Segmentation of the Indian Electric Vehicle Market

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GitHub Project Link : [EV Market Segmentation](#)

1. Problem Statement

As an emerging Electric Vehicle (EV) startup, our goal is to identify the most promising vehicle and customer segments within the Indian market for our EV offerings. To achieve this, we will conduct a comprehensive segmentation analysis of the Indian Electric Vehicle market to develop a strategic market entry plan. This analysis will involve identifying and profiling key vehicle and customer segments that are most likely to adopt Electric Vehicles.

We will explore various segmentation categories, including Geographic, Demographic, Psychographic, Behavioral, and other relevant factors based on available data. By understanding the unique characteristics, preferences, and needs of these segments, we aim to formulate a viable market entry strategy, targeting the segments with the highest potential for adoption, whether in the consumer or business sectors.

2. Fermi Estimation

Assumptions Based on Publicly Available Data:

1. Total Indian EV Market (2024): $34.8 billion (based on industry reports)
2. Expected Market Growth Rate: 22.92% CAGR (based on industry forecasts)
3. Market Distribution by Vehicle Segment:
   - Two-wheelers: 50% of the market
   - Three-wheelers: 30% of the market
   - Four-wheelers: 20% of the market
4. Urban/Rural Market Split:
   - Urban: 70% of the market
   - Rural: 30% of the market

5. Total Number of Vehicles in India:

   - Two-wheelers: Approximately 200 million
   - Three-wheelers: Approximately 15 million
   - Four-wheelers: Approximately 30 million

6. EV Penetration Rates:

   - Two-wheelers: 10% in urban areas, 5% in rural areas
   - Three-wheelers: 8% in urban areas, 4% in rural areas
   - Four-wheelers: 5% in urban areas, 2% in rural areas

7. Number of Major Competitors:

   - Two-wheelers: 10 major players
   - Three-wheelers: 5 major players
   - Four-wheelers: 8 major players

8. Average Market Share of a New Entrant: 1% for all segments in the first year

Calculations:

Two-Wheelers:

Urban Area:

- Potential Market Size: 200 million * 70% * 10% = 14 million EVs
- Total Addressable Market for New Entrant: 14 million / 10 = 1.4 million EVs
- Potential Market Share: 1.4 million * 1% = 14,000 EVs

Rural Area:

- Potential Market Size: 200 million * 30% * 5% = 3 million EVs

- TAM for New Entrant: 3 million / 10 = 300,000 EVs
- Potential Market Share: 300,000 * 1% = 3,000 EVs

Three-Wheelers:

Urban Area:
- Potential Market Size: 15 million * 70% * 8% = 840,000 EVs
- TAM for New Entrant: 840,000 / 5 = 168,000 EVs
- Potential Market Share: 168,000 * 1% = 1,680 EVs

Rural Area:

- Potential Market Size: 15 million * 30% * 4% = 180,000 EVs
- TAM for New Entrant: 180,000 / 5 = 36,000 EVs
- Potential Market Share: 36,000 * 1% = 360 EVs

Four-Wheelers:

Urban Area:

- Potential Market Size: 30 million * 70% * 5% = 1.05 million EVs
- TAM for New Entrant: 1.05 million / 8 = 131,250 EVs
- Potential Market Share: 131,250 * 1% = 1,313 EVs

Rural Area:

- Potential Market Size: 30 million * 30% * 2% = 180,000 EVs
- TAM for New Entrant: 180,000 / 8 = 22,500 EVs
- Potential Market Share: 22,500 * 1% = 225 EVs

To estimate the potential market share for an Electric Vehicle (EV) startup in India, we evaluated various vehicle segments—two-wheelers, three-wheelers, and four-wheelers—across urban and rural areas. Using current data, the estimated market sizes are approximately 17,000 EVs for two-wheelers, 2,040 EVs for three-wheelers, and 1,538 EVs for four-wheelers. These projections are based on conservative EV penetration rates and assume a 1% market share for new entrants.

3. Data Sources

Dataset 1: Indian Consumer Car Purchasing Behavior

❖ **Source:** [Indian Consumers Cars Purchasing Behavior Dataset](#)

❖ **Overview:** This dataset offers comprehensive insights into the car purchasing behavior of Indian consumers, capturing a variety of socio-economic factors. The dataset includes the following features:

➢ **Age:** The age of the car buyer.

➢ **Profession:** The occupation or profession of the buyer.

➢ **Marital Status:** The marital status of the buyer (e.g., single, married).

➢ **Education:** The highest level of education attained by the buyer.

➢ **Number of Dependents:** The number of dependents financially reliant on the buyer.

➢ **Personal Loan:** Indicates whether the buyer has an existing personal loan.

➢ **House Loan:** Indicates whether the buyer has a house loan.

➢ **Wife Working:** Denotes whether the buyer's spouse is employed.

➢ **Salary:** The individual salary of the buyer.

➢ **Wife Salary:** The individual salary of the buyer's spouse.

➢ **Total Salary:** The combined household income of the buyer and spouse.

➢ **Make:** The brand or manufacturer of the purchased automobile.

➢ **Price:** The purchase price of the automobile.

Dataset 2: State-wise Electric Vehicle Sales in India

• **Source:** [State/UTs Wise Current Sales of Electric Vehicles](#)

• **Overview:** This dataset provides detailed statistics on electric vehicle (EV) registrations across various states and union territories in India. It categorizes the EV data across multiple vehicle types and use cases, with the following features:

o **State Name:** The name of the state or union territory.

o **Two-Wheeler:** The number of two-wheeled EVs, such as electric motorcycles and scooters.

o **Three-Wheeler:** The number of three-wheeled EVs, including electric auto-rickshaws.

o **Four-Wheeler:** The number of four-wheeled EVs, typically electric cars.

o **Goods Vehicles:** The number of electric vehicles used for transporting goods.

- o **Public Service Vehicles:** The number of electric vehicles used for public transportation, such as electric buses.

- o **Special Category Vehicles:** Electric vehicles classified under special categories (specific criteria not provided).

- o **Ambulance/Hearses:** The number of electric ambulances and hearses.

- o **Construction Equipment Vehicles:** The number of electric vehicles used in construction activities, such as excavators and bulldozers.

- o **Other:** A catch-all category for other types of electric vehicles not specified in the previous columns.

- o **Grand Total:** The aggregate number of electric vehicles across all categories for each state or territory.

4. Data Preprocessing

The primary goal of pre-processing was to prepare the data for further analysis, segmentation, and profiling. Below is a detailed overview of the pre-processing steps and the libraries used.

1. **Libraries Used**
   - Pandas: For data manipulation, loading, and basic statistical analysis.

