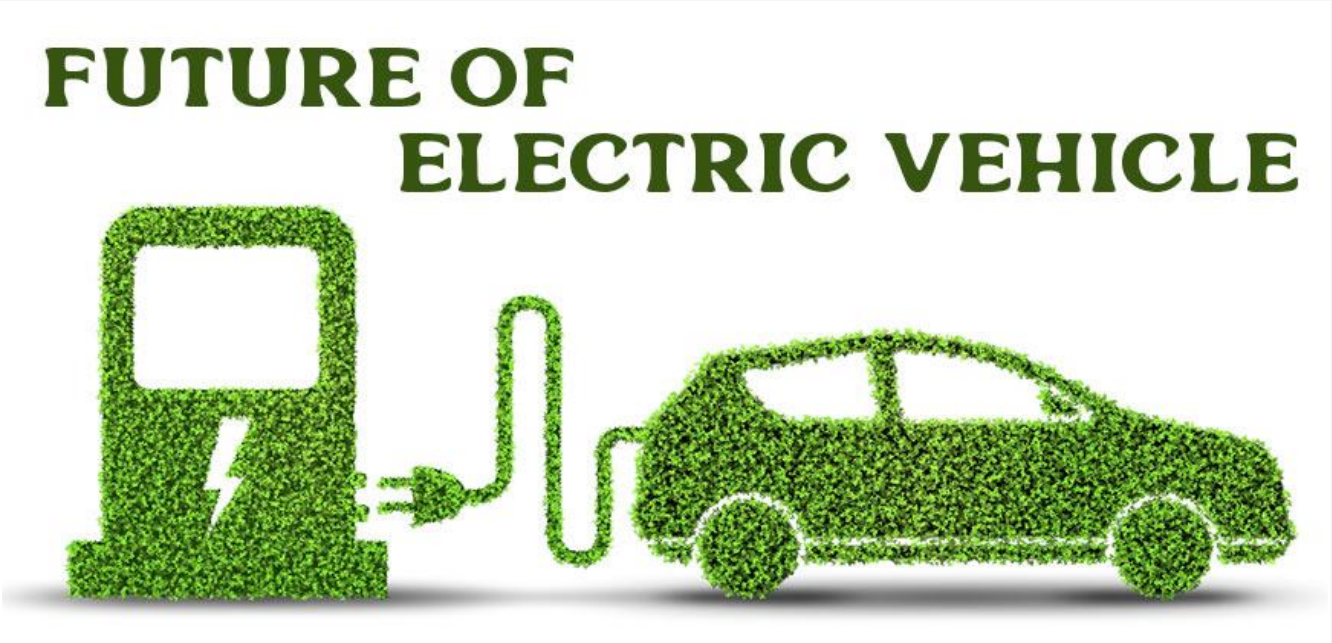


Market Segmentation

This analysis will enable us to identify the specific segments within the market that are most likely to adopt and utilize electric vehicles. By focusing our efforts on these target segments, we can develop a feasible and effective strategy for successful market entry.

Team Members Name

RAJEEV T M

SAMARTH RIKHE

VANUSHUL SHIIKKEWAL

CHARAN SAI GOTTIPATI

Data Sources

Cheapest Electric Cars:
https://www.kaggle.com/datasets/kkhandekar/cheapest-electric-cars

EVs - One Electric Vehicle Dataset - Smaller:
https://www.kaggle.com/datasets/geoffnel/evs-one-electric-vehicle-dataset?select=ElectricCarData_Norm.csv

Electric Vehicle Population:https:
//www.kaggle.com/datasets/ssarkar445/electric-vehicle-population

Electric Vehicle Population Data:
https://www.kaggle.com/datasets/ratikkakkar/electric-vehicle-population-data

EVPopulation:

https://www.kaggle.com/datasets/vijayakishoredusi/evpopulation?select=Electric_Vehicle_Population_Data.csv

Electric Vehicle in India 2022:
https://www.kaggle.com/datasets/fathimaibrahimkunju/electric-vehicle-in-india-2022

