Market Segmentation of Electronic Vehicles

Mathan Prasanna Kumar S

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Introduction

The Indian automobile industry, currently the 3rd largest in the world, is poised for a tectonic shift, driven in part by the rapid growth of electric vehicles (EVs). EVs are becoming increasingly popular in India, thanks to a number of factors, including the increasing awareness of the environmental benefits of EVs, the declining cost of EV batteries, and the growing availability of EV charging infrastructure.

For instance, a recent survey shows that between 2021 and 2022, the number of EVs sold in India jumped by a whopping 210 percent. Likewise, according to the Economic Survey of 2023, the country's yearly sale of electric vehicles will touch the 10 million threshold by 2030.

In this report , we have analysed the ev marked based on considering the behavorial and specification dataset , from the analysis and the formulated evidence companies can start their marketing campaign.

Market Overview

India is one of the world's largest markets for two- and three-wheeled vehicles, ranking among the global top five for private cars and commercial vehicles.

India sets an ambitious target for its EV ecosystem by 2030

Target EV to Standard Car Mix: India | 2030
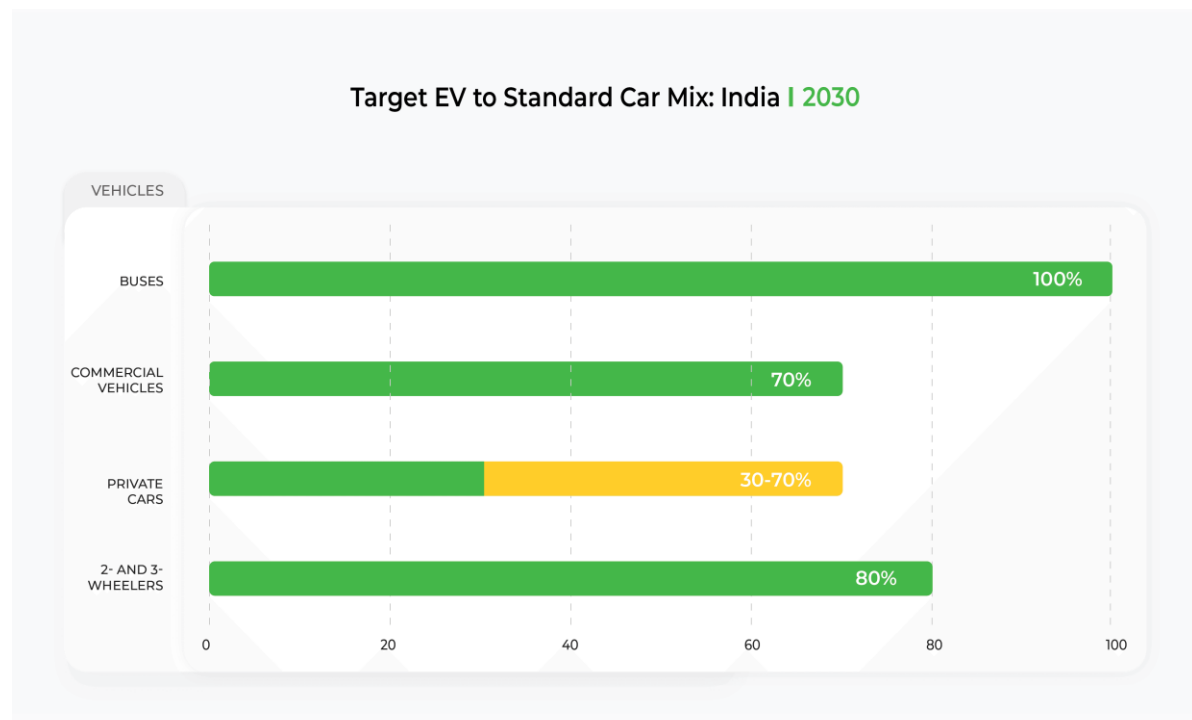
The Indian government has also formulated the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME) scheme. This plan should facilitate greater adoption rates in the coming years. The Finance Minister of India has also announced a reduction in customs duty and taxes for the 2023 budget. This will help boost the domestic production of lithium-ion batteries that power electric vehicles.

