ELECTRIC VEHICLE MARKET SEGMENTATION ANALYSIS

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ABSTRACT

This project offers a thorough examination of India's electric vehicle market, with a particular focus on segmentation derived from sales data, customer reviews, and technical specifications. The study underscores the robust growth trajectory of India's two-wheelermarket, establishing it as a primary revenue driver. By leveraging behavioural variables extracted from customer reviews, we conducted a rigorous market segmentation analysis using the standard k-means algorithm, effectively dividing the market into four distinct segments.The recommended specifications, thoughtfully aligned with the demands of this segment,play a crucial role in our approach. Furthermore, the price range closely aligns with median values, ensuring affordability and competitiveness. This strategic alignment with Segment 3,identified as the potential early market customer base, strategically positions our venture within India's electric vehicle landscape.

INTRODUCTION

India is witnessing a significant revolution in its transportation sector, primarily driven by the widespread adoption of Electric Vehicles (EVs). Factors such as rapid urbanisation, a burgeoning population, and rising income levels have propelled the embrace of EVs as a sustainable alternative. Electric two-wheelers, in particular, have spearheaded this movement owing to their affordability and widespread acceptance among consumers. These vehicles are reshaping India's mobility landscape by offering an eco-friendly solution to the challenges of pollution and greenhouse gas emissions.

The Indian government has been instrumental in fostering this transition by implementing policies that promote local manufacturing and support a robust ecosystem of manufacturers,

dealers, and service providers. As of 2023, the electric two-wheeler market in India has reached new heights, symbolising the success of these initiatives and the increasing adoption of clean mobility solutions.

This study delves deep into this transformative journey, with a specific focus on the electric vehicle sector, particularly electric two-wheelers. By amalgamating behavioural segments,

psychographic data, and detailed vehicle specifications, we provide well-informed recommendations on EV pricing. Through this comprehensive approach, our aim is to empower consumers, policymakers, and industry stakeholders alike. By gaining insights into the diverse dimensions of consumer behaviour and preferences, this study illuminates the pathway towards a sustainable, environmentally conscious, and consumer-centric electric

transportation ecosystem in India.

Problem Statement

The challenge at hand is to strategically position our Electric Vehicle Startup in the Indian market by utilising data-driven insights derived from sales data, customer reviews (encompassing behavioural and psychographic data), and technical specifications of electric vehicles. Our objective is to employ these insights to effectively segment the market and recommend target segments for our electric vehicles.

FERMI ESTIMATOION

The EV-Ready India dashboard has projected an impressive 45.5% Compounded Annual Growth Rate (CAGR) in electric vehicle sales between 2022 and 2030, indicating a substantial surge from the 6,90,550 electric two-wheelers (E2Ws) sold in 2022 to a staggering 1,39,36,691 E2Ws expected to hit the Indian roads by 2030.

Data Collection

Data was extracted from the various websites mentioned below for EV market segmentation.

Link for data extraction:

- https://pib.gov.in/PressReleasePage.aspx?PRID=1842704 https://www.ibef.org/blogs/electricvehicles-market-in-india https://evreporter.com/indias-region-wise-ev-market-jan-may-2022/

- https://www.india-briefing.com/news/indias-ev-manufacturing-capacity-and-marketpreferences- progress-25840.html/

Data from those links are extracted by Google play scraper available on libraries package. There are multiple datasets get extracted from those websites in CSV and Excel formats. There are some pdfs also which contains valuable information regarding the EV market. We have extracted data from those pdfs as well.

Columns explanations:

1. ‘Brand’ and tells the manufacturers of electric vehicles.

2. ‘model’ tells the various of electric vehicles.

3. ‘AccelSec’, ‘Top Speed’, ’Power Train’ tellsspecification about the vehicles.

4. ‘Range_km’, ‘Fast_Charge’, ‘Plug_type’ and ‘Bodystyle’ tells us about rangeof vehicle per full charge,fast charging is provided or not, type of charging plug and body style of vehicle respectively.

5. ‘Seats’ and ‘Price’ tells about the number of seats available on vehicle and theirprice.

6. ‘Region’ and ‘State/UT’ tells about the states of India.

7. ‘EV Charging Facility’ and ‘Chargers’ tells about the facility of charging in the respectivestates.

8. ‘2V’, ‘3V’, ‘4V’, ‘Bus’ tells about the type of vehicles in the market.

DATA PROCESSING

Steps taken to preprocess the scraped raw data:

1. Ordinal encoded 'PowerTrain'

2. Label encoded 'RapidCharge’

3. Used Label Encoder and Standard Scaler package for preprocessing of the dataset.

Exploratory Data Analysis

An Exploratory Data Analysis or EDA is a thorough examination meant to uncover the underlying structure of a data set and is important for a company because it exposes trends, patterns, and relationships that are not readily apparent. We analyzed our dataset using univariate (analyze data over a single variable/column from a dataset), bivariate (analyze data by taking two variables/columns into consideration from a dataset) and multivariate (analyze data by taking more than two variables/columns into consideration from a dataset) analysis. The bar graph below shows the diversity of the data geographically. We can see that we have the maximum amount of data of states Karnataka and Maharashtra; and minimum amount of data for Sikkim, Meghalaya, Lakshadweep, Ladakh, and Dadra and Nagar Haveli and Daman and Diu. There are a total of 1536 rows of data distributed amongthe cities shown in the graph.

