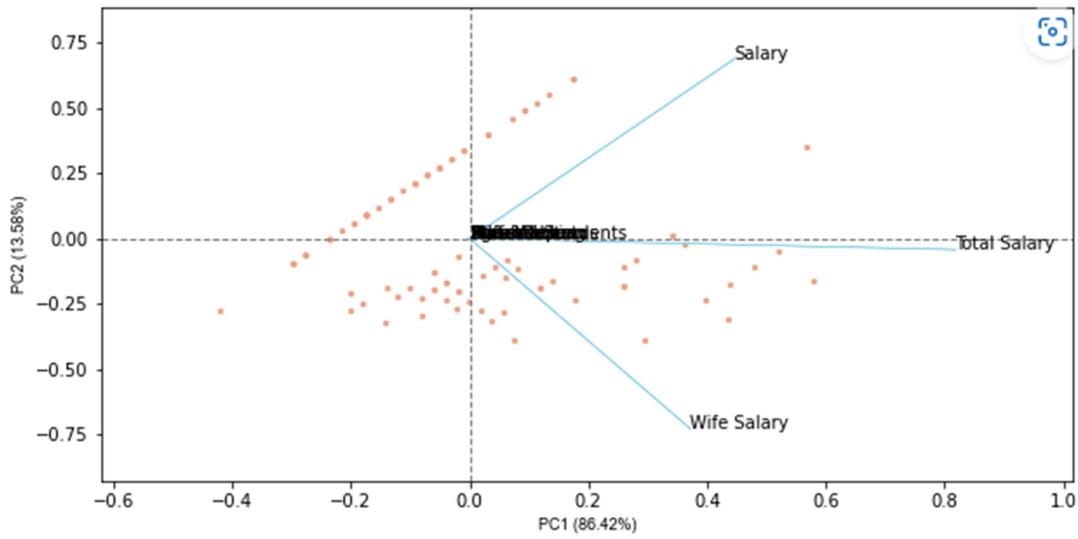
Hence the value of K for K-Means algorithm will be taken as 4. The clusters obtained after applying K-Means algorithm will be as follows –



Profiling and Describing Potential Segments

Now once we have extracted the segments from the dataset the next thing to do is to profile the segments. The Segments can be profiles by drawing a perceptual map of the dataset. This perceptual map will indicate the columns which are dominant in each segment. This perceptual map is used for segment separation using the Principal Components 1&2 for the Indian Consumers car Buying Behaviour Dataset.

The Perceptual Map will be as follows –



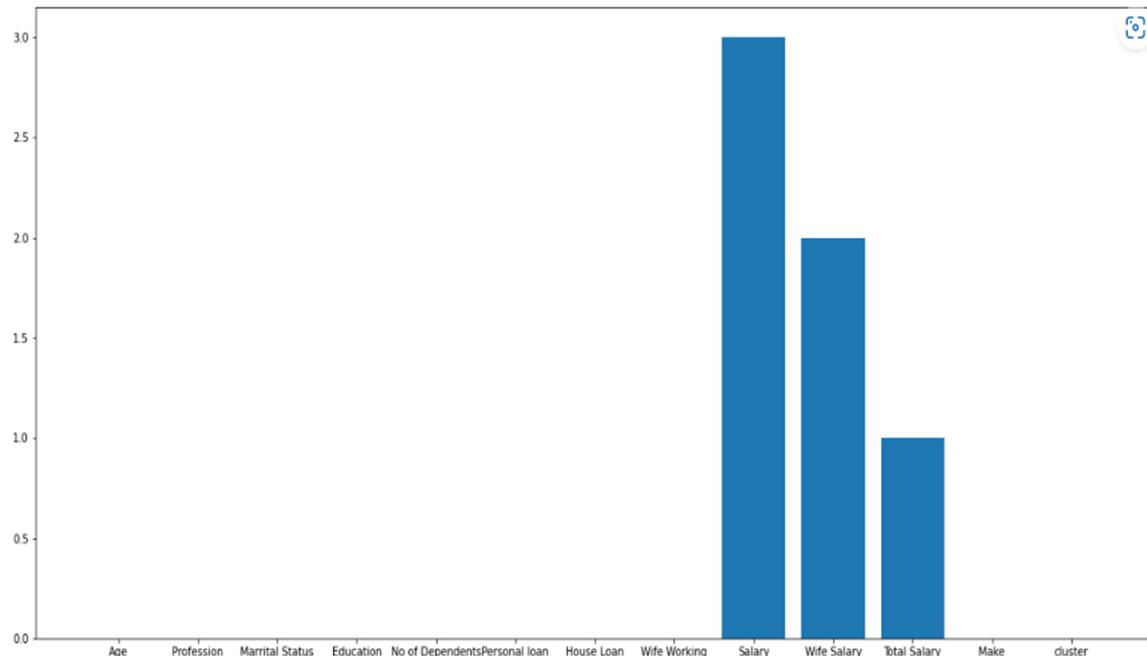
The perceptual map above shows that in the four segments the Segmentation Variables Salary, Total Salary, Wife Salary will be dominant in describing 3 segments. This can further be confirmed by plotting a segment profile plot. It can be plotted by first doing hierarchical clustering of the segmentation variables and then plotting them into a bar graph. The code for plotting the segment profile plot is as follows –

```

from sklearn.cluster import AgglomerativeClustering
from scipy.cluster import hierarchy as shc
from sklearn.metrics import pairwise_distances
clust2 = AgglomerativeClustering(n_clusters = 4).fit_predict(pairwise_distances(data_beh.transpose()))
plt.figure(figsize = (20,10))
plt.bar(data_beh.columns,clust2)