   - NumPy: For numerical operations and handling arrays.

   - Matplotlib & Seaborn: For visualization and plotting.

   - Scikit-learn: For clustering, scaling, and dimensionality reduction.

2. **Data Acquisition and Loading**
   - Both datasets, detailing vehicle registrations across Indian states and union territories, were imported using pd.read_csv().

3. **Initial Data Exploration**
   - Shape and Structure: The dimensions of each dataset were examined with df.shape, revealing the number of rows and columns.

   - Data Overview: The structure, including data types and non-null counts, was analyzed using df.info(). This step helped identify potential issues such as data type mismatches and missing values.

   - Descriptive Statistics: Key summary statistics were generated using df.describe(), providing insights into central tendencies, dispersion, and outliers in the datasets.

4. **Data Cleaning**
   - Handling Missing Values: In Dataset 1, missing values were replaced with 0 using df.fillna(0, inplace=True). This approach was based on the assumption that missing values indicated the absence of specific vehicle types in certain regions. & Dataset 2 did not contain any missing values, so no further action was needed.

   - Duplicate Detection: Each dataset was checked for duplicates using df.duplicated().sum(). No duplicates were identified, ensuring that each record was unique and valid.

5. **Feature Engineering and Transformation**
   - Label Encoding: For Dataset 1, categorical features were converted into numerical form using LabelEncoder from sklearn.preprocessing. This step was crucial for ensuring that the clustering algorithms could process the data effectively.

   - Scaling and Normalization: Although not explicitly performed initially, scaling and normalization were considered crucial for the subsequent clustering process. The use of StandardScaler from the sklearn.preprocessing module was planned to ensure that

all features contribute equally during the analysis, preventing any single feature from dominating due to differences in magnitude.

6. **Data Integrity Checks**
   - Final checks were conducted to ensure data integrity across both datasets, including consistency in column names, correct data types, and the absence of anomalies that could skew the analysis.

The comprehensive pre-processing of these datasets ensures they are well-prepared for in-depth analysis and segmentation. By systematically addressing issues such as missing values, duplicates, and potential data scaling needs, a robust foundation has been laid for the next steps in analysis.

5. Exploratory Data Analysis

Dataset: Indian Consumer Car Purchasing Behavior

1. Distribution of Key Numerical Features

This visualization illustrates the distributions of several key numerical features in the dataset. The key findings are as follows:

➢ **Age**: The average age of a car buyer is approximately 36 years. A significant majority (92%) of customers fall within the 25 to 45 age range.
➢ **Salary**: Most buyers earn between 1 million and 2.5 million, with 72% of customers within this salary range.
➢ **Price**: The majority of cars purchased are priced between 7 lakhs and 16 lakhs, with 79% of buyers choosing vehicles in this price bracket.
➢ **Wife Salary**: About 52% of car buyers have spouses who are employed.
➢ **Total Salary**: For 73% of customers, the combined household income is between 1 and 3 million.
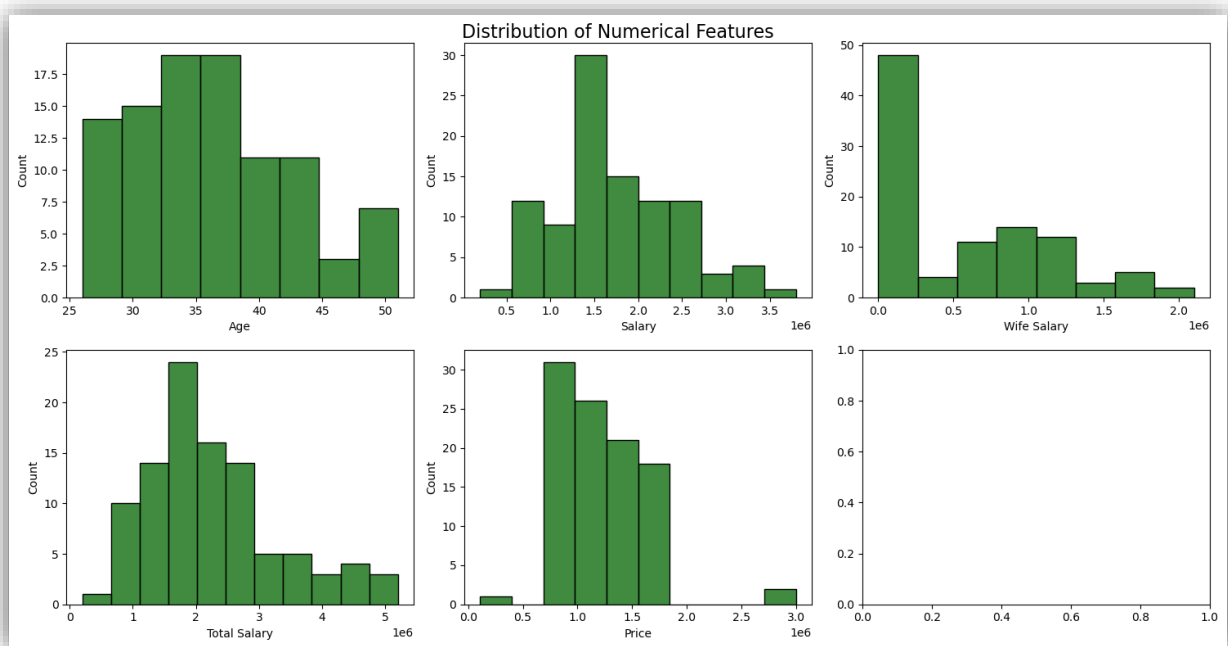

Fig 1: Numerical Feature Distribution

These insights provide a clear understanding of the typical profile of car buyers in the dataset, including their age, income, and purchasing behavior.

2. Distribution of Categorical Features

This visualization examines the distribution of various categorical features in the dataset. The key findings are as follows:

➢ **Number of Dependents**: Most customers have 2 to 3 dependents.

- **Profession**: Approximately 65% of customers are employed in salaried positions, while 35% are self-employed.
- **Marital Status**: About 15% of customers are single, and 85% are married.
- **Education**: Approximately 55% of customers hold a Post Graduate degree, while 35% have a Graduate degree.
- **Personal Loan**: Around 68% of customers do not have a personal loan.
- **House Loan**: About 62% of customers do not have a house loan.
- **Wife Working**: Approximately 52% of customers have working spouses.
- **Vehicle Make**: The most popular vehicle purchases among customers are SUVs and Baleno, followed by Creta.

