Electric Vehicle Market Segmentation

GitHub Link

https://github.com/giridhar3105/EV_Market_Segmentation_Analysis

AUTHOR

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13-06-2024

INTRODUCTION

The current depletion of fossil fuels and its price hike, there is a need for another energy resource to run the vehicle. The automobile sector is considering Electric Vehicle as a solution to the industry and environment in India. Electric Vehicles are the replacement for petroleum-based vehicles. They are one of the emerging technologies as well as eco-friendly and viable. The replacement of internal combustion engines with electric engines will reduce pollution to a great extent and be profitable to consumers. Many countries around the globe have implemented this technology and are contributing towards betterment of the environment.

India being an economy of around 140 crore people, our daily activities cannot be imagined without the use of vehicles. There has been a duopoly of petrol and diesel as our main source of fuel for the vehicles. This not only causes air pollution, but is also hard on our pockets. Petrol prices hiking as much as up to 98 rupees later, we are eagerly looking for a substitute. Commonly, the term EV is used to refer to an electric car. In the 21st century, EVs have seen a resurgence due to technological developments, and an increased focus on renewable energy and the potential reduction of transportation's impact on climate change and other environmental issues. Project Drawdown describes electric vehicles as one of the 100 best contemporary solutions for addressing climate change. The main reason for taking up this topic for research is to make people more aware about the Electrical vehicle Industry and it's comparison with the fuel operated vehicles so that people are made aware about the benefits of eco-friendly vehicles that go an extra mile to look out for environment.

Overview

The project aims to perform market segmentation for the electric vehicle (EV) market. Market segmentation involves dividing a broad market into distinct groups of consumers with similar characteristics and needs. By segmenting the EV market, we can gain valuable insights into different customer segments and tailor marketing strategies accordingly.

Problem Statement

We are a team working under an Electric Vehicle Startup. We have to decide which vehicle/customer space should be considered by the startup to develop its EVs.We have to analyse the Electric Vehicle market in India using Segmentation analysis and come up with a feasible strategy to enter the market, targeting the segments most likely to use Electric vehicles.

Data Sources

Dataset 1: https://electricvehicles.in/electric-vehicles-sales-report-in-india-2018/ : For

region-based analysis of different types of Electric Vehicle sales in India for the year 2018.

Dataset 2: https://www.kaggle.com/karivedha/indian-consumers-cars-purchasing-behaviour

: For behavioural, psychographic and demographic analysis of Indian automobile market.

Data Preprocessing Libraries Used:

- **NumPy**: Scientific Computing Library
- **Pandas**: Data Analysis Library
- **Matplotlib**: Data Visualization Library
- **Seaborn**: Data Visualization Library
- **Scikit-Learn**: Machine Learning Library

METHODOLOGY

1. Data Collection:

- Gather relevant data from multiple sources, including market reports, government publications, industry databases, and research papers.
- Collect data on various parameters such as vehicle type, technology, sales figures, charging infrastructure, consumer preferences, and regional market data.

2. Preprocessing and Data Preparation:

- Cleanse the data by removing any inconsistencies, errors, or missing values.
- Normalize or standardize the data to bring all variables to a common scale, ensuring no variable dominates the analysis.

3. Segmentation Criteria:

- Determine the segmentation criteria based on the research objectives and available data.
- Select relevant variables for segmentation, such as vehicle type, technology, sales volume, market share, charging infrastructure, and consumer preferences.

4. K-means Clustering:

- Perform K-means clustering on the transformed data obtained from PCA.
- Select the appropriate number of clusters based on techniques like the Elbow method or Silhouette analysis.
- Apply the K-means algorithm to assign each data point to the respective cluster based on the similarity of the variables.

5. Interpretation and Analysis:

- Analyze the results of the clustering to understand the characteristics and profiles of different market segments.
- Examine the distribution of variables within each cluster to identify the key differentiators.

EV MARKET ANALYSIS

- Evaluate the significance of each segment based on criteria such as market size, growth potential, and consumer demand.

- Conduct statistical tests or visualizations to compare the clusters and validate the segmentation results.

DATA USED FOR SEGMENTATION ANALYSIS:

The segmentation analysis of the Electric Vehicle (EV) market in India utilized data collected from diverse sources, including demographic, psychographic, and behavioural variables. The data columns used in the analysis are summarized below:

1. **Demographic Variables:**

- Age: Age of the respondents, providing insights into generational differences and life stage considerations.
- Profession: Occupation or profession of the respondents, indicating income level, lifestyle, and mobility needs.
- Marital Status: Marital status of the respondents, reflecting household composition and purchase decision-making dynamics.
- Education: Educational attainment of the respondents, influencing awareness, and perception of electric vehicles.

2. **Psychographic Variables:**

- No of Dependents: Number of dependents in the household, reflecting family size and transportation requirements.
- Personal loan: Indicates whether respondents have personal loans, providing insights into financial commitments and affordability.
- Total Salary: Total monthly salary of the respondents, indicative of disposable income and purchasing power.
- Price: Price of electric vehicles, influencing affordability and purchase considerations.