```

The resultant bar plot will be as follows –



From the above bar plot it can be confirmed that the Segmentation variables in the 4 segments are as follows –

Segment 0 – Age, Profession, Marital Status, Education, No of Dependents, Personal Loan, House Loan, Wife Working, Make.

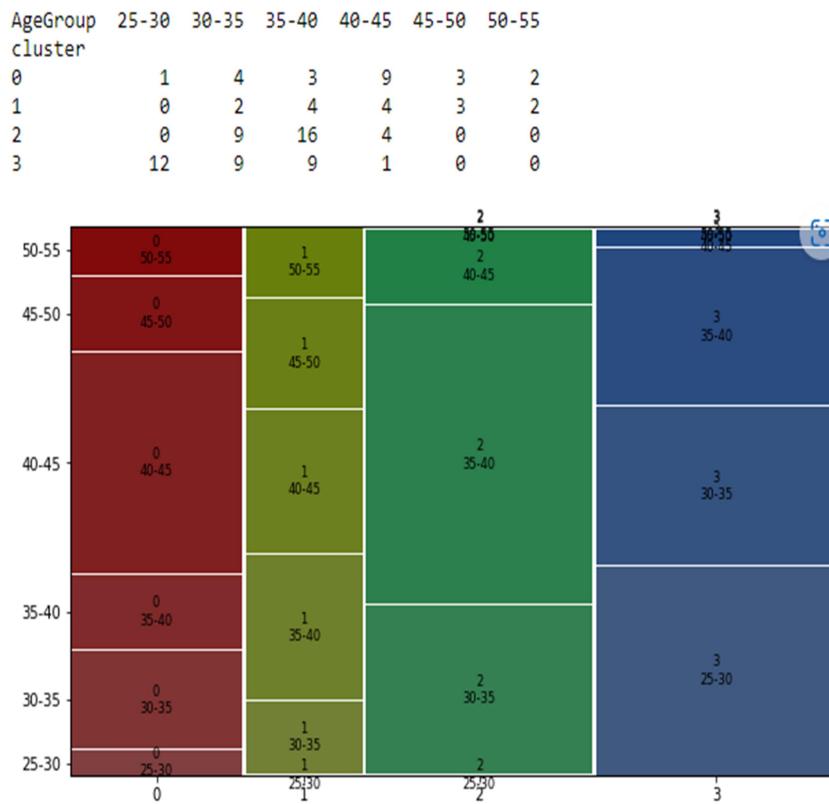
Segment 1 – Total Salary.

Segment 2 – Wife Salary.

Segment 3 – Salary.

Now these segments can be described further using various visualisations. In order to describe these segments we will plot the mosaic plot of these segments which will describe these segments to us on the basis of the variables. Some of these mosaic plots are as follows –

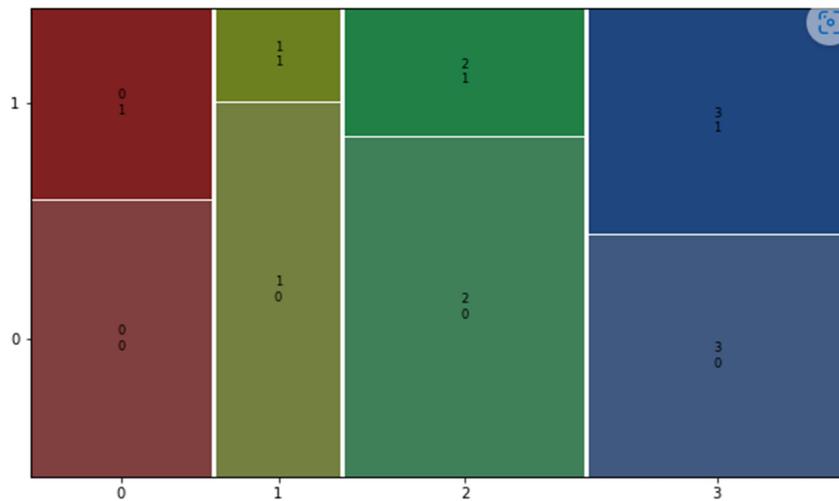
Mosaic Plot for AgeGroup



The above mosaic plot tells us that the Segment 0 has more people of the AgeGroup 40-45, the Segment 1 has more people in the AgeGroup 35-45, the Segment 2 has more people in the AgeGroup 35-40 and the Segment 3 has more people in the AgeGroup 25-30.

Mosaic Plot for Profession

Profession	0	1
cluster		
0	13	9
1	12	3
2	21	8
3	16	15



The above mosaic plot shows the relationship between Segments and profession as follows –

Segment 0 = Salaried People -13, Business People – 9.