Many state governments like Assam, Telangana, Tamil Nadu, and Gujarat have also created attractive policies and programs to incentivize EV manufacturing in their respective territories. Because of these scope of these vehicles in India, many private companies are attracted to this market, having the best strategy to market companies can achieve greater success in this market.

Environmental Opportunities for India

The shift towards electric vehicles in India will have a significant impact on the environment. Currently, the transportation sector in India is a major contributor to pollution. Take the capital, New Delhi, for example, where two- and three-wheelers contribute 50% to the surface PM 2.5 levels.

India's transportation sector also accounts for about one-fifth of the country's total energy use. In light of these numbers, EVs can have a huge impact on India's environment in the following areas.

1. Reducing Air Pollution

Within India alone, vehicular traffic contributes to 27% of total air pollution and claims 1.2 million deaths annually. EV adoption in India will therefore significantly reduce the negative global environmental impacts originating from Internal Combustion Engine (ICE) vehicles.

2. Reducing Noise Pollution

Noise pollution is also a major challenge in India due to the rapid urbanization increasing the need for vehicles. According to the 2022 UNEP report, five Indian cities feature in the world's noisiest cities. Though vehicles are not the only source mentioned in the report, EVs are likely to bring down the noise levels because they don't have the mechanical valves, gears, or fans common to ICE vehicles.

3. Improving Operational Efficiency

From a fuel efficiency standpoint, petrol or diesel cars convert only 17 to 21% of stored energy while EVs can convert 60% of electrical energy from the grid. Clearly, this shift to electric vehicles in India can improve the efficiency of fuel production and optimization. It will bring down the operational costs for end-users, thereby increasing demand for EVs.

Besides the above environmental impacts, the adoption of EVs in India will also present many economic opportunities for the country.

Market Segmentation

Here we will analyze two datasets and segment the EV market and will formulate conclusion on the market scope and the important features to consider in this market

1) Behavioural Dataset
2) Specification of EV vehicles Dataset

Study on Behavioural Dataset

To enter a market an in-depth knowledge of the end user psychology, behaviour is required. This market research is imperative for setting prices, study spending habits, study the product they use the most, like 4-wheel diesel/petrol automobiles, what is their price range, the requirement of the automobile etc. The next series of visualizations are regarding this niche where we do a requirement analysis.

The below violin plot shows top existing cars and their dependency on various variables such as age, marital status, price, salary and number of dependents.
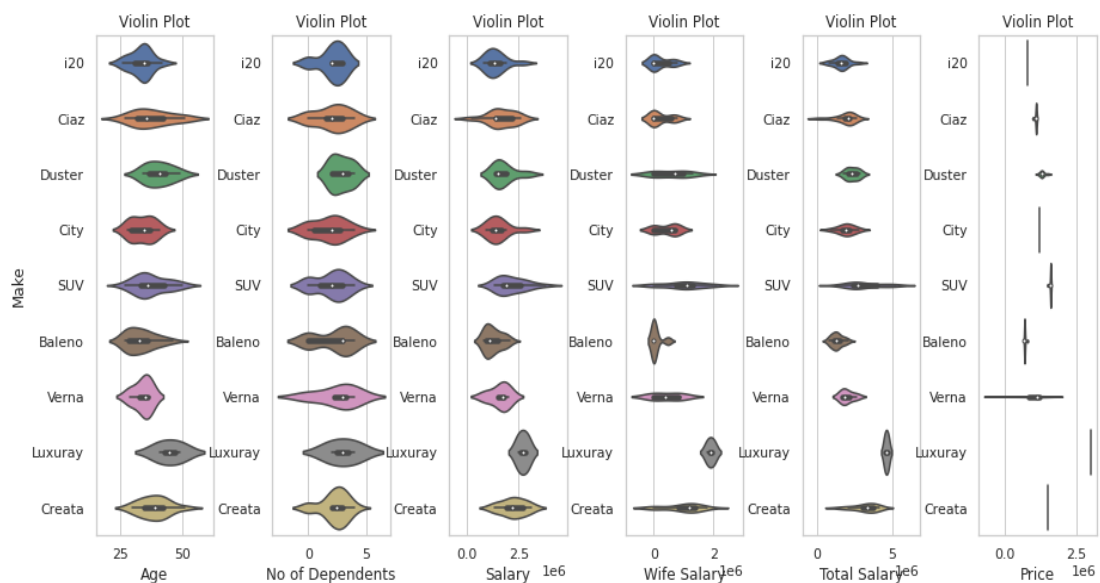

