MARKET SEGMENTATION ANALYSIS OF ELECTRIC VEHICLES IN INDIA

(Feynn Lab Project)

Name: Suraj Giramkar

Problem Statement:

The task is to apply segmentation analysis to study the Indian market for electric vehicles and provide a workable entry strategy that focuses on the demographic, Behavioural, demographic, and geographic groups most likely to use the product.

Understand the Indian electric vehicle market by dividing it into different groups based on demographics, behaviour, geography, cost, vehicle type, retail stores, manufacturers, body style, plug types, safety, and other factors. Focus on the most promising segments to create an entry strategy. Establish a strong retail presence, improve charging infrastructure, and offer excellent after-sales service. Collaborate with local partners and monitor market trends for continuous improvement.

Fermi Estimation:

The EV (Electric Vehicle) market in India, it is important to note that the specific numbers and assumptions will depend on the context and available data. Here is a possible breakdown of the Fermi estimation for the EV market in India:

- **Population estimation:** Estimate the total population of India (e.g., 1.4 billion).
- **Vehicle ownership:** Estimate the percentage of the population that owns vehicles (e.g., 10%) estimate the number of vehicles in India based on the population estimate (e.g., 140 million vehicles).
- **EV adoption rate:** Estimate the percentage of vehicles in India that are electric (e.g., 5%) calculate the number of EVs in India based on the estimated number of vehicles (e.g., 7 million EVs).
- **Charging infrastructure:** Estimate the number of public charging stations available in India (e.g., 10,000). Estimate the number of private charging points (e.g., assume 2 private charging points per public charging station).
- **Government initiatives and incentives:** Consider government policies and incentives that promote EV adoption (e.g., subsidies, tax benefits, etc.).
- **Market growth and future projections**: Research industry reports and studies on the projected growth rate of the EV market in India. Consider factors such as technological advancements, cost reductions, and increasing environmental consciousness.

Variables and Formulae:
- **Gather Data:**
  - Obtain data for the population of India ($P(x)$) for the specific year of interest (x).
  - Obtain data for the available labour ($A(x)$) for the specific year (x).
  - Determine the ratio of Indians between the age of 18 and 60 to the total population (r).
- **Calculate the employment ratio ($E(x)$):**
  - Plug in the values of $A(x)$, $P(x)$, and r into the formula:

$$\circ \quad E(x) = (A(x) * 100) / (P(x) * r)$$

- **Interpret the result:**
  - $\circ$ The resulting value of E(x) will represent the employment rate for the specific year (x) as a percentage. It represents the proportion of available labor (A(x)) relative to the population (P(x)) adjusted by the ratio of Indians between the age of 18 and 60 to the total population (r).

Data Collection:

- **For this project, we have worked with one dataset in order to come to a conclusion.**
- **Dataset-1: Ev_performance_data_in_India**
- **Dataset Link : https://d.docs.live.net/1c69abefc9ba095b/Documents**
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Data Pre-processing:

- We've used **Pandas** and **NumPy** for **Data Analysis** and Manipulation.
- **Matplotlib** and **Seaborn** for **EDA**.
- **Sklearn** for **training** the Machine Learning models.

Segment Extraction:

We utilised K-means clustering as a segment extraction method for all three datasets as it has following features:

- **Simplicity and Interpretability**
- **Scalability**
- **Flexibility**
- **Quantitative Evaluation**
- **Handling Continuous and Numeric Data**
- **Initial Seeds**
- **Handling Continuous and Numeric Data**
- **Quantitative Evaluation**

Accuracy of the trained models on the three datasets:

- Dataset-1: Ev_performance_data_in_India

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Accuracy score of  RandomForestClassifier = 100.0
Accuracy score of  KNeighborsClassifier = 40.243902439024396
Accuracy score of  SVC = 17.073170731707318
Accuracy score of  DecisionTreeClassifier = 100.0
Accuracy score of  GaussianNB = 63.41463414634146
```

- After observing the confusion matrices and classification reports, further development can be done using Random Forest Classifier, Decision Tree Classifier or Gaussian NB.

Selection of Target Variables:

In our dataset was trained on the different target variables which are considered the most important in that dataset.

- EV performance data in India: Efficiency of vehicle

Customizing the market mix:

- **Pricing:** Offer a range of EV models that cater to different consumer needs, including compact city cars, sedans, SUVs, and electric two-wheelers. Highlight features such as longer range, fast-charging capabilities, advanced safety features, and smart connectivity options.
- **Price:** Determine competitive pricing strategies that make EVs affordable and appealing to the Indian market. Leverage government incentives, subsidies, and tax benefits to reduce the upfront cost and make EVs more cost-effective compared to traditional vehicles. Consider offering flexible financing options, affordable lease programs, and attractive warranty packages to encourage adoption.
- **Promotion:** Raise awareness about EVs through targeted marketing campaigns that highlight their benefits, environmental impact, and cost savings. Engage in educational initiatives to address misconceptions and provide information about EV technology, charging infrastructure, and government incentives. Collaborate with influencers, celebrities, and industry experts to build credibility and generate buzz around EVs. Participate in EV expos, trade shows, and events to showcase the latest EV models and technologies.

MOST OPTIMAL MARKET SEGMENTS TO OPEN IN THE MARKET:

Based on market research and segmentation, here are some of the most optimal market segments to target for the EV market in India:

- **Urban Commuters:**
    - This segment includes individuals who frequently commute within urban areas.
    - They are likely to be attracted to EVs due to their lower operating costs, environmental benefits, and government incentives.
    - Focus on promoting EVs with compact designs, sufficient range for daily commuting, and fast-charging capabilities.
- **Environmentally Conscious Consumers:**
    - This segment consists of individuals who prioritize sustainability and are concerned about the environmental impact of traditional vehicles.
    - Position EVs as a greener alternative with zero emissions and emphasize their contribution to reducing air pollution and combating climate change.
    - Highlight the eco-friendly features of EVs and their positive impact on the environment.

- **Early Technology Adopters:**
  - This segment comprises individuals who embrace new technologies and innovations.
  - Position EVs as cutting-edge and futuristic vehicles with advanced features and smart functionalities.
  - Emphasize the technological advancements in EVs, such as regenerative braking, connected services, and autonomous driving capabilities.
- **Government and Public Sector:**
  - Engage with government agencies and public sector organizations to promote EV adoption.
  - Highlight the government's push for electrification, tax benefits, and incentives for EV purchases.
  - Showcase the potential cost savings for government organizations by transitioning to EVs.

- **Google-Colab Link:**
- https://colab.research.google.com/drive/1MqOUhpjhQV8TrsN_CN0GM0RdjpO9BpxH