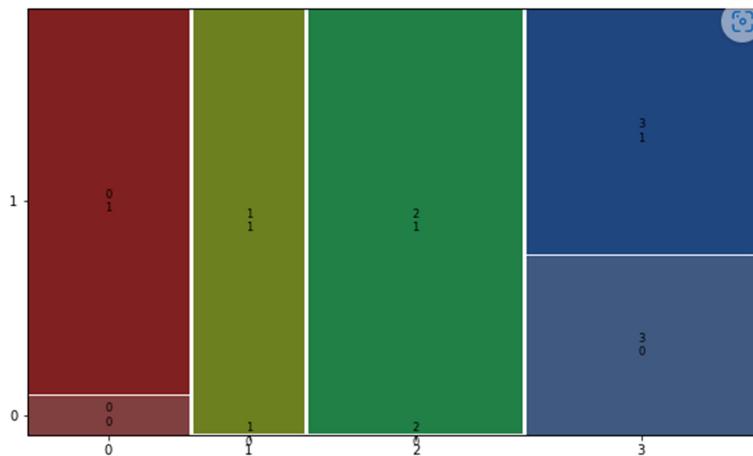
Segment 1 = Salaried People – 12, Business People – 3.

Segment 2 = Salaried People – 21, Business People – 8.

Segment 3 = Salaried People – 16, Business People – 15.

Mosaic Plot for Marital Status

Marital Status	0	1
cluster		
0	2	20
1	0	15
2	0	29
3	13	18



The above plot can be described as follows –

Segment 0 = Unmarried – 2, Married – 20.

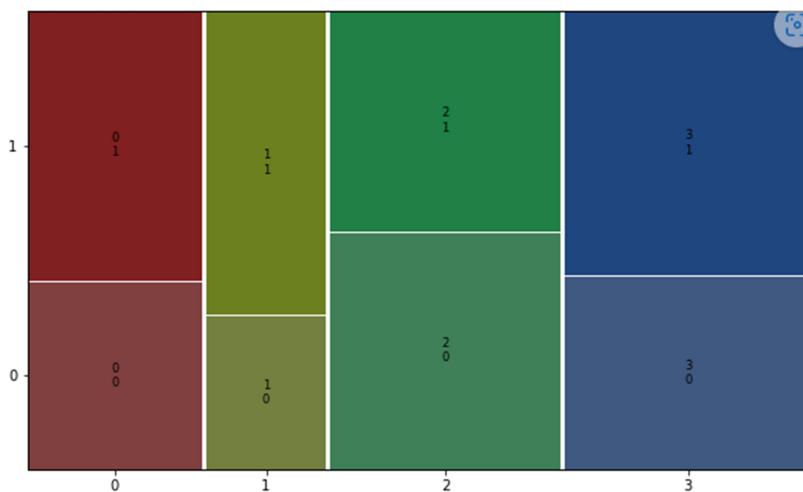
Segment 1 = Unmarried – 0, Married – 15.

Segment 2 = Unmarried – 0, Married – 29.

Segment 3 = Unmarried – 13, Married – 18.

Mosaic Plot for Education

Education	0	1
cluster		
0	9	13
1	5	10
2	15	14
3	13	18



The above mosaic plot can be described as follows –

Segment 0 = Graduate – 9, PostGraduate – 13.

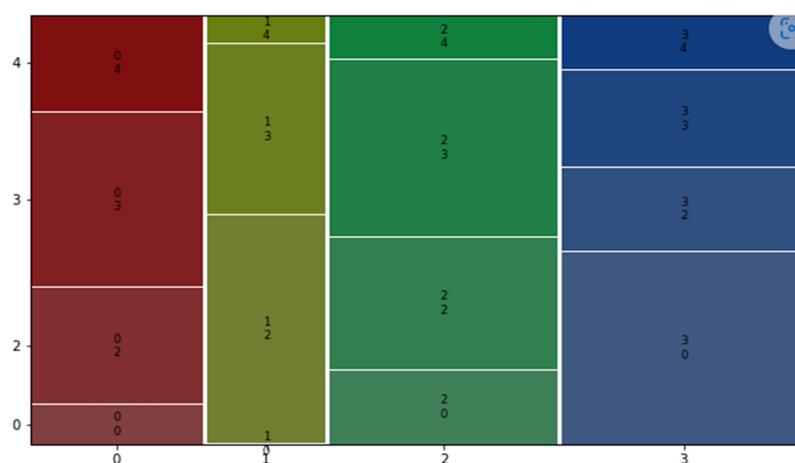
Segment 1 = Graduate – 5, PostGraduate – 10.

Segment 2 = Graduate – 15, PostGraduate – 14.

Segment 3 = Graduate – 13, PostGraduate – 18.

