SINCHANA V – EV MARKETING ANALYSIS REPORT

1. Problem Statement

The global automotive industry is witnessing a significant shift toward electric vehicles (EVs) due to growing environmental concerns, increasing fuel prices, and government initiatives promoting sustainable energy solutions. However, for manufacturers to maximize the adoption of EVs, it is crucial to understand the diverse customer preferences and market segments.

Problem: The objective of this report is to identify distinct consumer segments within the EV market and evaluate their preferences regarding vehicle types, spending capacity, and views on the future of EVs. By analyzing the dataset, we aim to uncover valuable insights into which consumer groups are most likely to transition to EVs, enabling more targeted marketing and strategic planning for businesses.

Specific Goals

The specific goals of this analysis are:

To segment the EV consumer market: Identify key consumer segments that have varying degrees of interest in replacing fuel vehicles with electric ones.

To profile each segment: Understand the demographic and behavioral characteristics (e.g., age, income, education) that define each segment.

To identify the most promising target segment(s): Based on the insights from the segment analysis, recommend which customer groups are the most viable for EV companies to focus on.

To derive strategic marketing insights: Provide actionable recommendations to help EV manufacturers and marketers tailor their strategies for each identified segment.

2. Data Collection

Overview of the Dataset: The dataset consists of responses from approximately 1000 individuals across various cities in India. It contains demographic information, consumer preferences for electric vehicles, and views on EV adoption.

Data Source: The data was collected via an online survey, targeting individuals in cities where the EV market is gaining momentum. Respondents were asked about their current vehicles, income, family size, and preferences related to EVs (e.g., type of EV preferred, spending capacity, etc.).

Key Attributes:

Age: Numeric values, representing the age of respondents.

City: Categorical values representing where the respondent lives (e.g., Pune, Mumbai, Delhi).

Profession: Categorical values that include types of professions (e.g., business, working professional).

Annual Income: Numeric values reflecting the individual's yearly income.

Preferences for replacing vehicles with EVs: Whether the respondent is willing to switch to an EV in the future (Yes, No, Maybe).

Type of EV preferred: SUV, Sedan, Hatchback, etc.

Spending Capacity: Numeric values reflecting the amount respondents are willing to spend on an EV.

3. **Overview of the EV Market Dataset**

In this section, provide a detailed description of the dataset, covering all the important attributes and what they represent. Here's a breakdown:

Age: This attribute provides insights into generational preferences for EVs. Younger individuals may show more willingness to adopt EVs due to concerns about sustainability.

City: Knowing the respondent's city helps understand regional preferences and infrastructure readiness for EV adoption.

Marital Status and Family Size: This could provide insight into family-oriented preferences for vehicle types (e.g., larger families may prefer SUVs).

Annual Income: Key factor in determining affordability and spending capacity for high-ticket items like electric vehicles.

Opinion on EV Economy: Determines the perception of EV affordability compared to traditional fuel-based vehicles, a major factor in adoption rates.

Spending Capacity: This helps in understanding market segments based on financial readiness to invest in an EV.

4. Data Collection Methods

Survey Distribution:

The data for this study was obtained through surveys distributed via online platforms, focusing on individuals who are likely to be knowledgeable about electric vehicles (EVs). The platforms were chosen to specifically target tech-savvy individuals and professionals living in urban areas. These regions were selected due to their more advanced charging infrastructure and higher public awareness of EVs. This urban focus allowed for insights into potential early adopters of EV technology, who are more likely to engage with the concept of electric vehicles.

Sampling Method:
A random sampling method was employed to ensure a diverse set of responses, capturing data from various income groups, professions, and cities. By using random sampling, the data collected reflects a wide range of experiences and perspectives. This diversity helps in understanding preferences across different demographics, which is critical for accurate market segmentation. The survey included participants from major cities and smaller towns to gain a comprehensive view of consumer preferences.

Respondents:
The respondents were individuals from different age groups, income levels, and professions, ensuring broad coverage of the potential EV market. This approach provided valuable insights into varying opinions on EVs based on factors like annual income, education, and vehicle usage patterns.