Age:

Younger people have a smaller number of dependents, less salary, and are single so the they are not usually our target segment but they are the most likely to buy electric vehicles are they are informed about climate change and it effects and want to help the Planet. The price range for younger target segment is below 10 Lakhs.

Number of Dependents:

The more the number of dependents, the bigger the need of cars for transportation, here SUVs are preferred for higher target segments.

Salary:

Different demographic has different people of different salaries. This is the main thing we should consider while segmenting the market based on 4-wheeler and 2-wheeler automobiles as higher salaried people are highly likely to purchase a 4-wheeler.
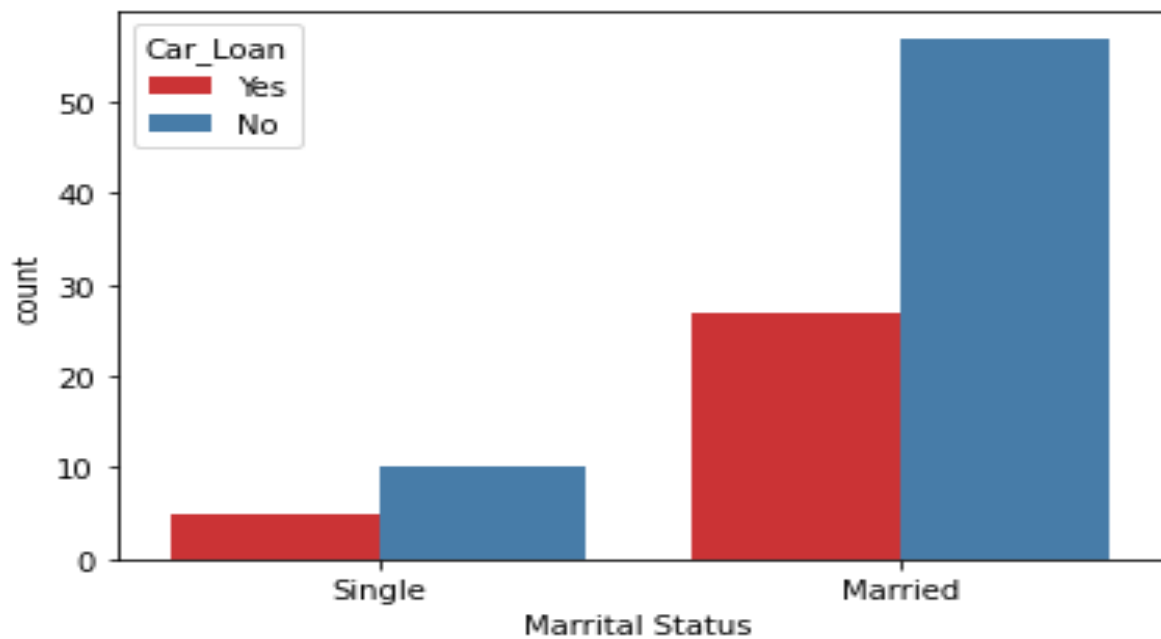