Mosaic Plot for Number of dependents

No of Dependents	0	2	3	4
cluster				
0	2	6	9	5
1	0	8	6	1
2	5	9	12	3
3	14	6	7	4



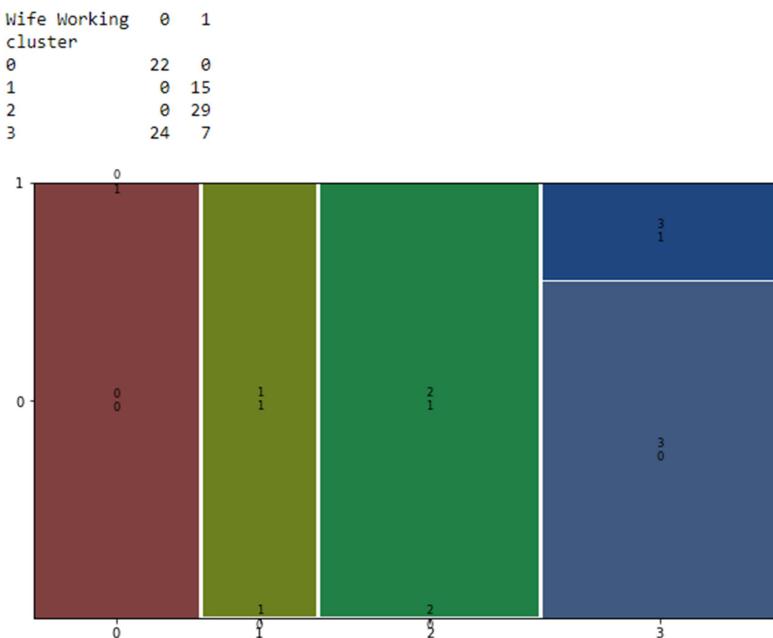
In the above mosaic plot it can be seen that –

Segment 0 and Segment 2 has most no of consumers having no of dependents 2 or 3.

Segment 1 has most no. of consumers having 2 number of Dependents.

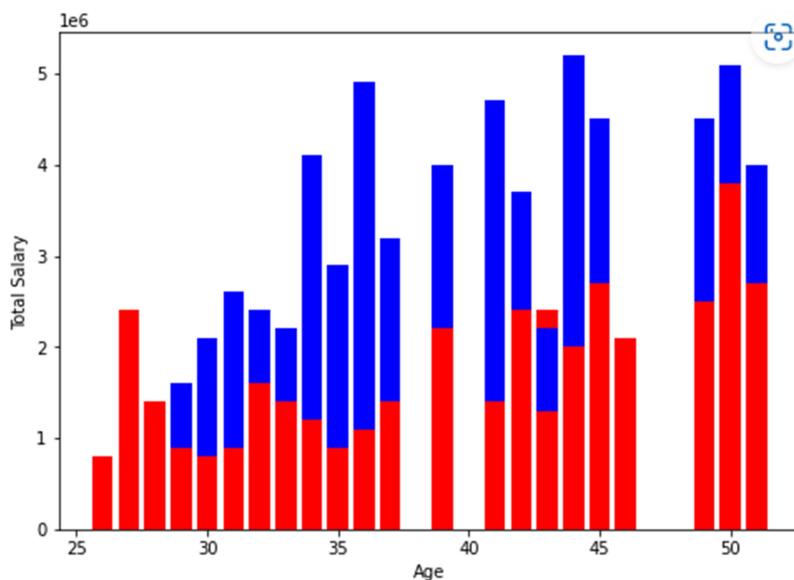
Segment 4 has most number of consumers having 0 Dependents.

