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MARKET SEGMENTATION ANALYSIS OF ELECTRIC VEHICLES IN INDIA

prepared by:
Himanshu
TAgdde

Market Segmentation Analysis of Electric Vehicles in India

Problem Statement

The Indian electric vehicle (EV) market is set for substantial growth due to rising environmental concerns, government support, and technological progress. However, the market's fragmentation—characterized by diverse consumer preferences, varying awareness levels, and regional differences—poses challenges for manufacturers and marketers in effectively reaching potential customers.

The absence of a comprehensive market segmentation analysis limits stakeholders' understanding of distinct consumer profiles and their motivations for adopting EVs. This can lead to misallocated resources and ineffective marketing strategies, causing businesses to miss opportunities in this dynamic market.

This study aims to identify and analyze key segments within the Indian EV landscape, offering insights into consumer demographics, psychographics, and behaviors. By addressing these challenges, we intend to help industry players tailor their strategies and enhance customer engagement, ultimately promoting the wider adoption of electric vehicles in India.

Approach

This project analysis will adopt an analytical approach grounded in the principles of exploratory data analysis (EDA). EDA is a crucial step in understanding the underlying patterns and relationships within data, providing insights that can inform decision-making and strategy development.

To begin, we will leverage Python libraries such as NumPy and Pandas for data preparation. These libraries are instrumental in manipulating and analyzing datasets efficiently. The first step involves cleaning the data to ensure its quality and reliability. This includes identifying and handling null values, which can skew analysis results, as well as correcting any inconsistencies or errors in the dataset. Techniques such as imputation or removal of missing data will be employed, along with normalization and transformation processes as necessary to ensure that the data is in a usable format for analysis.

Once the data is clean and prepared, we will move on to visualization using libraries like Matplotlib, Seaborn, SciPy, and Plotly. These tools allow for the creation of a wide variety of visualizations that can help in interpreting data trends and relationships.

- Scatterplots will be used to identify correlations between different variables, helping us understand how factors such as price and range affect consumer choices in the EV market.

- Heatmaps will provide a visual representation of data density, allowing us to see how different variables interact and where significant concentrations of data points lie.

- Boxplots will be instrumental in identifying the distribution and outliers within the data, particularly in relation to pricing or performance metrics across various EV models.

- Bar graphs will facilitate comparisons across different market segments, showcasing trends in consumer preferences or demographic shifts.

- K-Means Clustering: For identifying distinct market segments based on features such as price, horsepower, and consumer preferences.

By employing these visualization techniques, we aim to create compelling insights that not only highlight key findings but also engage stakeholders in understanding the complexities of the EV market. The visual representation of data will aid in communicating results effectively, allowing for a clearer interpretation of consumer behaviors and market dynamics.

Through this comprehensive approach, the analysis will provide actionable insights that can inform marketing strategies, product development, and overall business decisions in the growing electric vehicle sector in India.

Conclusion and Insights: Key Takeaways from the EV Market Segmentation Analysis in India

1 **Correlation Between Ex-Showroom Price and Displacement:**

- Ex-showroom price shows a positive correlation with engine displacement, indicating that higher displacement often leads to a higher price.
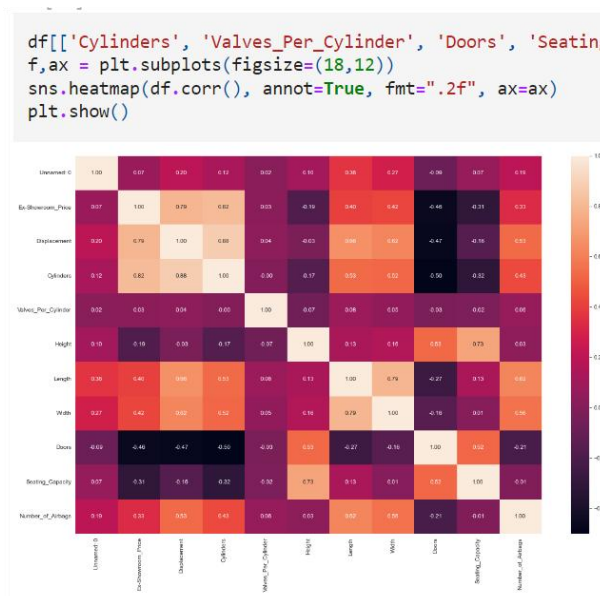
2 Correlation Between Ex-Showroom Price and Number of Cylinders:

- There is a positive correlation between ex-showroom price and the number of cylinders in a vehicle. More cylinders typically mean a higher price point, reflecting increased engine performance.

3 Displacement and Number of Cylinders:

- More cylinders generally result in higher displacement, which translates to greater power output from the engine.