From the below plot, the Age feature importance in the data is evident below,
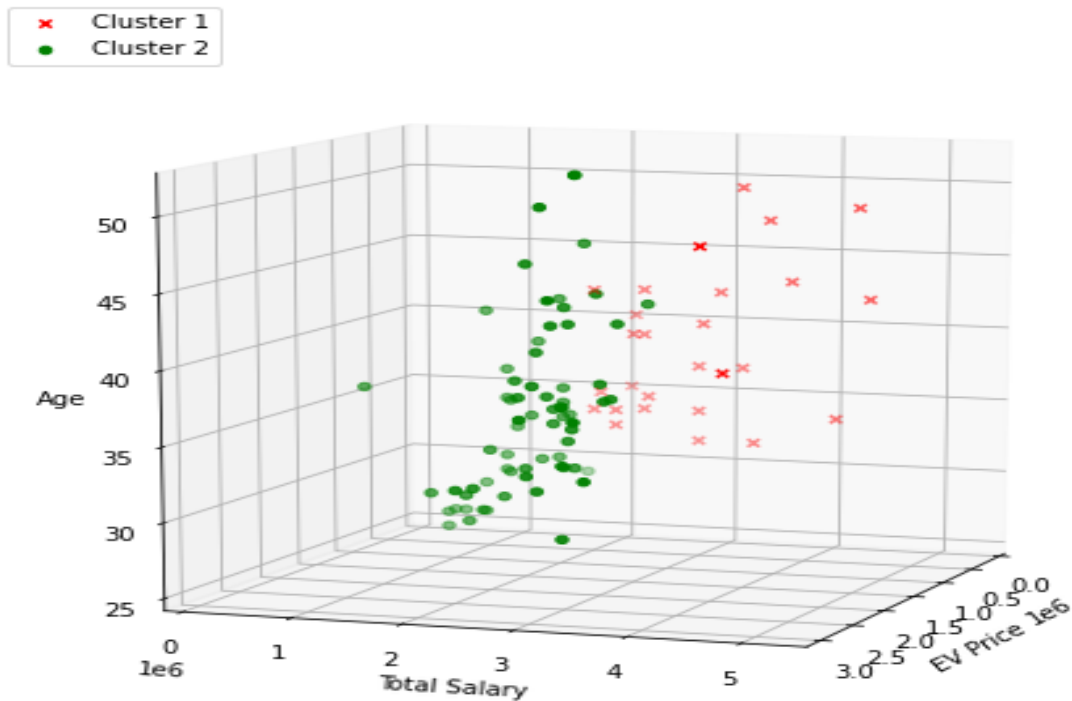
For this analysis , K- Means Clustering is used as it is one of most common exploratory data analysis techniques used to get an intuition about the structure of the data. It can be defined as the task of identifying subgroups in the data such that data points in the same subgroup (cluster) are very similar while data points in different clusters are very different. In other words, we try to find homogeneous subgroups within the data such that data points in each cluster are as similar as possible according to a similarity measure such as Euclidean-based distance or correlation-based distance. The decision of which similarity measure to use is application-specific.