Mosaic Plot for Wife Working

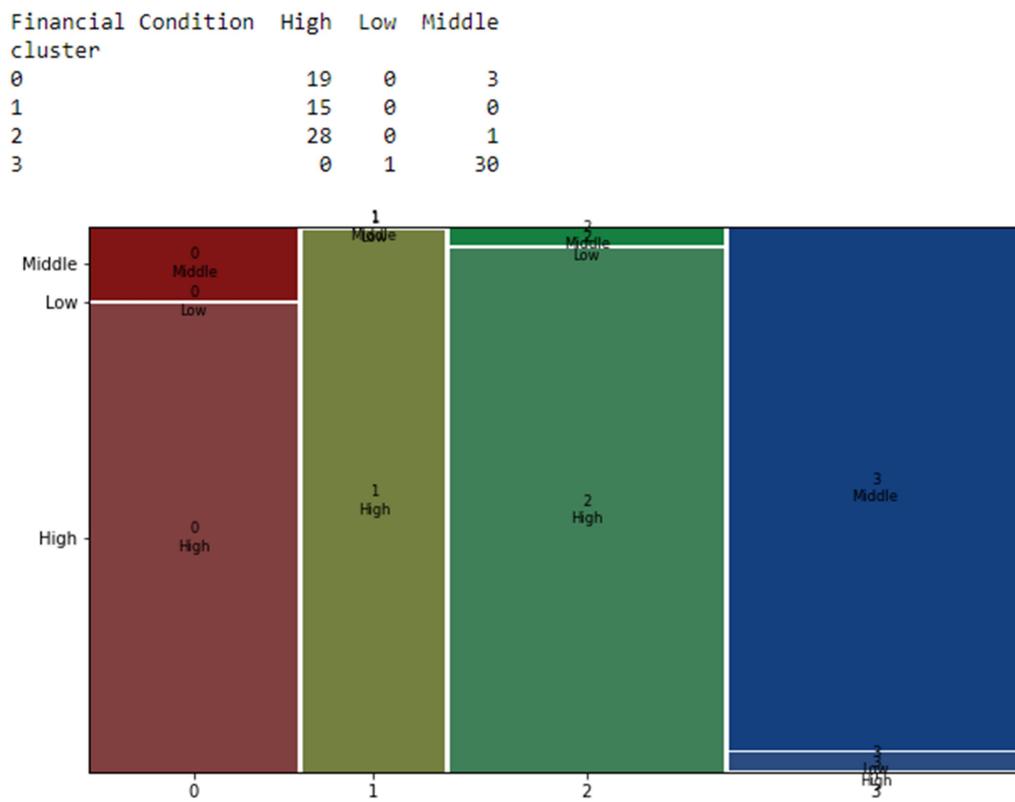


In the above mosaic plot it can be seen that Segment 0 has only Non-Working Wife whereas Segment1 and Segment 2 have only Working Wife. On the other hand Segment 3 has Majority of Non-Working Wife and minority of Working Wife.

Bar Plot Showing Total Salary of Consumers with respect to their Age.

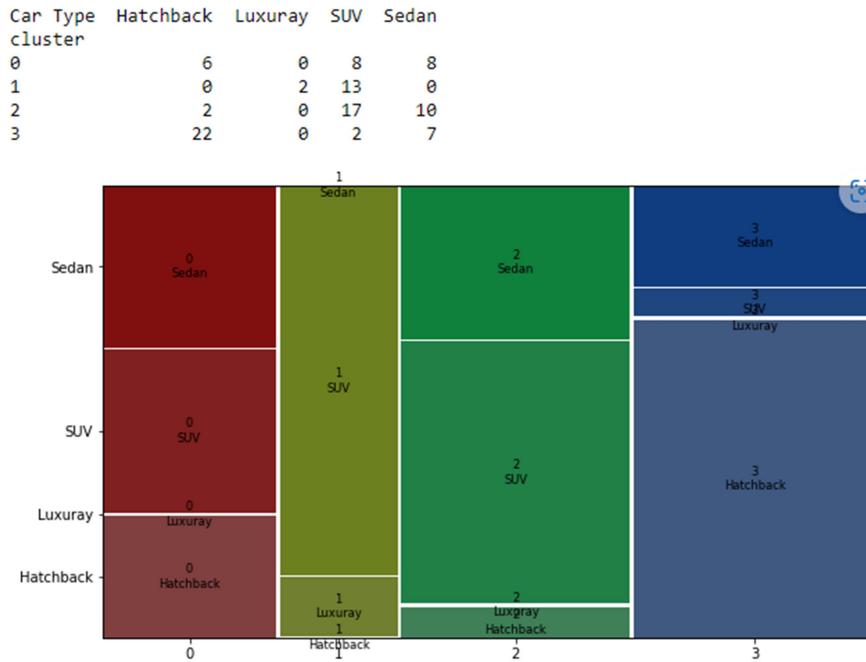


Mosaic plot for Financial Condition



In the above Mosaic plot it can be seen that in Segment 0, Segment 1, Segment 2 the number of people having High Financial Conditions are more whereas in Segment 3 the number of people having Middle Financial Condition are more.

Mosaic Plot for Car Type



In the above mosaic plot it can be seen that people from Segment 0, Segment 1, Segment 2 are more inclined towards buying an SUV whereas the people in Segment 3 are more inclined towards buying the Hatchback Car Type.

Selecting Target Segment

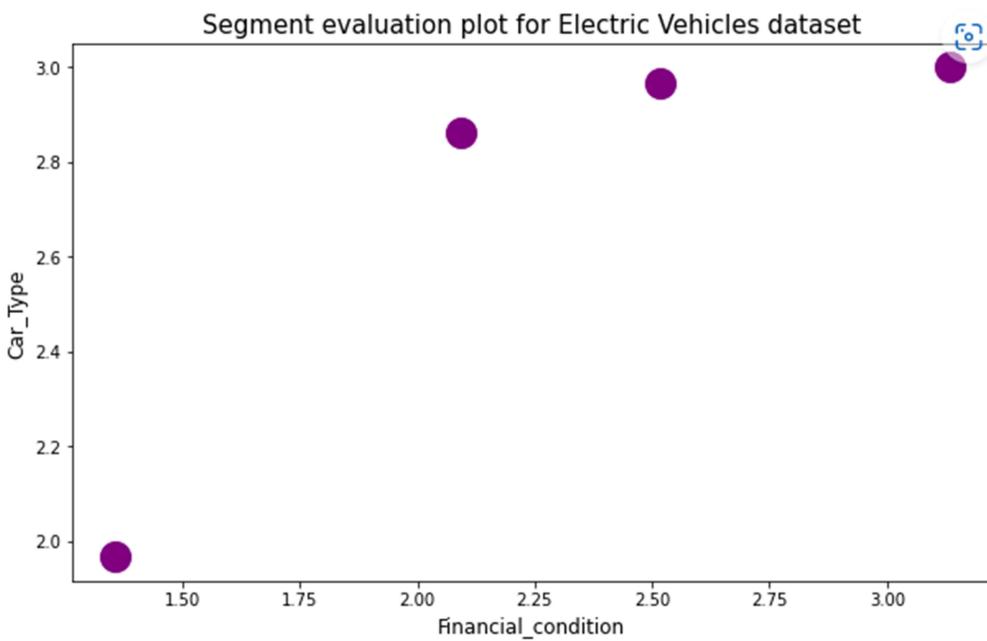
Selecting the target segment of many marketing segments is the most important decision. The selection of one or more target segments is a long-term decision significantly affecting the future performance of an organization. Below we can see a table which compares the values of all of the variables from each market segment.

