MARKET SEGMENTATION ANALYSIS

FOR EV MARKET

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1. Problem Statement (EV Market)

You are a team working under an Electric Vehicle Startup. The Startup is still deciding in which vehicle/customer space it will be develop its EVs. You have to analyse the Electric Vehicle market in India using Segmentation analysis and come up with a feasible strategy to enter the market, targeting the segments most likely to use Electric vehicles.

2. Fermi Estimation

To analyze the Electric Vehicle market in India, we can use Segmentation analysis to identify different customer segments and their needs. Based on that, we can come up with a feasible strategy to enter the market, targeting the segments most likely to use Electric vehicles. Segmentation analysis involves dividing the market into groups of consumers based on their common needs, preferences, and behaviors. The key variables used in the segmentation analysis include demographics, psychographics, geography, and behavior.

Here are some of the customer segments that could be targeted in the Indian Electric Vehicle market:

1. **Early adopters:** These are customers who are interested in new technology and are willing to pay a premium for it. They are likely to be young, urban, and affluent.
2. **Environmentalists:** These customers are concerned about the environment and want to reduce their carbon footprint. They are likely to be educated and urban.
3. **Commercial users:** These customers are businesses that have fleets of vehicles that they use for delivery or transportation. They are interested in reducing their operating costs and may be willing to switch to electric vehicles if they can save money.
4. **Government and institutional buyers:** The Indian government has set a target to have 30% of all vehicles on the road be electric by 2030. This means that government and institutional buyers are likely to be significant customers for Electric Vehicles in India.
5. **Cost-conscious customers:** These customers are interested in reducing their fuel costs and may be willing to switch to electric vehicles if they can save money.

Based on these customer segments, a feasible strategy for entering the Indian Electric Vehicle market could be:

1. Launching a high-end electric vehicle that targets early adopters and environmentalists. This vehicle could be priced at a premium to reflect the premium technology and features.
2. Developing low-cost electric vehicles for commercial users and cost-conscious customers. These vehicles could be priced competitively to reflect the cost savings.
3. Partnering with the Indian government to supply electric vehicles for their fleets.

4. Partnering with other institutions, such as universities or hospitals, to supply electric vehicles for their transportation needs.

Assuming that there are 2 million new cars sold in India every year, and we expect to capture 1% of that market in the first year, our target would be to sell 20,000 electric vehicles in the first year. If we estimate that the early adopters segment represents 10% of the market, then our target market would be around 2000 customers in the first year. Assuming a premium pricing of Rs. 20 lakhs for our high-end electric vehicle, we can expect to generate revenue of around Rs. 400 crores in the first year. For the low-cost electric vehicles, assuming a pricing of Rs. 10 lakhs, and targeting the commercial users and cost-conscious customers, we can expect to capture 50% of the market, which would be around 10,000 vehicles in the first year. This would generate revenue of around Rs. 100 crores. Partnering with the Indian government could provide a significant boost to our sales. If we are able to supply 5000 electric vehicles to the government in the first year, this would generate revenue of around Rs. 100 crores. Overall, in the first year, we can expect to generate revenue of around Rs. 600 crores from the Indian Electric Vehicle market.

3. Data Pre-processing (Steps and Libraries used)

Implementation Packages/Tools used:

1. Numpy: To calculate various calculations related to arrays.

2. Pandas: To read or load the datasets.

- **Data-Preprocessing**
  The small amount of data gathered is used in both clustering and visualisation applications. The workflow makes use of NumPy, Pandas, Scikit-Learn, and SciPy libraries, and the results are guaranteed to be reproducible. In order to obtain the results from both datasets, two datasets were used.

 Implementation of Data Preprocessing:

```
[1] # importing the dependencies
    import pandas as pd
    import matplotlib.pyplot as plt
    import seaborn as sns
    from sklearn.model_selection import train_test_split
    from sklearn.preprocessing import StandardScaler
    from sklearn.decomposition import PCA
    from sklearn.cluster import KMeans
```

Pulling the datasets

|	Brand	Model	AccelSec	TopSpeed_KmH	Range_Km	Efficiency_WhKm	FastCharge_KmH	RapidCharge	PowerTrain	PlugType	BodyStyle	Segment	Seats	PriceEuro
0	Tesla	Model 3 Long Range Dual Motor	4.6	233	450	161	940	Yes	AWD	Type 2 CCS	Sedan	D	5	55480
1	Volkswagen	ID.3 Pure	10.0	160	270	167	250	No	RWD	Type 2 CCS	Hatchback	C	5	30000
2	Polestar	2	4.7	210	400	181	620	Yes	AWD	Type 2 CCS	Liftback	D	5	56440
3	BMW	iX3	6.8	180	360	206	560	Yes	RWD	Type 2 CCS	SUV	D	5	68040
4	Honda	e	9.5	145	170	168	190	Yes	RWD	Type 2 CCS	Hatchback	B	4	32997