4 Negative Correlation with Number of Doors:

- The number of doors in a car exhibits a strong negative correlation with displacement, suggesting that vehicles designed with fewer doors may have smaller engines.

5 Market Dominance of Maruti Suzuki:

- Maruti Suzuki leads the Indian market with a greater variety of car models compared to competitors.
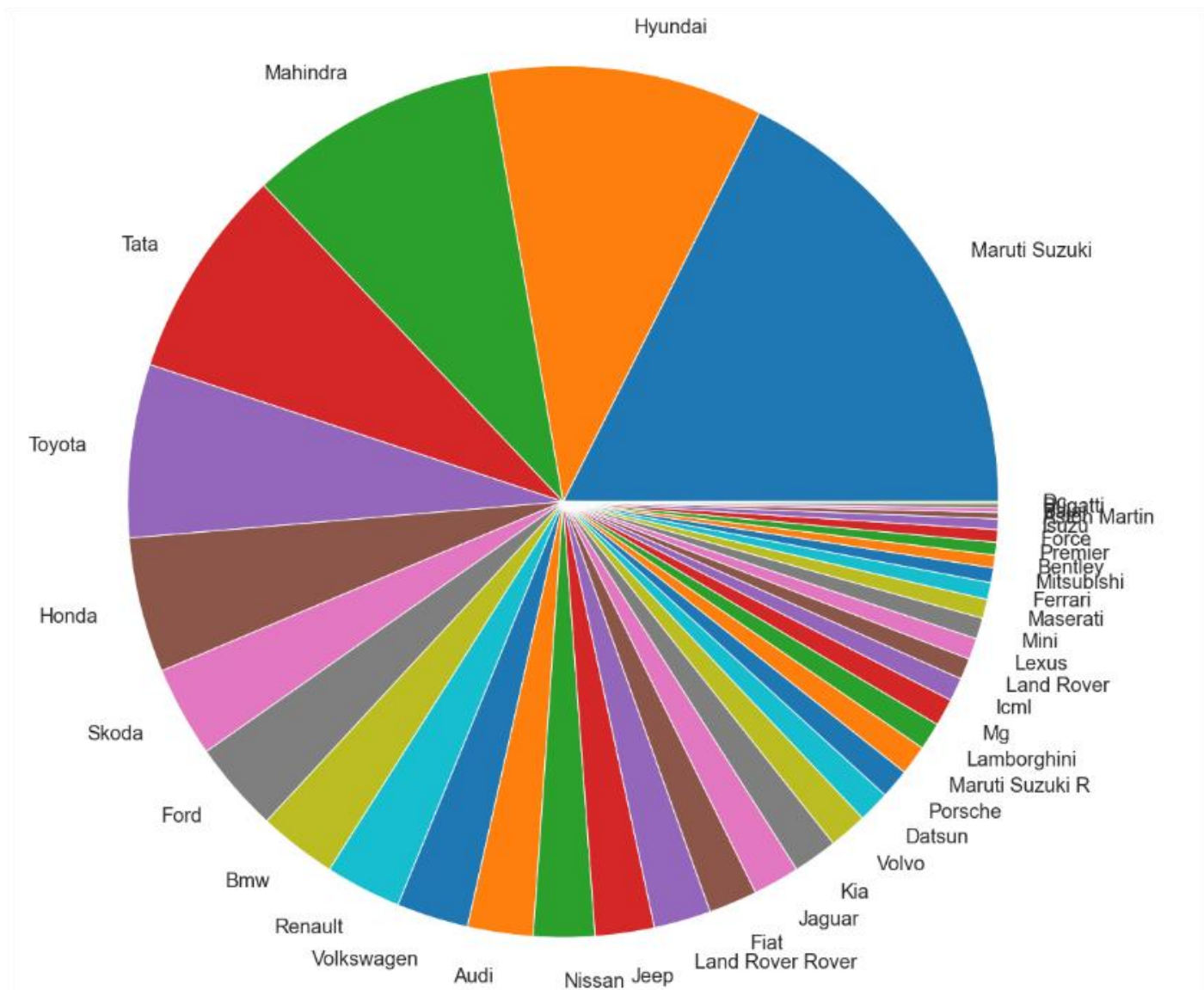
6 Consumer Preferences for Body Types:

- The Indian market shows a strong preference for SUVs, sedans, and hatchbacks, with MPVs, MUVs, and coupes being less favored.

7 SUV Market Potential:

- The total ex-showroom price of SUVs in the dataset approaches ₹2 billion, highlighting the significant consumer interest and market potential for this body type.