These insights highlight the typical demographic and financial characteristics of car buyers in the dataset, including their educational background, employment status, and loan holdings.
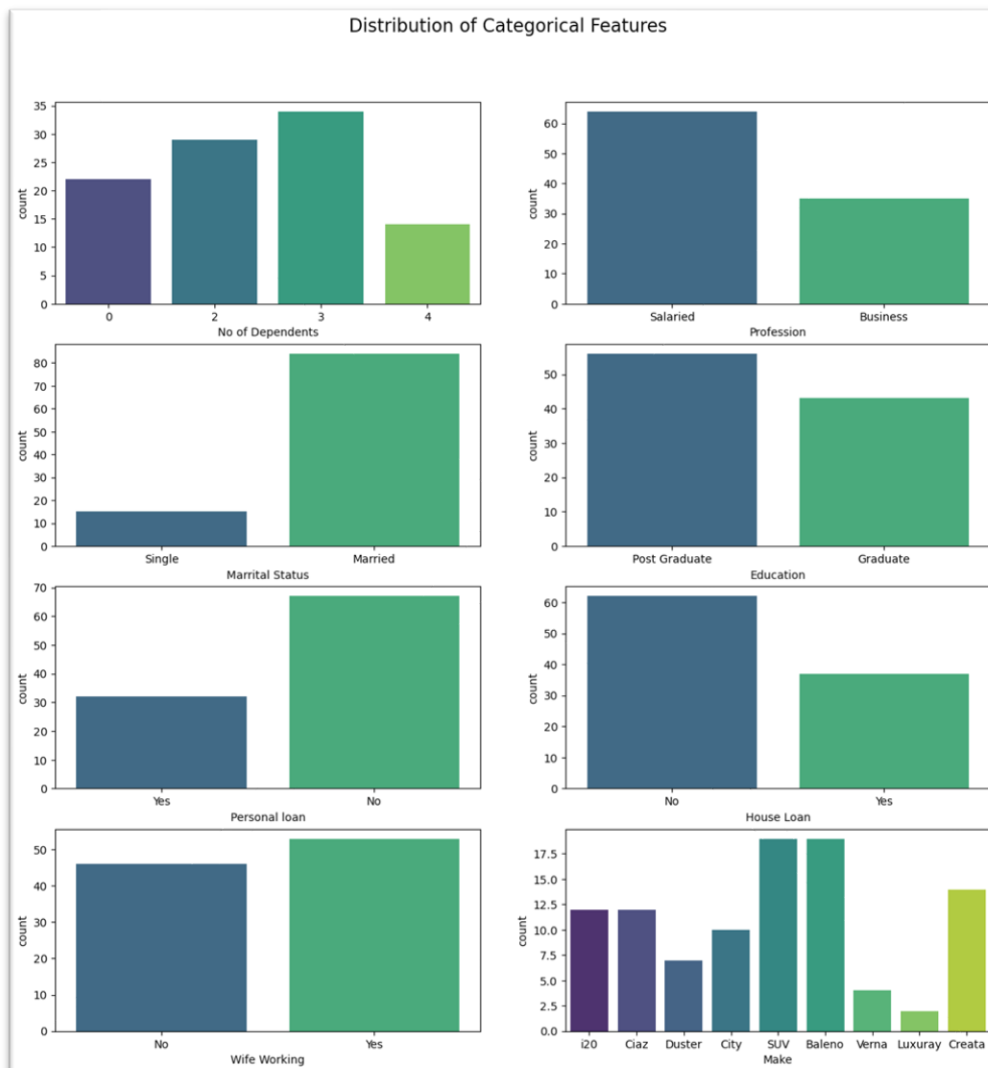

Fig 2: Categorical Feature Distribution

Summary of Key Findings In Indian Consumer Car Purchasing Behavior

1. **Customer Demographics:**
   - Average Age: 36 years
   - Age Distribution: 92% between 25 and 45 years old
   - Marital Status: 85% married, 15% single
   - Dependents: Majority have 2 or 3 dependents
   - Employment: 65% salaried, 35% self-employed
   - Education: 55% postgraduate, 35% graduate

2. **Financial Information:**
   - Salary Range: 72% earn between ₹1 - ₹2.5 million annually
   - Household Income: 73% have income between ₹1 - ₹3 million
   - Personal Loans: 68% do not have a personal loan
   - House Loans: 62% do not have a house loan
   - Working Spouses: 52% have working spouses

3. **Vehicle Purchases:**
   - Popular Models: SUVs, Baleno, Creta
   - Price Range: 79% purchase vehicles within ₹7 - ₹16 lakh
   - Luxury Vehicles: Few customers purchase luxury vehicles

Dataset: State-wise Electric Vehicle Sales in India

1. Distribution of Vehicle Registrations Across States

This section presents visualizations of the total registrations for two-wheelers, three-wheelers, and four-wheelers in various states, highlighting regional differences and key trends in vehicle ownership.

Key Findings:

1. **Total Two Wheelers:**
   - Highest: Karnataka (56,737), Maharashtra (51,149), Tamil Nadu (44,302)
   - Lowest: Arunachal Pradesh (14), Andaman and Nicobar Islands (1), Sikkim (1)

2. **Total Three Wheelers:**
   - Highest: Uttar Pradesh (257,159), Bihar (59,079), Karnataka (16,478)
   - Lowest: Mizoram (1), Ladakh (0), Arunachal Pradesh (0)

