

## **ELECTRIC VECHILES MARKET SEGMENTATION**



Project by

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## **ABSTRACT**

A first aim of this report was to identify specific groups of potential customers of a state-of-the-art electric vehicle. Socio-demographic, psycho-graphic and behavioral variables were included in a questionnaire to identify specific market segments. A second aim was to compare the effect of three different marketing communication strategies on the electric vehicle's perceived product attributes and inclination to change travel behavior according to these attributes. Finally, the last aim was to study how families in daily travel use an electric vehicle. The results show that attitudes towards the electric vehicle depend upon how the vehicles' compatibility, perceived advantage and safety are evaluated, of personal traits like innovativeness, environmental concern, and knowledge, and of background variables like gender, income, and number of vehicles, and that the intention to buy an electric vehicle, in turn, heavily depends on the attitude towards the vehicle.

### **0.Fermi Estimation:**

Fermi estimation is a quick and approximate way to make an estimation based on reasonable assumptions and rough calculations. Here is a Fermi estimation for the given problem statement:

Assumption 1: India has a population of 1.4 billion people

Assumption 2: The vehicle ownership rate in India is around 10%

Assumption 3: The percentage of people who use online vehicle booking services is around 5%

Assumption 4: The average revenue per ride for the online vehicle booking service is around 200 rupees

Assumption 5: The startup needs to generate at least 1 crore rupees per month to sustain itself

Calculation 1: The total addressable market for the online vehicle booking service in India is around  $1.4 \text{ billion} * 10\% = 140 \text{ million people}$

Calculation 2: The potential market for the startup is around  $140 \text{ million} * 5\% = 7 \text{ million people}$

Calculation 3: If each person in the potential market takes 2 rides per month, the total monthly revenue for the startup would be  $7 \text{ million} * 2 * 200 = 28 \text{ crore rupees}$

Calculation 4: The startup needs to capture at least 1 crore rupees of the total monthly revenue, which means it needs to capture around  $1 \text{ crore} / 28 \text{ crore} = 3.5\%$  of the potential market.

Conclusion: Based on this Fermi estimation, the startup needs to target a specific segment of the

7 million potential users and capture at least 3.5% of that segment to generate 1 crore rupees of monthly revenue. The team needs to conduct a detailed segmentation analysis to identify the most profitable segments and come up with a feasible strategy to enter the market. They also need to be prepared for the challenges of data collection and research required for the segmentation tasks.

## **1.Data Sources :**

<https://www.kaggle.com/datasets/nehalbirla/vehicle-dataset-from-cardekho>

<https://www.kaggle.com/datasets/geoffnel/evs-one-electric-vehicle-dataset>

<https://www.openml.org/search?type=data&sort=runs&id=54&status=active>

## **2.Data Pre-Processing:**

In this project we have used Pandas , Numpy and Sklearn Library.

Pandas is a popular Python library for data manipulation and analysis. It provides data structures for efficiently storing and manipulating large datasets, as well as functions for performing common data operations, such as filtering, grouping, joining, and aggregation. Pandas is widely used in data science, finance, and other fields where data analysis and manipulation is required.

The two main data structures provided by Pandas are

**Series:** A one-dimensional array-like object that can hold any data type, such as integers, floats, strings, or even other Python objects.

**DataFrame:** A two-dimensional table-like data structure that consists of rows and columns, similar to a spreadsheet or a SQL table. A DataFrame can be thought of as a collection of Series objects, where each column of the DataFrame is a Series.

Some of the key features of Pandas include

**Data cleaning and preparation:** Pandas provides functions for handling missing data, converting data types, and removing duplicates.

**Data exploration:** Pandas allows for slicing and filtering of data, grouping and aggregating data.

**NumPy** is a popular Python library for scientific computing, especially for working with numerical data. NumPy provides a powerful N-dimensional array object, along with functions

for performing a variety of mathematical operations on arrays. It is widely used in fields such as data science, machine learning, and scientific research.

The main data structure provided by NumPy is the ndarray, which is a multi-dimensional array that can hold elements of any data type, such as integers, floats, or complex numbers. NumPy arrays are much more efficient than Python's built-in lists for numerical operations, because they are implemented in C and use contiguous blocks of memory. NumPy also provides a large number of mathematical functions that can be applied to arrays, such as matrix operations, trigonometric functions, and statistical functions.

Scikit-learn (often abbreviated as sklearn) is a popular open-source Python library for machine learning. It provides a wide range of algorithms for supervised and unsupervised learning, as well as tools for model selection, data preprocessing, and data visualization. Scikit-learn is built on top of NumPy, SciPy, and matplotlib, and is widely used in academia, industry, and research.