3. **Additional Data Sources:**

- State: Geographic location of respondents, allowing for regional segmentation and analysis of market dynamics across different states in India.
- Two Wheelers, Three Wheelers, Passenger Cars, Buses: Categories of electric vehicles as per Central Motor Vehicles Rules, providing insights into vehicle preferences and market demand.
- Number of Electric Vehicle Charging Sanctioned: Availability of charging infrastructure in each state, influencing EV adoption and usage patterns.

Steps:

1. **Behavioural Analysis**
2. **Psychographic Analysis**
3. **Demographic Analysis**
4. **Geographic Analysis**

## Behavioural and Psychographic Analysis
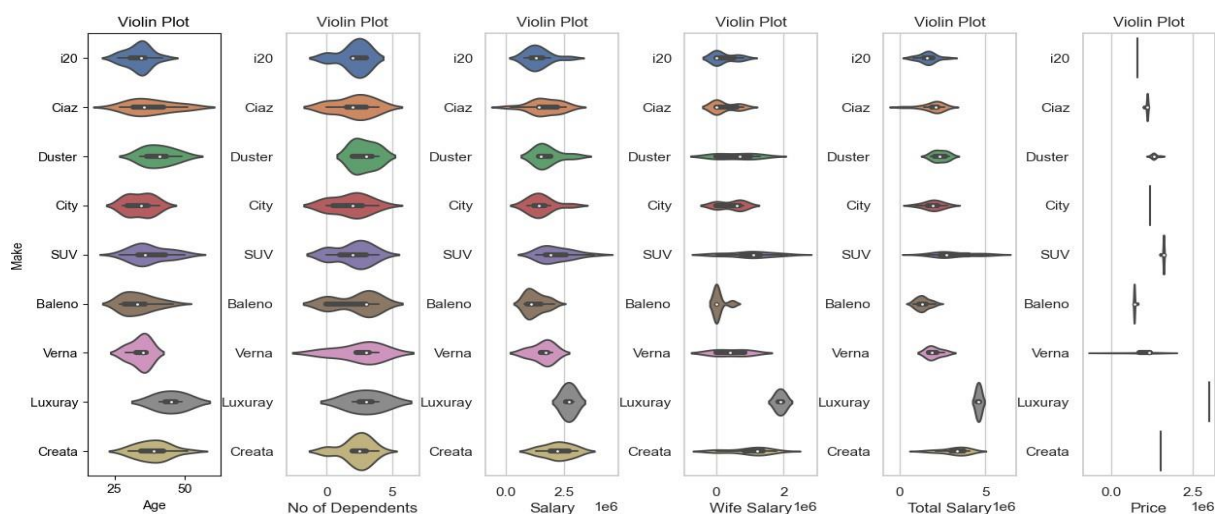
Behavioral Analysis:

- Understanding consumer behavior provides crucial insights for marketing strategies. Customers with higher total salaries tend to opt for higher-priced EVs, indicating a preference for premium offerings. Conversely, those with lower salaries may prioritize affordability, opting for more budget-friendly options.

- Overall, these analyses underscore the importance of tailoring marketing strategies to regional nuances and consumer preferences. By leveraging insights from both geographical and behavioral data, stakeholders can devise targeted approaches to effectively penetrate the EV market and cater to diverse consumer needs
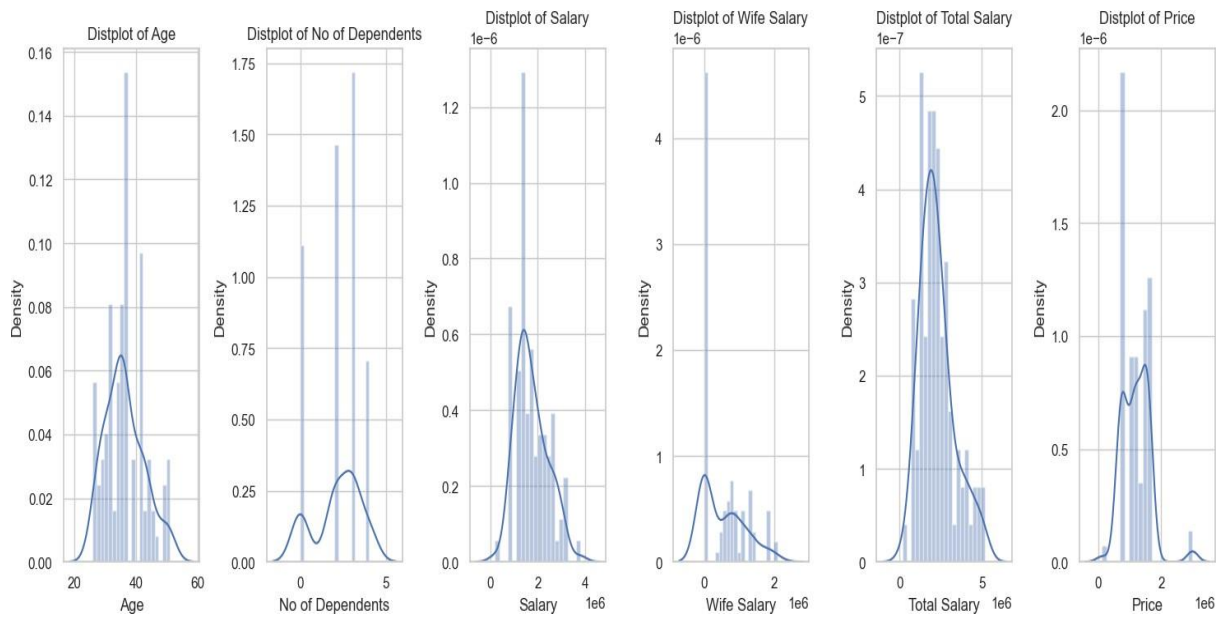
Observations:

1. **Age:** Younger consumers purchase less expensive vehicles.
2. **Number of Dependents:** Greater number of dependents makes the consumer buy a vehicle with more seats and so they prefer SUVs.
3. **Salary:** If you overlap the normalized salary plots with price plot, you would observe the median of salary violin plot matches that of the price of the vehicle indicating a very direct relationship.

EV MARKET ANALYSIS

Relation between consumers' total salary and the vehicles they tend to purchase
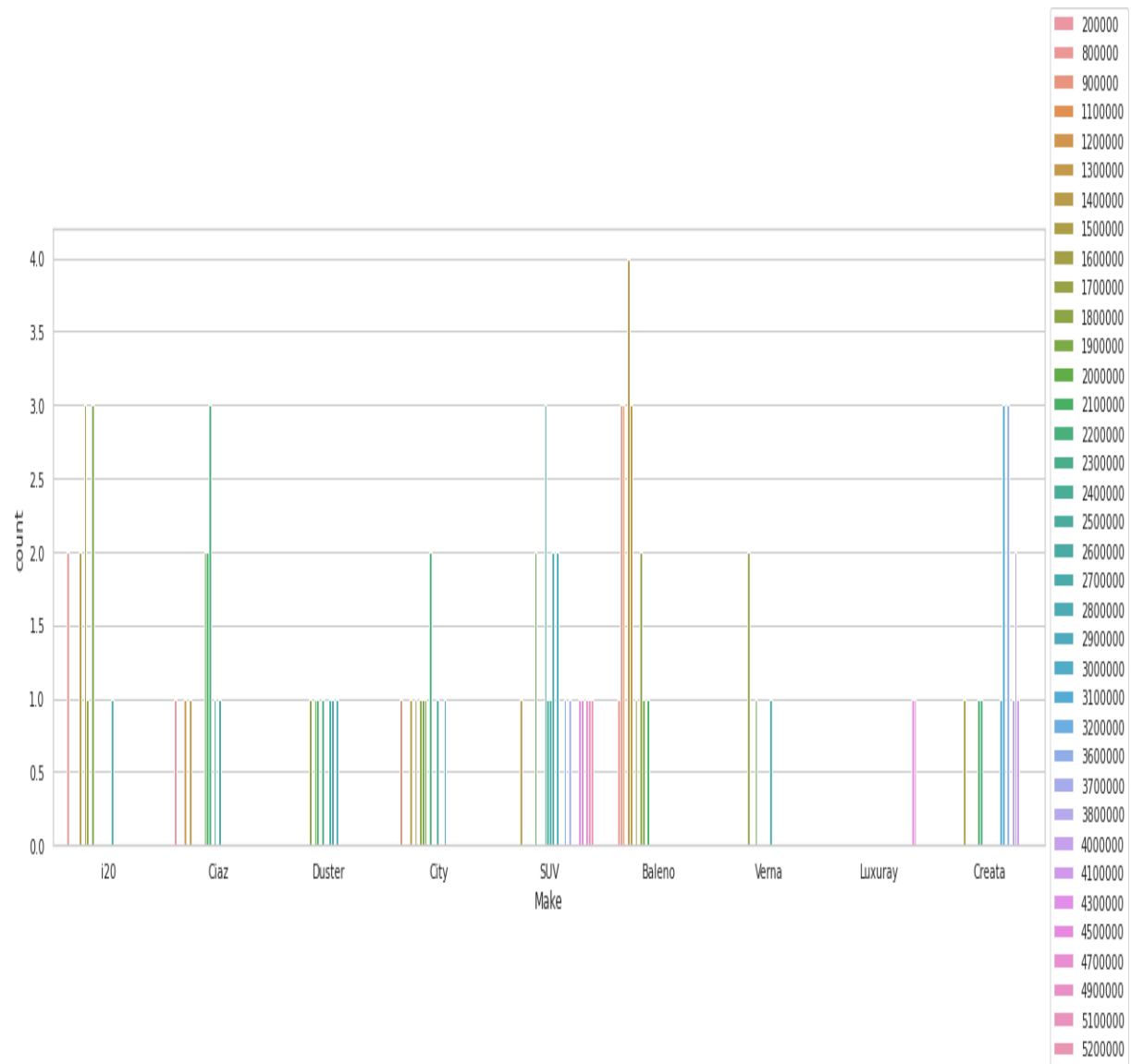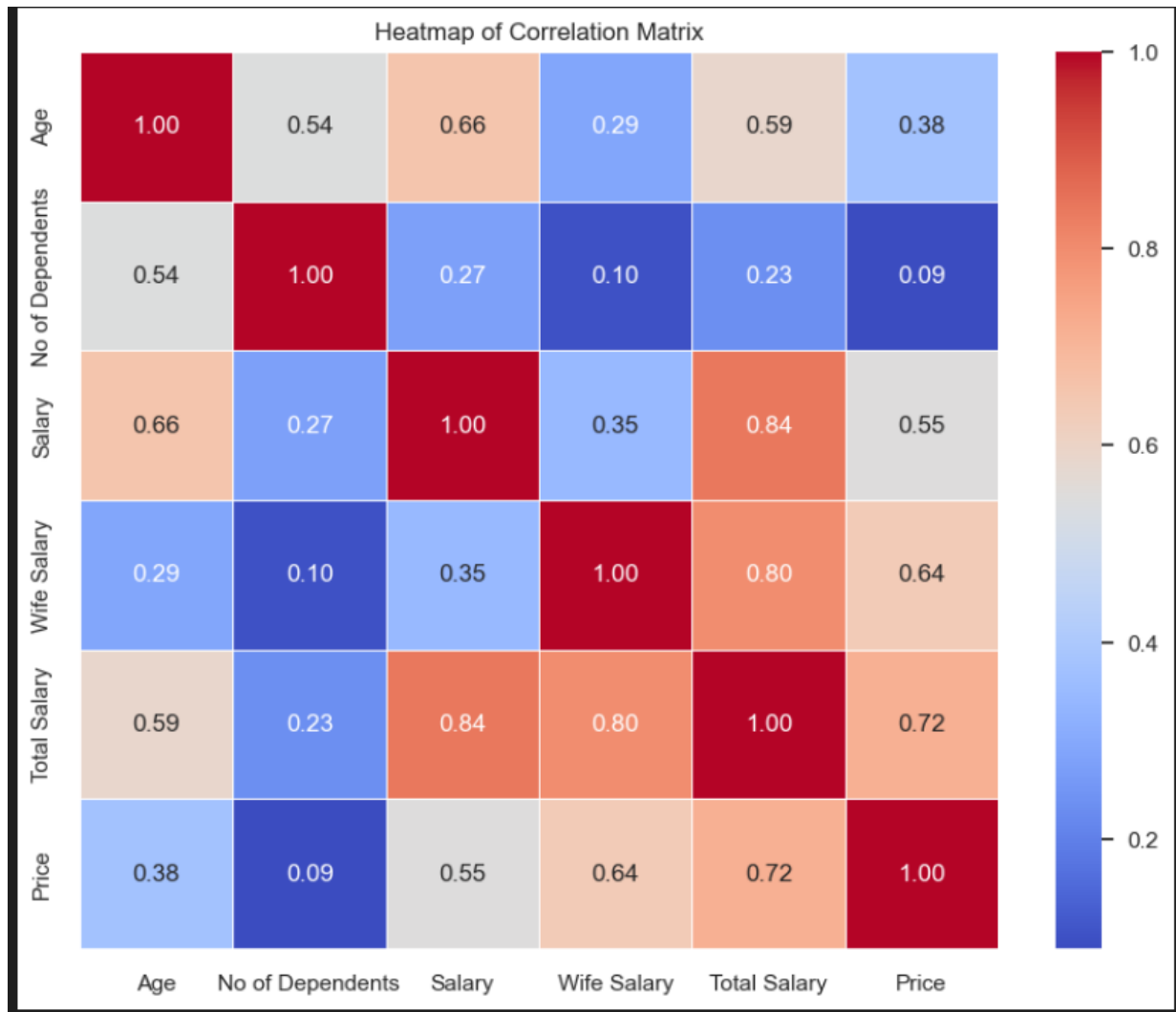
EV MARKET ANALYSIS

Demographic Analysis

Observations:

- ❖ People between the age group of 25 to 50 create the most of the consumer market.
- ❖ Most people having an average total salary of around 30 lakh tend to purchase vehicles more.
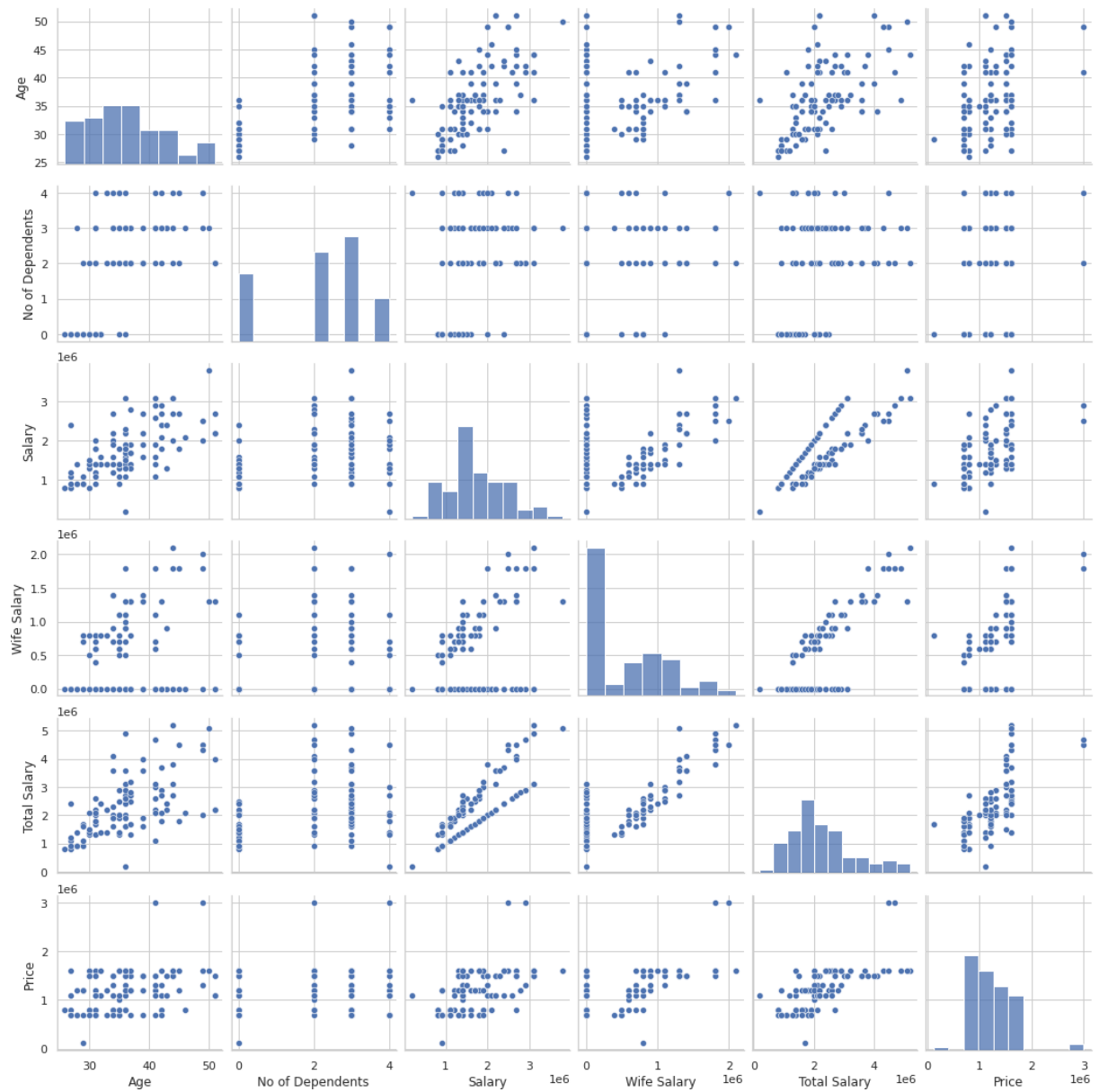- ❖ Most people spent around 10 to 20 lakhs for vehicles.
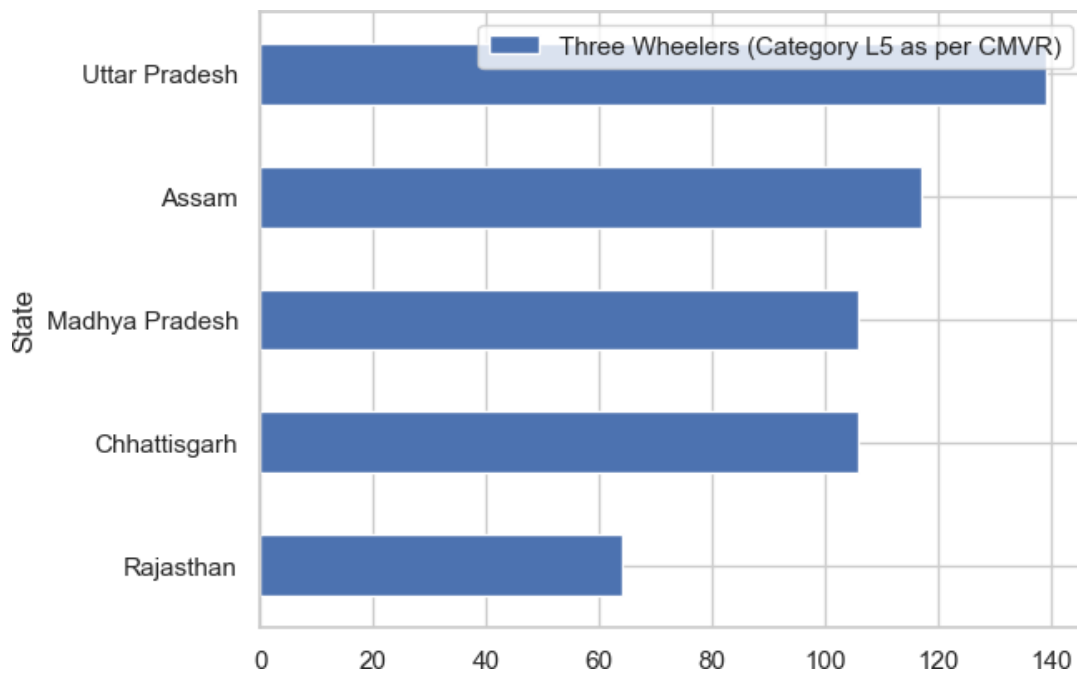
Heatmap of Correlation