3. **Total Four Wheelers:**
   - Highest: Delhi (3,051), Karnataka (7,212), Kerala (2,524)
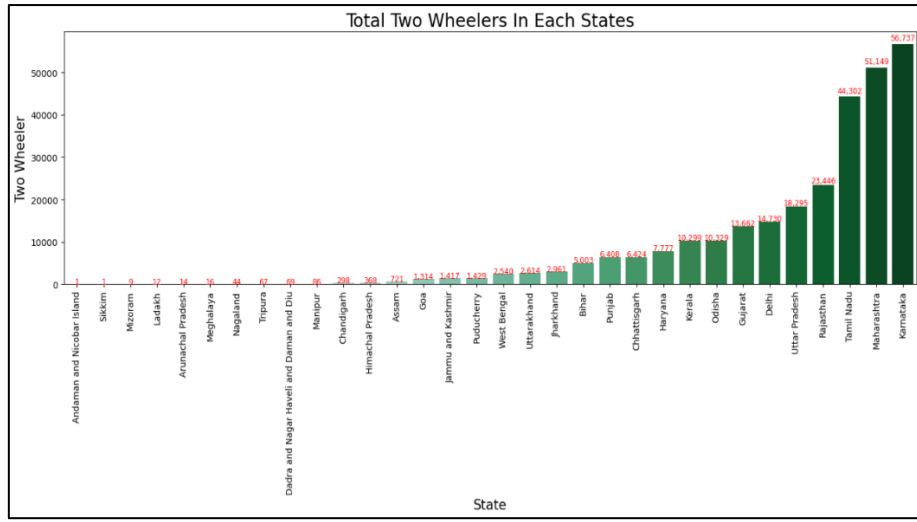   - Lowest: Maharashtra (2), Mizoram (4), Manipur (9)
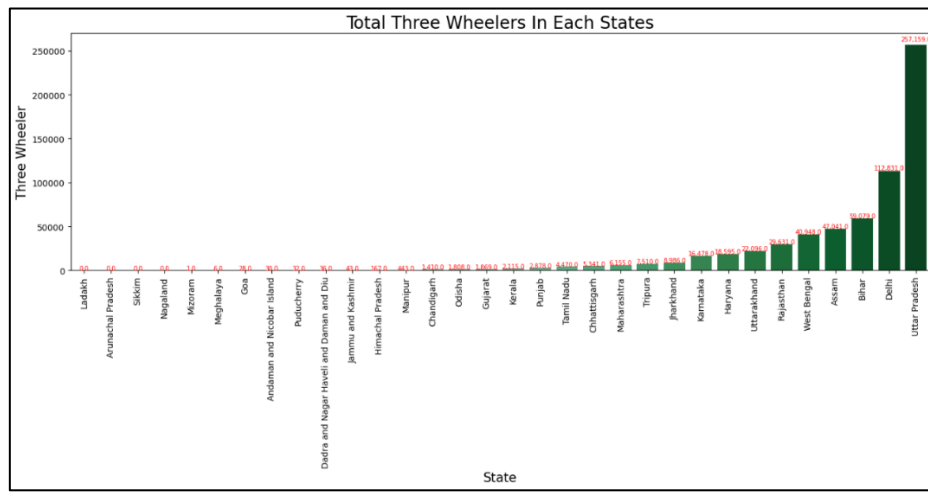
Fig 3: Total 2-Wheelers In Each State

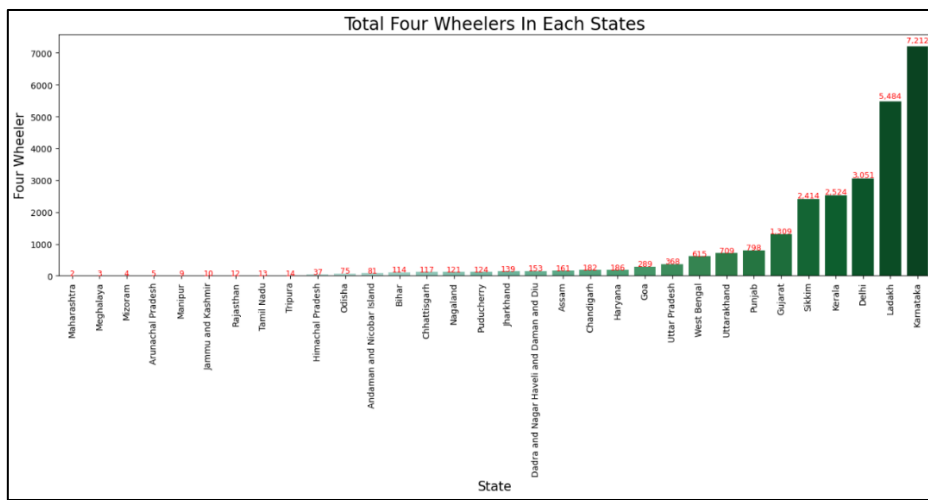**Fig 4: Total 3-Wheelers In Each State**

Fig 5: Total 4-Wheelers In Each State

2. Total Electric Vehicle Registrations by State

This plot illustrates the total number of electric vehicles (EVs) registered in each state, providing a comprehensive view of EV distribution across different regions.

Key Findings:

- **Highest Registrations**: Uttar Pradesh leads with the highest number of EV registrations at 276,217, significantly surpassing other states.

- **Regional Leaders**: Delhi (132,302) and Karnataka (82,046) follow, indicating high adoption rates in these regions.

- **Moderate Registrations**: States like Tamil Nadu (50,296), Maharashtra (58,815), and Rajasthan (53,141) show considerable EV presence.

- **Lower Registrations**: States such as Arunachal Pradesh (20) and Mizoram (20) exhibit minimal EV registrations, suggesting lower adoption or availability.
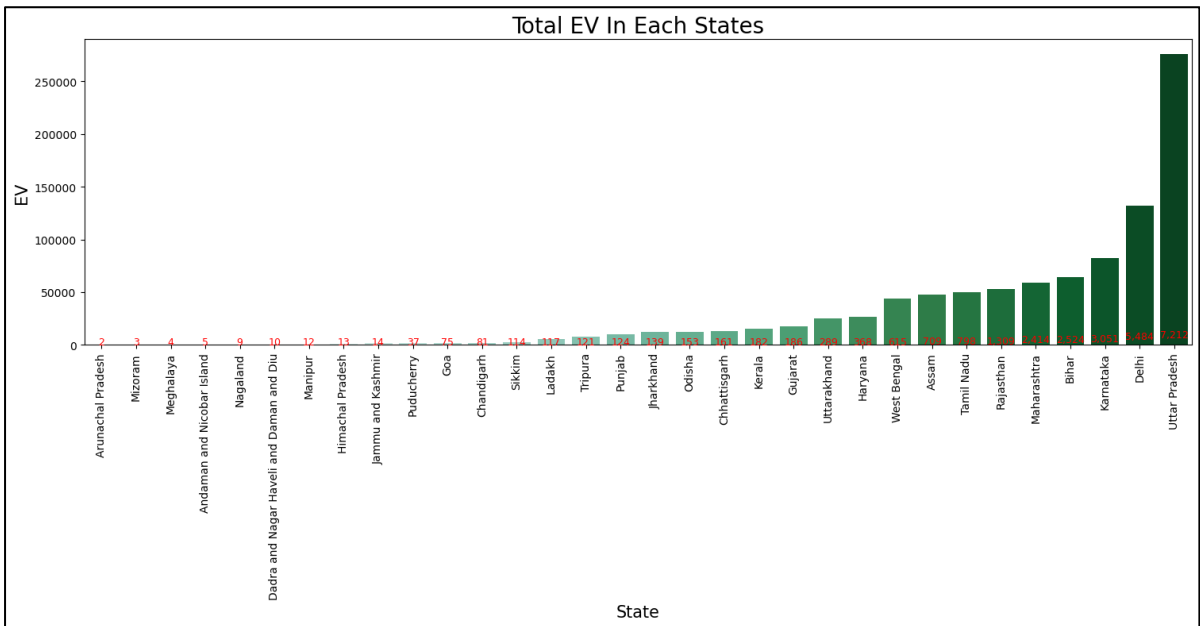

Fig 6: Total EVs In Each State

Summary of Key Findings In State-wise Electric Vehicle Sales in India

- **Top States**: Uttar Pradesh, Delhi, and Karnataka are the top three states with the highest total EV registrations, reflecting significant market activity in these regions.