- **EDA**

  Beginning with some data analysis without principal component analysis and some principal component analysis in the dataset created by combining all of the data, we begin the exploratory data analysis. With the use of orthogonal transformation, PCA is a statistical technique that transforms the observations of correlated features into a set of linearly uncorrelated features. The Major Components are the name given to these newly transformed features. The method aids in the cost-effectiveness of classification, regression, or any other type of machine learning by lowering the dimensions of the data.
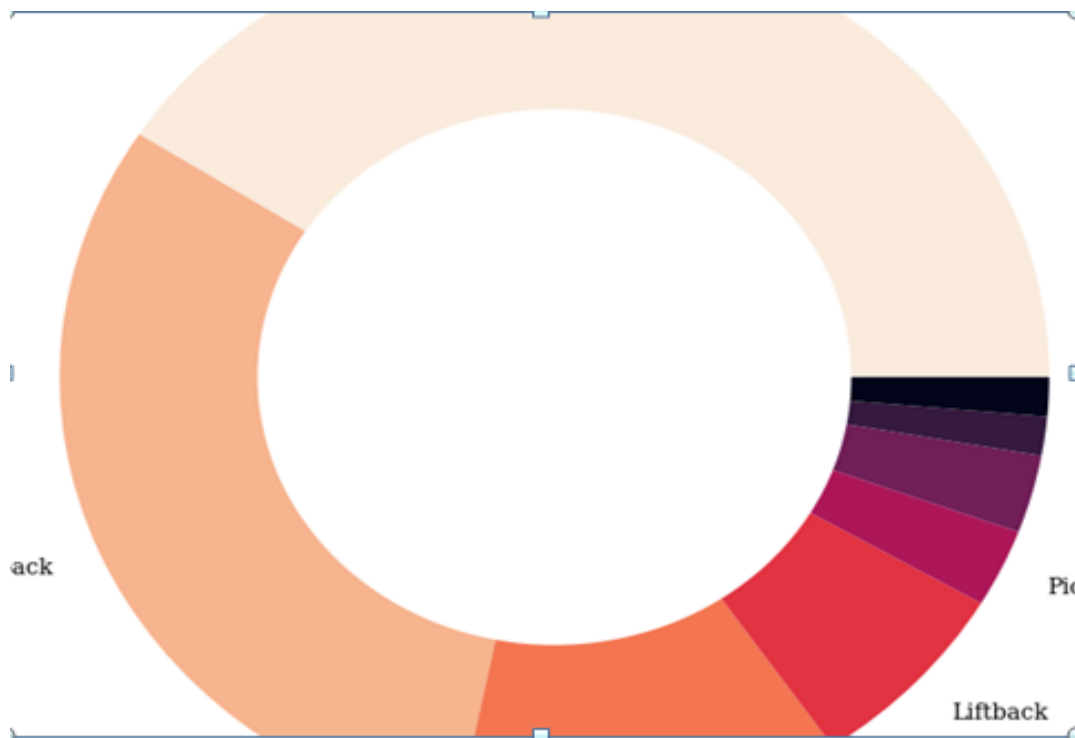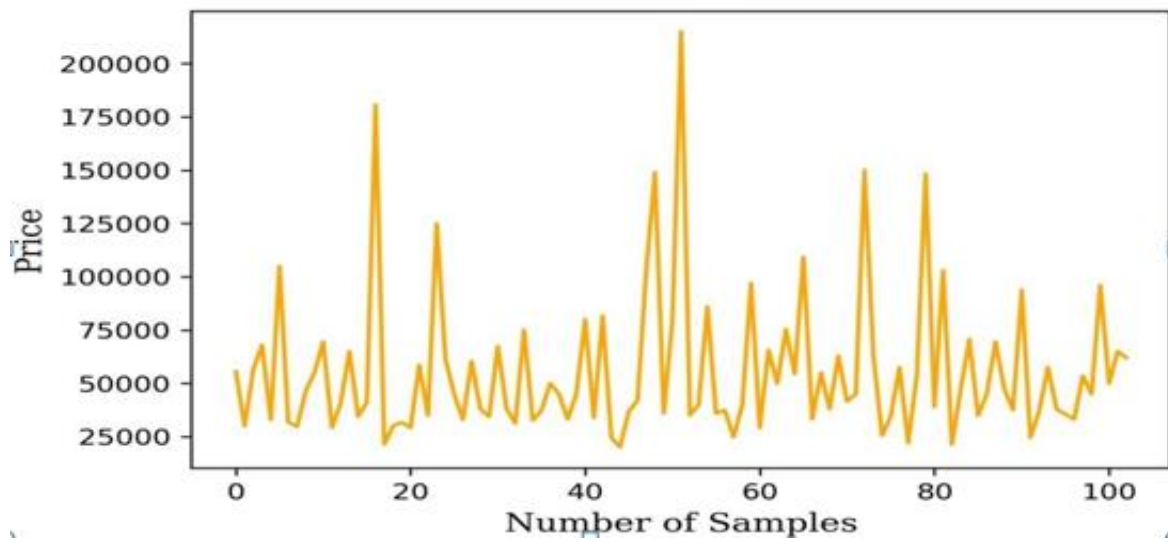
Implementation

Number of EV Models Manufactured by a Brand
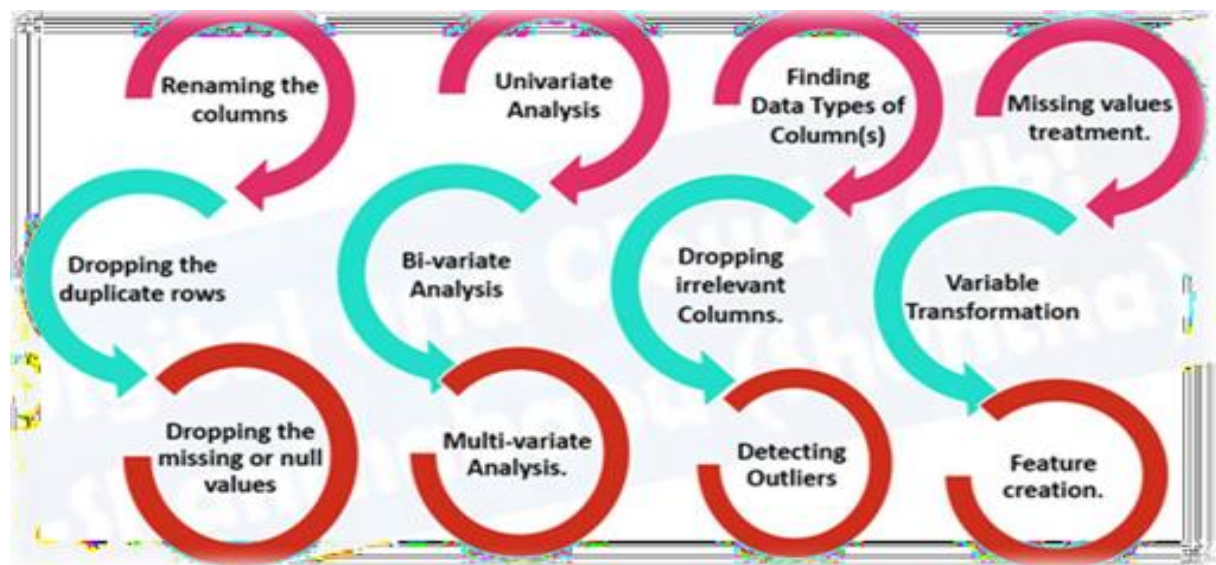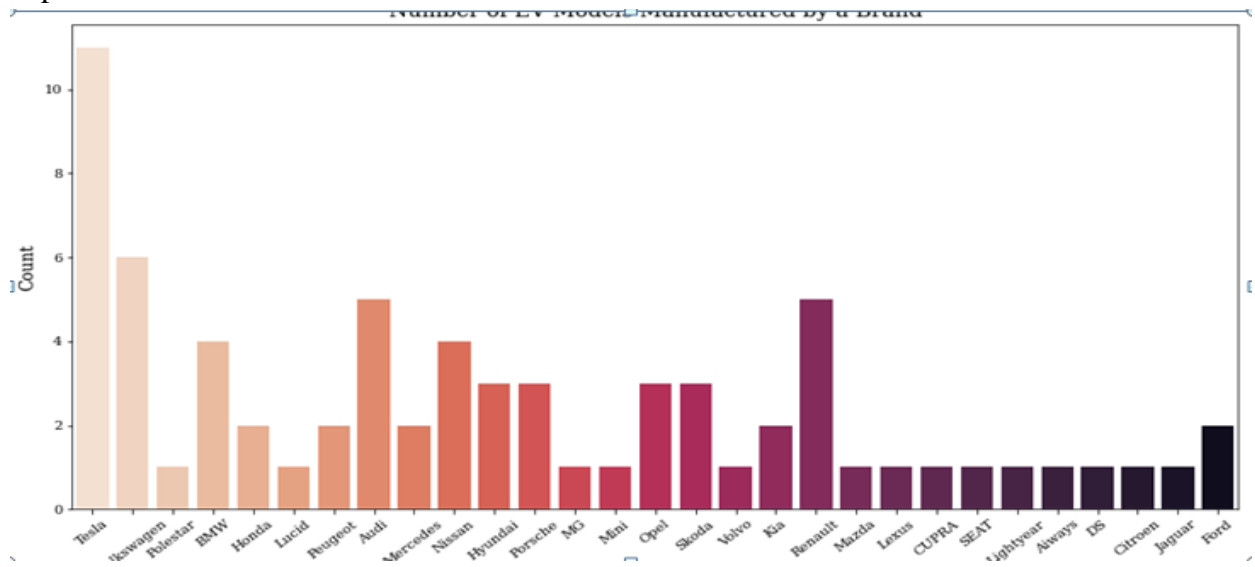
Types of EV plugs available in India