cluster	Financial Condition	Wife Salary	Salary	Total Salary	Age	Marital Status	Profession	Education	No of Dependents	Car Type	Price	
0	0	2.863636	0.000000e+00	2.290909e+06	2.290909e+06	40.545455	0.909091	0.409091	0.590909	2.681818	2.090909	1.136364e+06
1	1	3.000000	1.586667e+06	2.653333e+06	4.240000e+06	42.200000	1.000000	0.200000	0.666667	2.533333	3.133333	1.740000e+06
2	2	2.965517	8.655172e+05	1.517241e+06	2.382759e+06	35.379310	1.000000	0.275862	0.482759	2.275862	2.517241	1.341379e+06
3	3	1.967742	1.032258e+05	1.141935e+06	1.245161e+06	31.612903	0.580645	0.483871	0.580645	1.580645	1.354839	8.838710e+05

From the above table we can infer that our target segment should be Segment 2. The reason for this selection is as follows –

- 1) Consumers in Segment 2 have high Financial Status and hence they can easily afford to buy Electric Vehicles.
- 2) The average age in Segment 2 is close to 35 and hence this segment is more likely to buy EV as compared to others according to various researches which states than men aged between 30-45 years are most likely to buy EVs.
- 3) Also most of the consumers in this segment are salaried people and hence they have a stable income and comparatively more job secure and hence their chances of buying EV will be high.
- 4) Also the preferred Car Type of the Segment 2 is SUV and the average price range of an EV SUV is 14 lakh – 17 lakh which is closer to the price paid by this segment for their conventional SUVs. Hence EV SUVs will be able to easily attract this market segment.

Hence after going through all the analysis conducted above the target segment for an EV startup company should be segment 2. Now the other dilemma is to establish the type of Car to be manufactured to attract this market segment. Hence to analyse that we will plot a Segment Evaluation plot.



In the above segment evaluation plot it is clear that Segment 2 which is having good Financial Condition are preferring to Buy SUVs over other Car Types. Hence it can be concluded that the new EV Startup Company should initially focus on manufacturing EV SUVs in order to attract this particular market segment which will help them to create a strong potential customer base in the early market.

Marketing Mix

For marketing, geometric segmentation plays an important and crucial role.

Geographic segmentation categorizes the target market into segments where marketers can better serve customers in a specific region. This kind of Market segmentation is based on the geographical entities themselves (countries, states, city, etc.), but also depends on various geographical factors such as climate, culture, etc. settings, population, etc. Geographic segmentation includes segmentation Target users based on where they live or work. You can do this any number of times Possibilities: Group customers by country of residence or smaller geographical countries Department from region to city to postal code.

Geographic segmentation is probably the simplest market segmentation Please look back. However, there are still many opportunities that companies will never take advantage of think about. The size of the target area should be changed as needed business. In general, the bigger the company, the bigger the area it belongs to alignment. Ultimately a wider potential audience targeting each zip code individually is not cost effective.

After our analysis and research we came to the conclusion that in India there are 4-5 states such as Uttar Pradesh, Delhi, Maharashtra, Karnataka, Tamil Nadu etc which provide suitable locations for EV startups to start their operations. These states have announced several policies for the growth of EV Vehicles and hence are ideal destinations for any EV Start-up company to start their operations.

Potential Customer Base for Business Markets

There are 87,554 electric vehicles sold during 2017-2018, it increased to 131,554 units in 2018-2019 and again raised in 2019-2020 to 161,308 further due to Covid-19 it became 119,650 units. This number included both two-wheelers, three-wheelers, four wheelers and buses but two wheeler sales have been increasing. A significant portion of the electric vehicles registered in the country are two- and three-wheelers.