Vehicle Registration India 17-22:
https://www.kaggle.com/datasets/prasenjitsharma/fuel-type-wise-vehicle-registration-india

Global EV Outlook

https://www.iea.org/data-and-statistics/data-tools/global-ev-data-explorer

Overview

The global automotive industry predominantly relies on oil, with more than 90% of vehicles worldwide running on this non-renewable energy source. However, there is a noticeable shift in consumer preferences towards alternative energy sources to power vehicles. Consequently, the popularity of electric vehicles (EVs) has been steadily increasing. EVs operate using an electric motor instead of an internal combustion engine, which traditionally burns a mixture of fuel and gases. As a result, electric vehicles are viewed as potential replacements for conventional automobiles in the near future.

The rise in global air pollution levels has underscored the urgency of finding sustainable solutions, and electric cars offer a promising response to address this concern. However, the widespread adoption of electric vehicles necessitates smarter infrastructure and supportive government policies. In the context of India, electric vehicles have a significant role to play in the country's energy and mobility markets. Currently, the market share of electric, hybrid, and plug-in hybrid vehicles (EV/HEV/PHEV) in India stands at approximately 0.1%. The overwhelming majority of vehicles in the country still rely on fossil fuel-based transportation, leading to atmospheric pollution through greenhouse gas emissions and contributing to global warming.

India's transportation sector is experiencing rapid growth, amplifying the gap between domestic crude oil production and consumption. With India importing around 70% of its annual oil requirements, there is an urgent need to explore sustainable and clean alternatives for transportation systems. Electrified vehicles emerge as a promising solution, offering a cleaner and more sustainable form of transportation.

The current state of the road transportation sector can be summarized as follows:

- Energy consumption: The sector consumes a significant amount of energy, totaling 524 million tons of oil equivalent.
- Vehicle to people ratio: The ratio of vehicles to people is high, standing at 1:56.3.
- Per capita energy: On a per capita basis, the energy consumption amounts to 442 kg of oil equivalent.
- GHG emissions: The sector contributes to greenhouse gas emissions, with a total of 1,730 million tons of CO_2 equivalent.

- Electric Vehicles sold (2016): In 2016, a total of 25,000 electric vehicles were sold, with 2,000 of them being cars.

India, unlike other countries, faces a unique challenge where the vehicle to people ratio is notably high, indicating a significant number of vehicles on the road. However, due to the country's large population, the overall emissions remain high. In fact, India ranks third globally in terms of CO2 emissions, with a staggering 1.726 billion metric tons. To address this pressing issue, there is an urgent need to prioritize electric vehicle technology, which has the potential to achieve zero emissions and promote sustainable transportation.

Furthermore, the rapid increase in personal vehicles can be attributed to urbanization and the decentralization of city areas in India. In this context, adopting Electric Vehicles (EVs), Hybrid Electric Vehicles (HEVs), and Plug-in Hybrid Electric Vehicles (PHEVs) can offer several benefits for Indian roads. The following reasons support this assertion:

- Hybrid or electric powertrains exhibit significantly higher efficiency at lower Indian driving speeds compared to Internal Combustion Engines (ICEs).
- A substantial portion of energy per trip in India is lost through braking, but this energy can be effectively recovered in hybrid-electric vehicles (HEVs) and EVs through regenerative braking.
- HEVs and EVs do not consume fuel during idling, and given the higher prevalence of idling time in Indian traffic compared to the U.S. and Europe, this feature becomes particularly advantageous.
- The average travel range in India is typically smaller than that in the U.S. and Europe, making EVs highly feasible without encountering range limitations on a single charge.

- Vehicle usage and distance in urban driving cycles often involve frequent starts and stops and encounter high traffic. This pattern of urban driving benefits the efficiency of electric vehicles, allowing them to operate more effectively.

Therefore, considering these factors, the adoption of EVs, HEVs, and PHEVs can bring significant advantages to India's transportation sector, aligning with the specific characteristics of Indian roads and driving conditions.