Segment Extraction

K-Means Clustering is one of the most popular Unsupervised Machine Learning Algorithms Used for Solving Classification Problems. K Means segregates the unlabeled data into various groups, called clusters, based on having similar features, common patterns. Suppose we have N number of Unlabeled

Multivariate Datasets of various features like wateravailability, price, city etc. from our dataset. The technique to segregate Datasets into various groups, on the basis of having similar features and characteristics, is called Clustering. The groups being Formed are known as Clusters. Clustering is being used in Unsupervised Learning Algorithms in Machine Learning as it can segregate multivariate data into various groups, without any supervisor, on the basis of a common pattern hidden inside the datasets. In the Elbow method, we are actually varying the number of clusters (K) from 1 – 10. For each value of K, we are calculating WCSS (Within-Cluster Sum of Square). WCSS is the sum of squared distance between each point and the centroid in a cluster. Whenwe plot the WCSS with the K value, the plot looks like an Elbow.

As the number of clusters increases, the WCSS value will start to decrease. WCSS value is largest when K = 1. When we analyze the graph, we can see that the graph will rapidly change at a point and thus creating an elbow shape. From this point, the graph starts to move almost parallel to the X-axis. The K value corresponding to this point is the optimal K value or an optimal number of clusters.

Profiling Potential Segments

Behavioral Segmentation: Segmenting the market based on customer behavior aspects suchas what price range customers usually buy in, what kind of specifications customers look for in their cars, etc.

Psychographic Segmentation: Segmenting the market based on psychological parameters,such as the likes and dislikes of customers, whether they prefer comfort over speed of a vehicle, etc.

Geographic Segmentation: Segmenting the market based on geography. This mainlyincludes characteristics of the market based on the location.

Target Segments

Based on the analysis, the target segment can be narrowed down to EVs having:

- Psychographic factors such as Comfort and Value for Money
- Behavioral factors such as good Acceleration and viable Price range
- Geographic factors such as States which are more market friendly In conclusion, the target segment should comprise of EVs having Acceleration of 7.5-10 sec,High in Comfort and Value for Money ratings, have a Price range of 20-30 Lakhs, and be focused mainly on States such as Maharashtra, Karnataka, Tamil Nadu and Rajasthan.

Customizing the market mix

The marketing mix helps enable the growth of the business in the automotive industry. A company’s marketing mix or 4Ps (Product, Place, Promotion, and Price) specify the approaches and strategies that address the target market, based on the details of the marketing plan. The company’s aim is to maximize sales and improve market presence. With astrong position in the market,

However, strategic decision-makers must allow for flexibility in relevant strategies. The automotive market has various opportunities for the growth, such as opportunities for products that integrate advanced computing technologies. However, the company faces threatsin its business environment. Managers can use the SWOT Analysis to determine appropriate adjustments in the marketing mix or 4Ps to deal with these threats and opportunities.

Product Mix

This aspect of the marketing mix pertains to the outputs of the business. Each product line represents a group of outputs or products. The set of all the product lines is called the product mix. the product mix shows limited business diversification. Nonetheless, the company offers awide variety of products, such as different brands, types, and models of automobiles.

1. Automobiles 2. Automobile parts 3. Commercial vehicles 4. Financial services

Prices and Pricing Strategies

The setting of price points and price ranges for the company’s products is the main concern inthis aspect of the marketing mix. Pricing affects the perceived value of brands and products, and influences sales in price-sensitive markets. the pricing strategies for its automotive products are as follows:

1. Market-oriented pricing strategy 2. Premium pricing strategy

Promotional Mix

Promotional activities are considered in this aspect of marketing mix of 4Ps. These activities are also known as marketing communications tactics. The combination of these tactics is called a promotional mix or marketing communications mix the following promotional activitiesare used, arranged according to significance in the automotive business:

1. Advertising (primary) 2. Direct marketing 3. Personal selling 4. Sales promotion 5. Public relations

Place/Distribution

In this aspect of marketing mix or 4Ps, the virtual or physical locations of transactions are considered. Such locations are significant because they enable the company to reach targetcustomers in specific markets, while also allowing customers to access information and products available from the automotive business. The following places are used in the distribution of products and services:

1. Official websites 2. Dealerships 3. Automotive shows and exhibits

Potential Sales in Early Market

Purchasing a vehicle is one of those life accomplishments that top nearly everyone’s bucket list. The majority of the customers have

a family. For such folks there are a variety of reasons, including market and schooling. Whether you prefer a modernized urban loft or a sprawling suburban home with a white picket fence, most of us hope to find a vehicle that feels like it was made specifically for our family. Here is where our insights come in to assist such people to find a best vehicle at the best-fixed price according to the area and several other factors. Some of the key points required to focus for the development of EV in India are:

1. Retrofitting conversion of Public Transport (Bus), Taxi and Three-Wheeler (Auto) to PHEV:

This is one of the key requirements to move towards sustainable transportation. It will notonly balance emissions but also reduce the load on infrastructure requirement.