Time Period:
The data was collected over a period of several months to account for any temporal trends or seasonal influences on consumer attitudes towards electric vehicles. This time frame allowed for a more balanced and thorough understanding of EV market preferences.

5. Data Quality and Preprocessing

Data Quality: In this section, discuss how the data was cleaned and prepared for analysis. Outline the steps taken to ensure the accuracy and reliability of the dataset.

Missing Values: Missing values in columns such as annual income or preferences were either filled with mean values or removed if they were unrepresentative.

Label Encoding: Categorical values like “Yes”, “No”, and “Maybe” were encoded into numeric formats to make them compatible with clustering algorithms.

Normalization: Attributes like income and age were normalized to ensure that no feature dominated the clustering process.

Potential Analysis Limitations: Mention any limitations that may affect the analysis. These could include:

Bias in responses: Respondents may overestimate their willingness to adopt EVs.

Limited geographical scope: The dataset may focus primarily on urban areas, neglecting rural consumers who may have different preferences.

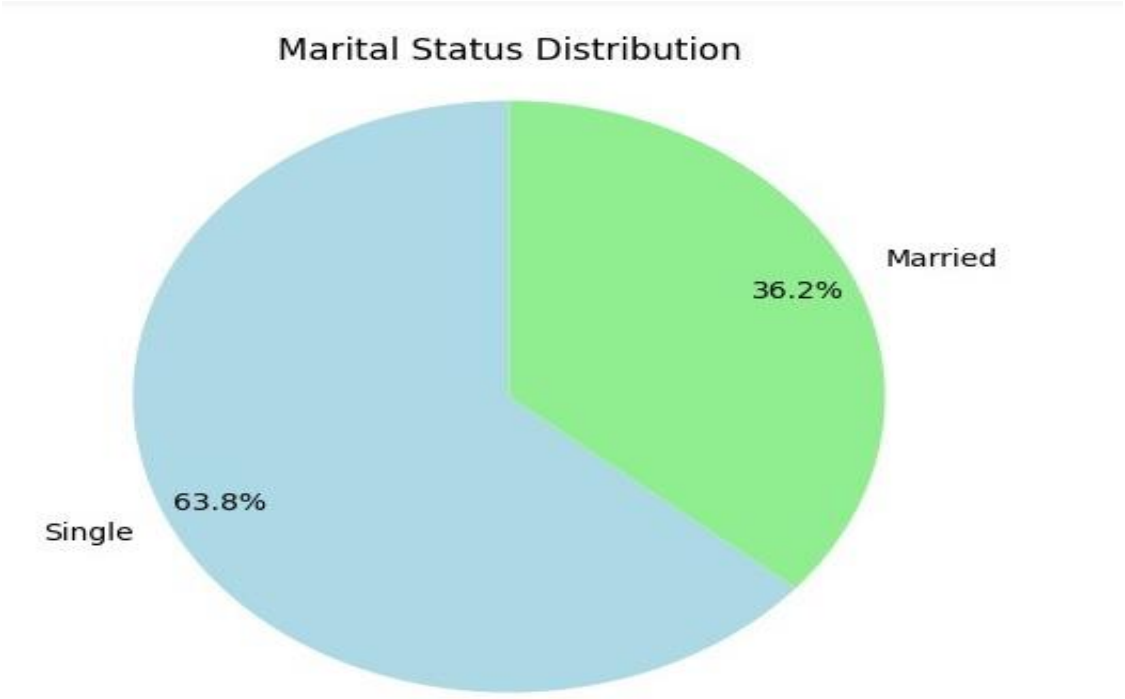
In this section, present the steps and code used to preprocess the data. For example:

Handling Missing Data: Fill missing values for “Age” and “Income”.

Encoding Categorical Variables: Convert non-numeric values to numeric for clustering.

Normalization: Use normalization for numeric variables like “Annual Income” and “Spending Capacity.”

Output: Include the Python code you used for preprocessing, along with sample outputs showing how the data looks after each step (e.g., after filling missing values or encoding categorical columns).



