Market Segmentation and Targeting Strategy for an Electric Vehicle Startup in India

Abinash Bora

IIT Bombay

1st August, 2024

1. Problem Statement for Electric Vehicles in India

The Indian automotive market is currently dominated by traditional petrol and diesel vehicles. Despite the increasing global shift towards electric vehicles (EVs) due to environmental and economic advantages, EV adoption in India faces significant challenges. These include limited charging infrastructure, high initial costs, range anxiety, and a lack of consumer awareness and trust.

To address these challenges and promote EV adoption, it is essential to:

1. **Develop a Comprehensive Market Analysis:** Understand the current market dynamics, customer preferences, and potential growth segments for EVs in India.
2. **Identify Key Segments:** Segment the market based on geographic, demographic, psychographic, and behavioral factors to pinpoint the most promising target customers.
3. **Formulate a Strategic Entry Plan:** Develop a strategy for market entry that includes location selection, target customer segments, and competitive pricing strategies.
4. **Enhance Infrastructure:** Address the uneven distribution of charging stations and ensure adequate infrastructure support across different regions and highways.
5. **Increase Consumer Awareness:** Promote the benefits of EVs and address common concerns like range anxiety and cost-effectiveness.

1. Data Collection:

- **Source:** Kaggle Dataset on Vehicle Registrations in India
- **Time Period:** January 2014 to July 2023
- **Content:** Vehicle registration data categorized by fuel type

- Vahan Parivahan, Government of India Vehicle Registration:
- **Source:** Press Information Bureau, Government of India
- **Description:** Provides comprehensive data on vehicle registrations across different states in India, including fuel type breakdowns and monthly registration figures. This dataset is crucial for analyzing the trends in EV adoption over time and across various regions
- **Data Available:**

  - State-wise sanctioned EV Charging Stations
  - City-wise sanctioned EV Charging Stations
  - Sanctioned EV Charging Stations on Expressways and Highways

2. Conclusion:

Graph Observations:

- **Petrol Vehicles:**
  - Petrol vehicles have the highest and most consistent registrations, showing their market dominance.
  - Petrol remains the leading fuel type from 2017 to 2023, although its dominance is slightly diminishing over time
- **Diesel Vehicles:**
  - Diesel vehicle registrations are stable, reflecting steady demand
  - Diesel registrations show consistent percentages, indicating steady demand likely due to economic considerations, industry needs, or evolving consumer preferences
  - Strongly correlated with petrol (0.75), indicating that as diesel registrations increase, petrol registrations also tend to be high. It shows a moderate negative correlation with Year (-0.38), suggesting a decreasing trend over time
- **Electric Vehicles (EVs):**
  - Electric vehicle registrations are rising, particularly from late 2021, highlighting growing interest in electric mobility
  - EV registrations are increasing over the years, reaching 6.8% by 2023, reflecting growing interest and adoption of electric mobility in India
  - Strongly correlated with hybrid combined (0.95) and Year (0.92), showing an increase in electric vehicle registrations as time progresses
- **Hybrid Vehicles:**
  - Hybrid vehicles exhibit a clear upward trend in registrations over time, indicating growing market potential
  - Strongly positively correlated with electric vehicles (0.95) and Year (0.92), reflecting significant growth over time

Market Analysis:

- **Traditional Fuels (Petrol and Diesel):**
  - The Indian vehicle market remains predominantly dependent on traditional petrol and diesel fuels.
  - The steady demand for traditional vehicles suggests a stable market presence, likely influenced by specific industry needs or established consumer preferences
- **Emerging Trends (Electric and Hybrid Vehicles):**
  - Electric and hybrid vehicles are experiencing notable growth, indicating a shift in consumer preferences towards more sustainable and eco-friendly transportation options
  - This increase in EV registrations suggests a shift towards cleaner and more sustainable transportation options

K-Means Clustering Analysis:

- **Data Preparation:**
  - Handling missing values, encoding text labels, and converting ordinal features into dummy variables
- **Clustering:**
  - Using Scikit-Learn's K-Means to identify clusters
  - Based on the elbow method, the optimal number of clusters for the given data is likely k=5, effectively grouping the data points into five distinct clusters with minimal distortion
- **Cluster Insights:**
  - **Cluster 0:** Predominantly electric vehicles, with fewer diesel and petrol vehicles
  - **Cluster 1:** Balanced distribution, with petrol vehicles leading, followed by electric and diesel
  - **Cluster 2:** Diesel vehicles dominate, with minimal representation of electric and petrol vehicles
  - **Cluster 3:** Moderate number of electric vehicles, with diesel and petrol vehicles also present

Charging Infrastructure:

- **State and City Distribution:**
  - Charging stations are unevenly distributed across states, with a few states having a high concentration and many states lacking any. This disparity could pose challenges for electric vehicle adoption in areas with limited charging infrastructure
  - Major cities like **Mumbai, Ahmedabad, Bengaluru, Kolkata,** and **Chennai** have significantly more stations compared to others
- **Highway Distribution:**
  - **Delhi-Kolkata, Mumbai-Delhi, Kolkata-Nagpur, and Chennai-Bhubaneswar Expressways/Highways** have the highest number of charging stations, reflecting their high traffic volumes
  - With a total of **1,576** stations across the network, expanding the infrastructure is crucial to support broader EV adoption on Indian highways

Target Audiences for the Startup:

1. **Environmentally-Conscious Consumers (Target Segment 0):**
   - Emphasize environmental benefits and lower running costs of EVs. Provide information on available charging

infrastructure

2. **Cost-Conscious Consumers (Segment 4):**
    - Highlight the flexibility of having both hybrid and electric options. Address pricing concerns and demonstrate the value proposition
3. **Diverse Needs and Budget-Conscious Buyers (Segments 1 and 5):**
    - Offer a range of EV and hybrid vehicles. Emphasize fuel efficiency, cost savings, and the evolving charging infrastructure
4. **Practical and Reliability-Focused Buyers (Segments 2 and 3):**
    - Focus on the practical benefits and reliability of hybrid vehicles. Address range anxiety and provide information on the growing EV infrastructure
5. **High-Traffic Highway Users:**
    - Expand charging infrastructure along high-traffic routes and emphasize the availability of charging stations for long-distance travel

By targeting these segments, the startup can tailor its marketing and strategic initiatives to effectively address the needs and preferences of different groups within the Indian market.

The complete code along with the dataset is available at: Internship-Feynn-Labs-.git