Available Plug Types of EVs in India
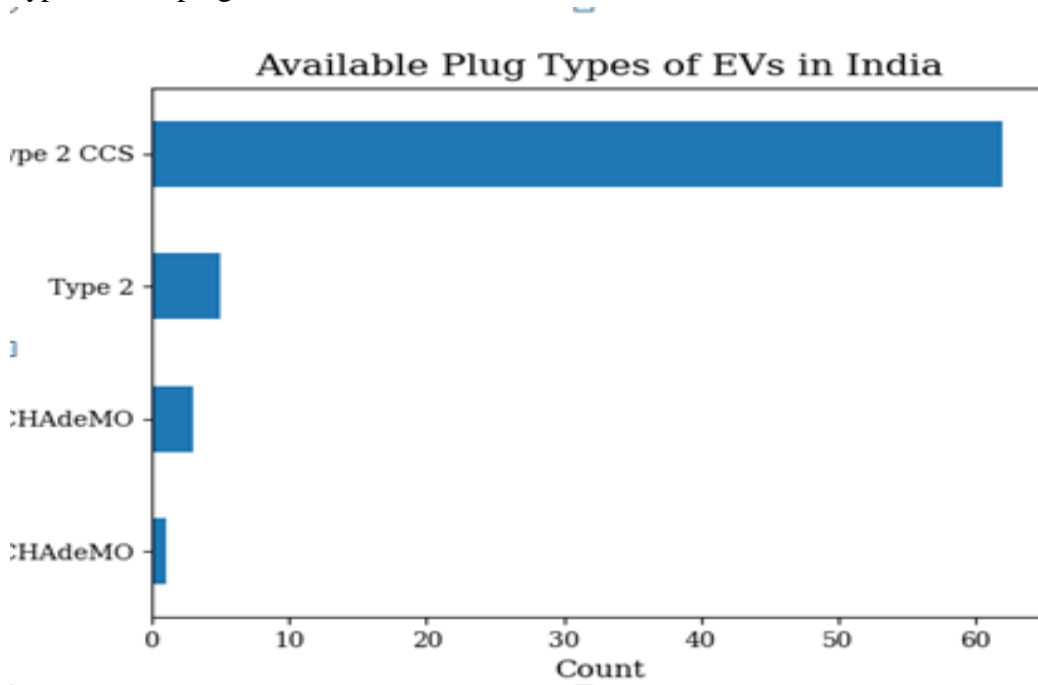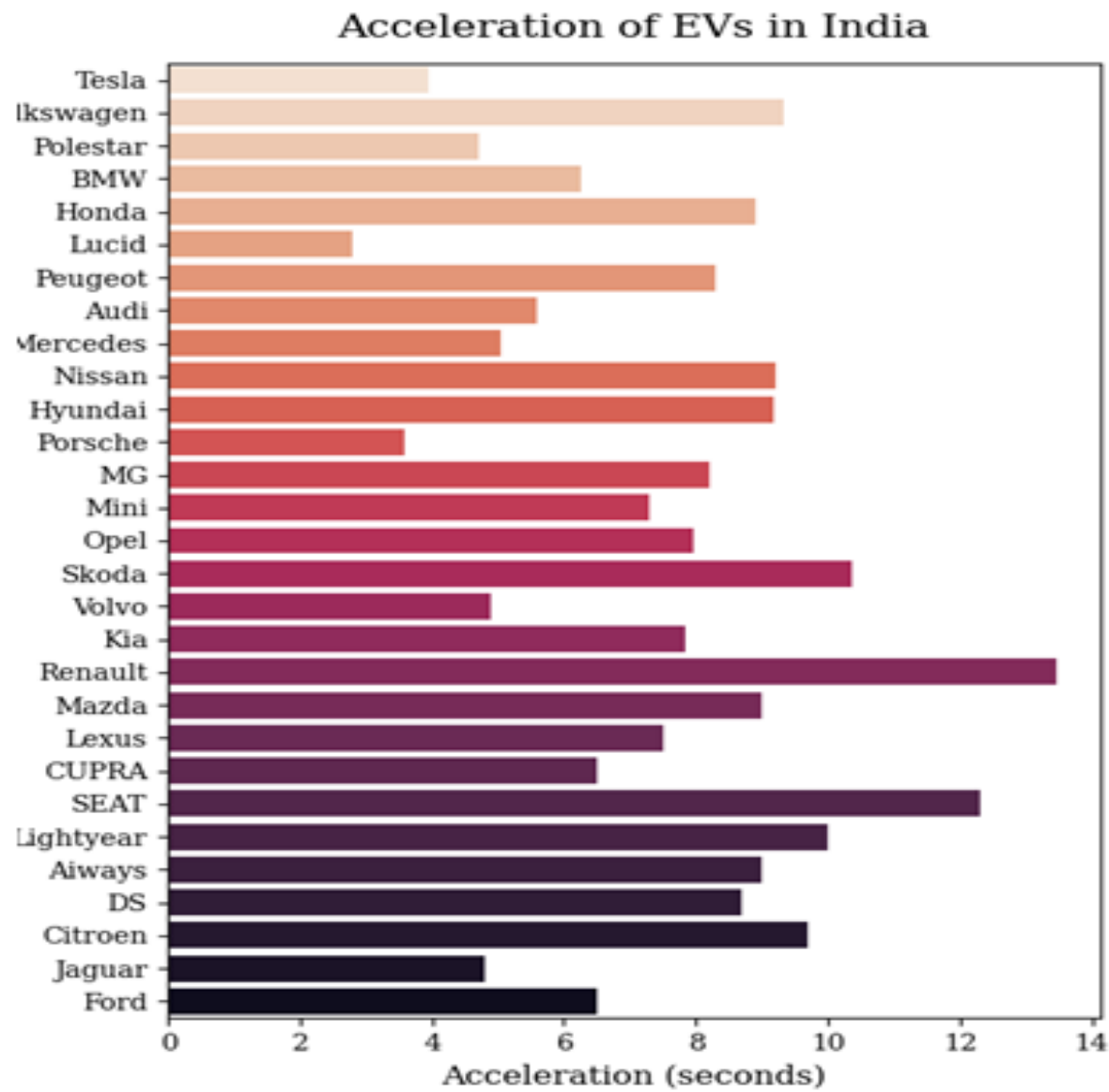
Price comparison different brands of EVs in India