Market Overview

The Indian Electric Vehicle Market demonstrates segmentation based on Vehicle Type and Power Source. Vehicle Type encompasses Passenger Cars, Commercial Vehicles, and Two- and Three-wheelers, while Power Source Type includes Battery Electric Vehicles, Plug-in Electric Vehicles, and Hybrid Electric Vehicles. Although our report primarily focuses on the Indian Electric Vehicle Market segmented by Vehicle Type, we briefly discuss the accessibility of Power Sources for Electric Vehicles, as it influences the market dynamics.

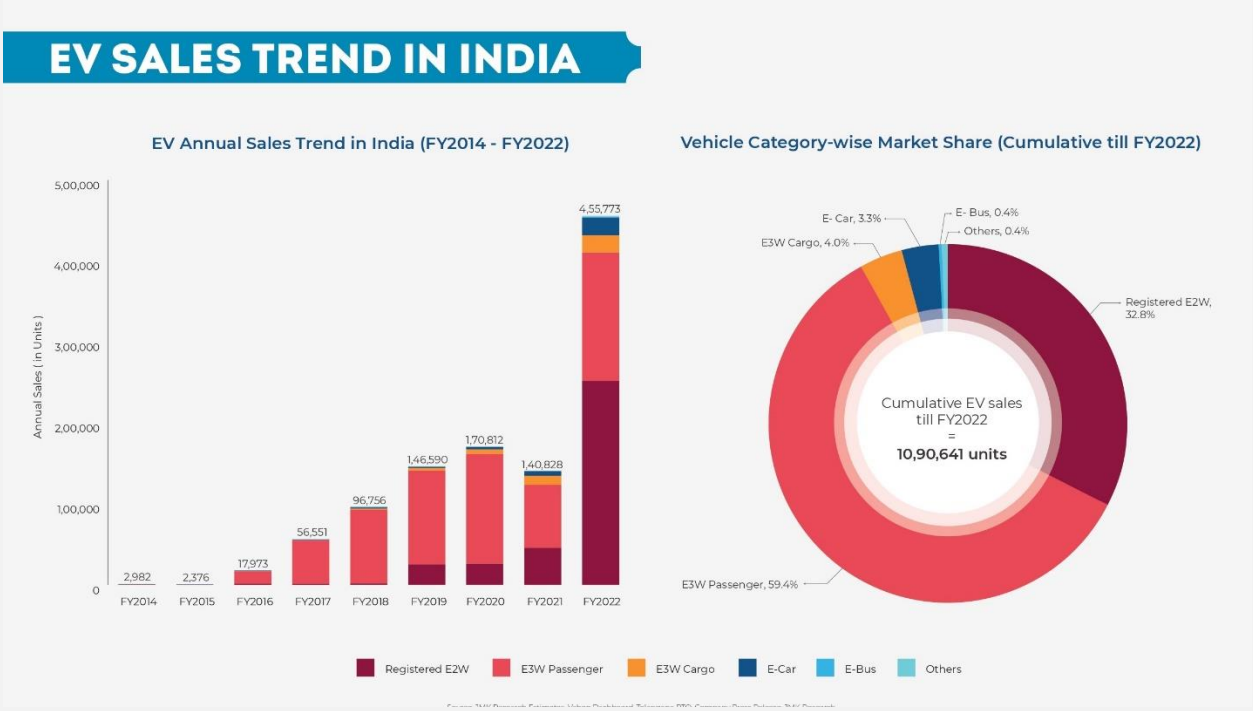
In 2020, the Indian Electric Vehicle Market was valued at USD 5 billion. It is projected to reach USD 47 billion by 2026, with a compound annual growth rate (CAGR) of over 44% during the forecast period (2021-2026). The market has experienced the impact of the COVID-19 pandemic, including disruptions in the supply chain and temporary closures of manufacturing units due to nationwide lockdowns and travel restrictions. However, the electric vehicle (EV) market in India is still in its early stages but anticipated to grow rapidly, driven by government initiatives and policies.

