EV Market Segmentation

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Github Link - https://github.com/ysmayur1992/Feyyn_Labs_Project_3

1) Introduction:

The automotive sector in India is dominated by Non-Electric Vehicles since decades. Majority of public buying fossil fuel engine based vehicles because of the its low prices, low maintenance cost and ease of availability of infrastructure for receiving facilities of petrol and diesel are another factor for popularity of these vehicles .

Electric Vehicles have become a new point of attraction in India. Many big automotive brands like TATA, Mahindra and other international companies are introducing their unique products in EV markets.

In this project, we have researched, analyzed and came up with space and specific range of products which will help us to produce our unique Electric Vehicle to compete with these brands and help Indian public to cope up with technological advances in vehicles with economical prices and this will help our startup to grow EV business shoulder to shoulder with the bigger automotive companies

2) Market Info:

a) General Usage Info:

- Electric Vehicles (EVs) currently account for less than 1% of total vehicle sales in India the market is growing rapidly and expected to be worth around at least INR 475 billion by 2025. Two-wheelers account for the largest share of this market at 62%, followed by three-wheelers at 37%.
- The Indian EV market varies significantly by state, depending on factors including demographics, income levels, regulatory landscape and urbanization. The state of Uttar Pradesh, for instance, with one of the lowest urbanisation rates, has seen significant uptake of electric two-wheelers.
- The four-wheeler segment currently has the lowest EV penetration of 0.12% (3,400 units of electric passenger cars sold in 2020) but may grow to 5% by 2025 in an optimistic scenario.

b) Battery Info:

- Lead-acid batteries currently dominate the market but demand for Lithium-ion battery models is expected to grow rapidly under government incentives and demand from bike and scooter.
- Current and desired driving range of different EV categories in India set by Government of India is presented in the following table.
- Table:

Vehicle Category	Battery Capacity (KwH)	Energy Consumption (kwh/km)
E-bike	1.2	0.016
2 WLS	2.2	0.025
2 WCS	3.0	0.030
2 WHP	4.6	0.035
Electric Cars	40	0.157
LPV	49	0.209

- The calendared lifetime of a battery used in an EV is dictated by the electrode materials. It is further determined by the number of charge and discharge cycles, charging speed, and temperature of operation.
- Batteries are generally retired from automotive application when they can retain only about 80% of their initial stated capacity, and proper treatment of retired EV batteries will both reduce their life-cycle greenhouse gas emissions and maximize their economic value.
- Before recycling, there are practical second-life applications of EV batteries. EV batteries that retain 80% of their original capacity might not be suitable for EVs, but are appropriate for less demanding applications such as grid-scale renewable energy storage.
- This strategy aligns with Government of India's target of installing 175 GW of renewable energy capacity by 2022. It is estimated that these batteries can serve as energy banks until they deteriorate to 60% of their initial capacity35 and this extends their economic life by another 10 years.

3) Market Segmentation Analysis

For this segmentation 5 types of datasets were used from different sources such as from government websites, car research platforms, and market research

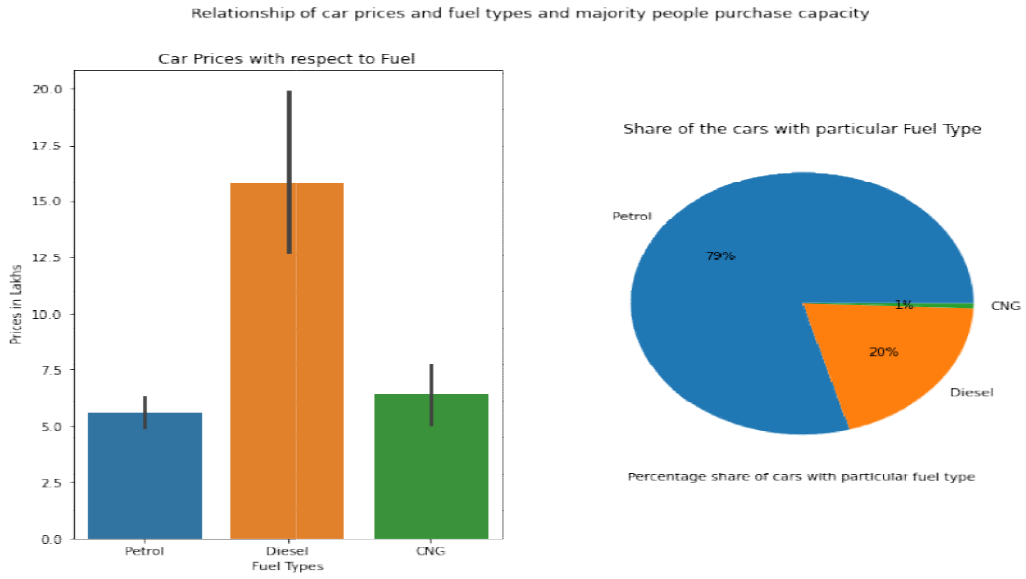
a) Visualization Analysis:

(a) Geographic and Demographic Research:

- South India being a Tech Hub is a backbone of EV demands.
- In earlier part, we analyzed that south Indian states has good number of charging stations available.

- Popular car brand's manufacturing plants and main head headquarters' are in south India as well, which plays an important role for ease of survey and fulfill consumer's demands by these top companies
- Delhi had highest number of charging stations (analyzed earlier), but still EV popularity is relatively low.
- North east India is gaining popularity in EV despite less infrastructure.
- Other states and regions especially North, West, East and Central India has a balanced numbers and competitive demands.
- We did not get any survey information on Daman and Diu and Lakshadweep, so these 2 regions are not analyzed properly.
- **On availability of charging stations, we observed:**
- First observation, only limited number of charging station is available in India as of 2023.
- Delhi being capital has more number of charging station as compared to other metro cities.
- South Indian metro cities have balanced number, but still many cities are missing from south India.
- Mumbai being the economic capital of India have only 1 charging station in Navi Mumbai (private charging stations not counted or being missed).

(b) Psychographic and Behavioral Research:



- Petrol cars are the most popular cars occupying 79% of its share in its competition. it is understandable because petrol cars are cheaper than Diesel cars and CNG cars.

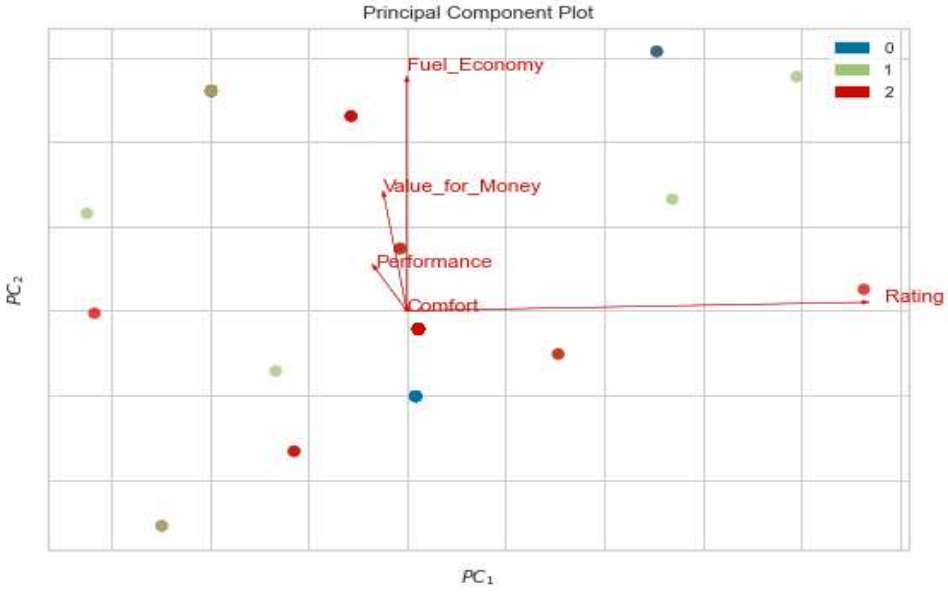
- Diesel cars, despite being costly, it occupies a noteworthy share of 20% of the popularity.
- Diesel cars are more popular than CNG, this is because current diesel engines have greater performaces than both petrol and CNG engines.
- Diesel cars are also very much long lasting running cars as compared to both bot the other cars, that's why it has more popularity.
- CNG cars have lowest popularity, just because this car lacks competitive performance, and engine durability. CNG cars only have good fuel economy, because CNG is cheap.
- Vehicle Price is a big concern, First Majority of public buying petrol cars because of the its cheap price.
- Second majority of public buying diesel cars, the public interested for high performance and long lasting low maintenance car.

