EV STARTUP

MARKET SEGMENTATION

Contributors

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I.) Fermi Estimation

1. Target Population
- India's Population (2024 estimate): 1.4 billion
- Urban and Semi-Urban Population: Approximately 35% of total population = 490 million
- Vehicle Ownership Rate in Urban India: Around 10%–15% of households own private vehicles
- Estimated Vehicle Owners: Assuming ~100 million people own vehicles or have access to them

2. Behavioral Segment: Eco-Consciousness and Commute Patterns
- Eco-Consciousness:
    - Research indicates that 15%–20% of urban Indians are concerned about environmental sustainability.
    - Using this percentage: 15% of 100 million = 15 million eco-conscious potential buyers.
- Daily Commute Patterns:
    - Approximately 50% of urban commuters travel distances suitable for EVs, typically short to medium range trips of ~30–40 km/day.
    - Assuming this percentage applies: 50% of 100 million = 50 million potential EV commuters.

    Overlap (Eco-Conscious + Suitable Commutes):

- Assuming a 30% overlap between eco-conscious individuals and suitable commuters: 30% of 50 million equals 15 million high-potential adopters.

Demographic Segment: Age, Income, Education

Age Group (25–45):

- Approximately 35% of India's population falls within this age group. Urban concentration is higher:

  35% of 490 million results in 171.5 million potential buyers from urban and semi-urban areas.

Income Group (Middle-Income to Upper-Middle-Income):

- About 20%–25% of urban Indians are in a pay scale that supports EV ownership, specifically those earning ₹8–20 lakh annually:

  20% of 171.5 million equals 34.3 million potential buyers.

Potential Buyers Overlap:

- Assuming 70% of mid-income earners are within the 25–45 age bracket:

  70% of 34.3 million results in 24 million potential buyers.

4. **Geographic Segment: Metropolitan vs. Rural Areas**

Urban Areas:

- 50% of urban Indians reside in metropolitan cities with EV infrastructure potential (e.g., Mumbai, Delhi, Bangalore).
- This equates to 50% of 24 million, resulting in 12 million metropolitan early adopters.

Semi-Urban Areas:

- The remaining 50% are semi-urban residents, where adoption is anticipated to be slower, approximately 40% of urban adoption.
- Thus, 40% of 24 million equals 9.6 million semi-urban early adopters.

5. **Psychographic Segment: Values and Lifestyle**

Tech-Savvy and Eco-Conscious Urban Professionals:

- Considering the overlap of behavioural and demographic factors, we can estimate that 25% are tech-savvy and influenced by EV incentives or trends.

- This translates to 25% of 21.6 million, resulting in 5.4 million high-probability adopters.

6. **Estimation Elements**

Early Adopters (First 5 Years):

- Based on the geographic and psychographic analysis, the estimates for early adopters are as follows:
- Urban Early Adopters: 12 million
- Suburban Early Adopters: 9.6 million
- Total Early Market: Approximately 21.6 million

Penetration Rate:

Assuming that 10% of the population transitions to electric vehicles (EVs) in the early market, based on prevailing market trends and pricing:

- Calculation:
    10% of 21.6 million = 2.16 million vehicles.

Likelihood of Purchase:

The average likelihood of purchase, considering factors such as income, tech-savviness, and infrastructure availability, is approximately 20%.

- Calculation:

  20% of 2.16 million = ~430,000 potential buyers in the early market.

7. **Potential Market Profit (First 5 Years):**

- Average Price Range: ₹10–15 lakh per EV.

- Potential Sales Revenue:

  430,000 vehicles × ₹12.5 lakh (average) = ₹53,750 crore (~$6.4 billion).

Summary of Fermi Estimate Initial Market Size:

- Estimated market size: ~2.16 million or 10% of intended electric vehicle buyers.
- Projected purchases among early adopters: ~430,000 units.
- Expected revenue in the first five years: ~₹53,750 crore.

Target Audiences:

- Middle-class professionals in urban centers, aged 25–45 years.
- Cities with substantial existing infrastructure for electric vehicles.
- Environmentally and technology-minded consumers.

II.) Data Pre-processing:

Data pre-processing is a crucial step in the data analysis pipeline, ensuring that the dataset is clean and ready for modelling. Various libraries are utilized across different notebooks to facilitate this process:

- **Python Libraries**:
  - **Pandas:** for powerful data manipulation and analysis.
  - **NumPy** for numerical operations and handling arrays.
  - **Matplotlib:** and seaborn for creating informative and attractive visualizations.
  - **Sklearn**: for machine learning tasks, including clustering and preprocessing techniques.