6. Segmentation Extraction

This section describes the process of extracting market segments using clustering techniques like KMeans and Gaussian Mixture Models (GMM). Provide details of the number of clusters, their characteristics, and visualizations.

KMeans Clustering: Describe how you implemented KMeans, the number of clusters you chose, and the logic behind selecting the number of clusters (e.g., based on inertia or the elbow method).

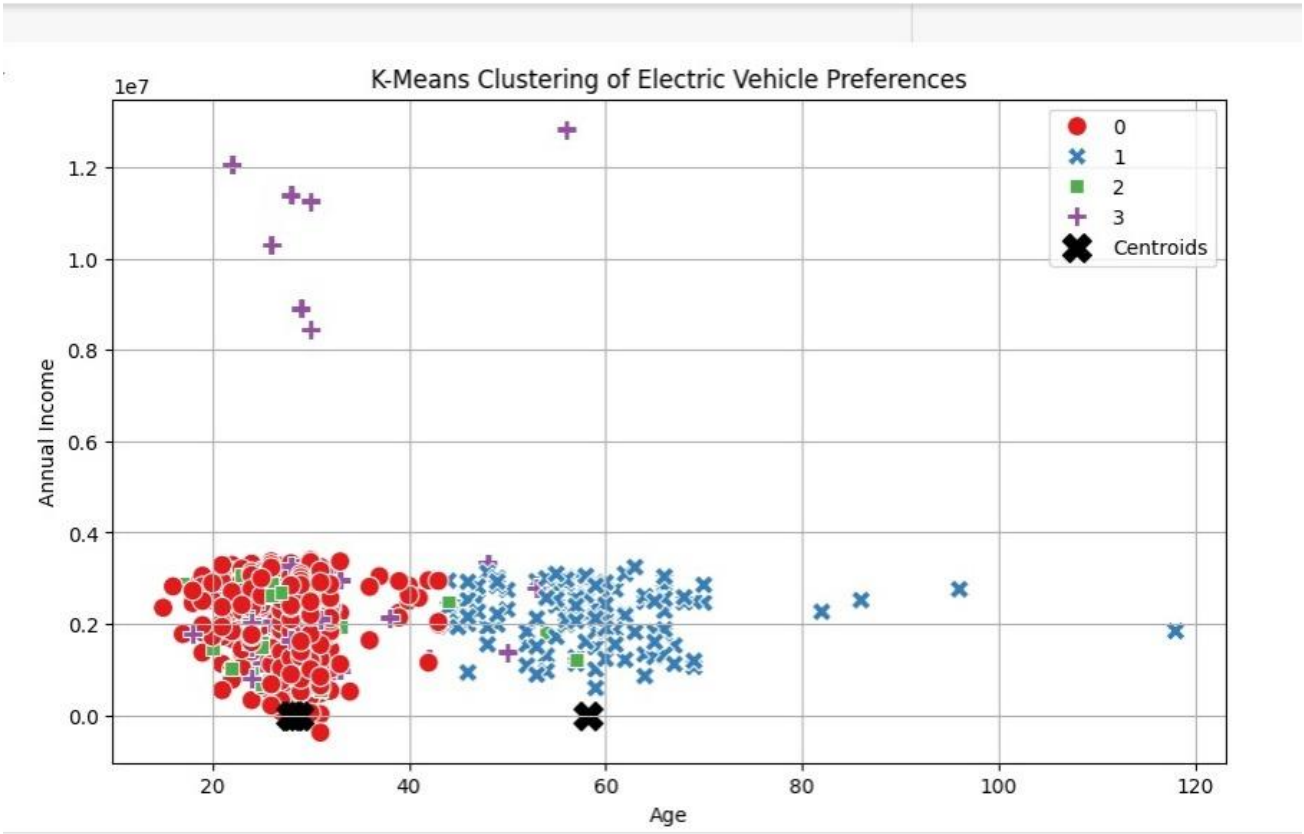
Gaussian Mixture Models (GMM): Explain how GMM clustering was performed and how it compares to KMeans. Mention metrics like AIC and BIC scores to show why a specific number of clusters was chosen.