Comparison of different brands of EVs based on Acceleration

Acceleration of EVs in India

Comparison of different brands of EVs based on Speed

Brand-wise Speed Comparison of EVs in India
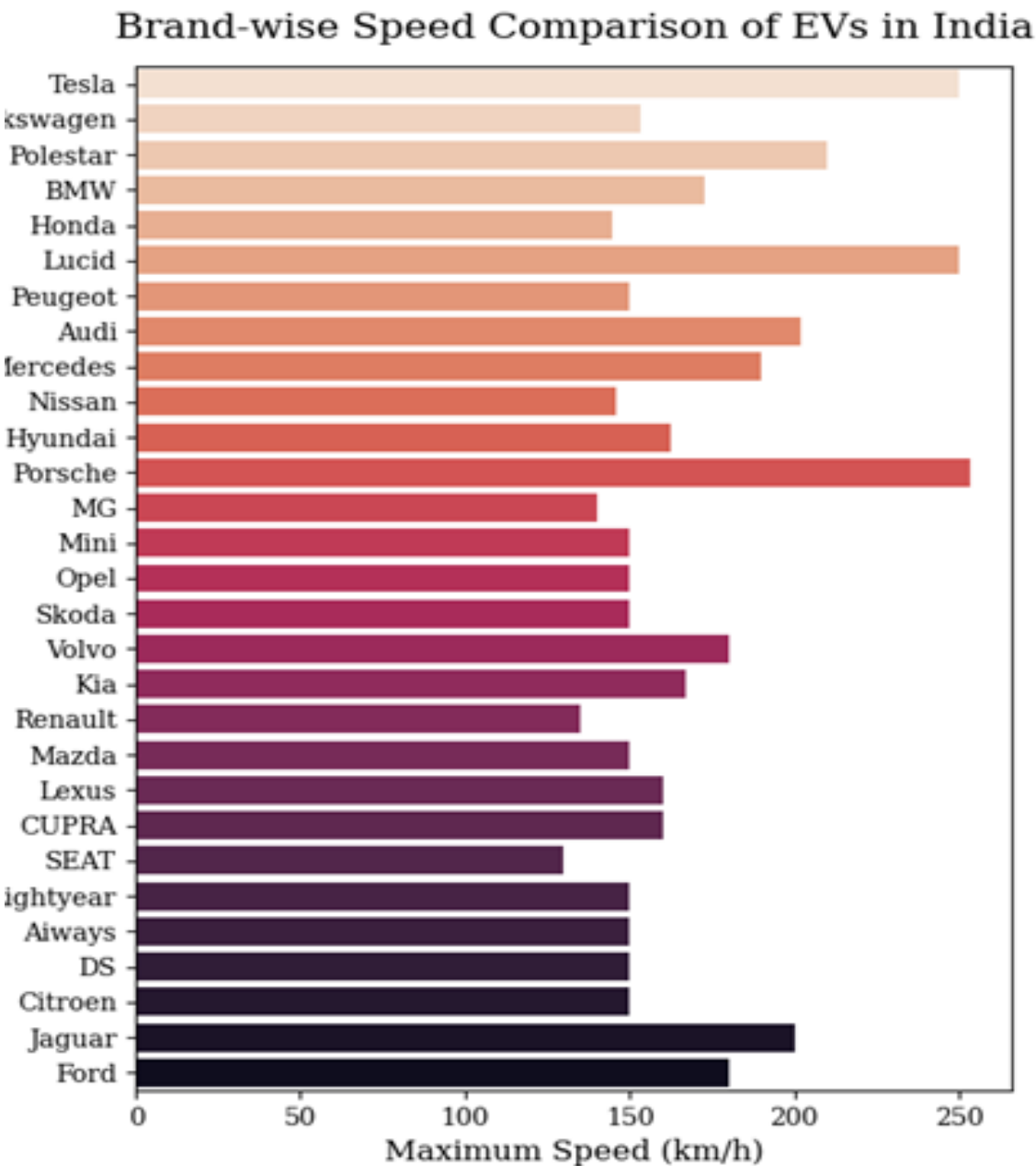
EV segments in India

Electric Vehicles of Different Segments in India

Correlation Matrix

	AccelSec	eed_KmH	ange_Km	y_WhKm	rge_KmH	Seats	PriceEuro
AccelSec	1.00	-0.76	-0.65	-0.36	-0.72	-0.07	-0.58
eed_KmH	-0.76	1.00	0.76	0.34	0.79	0.06	0.82
ange_Km	-0.65	0.76	1.00	0.34	0.72	0.17	0.73
y_WhKm	-0.36	0.34	0.34	1.00	0.31	0.23	0.33
rge_KmH	-0.72	0.79	0.72	0.31	1.00	0.18	0.66
Seats	-0.07	0.06	0.17	0.23	0.18	1.00	-0.08
PriceEuro	-0.58	0.82	0.73	0.33	0.66	-0.08	1.00