- **High Adoption Areas**: Delhi and Karnataka show particularly high adoption rates, which may be attributed to better infrastructure or targeted incentives.

- **Moderate Adoption**: Tamil Nadu, Maharashtra, and Rajasthan also demonstrate substantial EV registrations, indicating growing interest and infrastructure development in these states.

- **Low Adoption**: Arunachal Pradesh and Mizoram have the lowest registration numbers, suggesting either less availability of EV options or lower consumer demand in these areas.

- **Regional Insights**: The distribution of EVs across states reveals regional disparities in adoption rates, which can inform targeted marketing and policy-making efforts.

These observations highlight key areas for potential growth and focus in the EV market, guiding strategic decisions for expansion and investment.

6. Segment Extraction

1. Indian Consumer Car Purchasing Behavior

In the subsequent analysis, the k-means algorithm was applied to explore market segmentation possibilities, with cluster solutions ranging from 2 to 11 segments. The Within-Cluster Sum of Squares (WCSS) values were used to assess the optimal number of clusters, with a clear reduction in WCSS observed as the number of clusters increased, indicating improved cluster compactness.

A notable drop in WCSS between 3 and 4 clusters suggested that three clusters might provide an optimal balance between segment granularity and cohesion. To further validate this choice, silhouette scores were analyzed. The highest silhouette score corresponded to the three-cluster solution, indicating the best-defined separation between clusters and the highest average similarity within clusters.
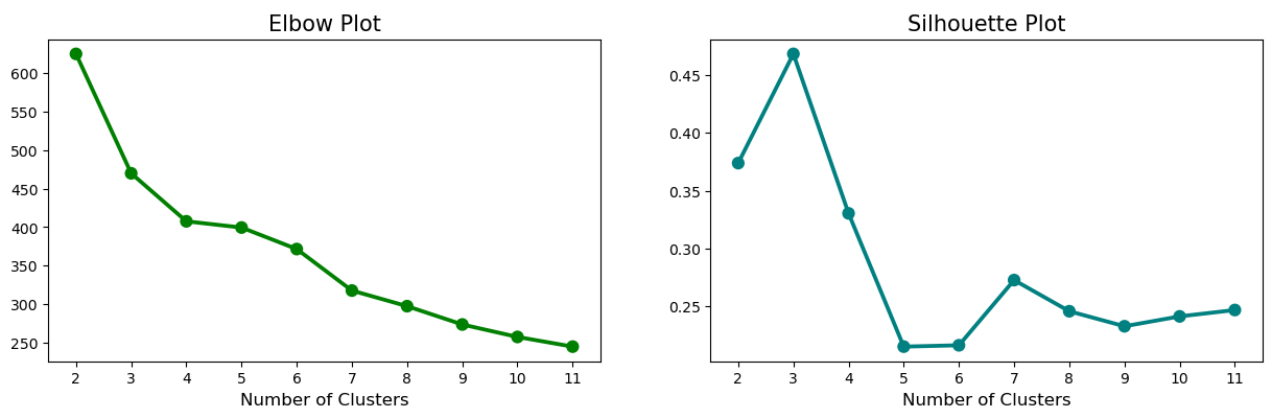

Fig 7: Elbow & Silhouette Plot

This combination of a significant reduction in WCSS and the highest silhouette score supports the decision to focus on a four-cluster solution, ensuring precision in segmentation and actionable insights.

2. State-wise Electric Vehicle Sales in India

In this segment, we analyze key aspects of India's Electric Vehicle (EV) market, revealing distinct regional patterns. Karnataka and Tamil Nadu lead in electric two-wheeler adoption, indicating strong demand and infrastructure for these vehicles. Uttar Pradesh and Delhi show a significant prevalence of electric three-wheelers, likely driven by their use in public and goods transportation. Ladakh and Sikkim stand out for their focus on electric four-wheelers, reflecting specific regional needs. States like Chhattisgarh and Gujarat have notable concentrations of specialized electric vehicles.

High adoption rates are observed in Uttar Pradesh and Delhi, showcasing advanced market development. Conversely, states such as Arunachal Pradesh and Mizoram present potential

for growth, highlighting opportunities for targeted strategies in both well-established and emerging markets.
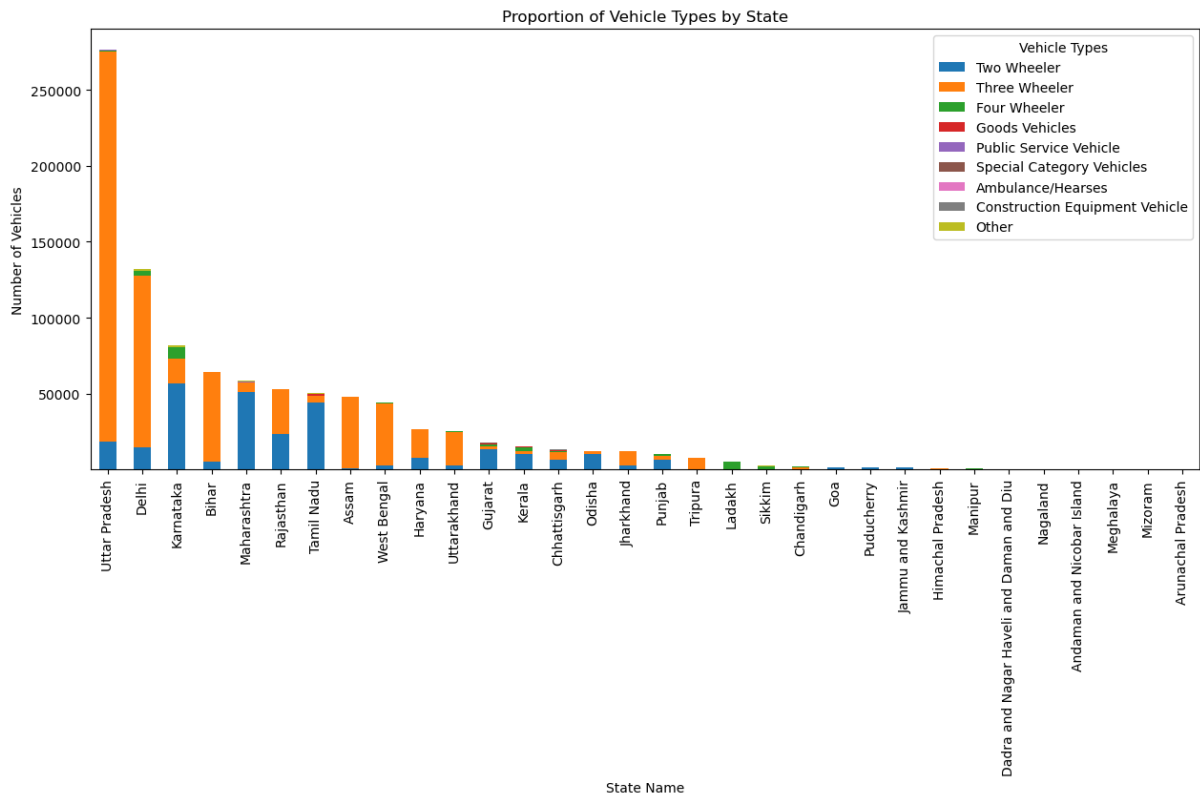