Visuals: Include plots such as:

Cluster distribution graphs

AIC and BIC plots for GMM

Cluster comparison between KMeans and GMM



7. Profile Segments

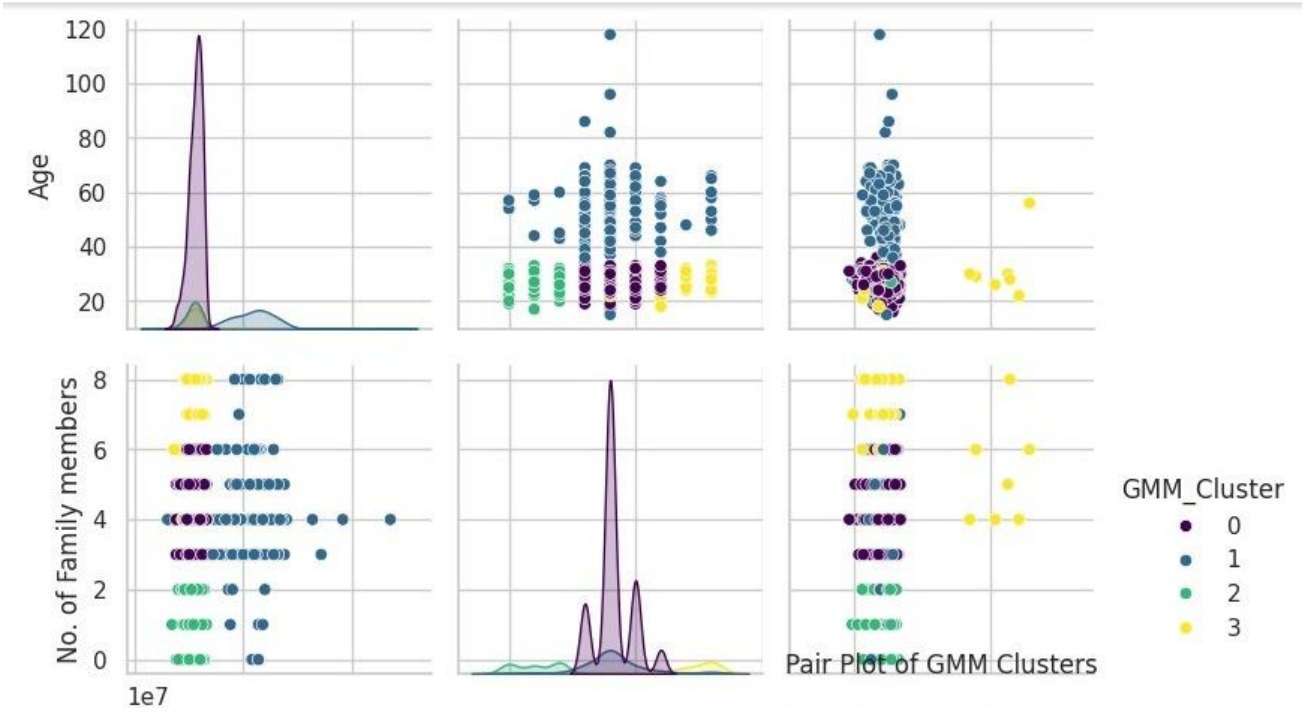
This section provides a deep dive into each segment's characteristics:

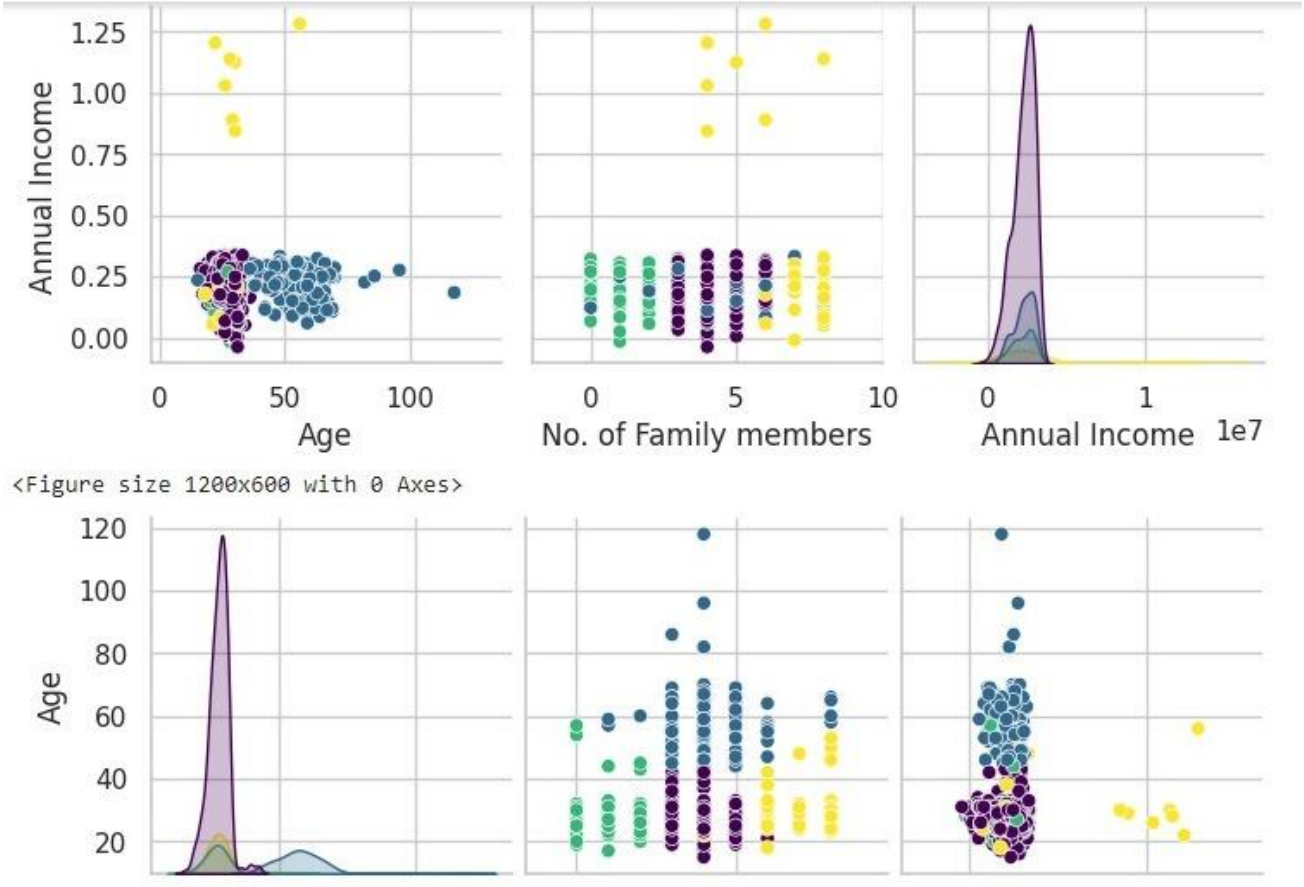
Segment 1 (e.g., Young Urban Professionals): Mostly individuals aged 25-35, with higher annual incomes, and a preference for EV SUVs.

Segment 2 (e.g., Middle-aged Family-Oriented Consumers): Aged 40-55, with family members, who prefer EVs for long-term family usage.

Segment 3 (e.g., Budget-Conscious Consumers): Aged 30-45, showing a preference for economical EV options and possibly considering EV hatchbacks.

Provide specific insights into each segment's preferences, demographics, and EV readiness.





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8. Selecting Target Segments (s)

Based on the profiles created in the previous section, discuss which segments are the most viable for targeting. You might focus on:

Size of the Segment: Larger segments are typically more attractive.
Spending Capacity: High-income segments may have greater potential for early adoption.
Willingness to Adopt: Segments that expressed a stronger intent to switch to EVs should be prioritized.
Output: Include tables or charts that display the characteristics of the target segments, showing why they are chosen.

