

Electric Vehicle Market Segmentation Analysis

Sovan Kumar Das

GitHub repository: Electric Vehicle Market Segmentation

1 Introduction

The document "Market Segment Analysis" provides a comprehensive overview of market segmentation of Electric vehicle, its strategic importance, and its benefits.

Fermi Estimation(Problem Breakdown)

Define the Problem

Start by clarifying the overarching goal of the project: *"Segment the EV market"*.

Identify Key Metrics

What are the specific metrics or criteria used to segment the market? These could include factors like:

- Vehicle type (e.g., passenger cars, trucks)
- Geographic regions
- Customer demographics
- Any other relevant variables

Data Requirements

Estimate the amount of data needed to effectively segment the market. This would include both the quantity and quality of data. For instance, you might estimate:

- The number of EV sales records required
- The diversity of data sources
- The level of data cleanliness needed

Data Collection

Estimate the time and effort required to collect and preprocess the necessary data. This might involve:

- Web scraping
- Data cleaning
- Merging datasets
- Dealing with missing values

Feature Engineering

Consider the complexity of feature engineering. Estimate the number of relevant features that need to be created or extracted from the raw data. This could include engineering features from:

- Vehicle specifications
- User behavior
- External factors like weather or economic indicators

Algorithm Selection

Estimate the time and computational resources needed to choose and implement suitable machine learning algorithms for market segmentation. This could involve:

- Clustering techniques
- Classification techniques
- Regression techniques

Model Training

Estimate the time and computational resources required to train the machine learning models on the prepared dataset. This can be influenced by:

- The size of the dataset
- The complexity of the chosen algorithms

Hyperparameter Tuning

Estimate the time needed for hyperparameter tuning to optimize the performance of the models. This is an iterative process that involves:

- Adjusting model parameters
- Improving accuracy

Model Evaluation

Estimate the effort required to evaluate the models' performance using appropriate metrics such as:

- Accuracy
- Precision
- Recall
- F1-score

Consider cross-validation and validation set preparation.

Interpretation and Visualization

Estimate the time and effort needed to interpret and visualize the results of market segmentation. How will the segments be presented and communicated to stakeholders?

EV Sales Share

- The global EV sales share has been increasing exponentially in recent years. In 2022, EVs accounted for 14% of global car sales, up from 4% in 2020.
- This growth is being driven by a number of factors, including government incentives, declining battery prices, and increasing consumer awareness of the environmental benefits of EVs.
- The IEA projects that the global EV sales share will reach 30% by 2030.

EV Stock

- The global EV stock (the number of EVs in operation) has also been increasing exponentially in recent years. In 2022, there were over 100 million EVs in operation worldwide, up from just 1 million in 2010.
- This growth is being driven by the same factors that are driving EV sales growth.
- The IEA projects that the global EV stock will reach 250 million by 2030.

EV Sales

- The global EV sales have been increasing exponentially in recent years. In 2022, there were over 10 million EVs sold worldwide, up from just 2 million in 2020.
- This growth is being driven by the same factors that are driving EV sales share and EV stock growth.
- The IEA projects that the global EV sales will reach 20 million by 2030.

Oil Displacement (Mbd)

- Oil displacement Mbd (million barrels per day) is the amount of oil that is displaced by EVs. In 2022, EVs displaced 1.5 million barrels of oil per day.
- This is equivalent to about 3% of global oil demand.
- The IEA projects that EV oil displacement will reach 5 million barrels per day by 2030.

Oil Displacement (Million LGE)

- Oil displacement, million lge (million liters of gasoline equivalent) is the amount of gasoline that is displaced by EVs. In 2022, EVs displaced 20 million liters of gasoline per day.
- This is equivalent to about 5% of global gasoline demand.
- The IEA projects that EV oil displacement will reach 100 million liters of gasoline per day by 2030.

EV Stock Share

- The EV stock share is the percentage of the total vehicle stock that is made up of EVs. In 2022, the EV stock share was about 3%.
- This is expected to increase to 10% by 2030.

Electricity Demand

- The increase in EV sales and stock is putting a strain on the electricity grid. In order to meet the growing demand for electricity from EVs, the grid will need to be upgraded and expanded.
- This is a challenge, but it is one that can be overcome.

PHEV: Plug-in Hybrid

BEV: Battery Electric Vehicle

The above graph shows the sales of plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs) from 2015 to 2022. As you can see, the sales of BEVs have been increasing exponentially over the past few years, while the sales of PHEVs have been decreasing.