- The Electric 2-Wheeler sales have increased by 463.61% from FY 2021 to FY2022. It is increasing rapidly; the Electric 2-Wheeler sale will reach 400,000 units to 450,000 units in FY 2023.
- The Electric 3-Wheeler sale has increased by 212.45% from FY 2021 to FY2022. It is increasing rapidly the Electric 3-Wheeler sale will reach 75,000 units to 80,000 units in FY 2023.
- The Electric 4-Wheeler sales have increased by 344.65% from FY 2021 to FY2022. It is increasing rapidly the Electric 4-Wheeler sale will reach 50,000 units to 55,000 units in FY 2023.
- Karnataka, Tamil Nadu, Maharashtra, Telengana and Rajasthan have combined 67% sales share in high speed 2-wheeler electric vehicles.
- Uttar Pradesh, Bihar, Delhi and Assam have highest percentage of L3 category 3-wheelers electric vehicles sales.
- Telangana, Karnataka and Delhi have highest number of high speed L5 category electric 3-wheeler vehicles sales.
- Maharashtra has highest 4-wheeler EV sales in 2021 (26%) followed by Delhi and Telangana(13% each).
- Maharashtra and Gujarat have highest e-Bus sales accounting for 47% and 18% units sold respectively.

Potential Customer Base * Your Target Price Range = Potential Profit

- For Electric 2-Wheeler, The per unit average price will be 1,00,000 and the number of units sold will be around 4,25,000.

Potential Profit in India = $425000 * 100000 = \text{Rs } 42.5 \text{ Billion}$

Potential Profit in Karnataka = $35,000 * 1,00,000 = \text{Rs } 3.5 \text{ Billion}$.

Potential profit in Maharashtra and Tamil Nadu = $30,000 * 1,00,000 = \text{Rs } 3 \text{ Billion}$ each in both the states.

- For Electric 3-Wheeler, The per unit Average price will be 2,00,000 and the number of units sold will be around 150000.

Potential Profit in India = $150000 * 200000 = \text{Rs } 30 \text{ billion}$

Potential profit in Uttar Pradesh = $65000 * 200000 = \text{Rs } 13 \text{ Billion}.$

- For Electric 4-Wheeler, The per unit Average price will be 15,00,000 and the number of units sold will be around 50000.

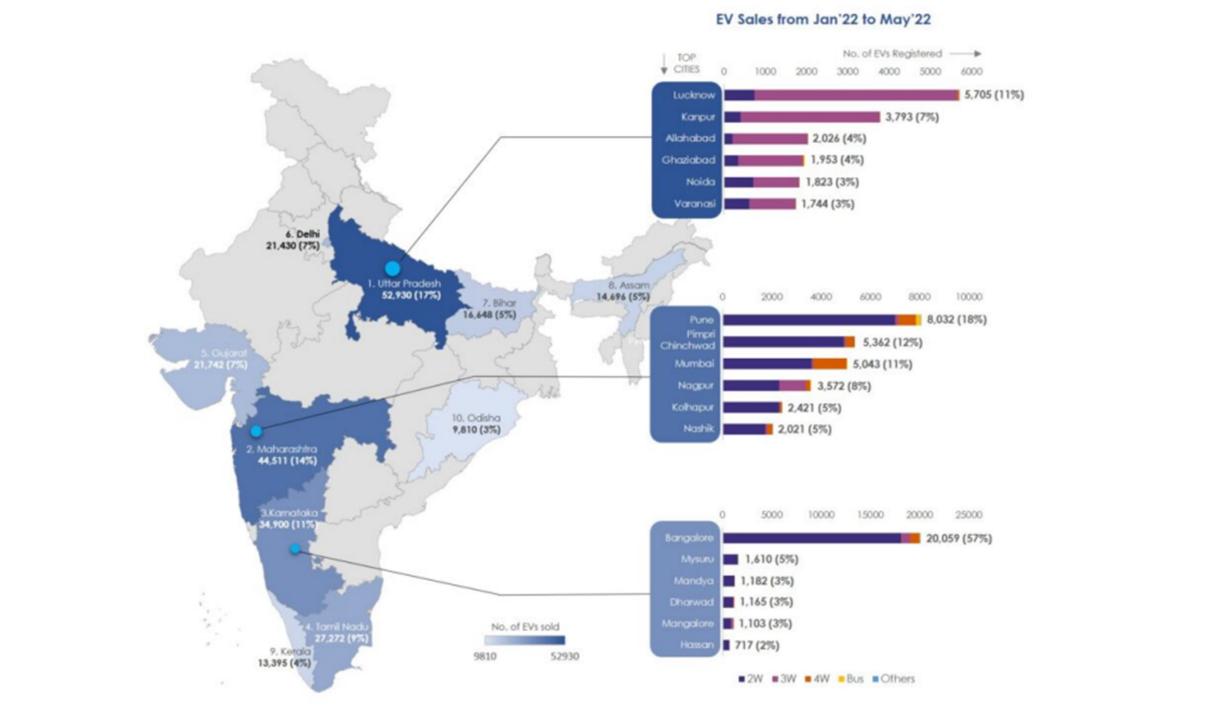
Potential Profit = $50000 * 15,00,000 = \text{Rs } 75 \text{ billion.}$

Potential Profit for Electric 4-wheelers in Maharashtra = $5000 * 15,00,000 = \text{Rs } 7.5 \text{ Billion}$