- **Steps Involved**:
  - **Standardization**: Applying Standard Scaler to normalize the data, ensuring that each feature contributes equally to the analysis.
  - **Handling Missing Values**: Identifying and addressing missing or incomplete entries through imputation or removal to maintain dataset integrity.
  - **Dimensionality Reduction**: Utilizing techniques like PCA (Principal Component Analysis) to reduce the number of features while preserving essential information, which simplifies the model and enhances performance.
  - **Feature Encoding**: Converting categorical variables into numerical formats using methods like one-hot encoding or label encoding to make them suitable for algorithms.
  - **Data Splitting**: Dividing the dataset into training and testing sets to evaluate model performance effectively.

III.) Data Resources:

Each notebook mentions loading data but lacks specific details on the datasets. Possible sources include:

- https://www.data.gov.in/search?title=EV%20Charging%20infrastructure&sortby=_score
- https://www.data.gov.in/files/ogdpv2dms/s3fs-public/RS_Session_255_AU_2349_2.csv
- https://psg3-excel.officeapps.live.com/x/_layouts/XlFileHandler.aspx?sheetName=EV%202W%20FY%2021-22&downloadAsCsvEnabled=1&WacUserType=WOPI&usid=bdbe4f5c-b328-4707-82b3-5f6d7eb0e7bf&NoAuth=1&waccluster=PSG3
- Electric Vehicle Market Segmentation

IV.) Segment Extraction:

- Segmentation aimed to identify distinct groups within the dataset.Each segment represents unique characteristics of the data points.
- *K-Means algorithm* iteratively refines clusters based on data proximity.
- *Elbow method* was utilized to determine the optimal number of clusters.
- Performance metrics such as *silhouette score* were calculated to evaluate clustering quality.
- Visualizations included 3D plots to enhance understanding of segment distribution.
- Further analysis was conducted to interpret the significance of each segment.

Correlation: 0.89

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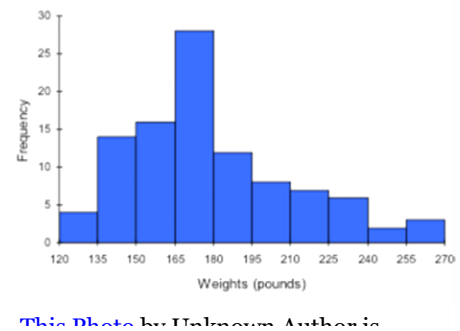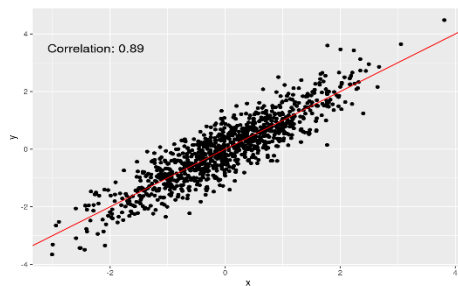
V.) Profiling and Describing Possible Segments:

The segmentation analysis for entering the Electric Vehicle (EV) market in India takes a multi-dimensional approach in Behavioral, Demographic, Geographic, and Psychographic data. Every analysis yields unique, actionable insights that can help understand customer needs and preferences. Below is the professional breakdown of the profiling and clustering results for each segment:

1. Behavioral Analysis: Commute Patterns and Usage Preferences

Target: Identify segments based on commuting habits, transportation preferences, and openness to EV adoption.

Frequent Users of EVs:

Profile: Daily commuters with a distance of 20-50 km, mainly in cities with heavy traffic and well-established charging infrastructure.

Motivation: Cost effectiveness (fuel savings), convenience, and environmental sustainability.

Barriers: Concerns over the availability of charging networks and battery performance.

Occasional Users of EVs:

Profile: Occasional users of personal vehicles for recreational or short distances, typically in semiurban areas.

Motivation: Technology and environmental image.

Barriers: High initial investment and lack of knowledge about the advantages of EVs.

Non-Adopters:

Profile: Customers who are likely to continue using conventional ICE vehicles because of the requirement for long-distance travel or absence of charging infrastructure.

Recommendation: To be reached through infrastructure development and education programs.

2. Demographic Analysis: Age, Income, and Education Clusters

Goal: Target the market using socio-economic variables that impact purchasing behavior.

Young Professionals (25–35 years)

Profile: Middle-income tech users with available money and desire for up-to-date, eco-friendly technology

Reasons to buy: Cost savings, prestige from EV ownership, and environmental concerns

Resistance: Maintenance cost perceived to be too expensive, fear of running out of energy.