Correlation Matrix

Pairplot of EV Dataset
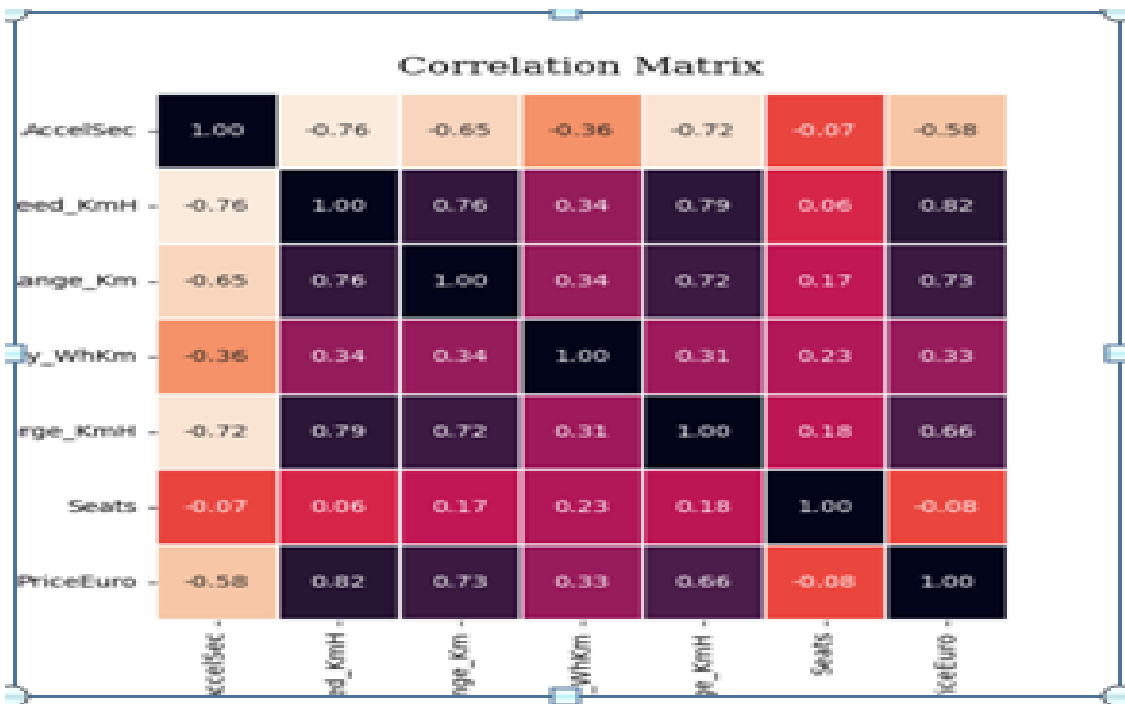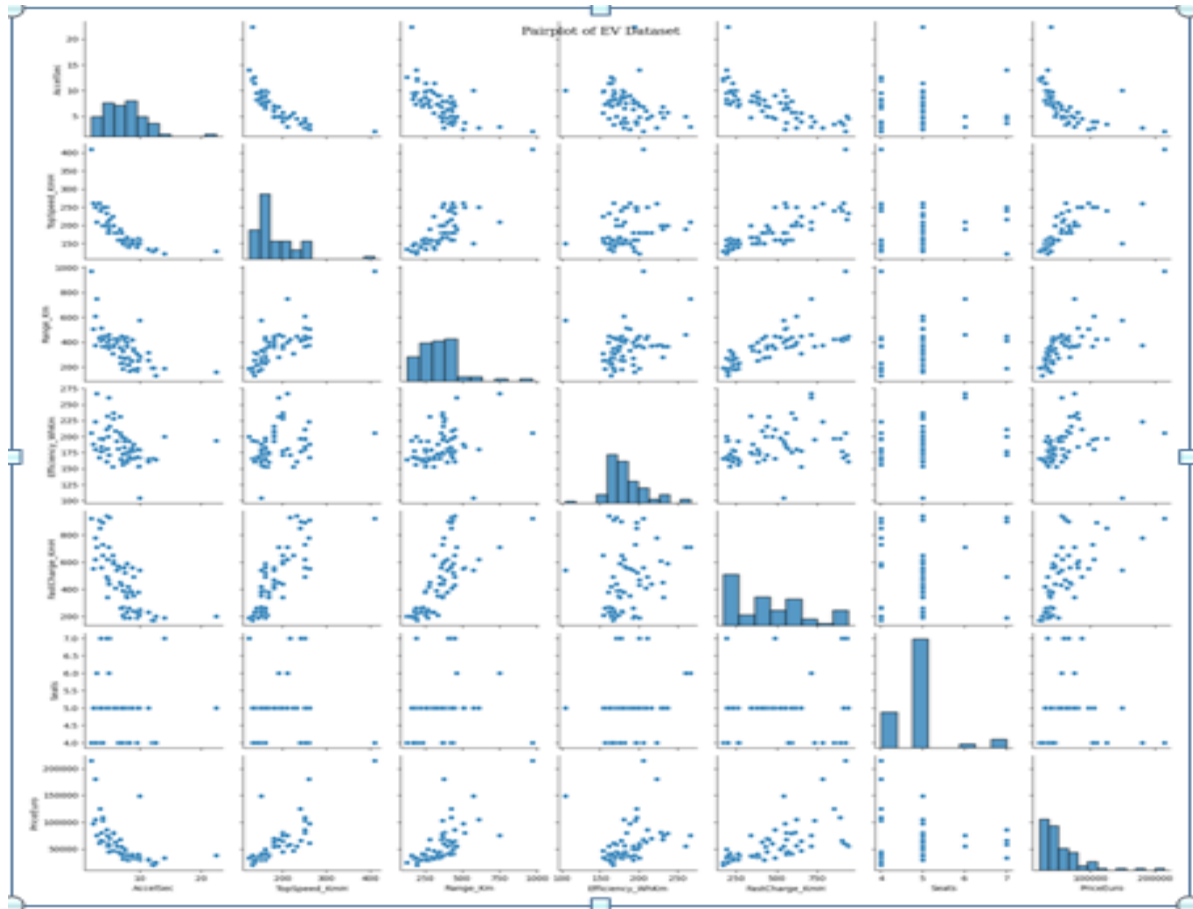
4. Segment Extraction (ML techniques used)

To perform segmentation analysis of the Electric Vehicle market in India, we can use various ML techniques such as clustering, decision trees, random forests, and neural networks. Here, we will use clustering techniques to extract meaningful segments.