Observations:

 ❖ There isn't any striking new relation found, but it confirms our previous observations.

Pair Plot

EV MARKET ANALYSIS

Geographic Analysis

Geographical Analysis: The distribution of EV usage across different regions reveals varying patterns. States like Gujarat and Andhra Pradesh exhibit a significant presence of EVs, with diverse vehicle types and infrastructure support. In contrast, regions like Assam show lower EV adoption rates and infrastructure development.
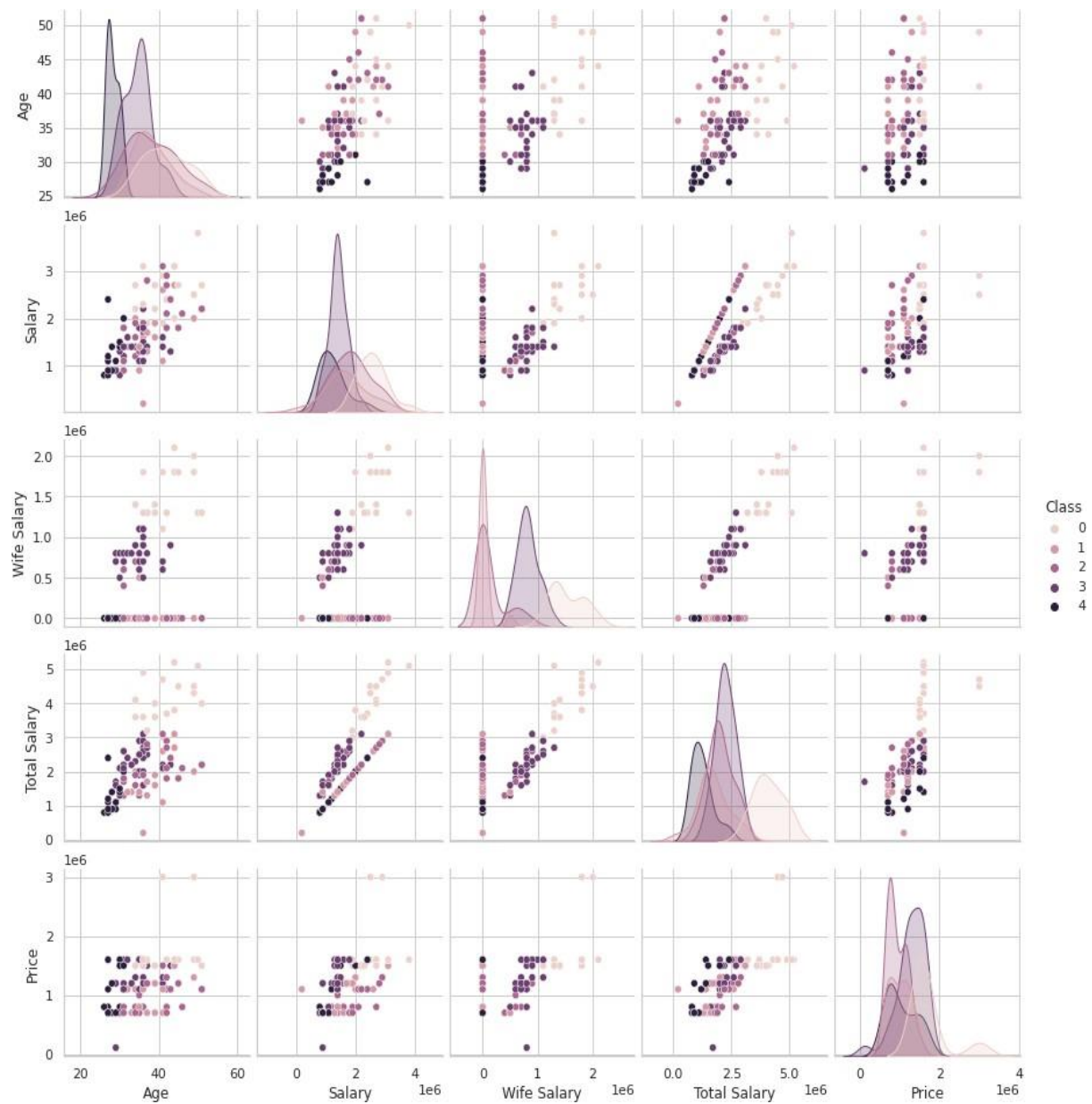
4. Segment Extraction