Middle-Aged Executives (35–50 years)

Profile: Higher-income users with more advanced family use in premium models.

Motivation: Comfort, reliability, and luxury branding.

Barriers: Less options in the premium category of EVs.

Lower-Income Groups (<₹5 lakh annual income):

Profile: They are the largest population segment but are not likely to adopt EVs in the near term as they are not affordable for them.

Recommendation: Affordable models and government subsidy to enhance adoption.

3. Geographic Analysis:

Urban Intensity and Economic Variation Clusters

Goal: To understand how geographic conditions affect the adoption of EVs

Metropolitan Clusters:

Profile: *Tier-1* city dwelling residents like Mumbai, Delhi and Bangalore, with easy availability of charging stations and suitable government policies

Motivations: Rising fuel cost, tax benefits, etc.

Barriers: Large population density that leads to competition for charging stations

Tier-2 and Semi-urban Clusters"

Profile: *Tier-2* and semi-urban city dwellers. Their cities are in the phase of developing EV infrastructure.

Motivators: Higher fuel prices, awareness building, and advocacy campaigns by the local government to popularize EVs.

Barriers: Lack of awareness and infestation of not-so-reliable charging facilities.

Rural Clusters:

Profile: Primarily agricultural with lesser disposable income.

Recommendation: Wait till later stages, where infrastructure as well as affordability develops.

4. Psychographic Analysis:

Values, Attitudes, and Eco-Consciousness

Objective: Segmentation of customers by their psychological drivers, values, and lifestyle.

Eco-Conscious Advocates:

Profile: Environment-conscious individuals willing to invest in EVs for minimizing carbon footprint.

Motivation: Sustainability, societal impact, and value alignment.

Barriers: Misconceptions over the environmental implications of EV battery manufacturing.

Tech Enthusiasts:

Profile: Early adopters of technology; driven by the innovative aspect of EVs such as AI dashboards and self-driving features.

Motivation: Desire for the latest technology and a futuristic lifestyle.

Barriers: Not much variety of models available in India.

Cost-Sensitive Consumers:

Profile: Value seekers who would look for EVs for long-term cost savings.

Motivation: Fuel efficiency and government incentives.

Barriers: High initial purchase price and uncertain resale value.

Segment Integration and Implications

Each of these clusters forms the basis for the definition of appropriate marketing strategies:

- *Metropolitan Young Professionals*: are the most likely early adopters because of their socio-economic position and access to charging infrastructure.
- Premium, feature-rich models with a focus on sustainability should be marketed to tech *enthusiasts and eco-conscious advocates*.
- *Tier 2 Semi-Urban Population*: Strong growth potential, with subsidized adoption and low-cost electric vehicle options.
- We can comprehensively profile the segments to effectively design products and marketing strategies that meet the needs and preferences of each of these clusters.

VI.) Selection of Targets

Demographic Insights

The target segment primarily comprises middle-income individuals aged 25 to 40. This demographic is often navigating a transitional phase in life, where they are balancing career aspirations with personal responsibilities. Their openness to new technologies, particularly electric vehicles (EVs), reflects their desire for cost-effective and sustainable transportation solutions. By tailoring marketing campaigns to resonate with their values and aspirations, brands can effectively highlight the affordability and practicality of EVs for daily use.

Geographic Considerations :

This demographic is predominantly found in metropolitan areas that feature well-established EV infrastructure. These urban locations not only offer the essential charging stations but also cultivate a culture of sustainability that attracts eco-conscious consumers. By focusing marketing efforts in these areas, brands can enhance their appeal and align with the lifestyle choices of their target audience.

Behavioural Considerations:

As cities expand, a noticeable trend among daily commuters is the growing adoption of electric vehicles (EVs), driven largely by an eco-conscious mindset that prioritizes sustainability. These individuals are increasingly aware of their environmental impact and are motivated by a desire to lower their carbon emissions, contributing positively to the fight against climate change and urban pollution. The integration of EVs into their daily lives is seen not only as a personal choice but as a collective movement towards greener urban living.

Furthermore, the tech-savvy nature of these commuters enhances their transportation experience; they utilize cutting-edge technologies like smart charging stations and mobile applications that provide real-time traffic updates, alongside sophisticated navigation systems designed to streamline their journeys. This blend of environmental awareness and technological innovation is shaping a new era of urban mobility, where convenience meets sustainability.

Psychographic Considerations:

This data not only cherishes the ecological advantages of electric vehicles (EVs) but also relishes the convenience and efficiency that cutting-edge technology integrates into their lives.