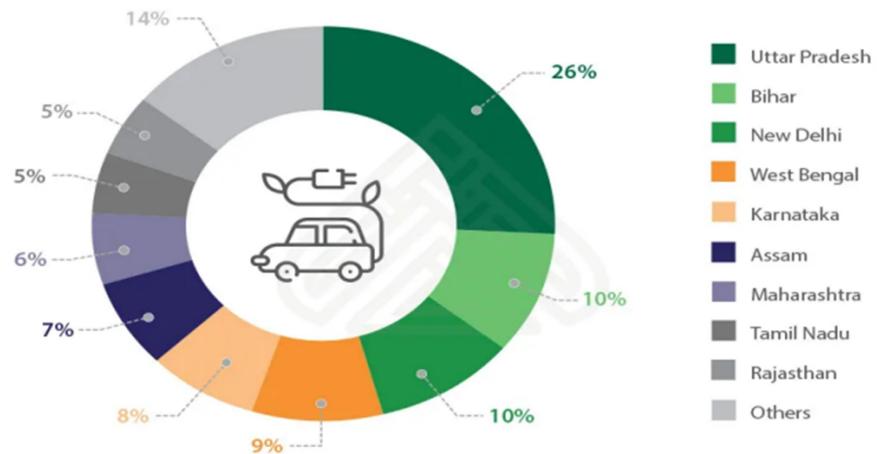
Potential Profit for Electric 4-wheelers in Delhi and Telangana = $2500 * 15,00,000 = \text{Rs } 3.75 \text{ Billion}$ each in both these states.

MOST OPTIMAL MARKET SEGMENTS

From the above report, we conclude that to create an Electric Vehicle startup in India, the most optimal market segment for us will be based on Geographic and Demographic segments which would be the most amount of EVs sold in particular states and the type of electric vehicle respectively.



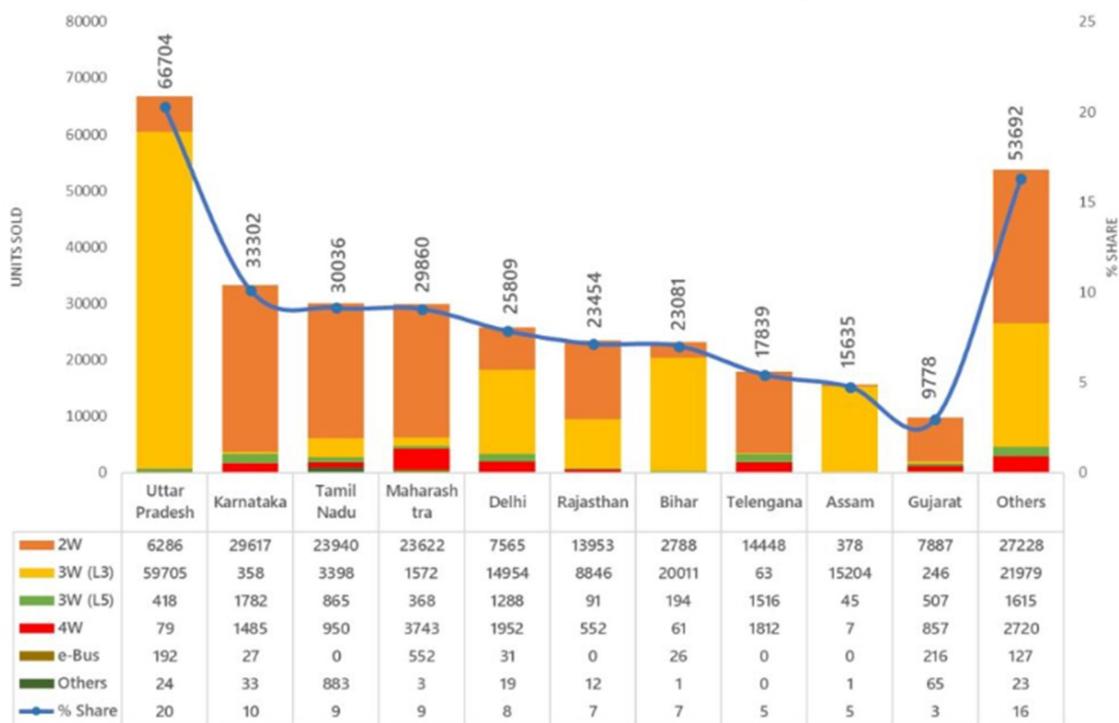
Regional Registered EV Sales Jan-Dec 2020



Source: Vahan Dashboard, JMK Research

Graphic © Asia Briefing Ltd.

State Wise Electric vehicle sales trend, 2021



Source : Vahan Website and Telangana regional transport data portal

After analysing the EV market using Market Segmentation Analysis, the feasible strategy that we have come up with is that we will be focussing on the states that have more demand for EVs like Uttar Pradesh, Delhi and Karnataka, Maharashtra. Also, one more reason to set up the startup in these 3 states is that the infrastructure required for the EVs including the charging station is available which would ease the burden in setting up of the startup process

and also the governments are providing a lot of subsidiaries to the people as well as for the company in order to encourage electric vehicles.

Also the EV start-up company should focussing on developing EV 2-Wheelers and SUVs in EV 4-wheelers which will help them get a good potential customer base according to our research and analysis and will help the company to grow in the early market.

Github Link

<https://github.com/VarunIyengar/Feynn-Labs-Project2>