There are a few reasons for this trend. First, BEVs are becoming more affordable. The cost of batteries has been declining, and governments are offering incentives to purchase BEVs. Second, BEVs are becoming more capable. They have longer ranges and faster charging times. Third, consumers are becoming more aware of the environmental benefits of BEVs.

As a result of these factors, it is expected that BEVs will become the dominant type of electric vehicle in the future. By 2030, it is estimated that BEVs will account for more than 80% of global electric vehicle sales.

Why BEVs are Becoming More Popular

- **Lower operating costs:** BEVs have lower fuel costs than gasoline or diesel vehicles. This is because electricity is cheaper than gasoline or diesel, and BEVs are more efficient.
- **Lower emissions:** BEVs produce zero emissions, which helps to improve air quality.
- **Government incentives:** Many governments offer incentives to purchase BEVs, such as tax breaks and rebates.
- **Improved technology:** Battery technology has improved significantly in recent years, which has led to longer ranges and faster charging times for BEVs.
- **Growing consumer awareness:** More and more consumers are becoming aware of the benefits of BEVs.

Weight and Efficiency

EVs are typically lighter than gasoline-powered cars because they don't have an engine or fuel tank. This means that they require less energy to move, which results in better fuel efficiency. In addition to these factors, EVs also benefit from other factors that improve fuel efficiency, such as regenerative braking and aerodynamic design. Regenerative braking is a system that captures energy that would otherwise be lost during braking and uses it to recharge the battery. Aerodynamic design is the process of designing a car that minimizes drag, which also improves fuel efficiency. As a result of these factors, EVs can achieve significantly better efficiency than gasoline-powered cars.

(a) Geographic and Demographic Research

- South India being a Tech Hub is a backbone of EV demands.
- In earlier part, we analyzed that south Indian states have a good number of charging stations available.
- Popular car brand's manufacturing plants and main headquarters in South India fulfill consumer's demands by these top companies.
- Delhi had the highest number of charging stations (analyzed earlier), but EV popularity is relatively low.
- North East India is gaining popularity in EV despite less infrastructure.
- Other states and regions, especially North, West, East, and Central India have balanced numbers and competitive demands.
- We did not get any survey information on Daman and Diu and Lakshadweep, so these two regions are not analyzed properly.
- On availability of charging stations, we observed:
 - First observation: only a limited number of charging stations is available in India as of 2023.
 - Delhi being the capital has more number of charging stations compared to other metro cities.
 - South Indian metro cities have balanced numbers, but still many cities are missing from South India.
 - Mumbai being the economic capital of India has only one charging station in Mumbai (private charging stations not counted or being missed).

(b) Psychographic and Behavioral Research

- Petrol cars are the most popular cars occupying 79% of its share in its competition. It is understandable because petrol cars are cheaper than Diesel cars and CNG cars.
- Diesel cars, despite being costly, occupy the second position in popularity.
- Diesel cars are more popular than CNG, this is because current diesel engines have greater performance than both petrol and CNG cars.
- Diesel cars are also very much long-lasting running cars as compared to both the other cars, that's why it has more popularity.

- CNG cars have the lowest popularity, just because this car lacks competitive performance and engine durability. CNG cars only have good fuel economy because CNG is cheap.
- Vehicle Price is a big concern:
 - First majority of the public buys petrol cars because of their cheap price.
 - Second majority of the public buys diesel cars, the public interested in high performance and long-lasting low-maintenance cars.

Summary: By understanding these concepts and implementing structured processes, organizations can effectively navigate the complexities of market segmentation to enhance strategic decision-making and market performance.

Final Thoughts on Startup Strategy

1. **E-Bikes:** We can target some East Indian states like Uttar Pradesh, Bihar, and West Bengal as the economic condition of the majority of people is low. A good competitive E-bike with a good number of features and a reasonable price range will be a good choice. Central Indian states like Madhya Pradesh will also be a good choice to introduce E-Bikes.
2. **E-Cars:** North-East India and Central India should be the first choice regions as they have good popularity of EVs. East Indian states would be the second choice after the popularity of the startup improves and we are safe to grow our business.
3. **North Indian States:** North Indian states are not recommended right now because of the analysis results. People are not buying EVs despite having lots of charging infrastructure.
4. **South Indian States:** South Indian states should be kept for the future as there are already many international brands that have launched their EVs at competitive prices and with tons of features. So South India will not be a safe option right now.