b) Segmentation Analysis:

In Segmentation analysis, we analyzed segments on public reviews from car research platform (carwale.com). Below are the results:
(Note: The detailed analysis explanation on segmentation is in the code file please refer github link for code file)

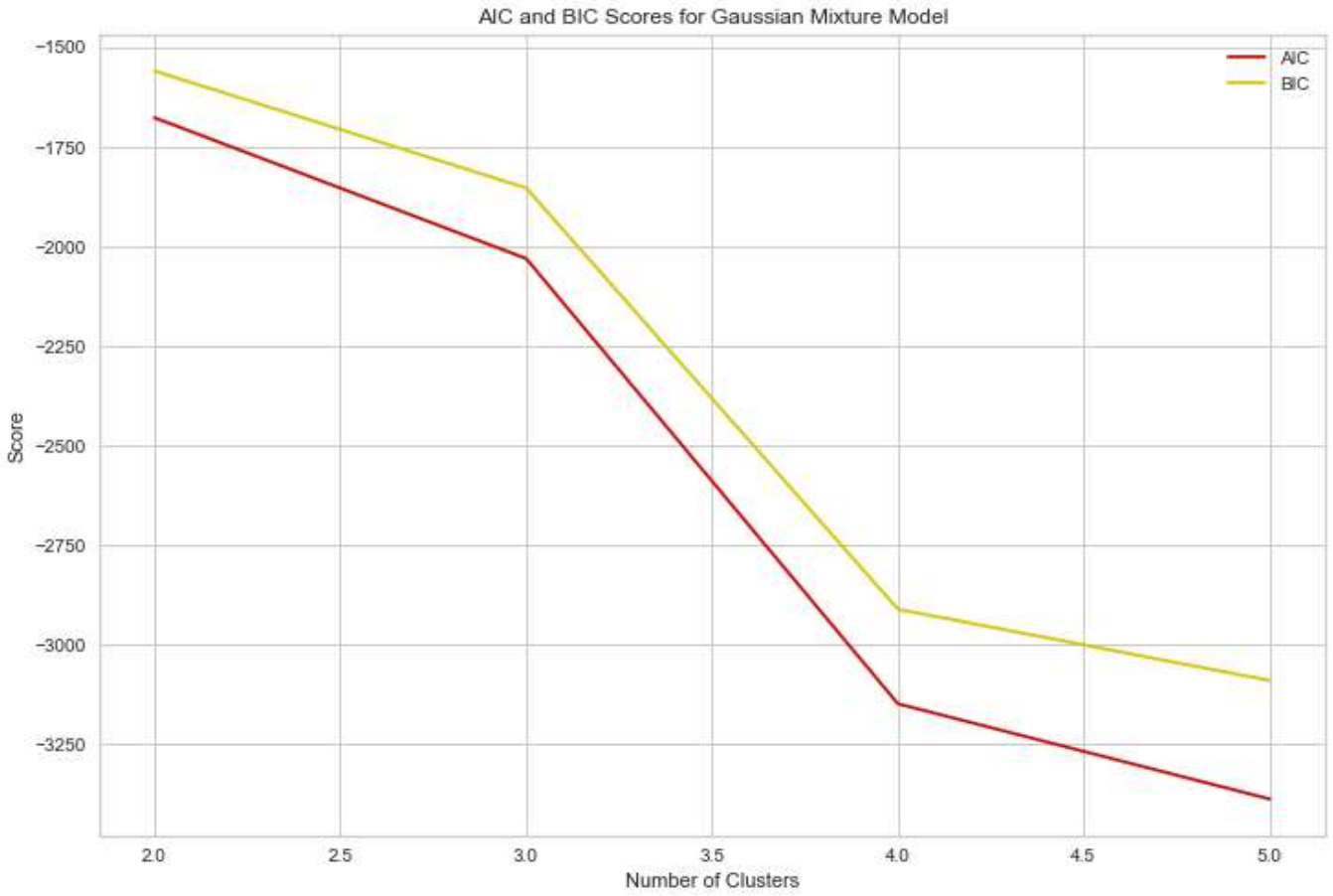
Psychographic and Behavioral Research:

❖ Principal Component Analysis



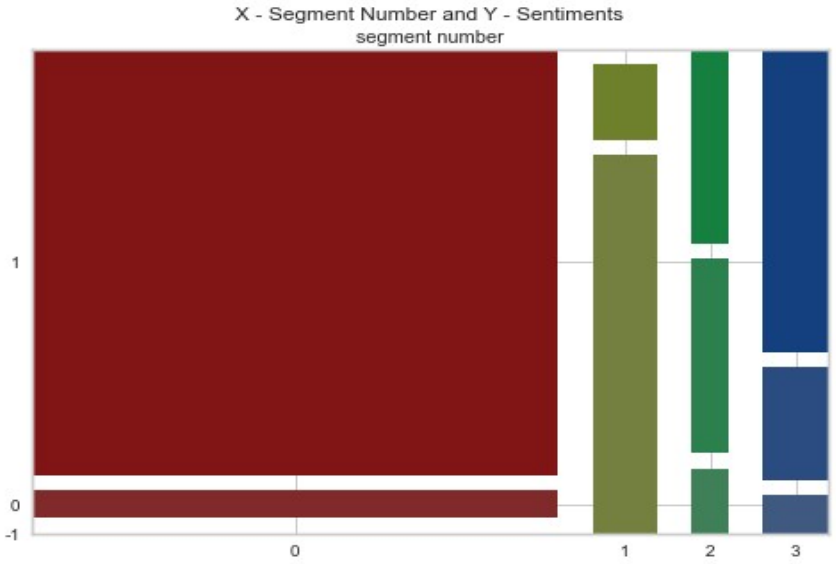
- PC1 and PC2 are the 2 componants captured highest of information contained in segmentation variables.
- The above Principal Component Plot shows clearly:
    - According to first principal Componant(PC1) we assess the fact that value for money, the performance and the Fuel economy feature of the EV has similar percentage and closest positive ratings.

❖ Segment Extraction:



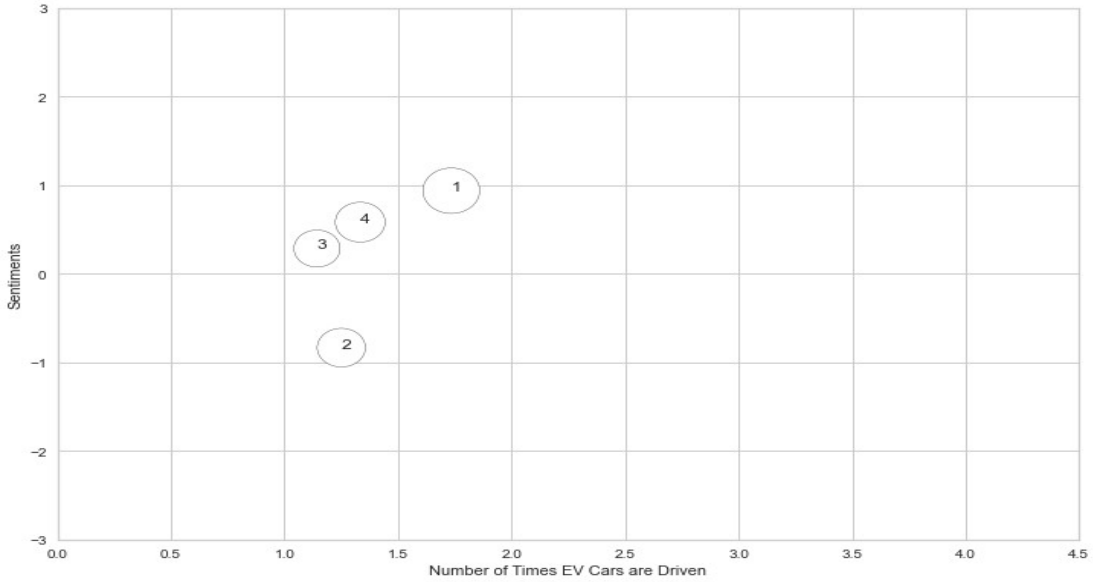
- From the plot above, we can clearly see that the 4 and 5 market segment solution have some stability here 4 market segment solution makes some stabilty and the curves flatten for a while

❖ Describing Segments:



- Members of segment 1 (depicted in the first column) expresses most positive responses of EVs the top left boxes being colored in red.
- In stark contrast, members of segment 2 expresses Negative Thoughts (as indicated by the pale green bar boxes).
- Segment 3 provides info about people expressing balanced responses (as indicated by dark green color).
- Segment 4 have majority of positive responses (as indicated by dark blue).