### **3. Segmentation Extraction:**

Clustering: Clustering is a machine learning technique used to group similar data points together into distinct clusters based on some measure of similarity or distance. It is a common unsupervised learning technique used to find patterns in unlabeled data.

In clustering, the goal is to group data points in such a way that points in the same cluster are more similar to each other than to points in other clusters. This involves identifying a set of features that best represent the data and selecting an appropriate distance metric or similarity measure to compare the data points. There are many clustering algorithms available, including k-means, hierarchical clustering, DBSCAN, and Gaussian mixture models, among others.

Clustering has many applications, including data analysis, image and signal processing, bioinformatics, and customer segmentation. It is often used as a preprocessing step for other machine learning tasks, such as classification or anomaly detection.

Clustering technique are divided into several types . In this project we have used K-means clustering.

K-means is a popular clustering algorithm that is used to partition a given set of data points into k clusters. The goal of k-means is to find k centroids (points that are the center of each cluster) in a way that minimizes the distance between the data points and their respective centroids

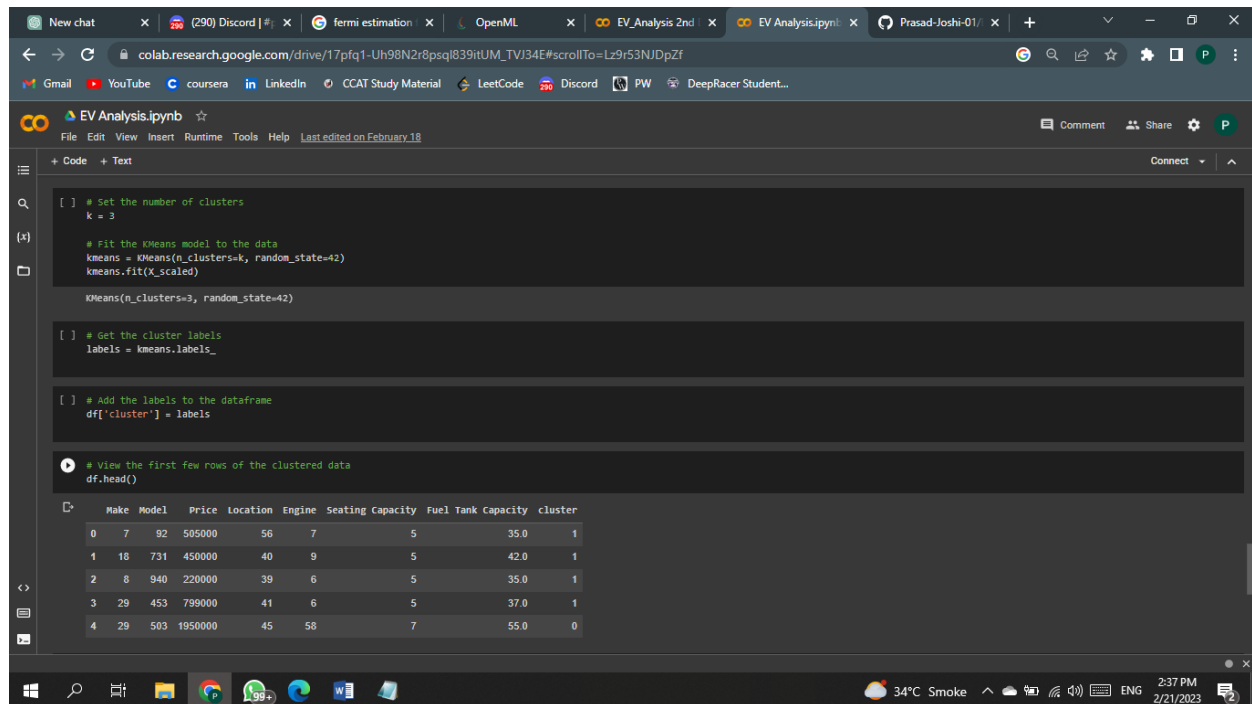
Here's how the k-means algorithm works:

Choose k initial centroids randomly from the data points.

Assign each data point to the nearest centroid based on the Euclidean distance between the point

and the centroid.