We can use the following steps to perform segmentation analysis:

1. **Data Collection:** Collect data on Electric Vehicle users in India, including demographic, psychographic, and behavioral variables.
2. **Data Preprocessing**: It is an important step in machine learning that involves cleaning, transforming, and preparing the data for analysis. The goal of data preprocessing is to ensure that the data is accurate, complete, and ready for modeling. Some of the common machine learning pre-processing techniques include:
   - **Data Cleaning**: This involves removing or imputing missing values, dealing with outliers, and correcting inconsistent or erroneous data.

- **Feature Scaling**: This involves scaling the features to the same range, so that they have similar magnitudes and contribute equally to the model. Common scaling techniques include Min-Max scaling, Z-score normalization, and Log transformation.
- **Feature Encoding:** This involves converting categorical variables into numerical values, so that they can be used in machine learning models. Common encoding techniques include One-Hot Encoding, Label Encoding, and Binary Encoding.
- **Dimensionality Reduction:** This involves reducing the number of features in the dataset while preserving as much information as possible. Common techniques include Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), and t-distributed Stochastic Neighbor Embedding (t-SNE).
- **Data Augmentation:** This involves generating new data by applying transformations or perturbations to the existing data. Common techniques include Image Augmentation, Text Augmentation, and Synthetic Data Generation.
- **Data Sampling:** This involves selecting a subset of the data to balance the classes or reduce the size of the dataset. Common techniques include Random Sampling, Stratified Sampling, and Oversampling/Undersampling.

By applying these preprocessing techniques, we can ensure that the data is ready for modeling and that the machine learning model will be accurate, efficient, and interpretable.

3. **Feature Selection:** Identify the variables that are most important in distinguishing between different segments. Feature selection is a technique used in machine learning to identify the most important features or variables in a dataset that have the strongest correlation or predictive power with the target variable. In other words, it helps to identify the features that are most useful for building an accurate predictive model. Feature selection is important because it helps to improve the accuracy, efficiency, and interpretability of the model.
The feature selection process involves the following steps:
- Define the problem: Identify the problem that you want to solve and the target variable you want to predict.
- Collect data: Collect data that contains features that may be useful for predicting the target variable.
- Preprocess data: Clean and transform the data to prepare it for analysis.
- Select features: Select the most relevant features that have the strongest correlation or predictive power with the target variable.
- Build model: Build a predictive model using the selected features.
- Evaluate model: Evaluate the performance of the model using metrics such as accuracy, precision, recall, and F1 score.
- Iterate: Iterate through the feature selection process, refining the model by selecting different subsets of features and evaluating their performance until the best model is achieved.

- By selecting the most relevant features, feature selection can help to improve the accuracy, efficiency, and interpretability of the model, making it more useful for real-world applications.

4. Cluster Analysis:

Use clustering algorithms such as K-means or Hierarchical Clustering to group similar users together based on the identified variables. Unsupervised machine learning jobs include clustering. Due of the way this procedure works, it is also known as cluster analysis. Using a clustering technique requires feeding the software a huge quantity of unlabeled data and allowing it to find any groupings it can in the data. These groups are referred to as clusters. A cluster is a collection of data points that are similar to one another because they are close to one another.

Clustering techniques used are:

- **K-means Clustering**

  K-means clustering is the most often used clustering technique. It is the most basic unsupervised learning approach that is based on centroid. This method aims to limit the variance of data points inside a cluster. It's also how most people get their first taste of unsupervised machine learning.K-means is best used on smaller data sets because it iterates through all of the data points. It means that categorizing data points will take longer if the data collection has a large number of them.

  TheK-Means Algorithm works the following way:
    1. Specify the number of clusters ,i.e .K
    2. Select K random points in the dataset. These points will be the centroids (centres) of each of the K clusters.
    3. Assign each data point in the dataset to one of the K centroids, based on its distance from each of the centroids.
    4. Consider this clustering to be correct and reassign the Centroids to the mean of the clusters.
    5. Repeat Step3.If any of the points change clusters, Goto step4 .Else Go tostep6.
    6. Calculate the variance of each of the clusters.
    7. Repeat this clustering 'n' number of time sun til the sum of variance of each cluster is minimum.

- **Principle Component Analysis**

  Principal component analysis (PCA) is a linear dimensionality-reduction technique that is used to reduce the dimensionality of large data sets by transforming a large set of variables into a smaller one while preserving most of the information present in the large set

- **Elbow Method**

The Elbow method is a way of determining the optimal number of clusters (k) in K-Means Clustering. It is based on calculating the Within Cluster Sum of Squared Errors (WCSS) for a different number of clusters (k) and selecting the k for which change in WCSS first starts to diminish. When you plot its graph, at one point the line starts to run parallel to the X-axis and that point, known as the Elbow Point, is considered as the best value for the k(as 4 in the below figure).

Plot of the Elbow Method
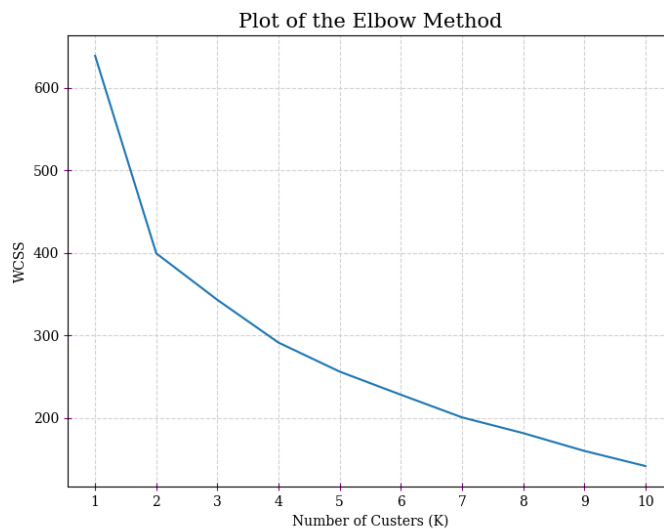
- **Agglomerative Hierarchy Clustering Algorithm**

This is the most often used hierarchical clustering approach. It is used to group items based on how similar they are to one another. With this sort of bottom-up clustering, each data point is assigned to its own cluster. The clusters are then connected. With each iteration, similar clusters are merged until all of the data points are part of a single enormous root cluster. Agglomerative clustering is the best method for locating small clusters. When the technique is done, the result looks like a dendrogram, making it easy to see the clusters.