E-commerce companies, like Amazon, are actively initiating e-Mobility initiatives for last-mile deliveries to reduce carbon

footprints. India is also experimenting with e-Mobility in public transportation, deploying electric intercity buses in major cities. State governments are actively involved in promoting EV usage through policy implementation. For example:

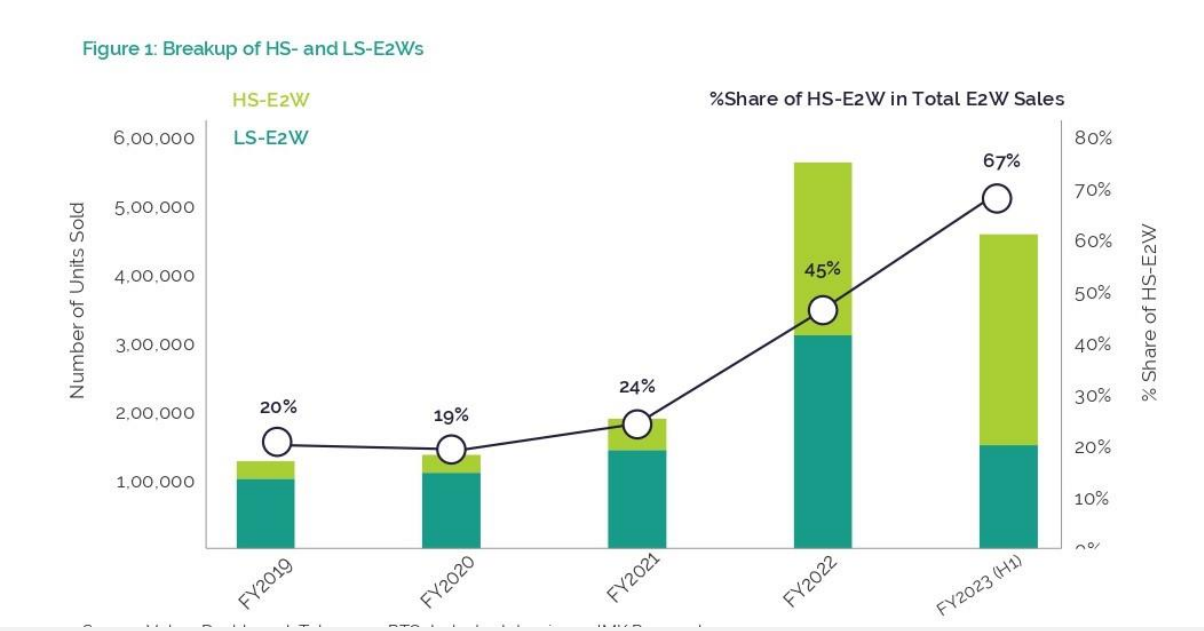
- Kerala aims to have one million EV units on the road by 2022 and 6,000 e-buses in public transport by 2025.
- Telangana has set EV sales targets for 2025, targeting 80% electrification for 2- and 3-wheelers, 70% for commercial cars (ride-hailing companies like Ola and Uber), 40% for buses, 30% for private cars, and 15% overall vehicle electrification.

The EV market in India has gained significant momentum following the implementation of the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) scheme. This scheme aims to promote e-mobility in response to international policy commitments and environmental challenges. Furthermore, India presents the world's largest untapped market, especially in the electric two-wheeler segment. The allowance of 100% foreign direct investment in this sector further supports the anticipation of market growth through automatic route investments during the forecast period.



Market Dynamics

In the fiscal year 2020-21, two-wheelers emerged as the dominant type of electric vehicles sold in India, with sales reaching approximately 144 thousand units. This represented a 5 percent decline compared to the previous year's figure of 152 thousand units. The only segment that witnessed growth during this period was four-wheelers. The Indian electric vehicle market is characterized by a concentration of major players, benefiting from the availability of affordable and abundant labour. However, established companies in the market are introducing fresh models to gain a competitive advantage over their counterparts. Startups are expanding their footprint by securing investments from investors and venturing into untapped cities. To establish their presence in the market, companies are making significant investments in research and development and launching new models.