8 Relationship Between Horsepower and Price:

- Horsepower is highly correlated with car prices, while body type shows less consistent relationships; hatchbacks tend to have the lowest horsepower and price.

```python
plt.figure(figsize=(16,10))
sns.scatterplot(data=df, x='Displacement', y='Ex-Showroom
plt.xticks(fontsize=16);
plt.yticks(fontsize=16)

plt.xlabel('Engine Displacement',fontsize=20)
plt.ylabel("Price",fontsize=20)
plt.title('Relation between Displacement and price',fonts
```
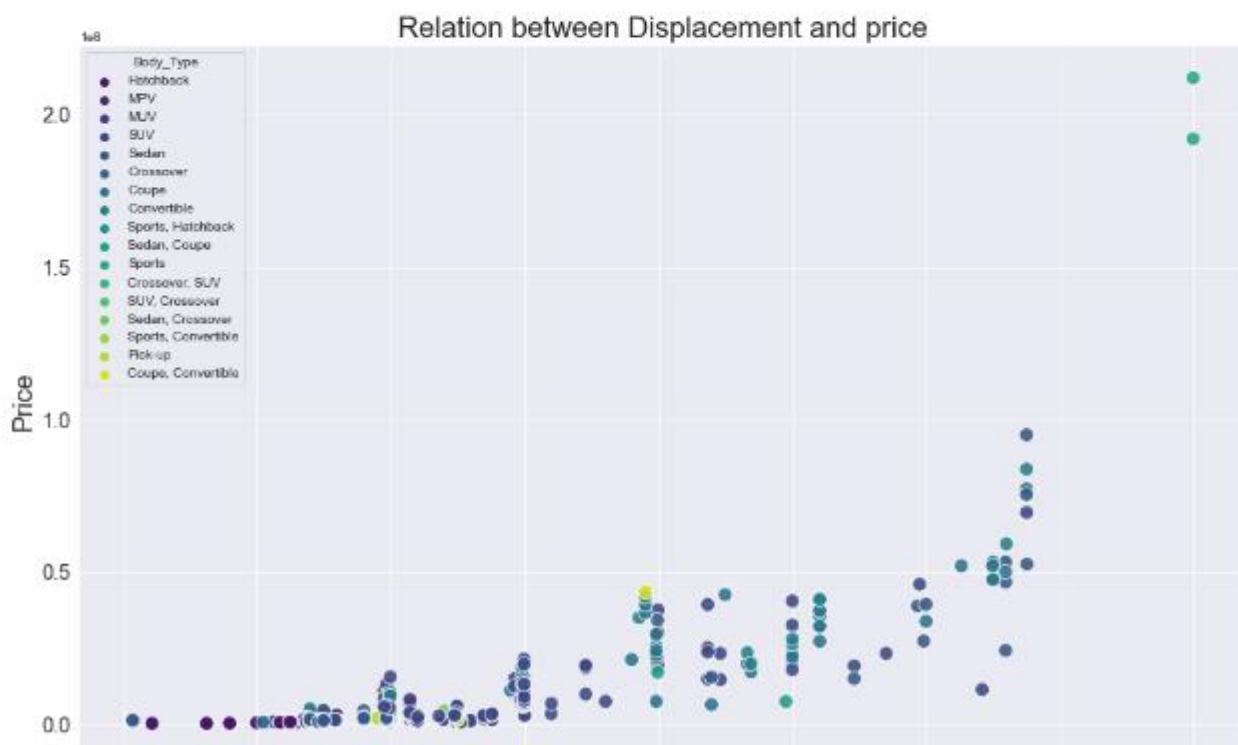
9 **Fuel Type Distribution:**

- Approximately 90% of Indian cars are powered by petrol or diesel, raising environmental concerns regarding pollution and CO2 emissions.

10 **Shift Towards Electric Vehicles:**

- The rise of electric vehicles in India is expected to alter the current fuel dynamics, as consumers increasingly opt for eco-friendly options.

11 **Utility of Pair Plot Visualization:**

- Pair plot visualizations are effective in exploratory data analysis (EDA) for understanding relationships between variables, whether continuous or categorical.

12 **Pollution Concerns:**

- The predominance of petrol and diesel vehicles is a significant pollution issue, though this is expected to change with the increasing shift toward electric cars from brands like Tesla and Tata.

13 **Leather as Preferred Seat Material:**

- Leather is the most commonly used seat material in Indian cars, indicating consumer preference for this luxury option.

14 **Automatic Transmission Preference:**

- Most cars in the Indian market feature automatic gear systems, reflecting a broader trend towards automation and user-friendly technology.

15 **Popularity of Turbocharged Engines:**

- The prevalence of turbochargers in many cars suggests that Indian consumers favor vehicles that offer better performance and efficiency.

16 **Top Car Manufacturers:**

- The top five companies with the most car variants in India are Maruti Suzuki, Hyundai, Mahindra, Tata, and Toyota.