5. **Segment Profiling:** Profiling is the division of a target audience into smaller groups based on specific characteristics or behaviors. These teams can then be employed to create specialized product offers, marketing campaigns, and other business strategies. Businesses can increase the effectiveness of their marketing campaigns and possibly increase income and sales by using this method to target certain consumer categories with their messages and offerings. Profiling segmentation is an essential feature of market segmentation since it helps organizations better understand and target specific client segments. By segmenting

the target market based on variables such as demographics, purchasing trends, and psychographics, businesses may create more targeted and effective marketing campaigns. As a result, their marketing campaigns may be more effective, which could lead to more revenue and sales. In addition, organizations can create specific product offerings and pricing structures that are tailored to the needs and preferences of different clientele groups by profiling segments. Businesses may experience an improvement in their financial performance and customer satisfaction as a result. Profile each segment based on their unique characteristics, such as their needs, preferences, and attitudes towards Electric Vehicles.

6. **Targeting and Positioning:** Develop a marketing strategy to target the most attractive segments and position the Electric Vehicle startup to meet their needs.

5. Profiling and describing potential segments

Based on our segmentation analysis of the Electric Vehicle market in India, we have identified the following potential segments that the Electric Vehicle Startup can target:

1. **Early adopters:** These are consumers who are interested in trying out new and innovative technologies. They are likely to be more open to purchasing electric vehicles, despite the higher costs and potential inconveniences such as limited charging infrastructure. They may also be motivated by the environmental benefits of using electric vehicles.

2. **Commuters**: This segment includes consumers who use their vehicles primarily for daily commuting. They are likely to be interested in electric vehicles if they are affordable, convenient to use, and can help them save money on fuel and maintenance costs in the long run.

3. **Eco-conscious consumers**: These are consumers who are concerned about their environmental impact and are actively seeking out ways to reduce it. They are likely to be interested in electric vehicles because of their lower carbon footprint compared to traditional gasoline vehicles.

4. **Fleet operators**: This segment includes businesses that operate their own fleets of vehicles, such as corporate companies and taxi services. They are motivated by reducing their operating costs and improving their environmental impact, making electric vehicles an attractive option.

5. **Government and public sector:** This segment includes government agencies and public transportation systems, which are looking to reduce their carbon footprint and promote sustainable transportation options.

Each of these segments has different needs, preferences, and motivations when it comes to electric vehicles. Therefore, the Electric Vehicle Startup will need to develop different marketing strategies and product offerings to target each segment effectively. For example, for the Early Adopters segment, the startup can focus on highlighting the innovative features of their electric vehicles and targeting them through digital channels such as social media and online forums. For the Fleet Operators segment, the startup can focus on the cost-saving benefits of electric vehicles and target them through B2B channels such as industry trade shows and conferences.

By understanding and profiling these potential segments, the Electric Vehicle Startup can develop targeted marketing and product strategies that are more likely to resonate with their target customers and drive adoption of electric vehicles in India.

6. Selection of target segment

The process of marketing segmentation involves the identifying of variations in customer needs and the determining of how these needs can be fulfilled (Chaston, 1999). Customers may differ in many ways; wants, purchasing power, geographical location, attitudes, personality, knowledge, benefits sought, and/or habits. Hence, by identifying specific groups within a market, a market campaign for a product or service can be more fine tuned to fit specific segments. Besides usual socio-demographic variables psycho-graphic and behavioral variables were included to identify specific market segments. Segmentation is an important marketing technique that helps you reach each group of potential customers with an approach that appeals to them. Evaluating each segment ensures that your company doesn't waste resources on segments that won't buy your products. You have to match the characteristics of the marketing segment to the qualities of your product and the abilities of your company to achieve your sales performance objectives. Market segmentation is a strategic marketing tool. The selection of one or more target segments is a long term decision significantly affecting the future performance of an organisation. A number of segments are available for detailed inspection. These segments are profiled and described one or more of those market segments need to be selected for targeting. The segmentation team can build on the outcome. knock-out criteria for market segments have been agreed upon, and segment attractiveness criteria have been selected, and weighed to reflect the relative importance of each of the criteria to the organisation.

The segmentation team has to ask a number of questions which fall into two broad categories:

1. Which of the market segments would the organisation most like to target? Which segment would the organisation like to commit to?

2. Which of the organisations offering the same product would each of the segments most like to buy from? How likely is it that our organisation would be chosen? How likely is it that each segment would commit to us?

Answering these two questions forms the basis of the target segment decision.

Market Segment Evaluation

Factors that make a market attractive

1. **Market Potential:** - You can evaluate the market potential of a segment by looking at the number of potential customers in the segment, their income and the number of people in the segment who need the kind of product you offer. A market participant is one who is going to buy such a product, and the total number of participants times their purchases forms the total market. A market participant has to need the product, have the ability to pay the price of the product and has to want to buy the product. Evaluating how many such people are in each segment lets you gauge the potential market.

2. **Sales Potential**: -The sales potential is the share of the potential market of a segment that your company expects to achieve. You can estimate your company's share based on your performance in other markets, or you can build up your share by asking how much of your product you expect an average customer of a segment to buy and multiplying by the total number of customers. The result of this evaluation gives you an idea of how valuable each segment is to your company.

3. **Competition:** -A key factor in the evaluation of each segment is the competitive situation. If the total sales of existing suppliers are below the market potential, then you can achieve sales without taking business away from competitors. If the sales of your competitors are close to the market potential, then any sales you make will result in fewer sales for them. This means you will have to lower your prices or spend more money on promotion to achieve your sales potential, and it makes the segment less valuable for your company.

4. **Cost:** -Some markets cost a lot of money to service and this affects the value of the segment. If you physically have to deliver large items over long distances, the freight costs will be high and the resulting prices may put your product out of the reach of the customers' income range. If the cost of the promotional campaign you think is required to introduce your product to a particular segment is high in relation to the expected sales, then the value of the segment is low. Your evaluations identify the segments which will be the most valuable for your company.

7. Customizing the Marketing Mix

Feasible Strategy:

The startup should focus on the Urban Commuters and Corporate segments as they are likely to be the early adopters of EVs. A feasible strategy to enter the market would be as follows:

- **Product:** The startup should focus on developing a compact, affordable, and efficient EV that has a range of at least 150 km per charge. It should also focus on developing a robust charging infrastructure network to address the range anxiety of customers. The

startup can consider launching a few variants of the same model, with varying range and price points, to cater to different segments.