- **K-Means Clustering**

EV MARKET ANALYSIS
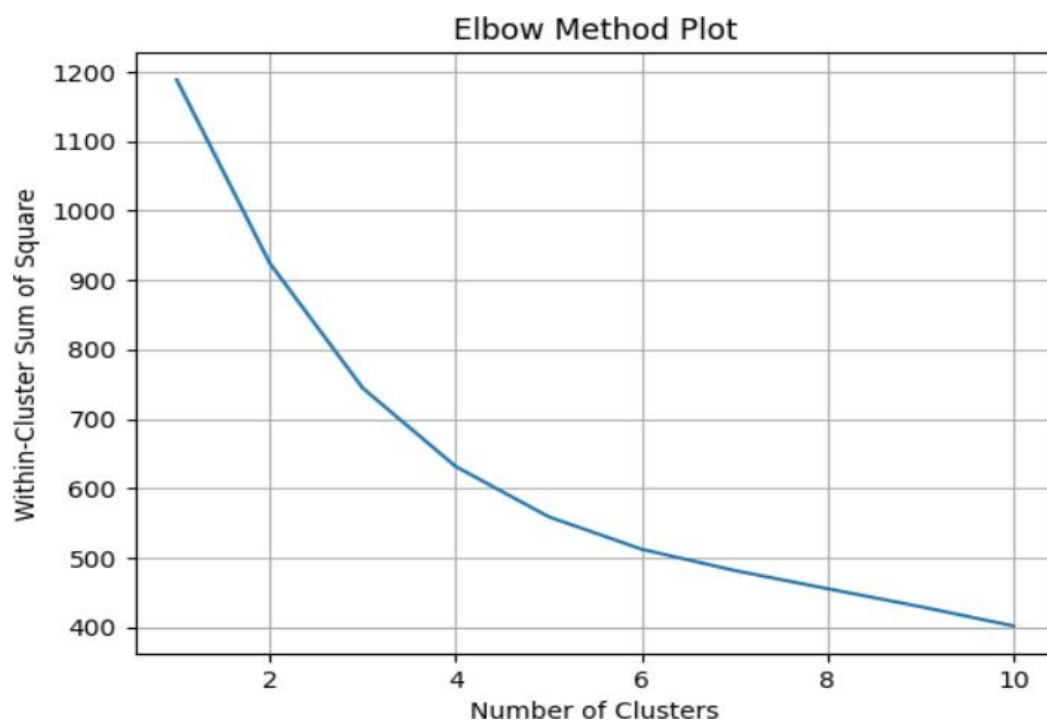
Number of Clusters =3

EV MARKET ANALYSIS
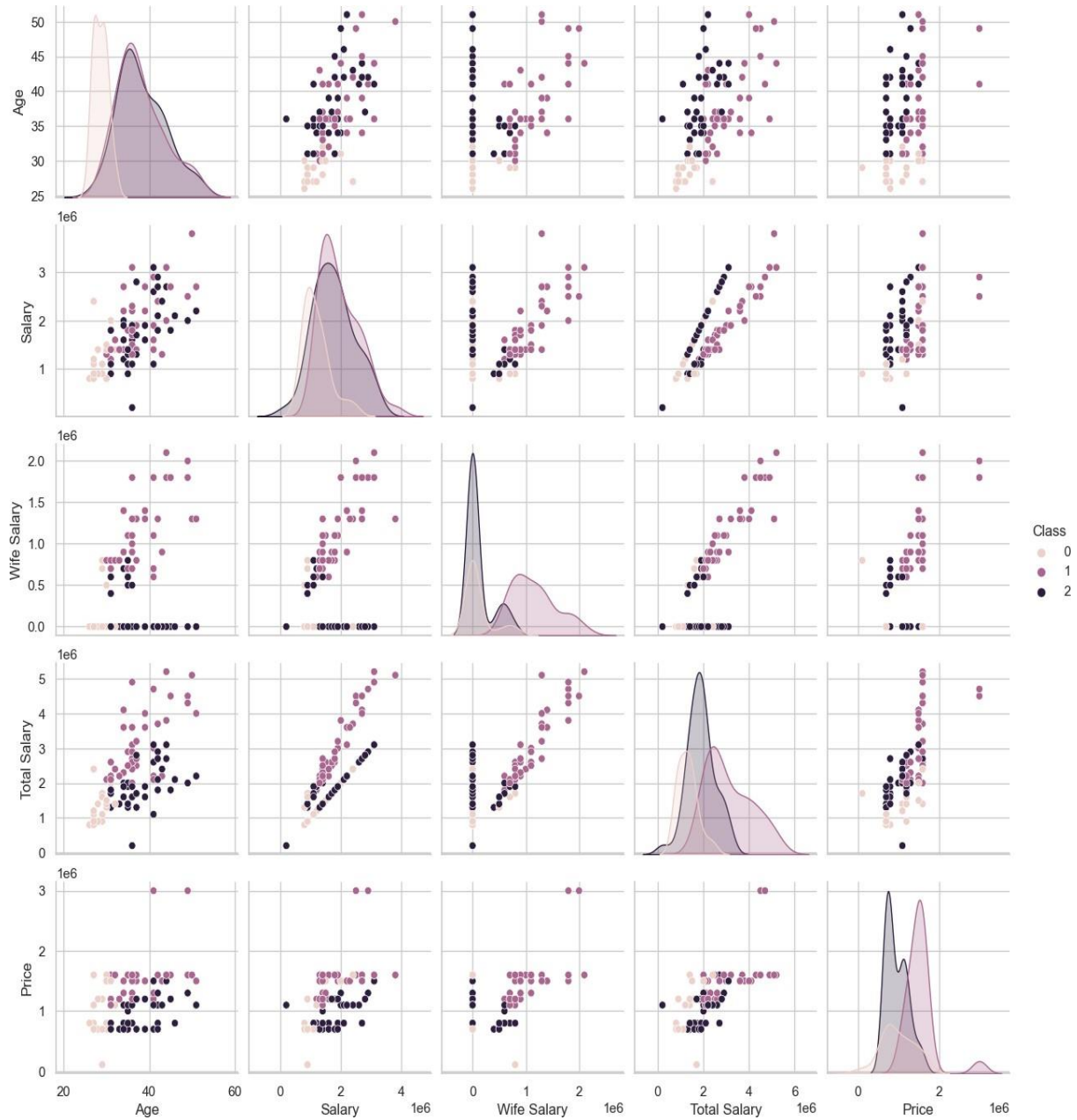
Number of Clusters =5