❖ Selecting The Segments:



- Market segments 1 are located in the attractive quadrant of the segment evaluation plot. Members of these two segments like EVs and recommend others to buy it. These segments need to be retained, and their feedbacks must be considered seriously.

- Market segment 3 and 4 also provides positive sentiments towards EVs but there driving frequency is less. Therfore, There feedbacks are also important and need special attention as well for the betterment in the Electric Vehicle.

- 3)Market segment 2 is located at least attractive position, members in this segment not having positive attitude towards EV, Thus making them unattractive as a potential market segment.

(c) Economical Research:

- Another dataset was consider for economical analysis to check for best technical specification and we come up with the best range for price, battery capacity, driving range, power, and the total charging time require.
- Below is the excel spreadsheet table of ranges:

1. Price range
2. Battery Capacity
3. Driving Range
4. Power (Performance)
5. Charging time

946000 Lakhs - 3950000 Lakhs
26.0 KwH - 107.8 KwH
315.0 KMs - 857.0 KMs
73.75 BHP - 516.29 BHP
1.5 Hours - 9.0 Hours

- We come up with a competitive range of price. Our product price range should be within range or more economical if possible.

- We defined a range of Kilo-Watt Hour battery capacity.

- The defined batteries should produce significant range of power as defined.

- We have to see if we can improve more on driving range provided, but our driving range should be at maximum of given range. Time taken to charge a battery should be within the range

4) Conclusion:

a) Geographic and Demographic analysis:

- We analyzed that south India region is more technologically advanced with good availability of charging infrastructure and Electric vehicles becoming more popular. Big Brands who already launched their products and have their manufacturing plants in south India. It is possible that we can create space for our EVs but it will be very difficult
- North Eastern states have growing popularity specially Sikkim, this is a good place for us to create space for our EVs
- Once our EV popularity grows up, we can target to East Indian states and central Indian states.

b) Psychographic and Behavioral analysis:

- From Reviews Dataset from carwale.com, I did market segmentation on people's reviews on EVs whether they have positive approach towards it. we found that 3 out 4 have positive approach and are likely to buy new EV. Those who have done small test drive are likely to buy. Those who already driving regularly are recommending others to buy it.
- Competitive prices, more features and good performance in EVs are key points to be considered, as in the analysis i come up with the observation of the people more tended to buy low priced and low maintenance cost vehicles.

c) Economical Analysis:

- From the information in the dataset about current details on electric cars. I came up with a dictionary of different specifications and its ranges.
- I came to the conclusion that, if we want to successfully come to the competition with other products, we need to follow this ranges.
- For the price range our product price should be within the maximum range of price and will keep on optimizing so we can keep our vehicle price low.
- Keeping an eye on price, we should deliver with maximum battery capacity and good quality battery following the guidelines of Government of India, so that the power sustain capability will improve and we will be capable of producing environment friendly vehicles.
- We have to balance our battery capacity with the performance power and driving range as well.
- Fast-charging mechanism should be implemented for better and faster charging ability and to keep the charging time within the range.

Final Thoughts on Startup Strategy

1) In case of E-Bikes we can target some East Indian states like Uttar Pradesh, Bihar and West Bengal as the economic condition of majority of people is low so a good competitive E-bike with good amount of features and reasonable price range will be a good choice. Central Indian States like Madhya Pradesh will also a good choice to introduce E-Bikes

2) In case of E-Cars North-East India and Central India should be the first choice region as they have good popularity of EVs. East Indian states would be the second choice after the popularity of the startup improves and we are safe to grow our business.

3) North Indian states are not recommended right now because of the analysis results. People are not buying EVs despite having lots of charging infrastructure.

4) South Indian states should be kept for future as there are already many international brands launched their EVs at competitive prices and tones of features. So South India will not be a safe option right now.