Recalculate the centroid of each cluster as the mean of all data points assigned to that cluster.



```
[ ] # Set the number of clusters
k = 3

# Fit the KMeans model to the data
kmeans = KMeans(n_clusters=k, random_state=42)
kmeans.fit(X_scaled)

KMeans(n_clusters=3, random_state=42)

[ ] # Set the cluster labels
labels = kmeans.labels_

[ ] # add the labels to the dataframe
df['cluster'] = labels

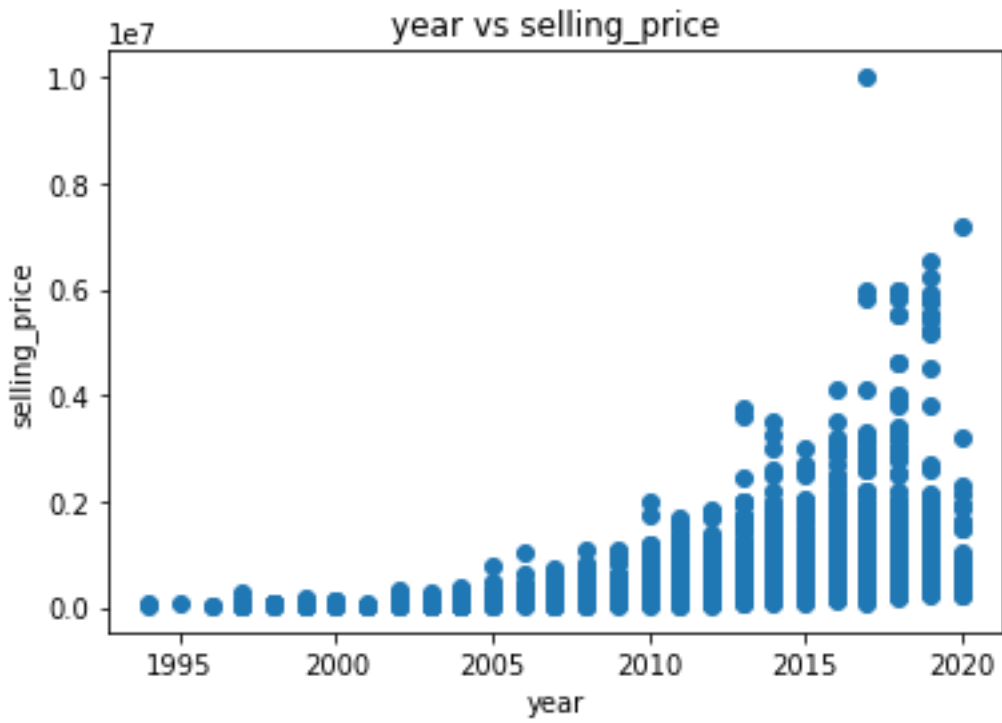
# view the first few rows of the clustered data
df.head()
```

	Make	Model	Price	Location	Engine	Seating Capacity	Fuel Tank Capacity	cluster
0	7	92	505000	56	7	5	35.0	1
1	18	731	450000	40	9	5	42.0	1
2	8	940	220000	39	6	5	35.0	1
3	29	453	799000	41	6	5	37.0	1
4	29	503	1950000	45	58	7	55.0	0

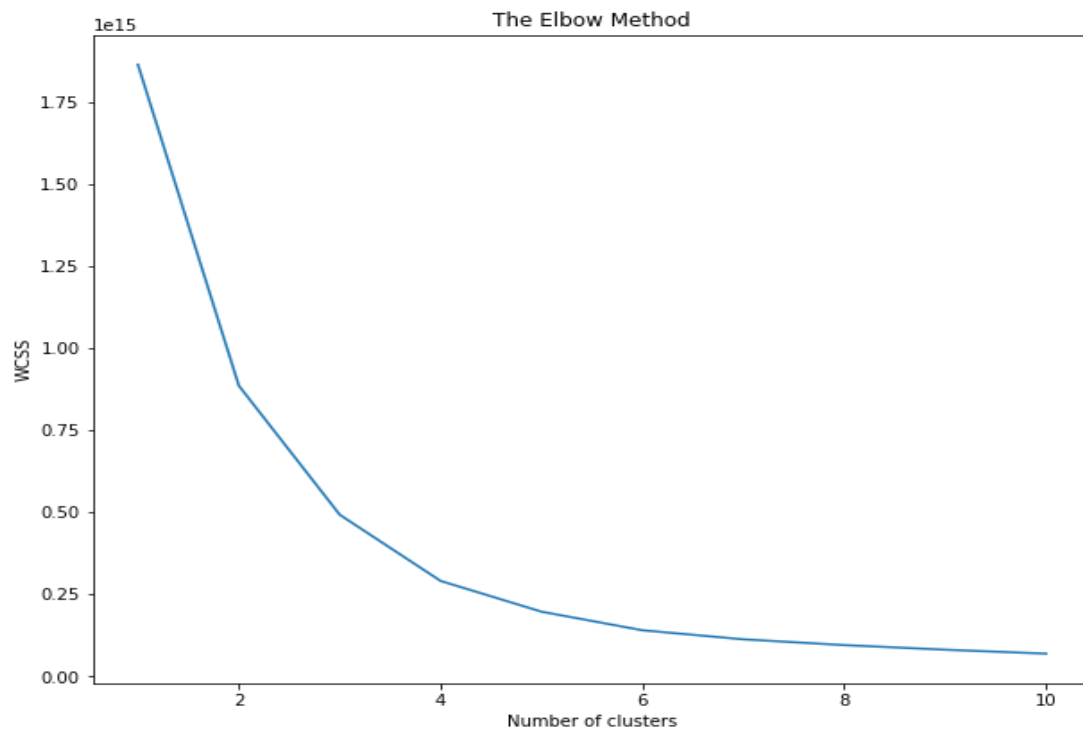
Repeat steps 2 and 3 until the centroids no longer change or a maximum number of iterations is reached.