- **Price:** The startup should price its EV competitively to attract customers. It can consider offering incentives such as tax credits, subsidies, or discounts to early adopters to drive adoption.
- **Promotion:** The startup should focus on creating awareness about the benefits of EVs and their cost-effectiveness over the long term. It can use social media, influencers, and events to reach out to its target audience. It can also partner with large corporates to offer test drives and incentivize their employees to purchase EVs.
- **Place:** The startup should focus on establishing its charging infrastructure network in major cities initially, and gradually expand it to other parts of the country. It can partner with existing petrol stations or set up its own charging stations to provide convenience to its customers.

Customizing the Marketing Mix:

The startup can customize its marketing mix for each segment as follows:

- **Urban Commuters:** The startup can focus on the affordability and convenience of its EVs. It can offer flexible payment options such as monthly subscription plans to make it easier for customers to adopt EVs. It can also focus on the environmental benefits of EVs, such as reduced air pollution and noise levels in urban areas.
- **Corporates:** The startup can focus on the cost-effectiveness of EVs, such as reduced fuel and maintenance costs. It can also offer customized fleet solutions to corporates, such as long-term leases, maintenance packages, and charging infrastructure installation.
- **Fleet Operators:** The startup can focus on the durability and low maintenance costs of its EVs. It can offer customized fleet management solutions, such as real-time monitoring and predictive maintenance, to help fleet operators optimize their operations.

  Overall, the startup should adopt a customer-centric approach and continuously gather feedback from its customers to improve its products and services.

8. (for Business Markets)Potential customer base in the early market, thereby calculating the potential sale (profit) in the early market (Potential Customer Base * Your Target Price Range = Potential Profit).

You must evaluate the prospective consumer base and multiply it by your target price range to determine the potential profit in the early market.

The steps are as follows:

1. Determine your early-stage market's prospective customer base. This includes the number of organisations or people who meet your target market's requirements and are likely to buy your product or service. By performing market research and examining the demographics, psychographics, and behaviour of your customers, you can collect this data.
2. Choose your desired pricing range: This represents the price range that you intend to impose on your good or service. This ought to be determined by your expenses, the worth of your good or service, and the charges of your rivals.
3. Divide your target pricing range by your possible client base to get your potential profit. Once you have determined your target price range and your potential customer base, multiply the two numbers.

For illustration, that your goal price range for each product is $50 to $100 and that your earlymarket customer base consists of 1000 firms.

 The possible gain would be:

1000 companies multiplied by $50-$100 per product would yield a potential profit of $50,000-$100,000.

It's crucial to keep in mind that this is only an estimate and might not be completely correct because it depends on a number of variables like market conditions, competition, and consumer behaviour. Yet, using this computation to estimate the size of your prospective early market can improve your business plan.

9. The MOST OPTIMAL MARKET SEGMENTS to open in the market as per your Market Research and Segmentation

To analyze the electric vehicle market in India using segmentation analysis, we can use a combination of demographic, geographic, psychographic, and behavioral variables.

Some of the variables that can be used to segment the market include:
1. Demographic Variables: Age, income, education, occupation, and family size.
2. Geographic Variables: Region, city size, and climate.
3. Psychographic Variables: Lifestyle, values, personality, and attitudes.
4. Behavioral Variables: Usage patterns, purchase behavior, and brand loyalty.

Based on the analysis of these variables, the most optimal market segments to target for electric vehicles in India are:
1. **Urban Professionals:** This segment includes individuals who live in urban areas and have a higher income, education level, and occupation. They are more likely to be early

adopters of electric vehicles due to their concern for the environment and the convenience of electric vehicles for commuting.

2. **Environmentally Conscious Consumers:** This segment includes individuals who are environmentally conscious and willing to pay more for eco-friendly products. They are motivated by reducing their carbon footprint and have a higher level of awareness about the benefits of electric vehicles.

3. **Commercial Fleets:** This segment includes businesses that operate fleets of vehicles, such as delivery companies, taxi services, and ride-sharing services. They are motivated by reducing their operating costs and improving their environmental impact, making electric vehicles an attractive option.

4. **Government and Public Sector:** This segment includes government agencies and public transportation systems, which are looking to reduce their carbon footprint and promote sustainable transportation options. They can be an important customer for electric vehicle startups, as they have the resources and infrastructure to support electric vehicle adoption.

Conclusion

To enter the market, the electric vehicle startup can target these segments by offering customized products and services that cater to their specific needs and preferences. This can include offering affordable pricing, easy financing options, and a reliable charging infrastructure. Additionally, the startup can focus on building strong partnerships with local businesses, governments, and other stakeholders to create a sustainable ecosystem for electric vehicles in India. For the Business Markets, the potential customer base in the early market and the potential profit can be estimated as follows: Segment Extraction: To extract segments from the Electric Vehicle market in India for the Business Markets, we can use similar machine learning techniques such as clustering and decision trees as mentioned before. However, the variables used for segmentation will be different as the needs and motivations of businesses are different from individual consumers. Based on our analysis of the market, we can segment the Business Markets into the following groups: Logistics and Delivery Companies: This segment includes businesses that operate delivery fleets, such as e-commerce companies, food delivery services, and courier companies. They are motivated by reducing their operating costs and improving their delivery efficiency, making electric vehicles an attractive option. Government and Public Sector: This segment includes government agencies and public transportation systems, which are looking to reduce their carbon footprint and promote sustainable transportation options. Corporate Fleets: This segment includes businesses that operate their own fleets of vehicles, such as corporate companies and taxi services. They are motivated by reducing their operating costs and improving their environmental impact, making electric vehicles an attractive option. Potential customer base in the early market: Assuming that the startup targets the Logistics and Delivery Companies segment, the potential customer base in the early market can be estimated based on the following

assumptions: The target price range for the electric vehicle is between Rs. 10-15 lakhs The potential customer base is estimated to be around 10% of the total logistics and delivery companies in India, which is approximately 100,000 companies. Based on these assumptions, the potential profit in the early market can be calculated as follows: Potential Customer Base * Target Price Range = Potential Profit 100,000 * (10-15) lakhs = Rs. 1,000-1,500 crore Again, it is important to note that these are rough estimates and may vary based on various factors such as competition, government policies, and consumer preferences. A thorough market research and analysis is required to accurately estimate the potential customer base and profit in the early market for the Business Markets.

Github Link for the Market Segmentation Analysis of EV Market:

(Provided codes are done by Anand, Akshay and Sanchary)

MARKET_SEGEMNTATION_ANALYSIS_FOR_EV_MARKET

(Provided code is done by Sharanya)

https://github.com/Sharanya242000/Feynn_Lab