Clustering analysis can be done on the basis of features where we try to find subgroups of samples based on features or on the basis of samples where we try to find subgroups of features based on samples.

Study on the Specification of EV cars

Below plot describes the brands of EV cars which is having greater interest in this market.

Brands in the dataset
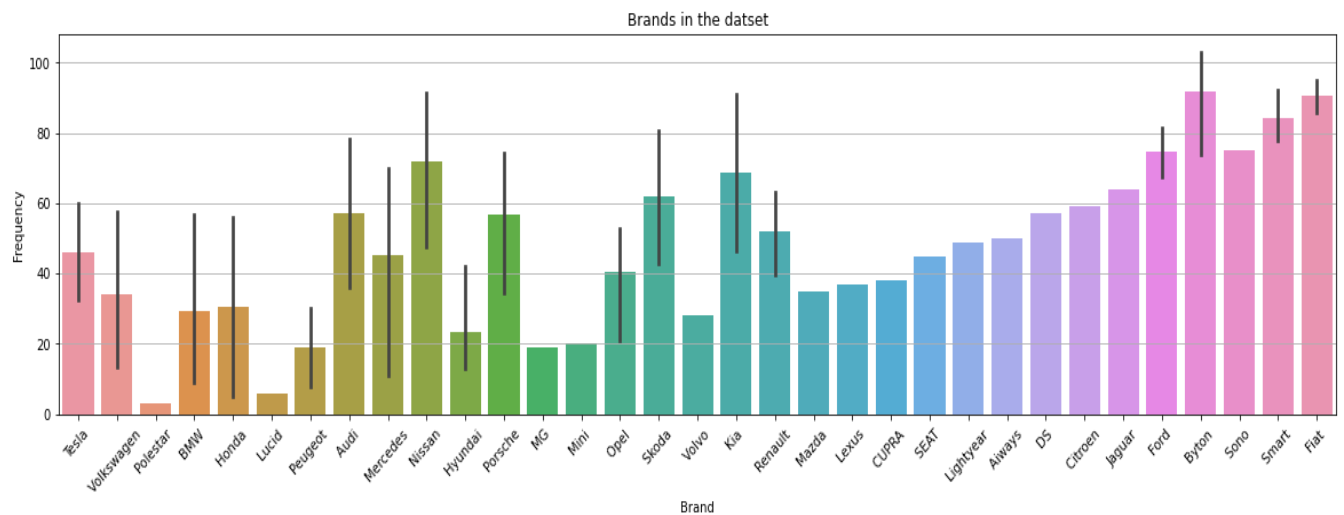
Charging socket for these EV cars will play a important role as based on the charging socket, the plug and the charging station availability should also be considered while buying the cars. It is advisable for the companies to follow the socket design similar to the major players in the current market as the socket design is not standardized , standardization of these socket might be biased towards towards the major players.

Plug Type
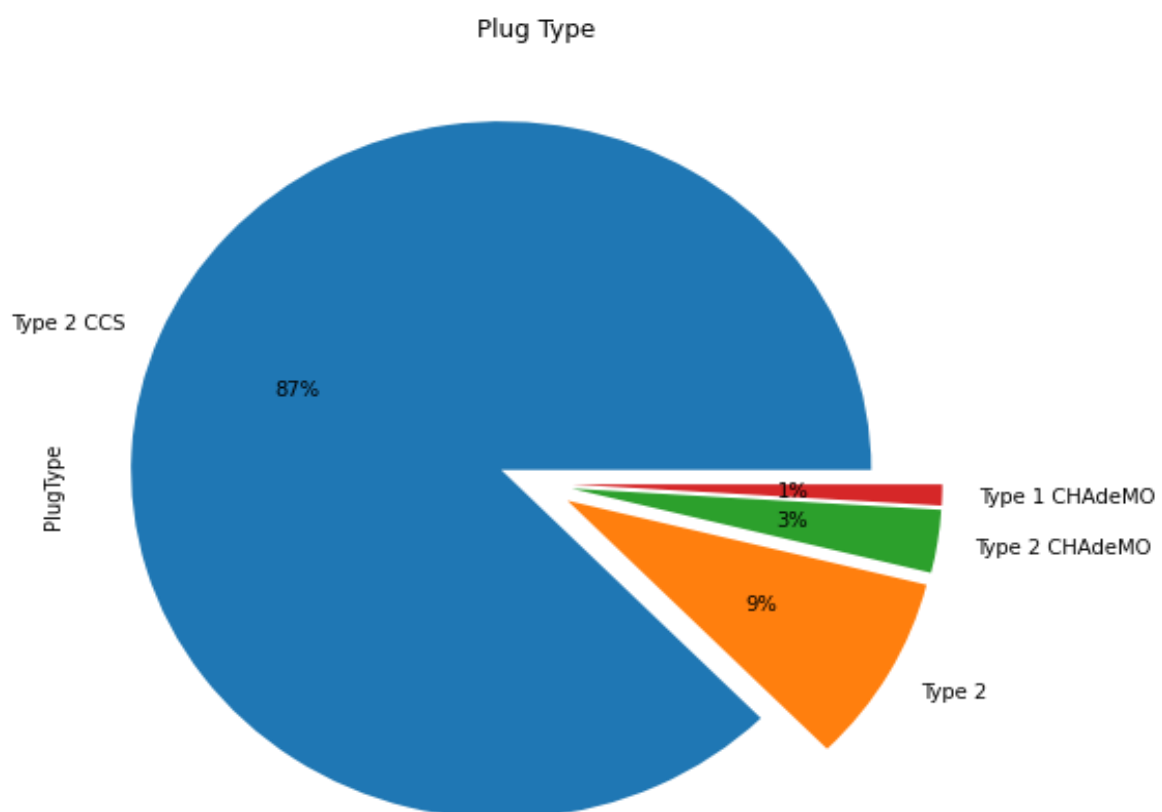
For this Dataset , K means Clustering is used for the analysis,