The result of the k-means algorithm is k clusters, where each cluster is represented by a centroid. The algorithm can be sensitive to the initial placement of centroids, so it is often run multiple times with different initializations to improve the chances of finding a good solution.

K-means has many practical applications, such as customer segmentation, image segmentation, and anomaly detection. However, it has some limitations, such as the requirement for the user to specify the number of clusters (k) in advance, the sensitivity to the initial placement of centroids, and the assumption that clusters are spherical and equally sized.



Above graph shows the relationship between Year and the selling price.



#### **4. Profiling and describing potential segments:**

Profiling and describing potential segments in the EV market involves analyzing the characteristics and behavior of different groups of consumers who are interested in purchasing electric vehicles. By understanding the needs and preferences of these segments, automakers can design and market their products more effectively, and policymakers can develop policies that encourage the adoption of electric vehicles.

Here are some potential segments in the EV market and their characteristics:

**Early adopters:** These are consumers who are enthusiastic about new technology and are often willing to pay a premium for it. They are likely to be interested in EVs because of their environmental benefits, and they may be attracted to EVs that have the latest technology and features.

**Urban drivers:** These are consumers who live in cities and may be attracted to EVs because of their low emissions and reduced noise pollution. They may be interested in compact EVs that are easy to maneuver in urban environments.

**Commuters:** These are consumers who use their cars primarily for commuting to work or school. They may be interested in EVs that have a long range and are affordable to operate, and they may be attracted to EVs that can be charged quickly.

**Fleet operators:** These are companies or organizations that operate large fleets of vehicles, such as delivery companies or taxi services. They may be interested in EVs that are cost-effective and have low maintenance costs, and they may be attracted to EVs that have a long range and can be charged quickly.

**Budget-conscious consumers:** These are consumers who are interested in EVs primarily because of their low operating costs. They may be attracted to EVs that have a low purchase price and are affordable to maintain and operate.

To profile and describe these segments, analysts would typically use data from market research surveys, sales data, and other sources to identify common characteristics and behaviors. They might also use clustering algorithms to group consumers based on similarities in their demographic, geographic, and psychographic characteristics.

Once the segments have been identified, automakers and policymakers can develop targeted marketing campaigns and policies to encourage the adoption of EVs among each segment. For example, automakers might design and market different types of EVs to appeal to different segments, while policymakers might offer incentives and subsidies that are targeted to specific segments.

## **5. Selection of target segment:**

The selection of a target segment in the EV market depends on various factors such as market size, growth potential, competitive landscape, and the company's goals and resources. Here are some key considerations when selecting a target segment in the EV market:

**Market size:** Companies should evaluate the size of the market and the potential demand for EVs in different segments. They should consider factors such as the number of potential customers, the frequency of purchases, and the overall revenue potential of each segment.

**Growth potential:** Companies should also consider the growth potential of each segment. They should evaluate trends in consumer behavior, government regulations, and technological advancements that could impact the demand for EVs in each segment.

**Competitive landscape:** Companies should evaluate the competition in each segment, including the number of competitors, their market share, and their competitive advantage. They should consider the strengths and weaknesses of each competitor and evaluate their ability to compete effectively in each segment.

**Goals and resources:** Companies should consider their own goals and resources when selecting a target segment. They should evaluate their marketing and distribution capabilities, as well as their product development and production capabilities. They should also consider their financial resources and their ability to invest in research and development, marketing, and other activities necessary to succeed in each segment.

Based on these considerations, companies may choose to target one or more segments in the EV market. For example, a company may choose to target urban drivers who are interested in EVs because of their low emissions and reduced noise pollution. They may develop and market compact EVs that are well-suited for urban environments and offer features such as fast charging and advanced safety features. Another company may choose to target early adopters who are interested in the latest technology and may be willing to pay a premium for it. They may develop and market high-end EVs that offer the latest technology and advanced features.