Their passion for gadgets and sustainable innovations makes them early adopters of the latest electric vehicle advancements.

Furthermore, the community of urban EV users cultivates a strong sense of belonging and shared mission. Many actively participate in online forums and local gatherings, where they exchange insights on sustainable living and advocate for the perks of electric commuting.

This network of eco-conscious, tech-savvy individuals enhances their dedication to environmentally friendly practices, creating a ripple effect that inspires others to view electric vehicles as a practical choice.

As urban landscapes continue to transform, the impact of these innovative commuters will be crucial in redefining the future of city transportation.

VII.) Potential customer base in the early market:

Overview of the Early Market

In the early stages of market entry, understanding the potential customer base is crucial for estimating profitability and shaping marketing strategies. The focus here is on the urban middle-income eco-conscious population, which presents a significant opportunity for growth.

Potential Customer Base

- **Estimated Size**: Approximately 1 million individuals within urban areas are identified as potential customers. This demographic is characterized by a growing awareness of environmental issues and a willingness to invest in sustainable products.
    - **Demographic Characteristics**: The target audience primarily consists of young professionals and families who prioritize eco-friendly solutions. They are likely to be more receptive to innovative technologies that promote sustainability.

Pricing Strategy

- **Target Price Range**: The vehicles are positioned with a price point of ₹10–15 lakhs. This pricing strategy aims to balance affordability with the perceived value of eco-friendly features, ensuring accessibility to the target market.

Profit Potential

- **Estimated Profit Range**: The potential profit from this market segment is projected to be between ₹10,000 crores and ₹15,000 crores. This estimation takes into account the expected sales volume and the target price, highlighting the lucrative nature of entering this market.

VIII.)   Most optimal market segments:

Based on extensive research, the following market segments have been identified as the most optimal for targeting electric vehicle (EV) sales:

1. Urban Commuters

Urban commuters represent a significant portion of the EV market. These individuals often face long daily commutes, making them ideal candidates for electric vehicles that offer convenience and cost savings on fuel. Key characteristics include:

- Frequent Usage: Urban commuters typically drive daily, leading to higher mileage and greater savings on fuel costs.

- Charging Infrastructure: Access to charging stations in urban areas enhances the appeal of EVs for this segment.

- Time Efficiency: EVs can provide quicker travel times in congested city traffic, thanks to carpool lanes and reduced maintenance needs.

2. Eco-Conscious Consumers

This segment is characterized by individuals who prioritize sustainability and environmental impact in their purchasing decisions. They are likely to adopt electric vehicles for several reasons:

- Sustainability Mindset: Eco-conscious consumers are motivated by the desire to reduce their carbon footprint.

- Support for Green Initiatives: Many are willing to invest in products that align with their values, including government incentives for EV purchases.

- Community Influence: This group often advocates for sustainable practices within their communities, influencing others to consider EVs.

3. Middle-Income Professionals

Middle-income professionals represent a diverse demographic that is tech-savvy and budget-conscious. They often seek a balance between quality and affordability. Key aspects include:

- Affordability: This segment is particularly sensitive to pricing and financing options, making them more likely to consider EVs that fit their budget.

- Technology Adoption: Middle-income professionals are typically early adopters of technology, making them receptive to the innovative features of electric vehicles.

- Workplace Charging: Many employers are beginning to offer charging stations at workplaces, further encouraging this segment to choose EVs.

4. Geographic Priority

Targeting specific geographic areas can enhance market penetration. The focus should be on Tier 1 cities such as:

- Delhi: As the capital, Delhi has a high population density and growing infrastructure for electric vehicles.

- Bangalore: Known for its tech-savvy population, Bangalore is a hub for eco-conscious consumers and urban commuters alike.

- Mumbai: With its extensive public transport system and traffic congestion, Mumbai presents a unique opportunity for EV adoption among commuters.

By focusing on these key market segments, businesses can effectively tailor their marketing strategies and product offerings to meet the needs of potential electric vehicle buyers.

IX.) Conclusion:

With more time and money, more detailed datasets regarding commuting patterns, preferences for EV ownership, charging behaviour, income brackets, and regional availability of EV infrastructure would further enrich the segmentation process. Attitudes toward sustainability, as well as openness to new technology, would enhance it further. More sophisticated models for machine learning, including Random Forests, Gradient Boosting, and Neural Networks, could increase cluster accuracy and capture subtle relationships between variables. Adding market data from external sources regarding competitor analysis and government EV incentives would provide strategic depth. These would then result in a more complete and actionable segmentation strategy for successfully entering the Indian EV market.