Fig 8: Proportion of EVs In Each State

7. Profiling and Describing Potential Segments

Profiling Segments: The following analysis provides a comprehensive overview of consumer segments based on their mean characteristics, as illustrated in the accompanying diagram.
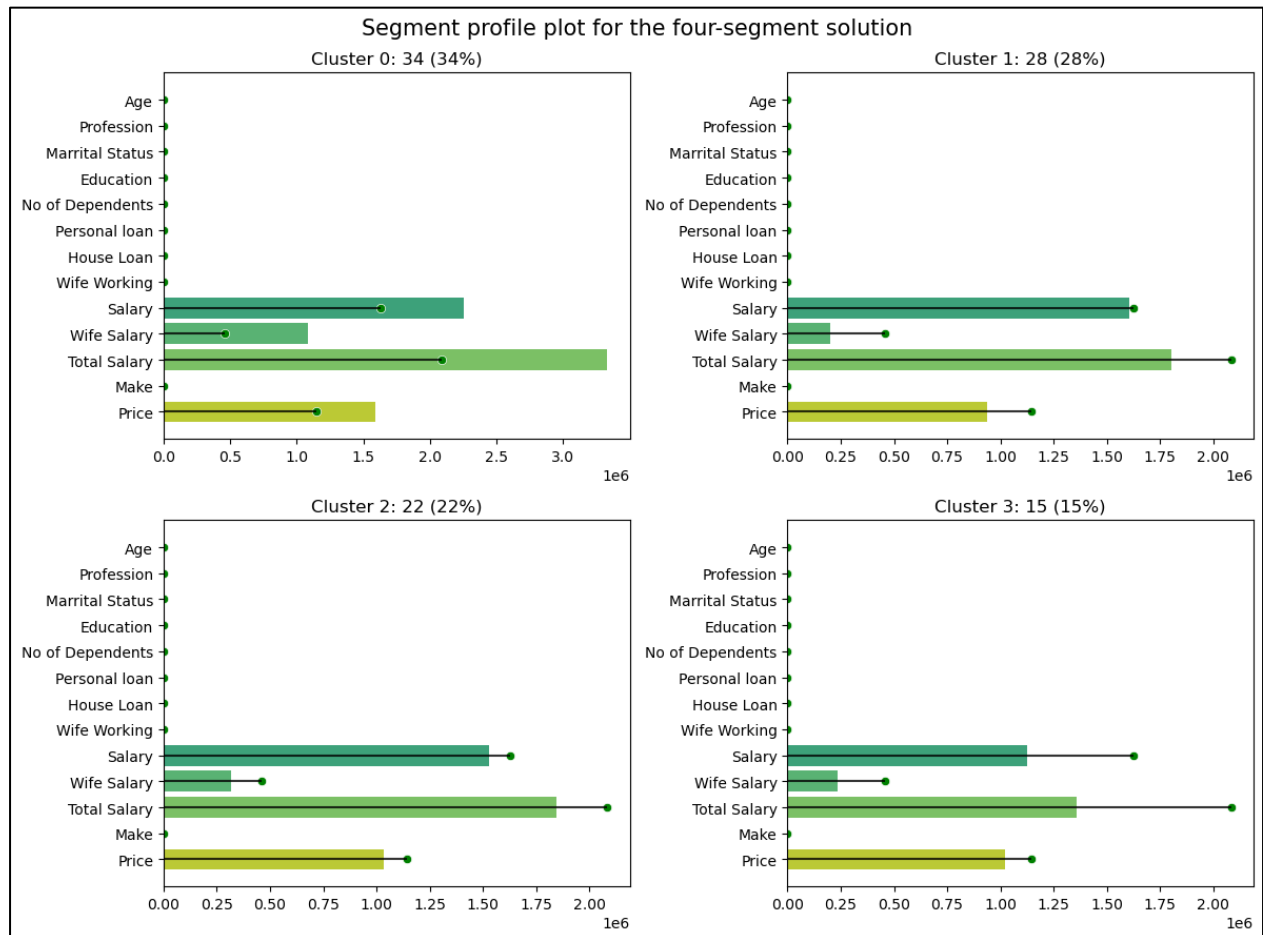

Fig 9: Segment Profile Plot

Each segment is defined by distinct financial profiles and priorities:

- **Segment 0** (34% of consumers): This segment represents a more affluent demographic, characterized by higher average values in salary, total salary, and vehicle make. Members of Segment 0 also tend to have a working spouse and higher levels of personal and house loans. They place significant value on education and have relatively fewer dependents, suggesting a profile of financial stability and higher education.

- **Segment 1** (28% of consumers): Segment 1 features moderate average values in salary and total salary, along with increased personal and house loans. This group has a higher number of dependents and places less emphasis on education compared to Segment 0. The lower "Make" value indicates a reduced focus on vehicle brand prestige.

- **Segment 2** (22% of consumers): This segment is noted for high values in salary, total salary, and vehicle make, similar to Segment 0. However, Segment 2 differs in marital status and has fewer dependents and moderate levels of personal and house loans. There is

a notable appreciation for vehicle make and price, suggesting a preference for value and brand prestige.

- **Segment 3** (15% of consumers): Segment 3 is characterized by the lowest average values in salary and total salary, with minimal personal and house loans. This group has fewer dependents and a moderate level of a working spouse. The segment places higher importance on marital status and personal loans, reflecting distinct priorities compared to other segments.

In summary, each segment reveals unique financial profiles and preferences. Understanding these distinctions allows for more targeted marketing strategies tailored to the specific needs and characteristics of each consumer group.