Selection of Target Segment

❖ The younger population is more likely to purchase products with new technology, especially Electric Vehicles as they are aware of the environmental benefits and would like to bring that change, but our report showed that younger population buys less expensive vehicles and so Electric Vehicles not being affordable can be a downside. It is then suggested to target a segment which is still eager to try new technologies but financially well enough to be able to afford Electric Vehicles. These people are likely to be in an age-group of 30 to 40 years.

❖ People from urban cities with available infrastructure and education about technology and its benefits will tend to purchase electric vehicles More. People who are married and who have dependents are more likely to go ahead and purchase a vehicle and so they could be targeted. Average salary of people who buy vehicles is around 30 lakh and the most purchases for automobiles lies in the range 10-20 lakh and lesser for two-wheelers. These aspects need to be kept in mind too.

Customizing the Marketing Mix

❖ Setting prices for our products is both an art and a science. Most importantly, you must know and understand your cost of production. From there you can adjust based on product characteristics, a specific pricing strategy, customer price sensitivity, customer values, and other factors. Marketing Mix helps understand what our product or service can offer to our customers and helps plan a successful product offering. Helps with planning, developing and executing effective marketing strategies. Help determine whether your product or service is suitable for your customers.

4Ps of Marketing Mix

1. **PRODUCT**

   The type of product would obviously depend on the EV Startup, but throughout our analysis we figured that for India it is best to enter the market with two-wheelers because the most automobile market-share is of two-wheelers. Most people would purchase a two-wheeler because it is cost effective, and the current infrastructure would support that. Another type of product EV Startup can look into is public transport vehicles, because the current government policies are supportive for revamping public transport to electric-based engines.

2. **PRICE**

   Affordability is a major issue with the growth of Electric Vehicles. It is important to keep in mind that in order to appeal to the consumers, the company's product has to be cost effective to both purchase and maintain. The product's price should ideally range between 10 to 20 lakhs, as most people would make a purchase in this range.

3. **PLACE**

   Infrastructure is another important aspect that has to be kept in mind while creating any product and launching it. Major urban cities of the country should be targeted as these are the places where infrastructure would support. Another reason for targeting urban cities is that here it is more likely to have an educated population willing to buy Electric Vehicles because they are aware of the environmental benefits. For different types of vehicles, the list of top states which will promise a good market have been given in our geographical analysis.

4. **PROMOTION**

   Promotion is product dependent. The best possible promotion is to educate people of the benefits of EV/HEV/PHEV over fuel-based vehicles. If the Startup comes up with an affordable product that should definitely be promoted.

CONCLUSION:

In conclusion, the combined geographical and behavioural analyses offer valuable insights into the electric vehicle (EV) market:

Geographical Analysis: The distribution of EV usage across different regions reveals varying patterns. States like Gujarat and Andhra Pradesh exhibit a significant presence of EVs, with diverse vehicle types and infrastructure support. In contrast, regions like Assam show lower EV adoption rates and infrastructure development.

Behavioural Analysis: Understanding consumer behavior provides crucial insights for marketing strategies. Customers with higher total salaries tend to opt for higher-priced EVs, indicating a preference for premium offerings. Conversely, those with lower salaries may prioritize affordability, opting for more budget-friendly options.

Overall, these analyses underscore the importance of tailoring marketing strategies to regional nuances and consumer preferences. By leveraging insights from both geographical and behavioural data, stakeholders can devise targeted approaches to effectively penetrate the EV market and cater to diverse consumer needs.