17 **Limited Sports Car Availability:**

- The market for sports car variants in India remains quite low, indicating a niche segment with limited consumer interest.

Electric Vehicle Market in India

As of 2023, the estimated market size for electric vehicles (EVs) in India is projected to be around $7-10 billion. The Indian EV market is expected to grow rapidly, with projections estimating it could reach $40 billion by 2030, driven by government initiatives, increasing consumer awareness, and the push for sustainable mobility solutions.

DATA Collection

The objective was to gather comprehensive information on vehicle specifications, pricing, and consumer reviews, which would provide valuable insights for market analysis in the automotive sector. Utilizing web scraping, Python and libraries such as Beautiful Soup and Pandas, data was systematically extracted from reputable sites like

1 **CarDekho**

2 **CarWale**

3 **BikeWale**

4 **ZigWheels**

5 **AutoCar India**

The project successfully collected data on approximately 1000 car models and 100 bike models, revealing consumer preferences and emerging market trends, including a growing interest in SUVs and electric vehicles. The findings highlight the need for ongoing data updates and advanced analytical techniques to further explore consumer behavior and market dynamics, serving as a foundational resource for strategic decision-making in the industry.

Leveraging Additional Time and Budget for Data-Driven Insights

To optimize my automotive market segmentation project, I propose significant enhancements in data collection through targeted data enrichment strategies. By purchasing datasets that encompass consumer behavior, demographics, and preferences related to automotive purchases, I can gain deeper insights into my target audience. Sources such as market research firms and specialized online databases focused on automotive trends will be invaluable.

Key data points to consider include demographic factors like age, gender, and income levels; psychographic elements such as lifestyle choices and values; and behavioral metrics including purchase history and brand loyalty. Additionally, I will monitor market trends related to emerging technologies, such as electric and hybrid vehicles, along with consumer sentiment analysis.

To further refine my understanding, I plan to add columns for customer preferences, social media sentiment, and economic indicators that could influence car buying decisions. By employing advanced machine learning models—such as K-Means for clustering, Random Forest for predictive modeling, and collaborative filtering for recommendation systems—I can uncover natural groupings, predict vehicle preferences, and suggest tailored options to potential customers. Furthermore, leveraging Natural Language Processing (NLP) will allow me to conduct sentiment analysis on reviews and social media data, enhancing my understanding of consumer perceptions towards specific automotive models. This

comprehensive approach will not only strengthen my segmentation efforts but also provide actionable insights to inform my marketing strategies.

Personal Opinion

After conducting a thorough analysis of the electric vehicle market in india launching an electric scooter manufacturing startup appears to be a highly promising opportunity.

The Indian EV market is projected to reach $40 billion by 2030, with electric scooters emerging as a key segment due to their affordability and suitability for urban commuting. With rising urbanization and increasing traffic congestion, consumers are actively seeking efficient, eco-friendly transportation options. Electric scooters perfectly align with these needs.

Additionally, supportive government policies and incentives are enhancing the attractiveness of this market. By focusing on cost-effective, high-performance scooters, we can tap into the growing demand for sustainable mobility solutions.

I believe that with the right strategy and execution, we can establish a strong foothold in this expanding market.

Locations for Establishing an Electric Vehicle (EV) Startup

Pune, Maharashtra

Pune has a rich automotive heritage, with many leading automotive manufacturers and a growing base of component suppliers. This city is strategically located near Mumbai, providing access to a large market and extensive logistics networks. Pune's focus on innovation and collaboration among automotive firms and research institutions makes it an ideal environment for startups looking to develop new electric vehicle technologies and solutions.

Bangalore, Karnataka

Bangalore is recognized as India's tech capital, hosting a vibrant startup ecosystem that fosters innovation and collaboration. The city's extensive network of technology companies and research institutions provides access to skilled talent in software, engineering, and design. The Karnataka government has implemented supportive policies for electric vehicles, including subsidies and incentives, which create a favorable environment for EV startups. Additionally, Bangalore's commitment to sustainable urban transport makes it an ideal testing ground for new mobility solutions.

Hyderabad, Telangana

This city offers a robust IT infrastructure, favorable government policies, and a growing interest in sustainable transportation solutions.

Ahmedabad, Gujarat

Ahmedabad is known for its business-friendly environment and proactive government support for clean technologies. The Gujarat government has launched several initiatives to promote electric vehicles, including subsidies for manufacturers and incentives for consumers. With a strong industrial base and a focus on renewable energy, Ahmedabad is an excellent location for startups looking to enter the EV market and collaborate with local businesses.

GITHUB - https://github.com/Himanshu-Tagde/Market-Segmentation-Analysis-of-Electric-Vehicles-in-India