In this section, provide actionable recommendations based on the target segments:

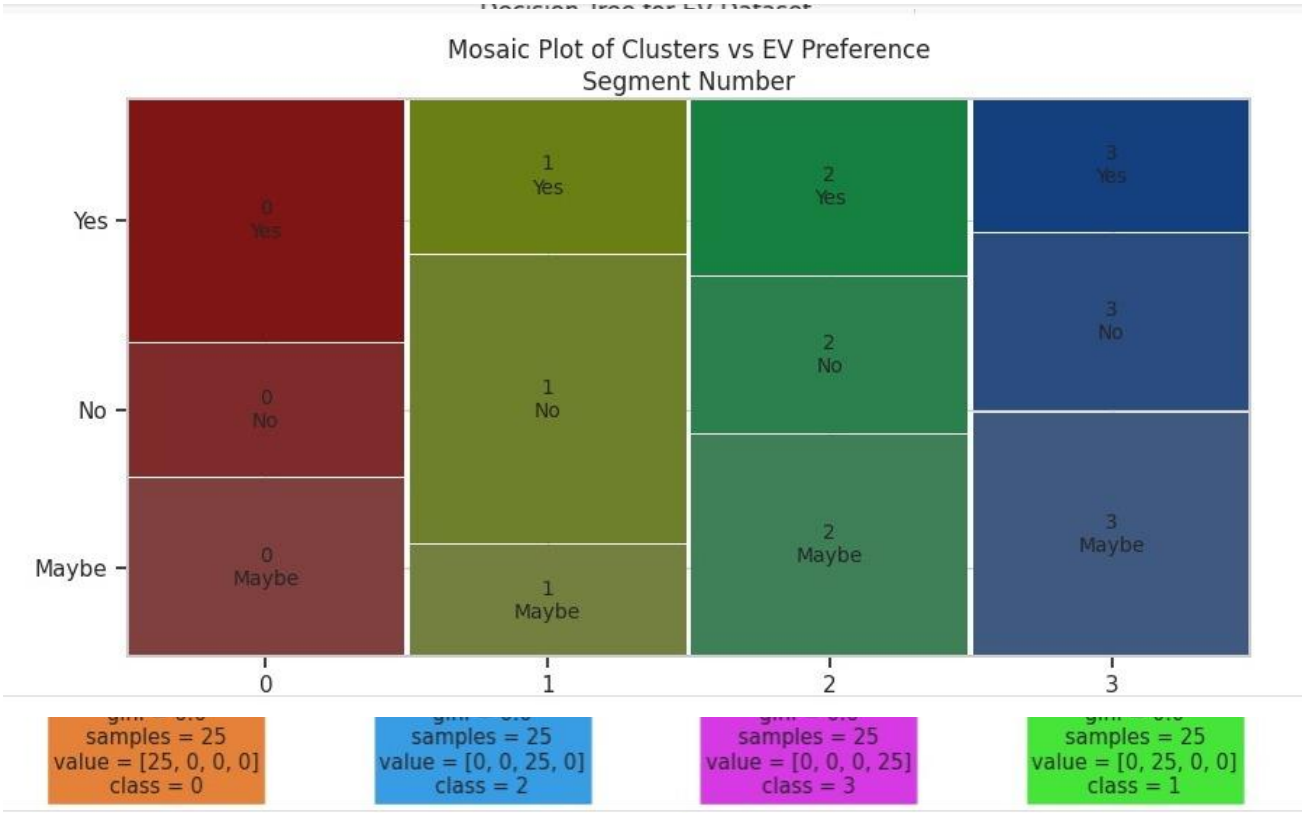
Marketing Strategies: Discuss how businesses should tailor their messaging for each target segment. For example, for younger professionals, focus on the technological and environmental benefits of EVs. For family-oriented consumers, highlight safety and long-term cost savings.
Product Development: Suggest product features that may appeal to different segments (e.g., larger EVs for family-oriented consumers, budget-friendly options for lower-income groups).
Pricing and Incentives: Propose tiered pricing strategies and incentives that could increase the appeal of EVs to different market segments.