2. Government Incentives: Another key factor for XEV market to lift up will be identification of strategic incentives for electric vehicles. This will increase adoption rate and decrease main element barrier of the price of electric vehicles to customers. The incentive can be subsidy scheme for electric vehicles bridging gap price between the conventional and electric vehicle in similar performance range. e.g., if the cost of internal combustion engine car is INR 5 lakh and that of the electric vehicle is INR 6.5 lakh, the government can intend to offer discount or subsidy of the differential cost. In addition, benefit of Discount on VAT//Discount on Registration/Discount on Toll Plaza to motivate sell of EV can be planned.

3. Charging Infrastructure: Charging infrastructure development will occur with the development of XEV market. However, motivation can be provided by developing grid-connected

charging station withthe moderate tariff, promotion to standalone renewable (solar/wind) charging station, add onfacility at petrol pump and bus stops for charging and state transport charging stations and permitting the development of private renewable charging stations.

4. Electrical Propulsion System (EPS): Currently no Indian manufacturer provide electrical propulsion system (EPS) manufactured in India, even REVA has a tie-up with Italy for EPS. Hence support and positive atmospherebuild-up in manufacturers in one of the critical tasks. Development of clear policies for supporting the growth of supply, manufacturing, and recycling of propulsion system. Power electronics converter and motor technology development are feasible as technology base is available in India, however currently used cost-effective Li-ion technology of battery development is challenging task as the majority of lithium stock are available in China and USA. In addition, battery replacement/swapping can be one of the promising and viable options in India.

5. Development of Skilled Manpower: Consideration of safety and advanced technology involved, development of certified skilled technician and professionals is one of the requirements.

6. Awareness: Awareness on benefits of XEV and promotions of the government can play a significant rolein development. It can be done with the help of extensive advertisement at airport/bus station/cinema halls/government offices/public places using banners/hoardings, use of print media-newspaper/magazines/periodicals, digital media/radio/e media-internet, TV shows, expert talks, providing micro-funding for projects/conferences in schools, colleges and industry, supplying

R & D grants to research scholar/institute/industry. The promotional highlights for the consumer can be:

a. Good for the environment/Lowers Emission: Electric vehicles emit lower levels of a Page | 24 range of air pollutants, e.g. nitrogen oxides, particulate matter and greenhouse gases(e.g. carbon dioxide-CO2) than vehicles using conventional petrol and diesel engines.

b. Cheaper to run/Improve Fuel Economy: As electricity is cheaper than petrol or diesel,the running costs of EVs are less than conventional vehicles.

c. Less Life Cycle Cost.

d. Perfect for urban use: Reduced levels of pollution and noise make EVs ideal for innercity and urban use.

e. Smooth acceleration and deceleration: EVs benefit from smooth gearless acceleration and deceleration, as a result of the characteristics of the electric motor.

f. Quieter than conventional vehicles: EVs are also quieter than conventional vehicles. Battery operated cars operate in almost complete silence except noise from the tires.

g. Proved Technology (a sharp rise in the market of XEV all over the world).

Most Optimal Market Segment

There are many EV manufacturing companies in the country like Hero Electric, Tata Motors, Ather Energy, Ashok Leyland,

Hyundai Kona Electric, etc. Tesla has also arrived; the demand will get higher & higher since it is automotive so the investments and policies and all that would be bigger but it will take some time to perfectly settle in India. The following are the key insights of the project:

 The electric vehicle industry has not done that much good due to the devastating hit of the Covid outbreak but it will take a huge jump in upcoming years.

 The use of EVs will be game-changing in terms of environment, air, noise pollution-free, postelectric, and much more.

 The company should plan to establish local operations in India either by partnering with a local company or by setting up its own manufacturing/ development unit, potentially combined with imports of specific components.

 The company would expect to further grow in India, underpinned by a growing commercial fleet market for two-wheelers and three-wheelers especially for last km delivery/urban freight services. The company must see opportunities across the supply chain in the battery, EV component and charging infrastructure segments including the machinery and equipment needed for establishing manufacturing plants, training and provision of skilled workforce etc.

 The company should start their business from Metro Cities in India and then after considerable business expand to other cities of the same state of the Metro Cities. This will help the company to expand easily as they will be having a prior knowledge of business from Metro Cities and Network of Supply chain will be

easy for the company as the time goes in business. In the conclusion, electric vehicles are the future hence - “Go Green Go Electric”.

Git Hub Link : https://github.com/Yaduvipin/Project-2-EV-market-segmentation