Describing Segments:

This section provides a detailed analysis of each consumer segment, highlighting their unique characteristics and behaviours:

Dataset 1: Segmentation Based on Indian Vehicle Buyer's Behaviour Data

Cluster 0: High-Income Families

- Average Age: 41 years
- Number of Dependents: 3
- Average Salary: ₹2,200,000
- Average Wife's Salary: ₹1,200,000
- Total Household Salary: ₹3,100,000
- Wife Working Status: Yes, dual-income households
- Education Level: Predominantly Post Graduate
- Marital Status: Married
- Loan Status: Typically, no personal or house loans
- Most Common Car Make: SUV
- Average Price of Car Purchased: ₹1,500,000
- Segment Size: 34 customers
- Marketing Focus: Luxury, premium products, and financial stability

Cluster 1: Family-Oriented Middle-Income

- Average Age: 36.5 years
- Number of Dependents: 3
- Average Salary: ₹1,500,000
- Average Wife's Salary: ₹0 (Wife typically does not work)
- Total Household Salary: ₹1,900,000
- Wife Working Status: No
- Education Level: Graduate

- Marital Status: Married
- Loan Status: Often have house loans
- Most Common Car Make: Baleno
- Average Price of Car Purchased: ₹1,050,000
- Segment Size: 28 customers
- Marketing Focus: Family values, affordability, and financial security

Cluster 2: Affluent Young Professionals

- Average Age: 34 years
- Number of Dependents: 2
- Average Salary: ₹1,500,000
- Average Wife's Salary: ₹0
- Total Household Salary: ₹1,800,000
- Wife Working Status: No
- Education Level: Post Graduate
- Marital Status: Married
- Loan Status: Typically, no personal or house loans
- Most Common Car Make: i20
- Average Price of Car Purchased: ₹800,000
- Segment Size: 22 customers
- Marketing Focus: Value, quality, and aspirational products

Cluster 3: Emerging Young Professionals

- Average Age: 29 years
- Number of Dependents: 0
- Average Salary: ₹1,100,000
- Average Wife's Salary: ₹0
- Total Household Salary: ₹1,300,000
- Wife Working Status: No
- Education Level: Post Graduate
- Marital Status: Single
- Loan Status: Avoid personal and house loans
- Most Common Car Make: Baleno
- Average Price of Car Purchased: ₹1,100,000
- Segment Size: 15 customers
- Marketing Focus: Practicality, affordability, and career growth

This segmentation helps in tailoring marketing strategies to meet the distinct needs and preferences of each cluster, ensuring targeted and effective communication.

Dataset 2: Segmentation Based on Electric Vehicle Data

Segment 1: High Overall EV Adoption with Two-Wheeler Dominance

- **States:** Uttar Pradesh, Delhi, Karnataka
- **Characteristics:**
    - Total EV Adoption: High
    - Dominant Vehicle Type: Two-Wheeler
    - Vehicle Counts:
        - Uttar Pradesh: Two-Wheeler: 18,295; Three-Wheeler: 257,159; Four-Wheeler: 368
        - Delhi: Two-Wheeler: 14,730; Three-Wheeler: 112,831; Four-Wheeler: 3,051
        - Karnataka: Two-Wheeler: 56,737; Three-Wheeler: 16,478; Four-Wheeler: 7,212
- **Description:**
    - This segment includes states with a high total number of electric vehicles, with a specific focus on two-wheelers. These states have significant numbers of two-wheelers compared to other vehicle types. They are leading in overall EV adoption and might have well-developed markets for electric two-wheelers. Infrastructure development is likely necessary to support the high number of EVs.

Segment 2: Moderate EV Adoption with Four-Wheeler Dominance

- **States:** Tamil Nadu, Gujarat, Kerala
- **Characteristics:**
    - Total EV Adoption: Moderate
    - Dominant Vehicle Type: Four-Wheeler
    - Vehicle Counts:
        - Tamil Nadu: Two-Wheeler: 44,302; Four-Wheeler: 13
        - Gujarat: Two-Wheeler: 13,662; Four-Wheeler: 1,309
        - Kerala: Two-Wheeler: 10,299; Four-Wheeler: 2,524
- **Description:**
    - States in this segment show moderate levels of EV adoption with a dominant focus on four-wheelers. Although the total number of EVs is moderate, these states have a notable number of four-wheelers. This might indicate a growing market for electric cars, with potential opportunities for expansion and increased infrastructure investment.

Segment 3: Low EV Adoption with Three-Wheeler Dominance

- **States:** Bihar, Assam, West Bengal
- **Characteristics:**
    - Total EV Adoption: Low
    - Dominant Vehicle Type: Three-Wheeler
    - Vehicle Counts:
        - Bihar: Two-Wheeler: 5,003; Three-Wheeler: 59,079
        - Assam: Two-Wheeler: 721; Three-Wheeler: 47,041

- West Bengal: Two-Wheeler: 2,540; Three-Wheeler: 40,948
- **Description:**
  - This segment includes states with low overall EV adoption, with a significant presence of three-wheelers. These states have a lower number of total EVs, but three-wheelers are the predominant type. This could reflect a market focused on commercial use of electric vehicles. The low adoption rate presents an opportunity for growth with proper infrastructure and incentives.

Segment 4: Very Low Adoption and Specialized Vehicle Focus

- **States:** Ladakh, Sikkim, Dadra and Nagar Haveli and Daman and Diu
- **Characteristics:**
  - Total EV Adoption: Very Low
  - Dominant Vehicle Type: Specialized Vehicles
  - Vehicle Counts:
    - Ladakh: Two-Wheeler: 12; Four-Wheeler: 5,484
    - Sikkim: Two-Wheeler: 1; Four-Wheeler: 2,414
    - Dadra and Nagar Haveli and Daman and Diu: Two-Wheeler: 69; Four-Wheeler: 153
- **Description:**
  - States in this segment show very low overall EV adoption with a focus on specialized vehicles. The adoption is minimal, and the data suggests that the market for electric vehicles is quite niche or specialized. These regions might benefit from targeted initiatives to boost overall adoption and improve the availability of EV infrastructure.

These segments provide insights into different levels of electric vehicle adoption and dominance of vehicle types across various states. Understanding these segments helps in targeting specific regions for investment and policy-making to enhance electric vehicle adoption and infrastructure development.