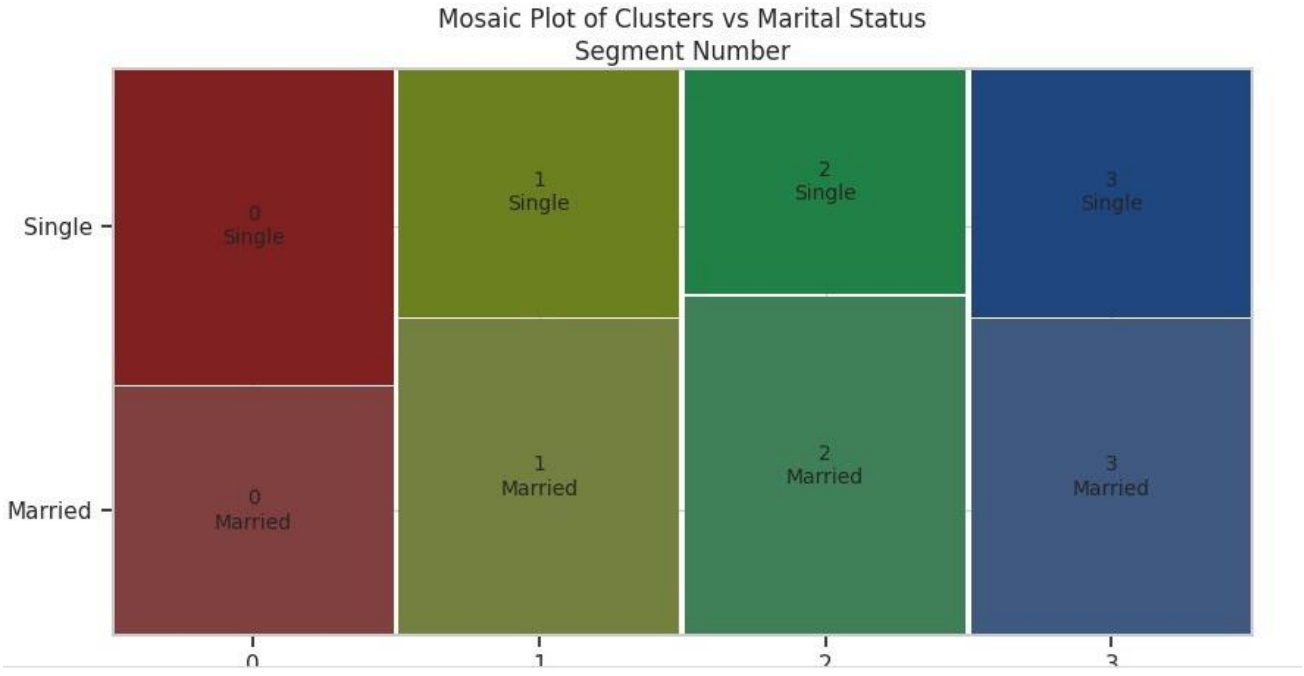
9. Mosaic plot

In the EV marketing report, various visualization techniques were employed to gain insights into customer segments and preferences. A mosaic plot was used to analyze clusters based on respondents' preferences for adopting electric vehicles (EVs), categorized as "Yes," "No," or "Maybe." The mosaic plot displayed a clear visual representation of how different segments varied in their EV preferences, helping identify the concentration of preferences across different clusters.

A similar mosaic plot was used to explore the relationship between marital status (Single or Married) and the identified clusters. This provided a deeper understanding of how marital status may influence decision-making in the context of EV adoption.

Furthermore, a decision tree was utilized to analyze the relationship between annual income and EV preference. The decision tree effectively classified respondents into different segments based on their income, showcasing how income brackets influenced their likelihood of considering or adopting EVs. The Gini index was employed to evaluate the purity of the splits, ensuring that each segment was distinctly categorized based on their income and EV preference.





10. Conclusion

Summarize the key findings and restate the significance of the segmentation analysis. Reinforce how targeted marketing and product development strategies based on these segments can

significantly boost EV adoption in the market. Additionally, suggest areas for future research, such as incorporating behavioral data or expanding the dataset to rural regions.