Overall, the selection of a target segment in the EV market requires careful consideration of market size, growth potential, competitive landscape, and the company's goals and resources. By targeting the right segment, companies can improve their chances of success in the highly competitive and rapidly evolving EV market.



## **6. Customizing the Marketing Mix:**

Customizing the marketing mix in the EV market involves tailoring the product, price, promotion, and distribution strategies to meet the needs and preferences of different customer segments. Here are some ways to customize the marketing mix in the EV market:

**Product:** Companies can customize their products to meet the needs of different customer segments. For example, they can offer EVs with different range options to meet the needs of customers who have different driving patterns. They can also offer different sizes and models of EVs to appeal to customers with different preferences and budgets

**Price:** Companies can customize their pricing strategies to appeal to different customer segments. For example, they can offer incentives and rebates to budget-conscious customers who are sensitive to price. They can also offer premium features and upgrades to customers who are willing to pay more for the latest technology and advanced features.

**Promotion:** Companies can customize their promotional strategies to reach different customer segments. For example, they can use social media and digital marketing to reach younger customers who are more likely to use these channels. They can also use traditional media, such as television and radio, to reach older customers who may be less likely to use digital channels.

**Distribution:** Companies can customize their distribution strategies to reach different customer segments. For example, they can offer home delivery and installation services for customers who are less likely to visit dealerships. They can also offer test drive opportunities and in-person consultations for customers who prefer a more hands-on approach.

Overall, customizing the marketing mix in the EV market requires a deep understanding of customer needs and preferences. Companies must use market research and data analysis to identify different customer segments and tailor their product, price, promotion, and distribution strategies accordingly. By customizing the marketing mix, companies can better meet the needs of their customers, differentiate themselves from competitors, and improve their chances of success in the highly competitive EV market.

## **7. Potential customer base in the early market, thereby calculating the potential sale (profit) in the early market:**

Assuming that India has a population of approximately 1.3 billion people, and assuming that the percentage of people who can afford to buy a car is around 10%, we can estimate that the potential car-buying population in India is around 130 million people.

Next, assuming that the percentage of people who might be interested in buying an EV is around 5%, we can estimate that the potential EV-buying population in India is around 6.5 million people.

Based on data from the Society of Indian Automobile Manufacturers (SIAM), EV sales in India reached 56,000 units in the financial year 2020-2021. Assuming that the growth rate of EV sales continues at a rate of around 50% per year, we can estimate that EV sales in India might reach around 84,000 units in the financial year 2021-2022 and around 126,000 units in the financial year 2022-2023.

Based on these estimates, we can conclude that the EV market in India is still relatively small, with significant potential for growth in the coming years. However, there are several factors that could impact the growth of the market, including government policies and incentives, availability of charging infrastructure, and the cost and quality of EVs compared to traditional vehicles.

## **8.Conclusion :**

Price segmentation:

The Indian vehicle market can be segmented based on price into four categories, which are entry-level, mid-range, premium or luxury, and ultra-luxury or exotic segments.

Mileage segmentation:

The Indian market is very sensitive to fuel efficiency, and therefore mileage is an important factor in vehicle segmentation. Vehicles that offer high mileage are popular in India, and as a result, this segment can be further divided into:

Economy segment: Vehicles in this segment offer excellent mileage and are priced competitively. The price range for this segment typically falls between INR 3-8 lakhs.

Mid-range segment: Vehicles in this segment offer good mileage along with better features and amenities than economy segment vehicles. The price range for this segment is usually between INR 8-15 lakhs. Examples of vehicles in this segment include the Honda City, Hyundai Verna, and Toyota Yaris.

Location segmentation:

The Indian market is very diverse, and vehicle demand varies greatly from one region to another. Therefore, vehicle segmentation can also be based on the location. For example:

Urban segment: Vehicles in this segment are designed for urban areas and offer good maneuverability, compact size, and better fuel efficiency. Examples of vehicles in this segment

include the Maruti Suzuki Swift, Hyundai i20, and Tata Nexon.

Rural segment: Vehicles in this segment are designed for rural areas and offer good ground clearance, robust build quality, and better performance on rough roads. Examples of vehicles in this segment include the Mahindra Bolero, Tata Sumo.

It is important to note that these segments are not mutually exclusive, and some vehicles may fit into multiple segments depending on their price, mileage, and location characteristics. Additionally, these segments may change over time based on shifting consumer preferences and market trends.

**GitHub Link:**

<https://github.com/Prasad-Joshi-01/EV-Market-Segmentation>