8. Selection Of Target Segment

To develop a feasible strategy for an Electric Vehicle (EV) startup to enter the Indian market by analyzing various segments and targeting the most promising ones. Here's how you can approach this:

1. Analyze the Market Segmentation

Segment 1: Based on Vehicle Buyer's Behaviour Data

- High-Income Families
- Family-Oriented Middle-Income
- Affluent Young Professionals
- Emerging Young Professionals

Segment 2: Based on Electric Vehicle Data

- High Overall EV Adoption with Two-Wheeler Dominance
- Moderate EV Adoption with Four-Wheeler Dominance
- Low EV Adoption with Three-Wheeler Dominance
- Very Low Adoption and Specialized Vehicle Focus

2. Strategy Development

a. Target Segments Based on Customer Data

1. **High-Income Families (Cluster 0)**

   - Characteristics: High salaries, dual-income households, premium vehicle buyers.
   - Opportunity: High potential for premium electric vehicles (e.g., luxury electric cars, high-end SUVs).
   - Strategy:
     - Develop premium electric vehicles with advanced features and high performance.
     - Focus on marketing luxury and status to attract this segment.
     - Partner with high-end dealerships and provide premium after-sales services.

2. **Affluent Young Professionals (Cluster 2)**

   - Characteristics: High earning, young professionals, quality-focused.
   - Opportunity: Potential for quality electric vehicles with innovative features.
   - Strategy:
     - Offer electric vehicles that blend performance, technology, and style.
     - Emphasize sustainability and cutting-edge technology in marketing.
     - Create flexible financing options and subscription models.

b. Target Segments Based on EV Data

1. **High Overall EV Adoption with Two-Wheeler Dominance (Segment 1)**

   - Characteristics: High adoption of electric two-wheelers.
   - Opportunity: Strong market for electric two-wheelers.
   - Strategy:
     - Focus on developing and expanding the range of electric two-wheelers.
     - Invest in charging infrastructure and battery-swapping solutions.
     - Partner with local dealers and service centers to build market presence.

2. **Moderate EV Adoption with Four-Wheeler Dominance (Segment 2)**

   - Characteristics: Growing market for electric four-wheelers.
   - Opportunity: Potential for expansion in electric cars.
   - Strategy:
     - Develop electric four-wheelers that cater to a moderate budget.
     - Focus on improving vehicle range and performance.
     - Invest in building charging networks and supporting infrastructure.

The targeted segments for the EV startup include **High-Income Families** and **Affluent Young Professionals**. High-Income Families are ideal for luxury electric vehicles due to their substantial earnings and preference for premium products. Affluent Young Professionals, focused on quality and innovation, are suited for stylish and high-performance electric cars.

Additionally, the startup should focus on regions with High EV Adoption and **Two-Wheeler Dominance**, where there is a significant market for electric two-wheelers, and Moderate EV Adoption with **Four-Wheeler Dominance**, which presents opportunities for expanding the electric car market. These segments offer the best potential for growth and market penetration based on current EV adoption trends and customer profiles.

9. Customizing the Market Mix

Customizing the marketing mix involves meticulously tailoring the product, price, place, and promotion strategies to resonate with the unique preferences of each target segment. For **High-Income Families**, the focus should be on delivering electric vehicles that epitomize luxury and sophistication, featuring cutting-edge technology, premium materials, and outstanding performance. Pricing strategies should align with the premium market, incorporating bespoke and exclusive options. Distribution channels should encompass high-end showrooms and bespoke online platforms, complemented by a high-touch service experience. Promotional activities should underscore the vehicle's luxury, environmental benefits, and status appeal through elite advertising campaigns and exclusive events.

Conversely, for **Affluent Young Professionals**, the marketing mix should spotlight stylish, technologically advanced electric vehicles offered at more accessible price points. Distribution should capitalize on modern online platforms and sleek dealerships, highlighting innovative features and contemporary design. Promotional efforts should leverage digital marketing, social media, and influencer collaborations to connect with their desire for modernity and quality. By meticulously aligning the marketing mix with each segment's distinct characteristics, the startup can create compelling, targeted strategies that drive customer engagement and brand loyalty.

10. Potential Early Market Customer Base

To estimate the potential market share for an Electric Vehicle (EV) startup in India, focusing on **High-Income Families** and **Affluent Young Professionals**, we analyzed the market sizes for two-wheelers and four-wheelers.

Target Prices:

- **Two-Wheelers:** ₹150,000
- **Four-Wheelers:** ₹1,300,000

Potential Market Sizes:

- **Two-Wheelers:**
    - High-Income Families: 140,000 EVs
    - Affluent Young Professionals: 70,000 EVs
- **Four-Wheelers:**
    - High-Income Families: 10,500 EVs
    - Affluent Young Professionals: 5,000 EVs

Revenue Calculations:

- **Two-Wheelers:**
    - High-Income Families: 140,000 EVs × ₹150,000 = ₹21 billion
    - Affluent Young Professionals: 70,000 EVs × ₹150,000 = ₹10.5 billion
- **Four-Wheelers:**
    - High-Income Families: 10,500 EVs × ₹1,300,000 = ₹13.65 billion
    - Affluent Young Professionals: 5,000 EVs × ₹1,300,000 = ₹6.5 billion

Total Revenue:

- **High-Income Families:** 21 billion (two-wheelers) + ₹13.65 billion (four-wheelers) = ₹34.65 billion

- **Affluent Young Professionals:** ₹10.5 billion (two-wheelers) + ₹6.5 billion (four-wheelers) = ₹17 billion

Total Revenue: ₹34.65 billion (High-Income Families) + ₹17 billion (Affluent Young Professionals) = ₹51.65 billion (~$631 million)

The analysis indicates a promising market opportunity for electric vehicles (EVs) in India, particularly among high-income and affluent young professionals. Targeting both two-wheelers and four-wheelers in this segment has the potential to generate substantial revenue for the startup.

11. Most Optimal Market Segment

Based on the market research and segmentation for an Electric Vehicle (EV) startup in India, the most optimal market segments are **High-Income Families** and **Affluent Young Professionals**. Focusing on these segments reveals substantial revenue potential.

For **High-Income Families**, the market opportunity includes approximately 140,000 two-wheelers and 10,500 four-wheelers, leading to an estimated revenue of ₹21 billion from two-wheelers and ₹13.65 billion from four-wheelers, totaling around ₹34.65 billion (~$431 million).

For **Affluent Young Professionals**, the potential market encompasses 70,000 two-wheelers and 5,000 four-wheelers, generating about ₹10.5 billion from two-wheelers and ₹6.5 billion from four-wheelers, adding up to ₹17 billion (~$200 million).

Altogether, targeting these segments offers a combined revenue potential of ₹51.65 billion (~$631 million), highlighting a significant and lucrative opportunity in the Indian EV market.

GitHub Project Link:

https://github.com/harshitpathak18/Data-Science-Internship-Feynn-Lab-/tree/main/Project%202.1%20-%20EV%20Market%20Segmentation