K Means algorithm is an iterative algorithm that tries to partition the dataset into pre defined distinct non-overlapping subgroups (clusters) where each data point belongs to only one group. It tries to make the intra-cluster data points as similar as possible while also keeping the clusters as different (far) as possible. It assigns data points to a cluster such that the sum of the squared distance between the data points and the cluster's centroid (arithmetic mean of all the data points that belong to that cluster) is at the minimum. The less variation we have within clusters, the more homogeneous (similar) the data points are within the same cluster.

The way k means algorithm works is as follows:

1. Specify number of clusters K.

2. Initialize centroids by first shuffling the dataset and then randomly selecting K data points for the centroids without replacement.

3. Keep iterating until there is no change to the centroids. i.e. assignment of data points to clusters isn't changing.

The approach k-means follows to solve the problem is expectation maximization The E-step is assigning the data points to the closest cluster. The M-step is computing the centroid of each cluster. Below is a breakdown of how we can solve it mathematically.

Highest Sales in EV vehicles

All-Electric EV Sales Share (%)
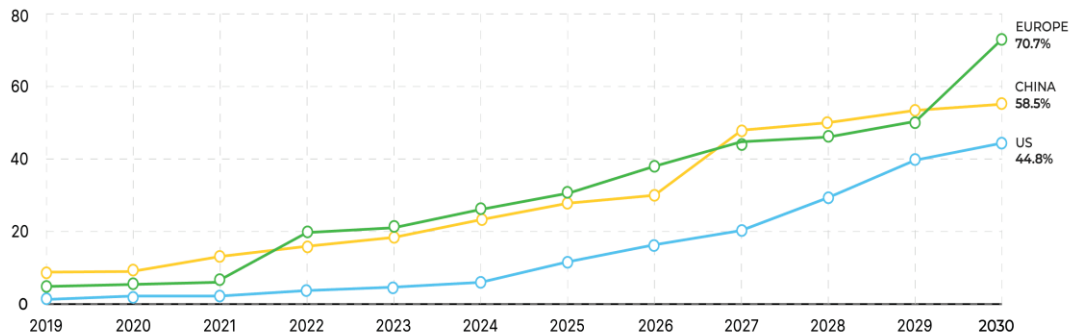
Source: European Automobile Manufacturers' Association (ACEA)

Conclusion

The future of electric vehicles in India holds great promise and is poised for significant growth in the coming years. With supportive government policies, increasing consumer awareness, and advancements in EV technology, the country is well-positioned to embrace this shift toward sustainable transportation.

The increasing demand for EVs is also leading to an expansion of charging infrastructure and the development of locally produced battery technologies. The automotive industry in India is also poised to play a major role in the global shift towards EVs, with the country having the potential to become a leader in this space.

Private companies play a critical role in offering smart digital solutions that will contribute to infrastructure development while acting as a bridge between government agencies and end-users. Initiatives from these companies will help fleet operators make the shift to EVs and OEMs to provide seamless driving experiences to their customers.

Collaboration with local governments will also help expedite the construction of charging stations, along with creating greater awareness among Indian customers. This will contribute to the rapid growth of the EV industry.

It is therefore up to both the public and private sectors to continue working together to make India's ambitious goals a reality. The right combination of innovation and investment has the potential to accelerate the adoption of electric vehicles in India, transforming the country's transportation landscape and contributing to a cleaner, greener future.

Github

https://github.com/mathanprasannakumar/EV_SEGMENTATION