GOVERNMENT INITIATIVES AND POLICIES SUPPORTING THE EV INDUSTRY

The Indian government has implemented various initiatives and policies to support the electric vehicle (EV) industry and encourage its growth. Some of the key government initiatives and policies are:

- **Faster Adoption and Manufacturing of Electric Vehicles (FAME) Scheme**: The FAME scheme was launched to promote the adoption of electric and hybrid vehicles in India. It provides incentives to both buyers and manufacturers of EVs, including subsidies on the purchase of EVs and support for establishing charging infrastructure.

- **National Electric Mobility Mission Plan (NEMMP):** The NEMMP aims to achieve national fuel security and reduce vehicular emissions by promoting the adoption of electric and hybrid vehicles. It sets ambitious targets for electric vehicle

deployment and emphasizes the development of charging infrastructure across the country.

- **GST Benefits**: The Goods and Services Tax (GST) on electric vehicles has been reduced to encourage their affordability and adoption. The reduced GST rates make EVs more attractive to consumers and help lower the overall cost of ownership.

- **Charging Infrastructure Development**: The government has undertaken initiatives to develop a robust charging infrastructure across the country. It offers subsidies and incentives to individuals, businesses, and organizations for setting up charging stations. Additionally, guidelines and standards for charging infrastructure installation have been established.

- **Import Duty Reduction**: The government has reduced import duties on components and parts required for manufacturing electric vehicles. This reduction in import duties helps in lowering the production costs of EVs and makes them more competitive in the market.

- **Research and Development (R&D) Support:** The government provides financial assistance and support for research and development activities related to electric vehicles. This support encourages innovation, technology development, and indigenous manufacturing of EV components.

- **State-level Incentives**: Several state governments in India have introduced their own incentives and policies to promote electric vehicles. These include subsidies, tax exemptions, and waivers on registration fees, road tax, and parking charges.

These government initiatives and policies collectively aim to accelerate the adoption of electric vehicles in India, reduce dependence on fossil fuels, curb pollution, and drive sustainable transportation solutions.

MARKET CHALLENGES

While the electric vehicle (EV) market in India has shown significant potential, there are several challenges that hinder its widespread adoption. Some of the key market challenges in the Indian EV industry are:

- **High Initial Cost:** Electric vehicles often have a higher upfront cost compared to conventional internal combustion engine vehicles. The higher cost of EVs, including the cost of batteries, remains a significant barrier for many potential buyers, limiting their affordability and mass adoption.

- **Limited Charging Infrastructure:** The availability of a robust charging infrastructure is crucial for the widespread adoption of EVs. However, the charging infrastructure in India is currently limited, especially in non-metro cities and rural areas. The lack of a well-developed charging network creates "range anxiety" among potential EV buyers who are concerned about the availability and accessibility of charging stations.

- **Range Anxiety:** Range anxiety refers to the fear or uncertainty about the limited driving range of electric vehicles before they need to be recharged. While EV technology has been improving,

many consumers are still concerned about the range of EVs and the availability of charging stations during long-distance travel.

- **Battery Technology and Limited Supply Chain:** Battery technology plays a critical role in the performance and cost of electric vehicles. Currently, the dependence on imported battery technology and limited domestic manufacturing capabilities pose challenges in terms of cost, supply chain, and availability of high-quality batteries in India.

- **Consumer Awareness and Perception:** There is a lack of awareness and understanding among consumers about the benefits and features of electric vehicles. Many potential buyers are not fully aware of the long-term cost savings, environmental advantages, and technological advancements associated with EVs. Consumer perception, including concerns about performance, charging time, and battery life, also affects the adoption rate.

- **Limited Model Options and Variety**: While the number of electric vehicle models available in India is increasing, the options and variety are still limited compared to conventional vehicles. The availability of diverse models, including affordable options in various vehicle segments, is crucial to cater to different consumer preferences and needs.

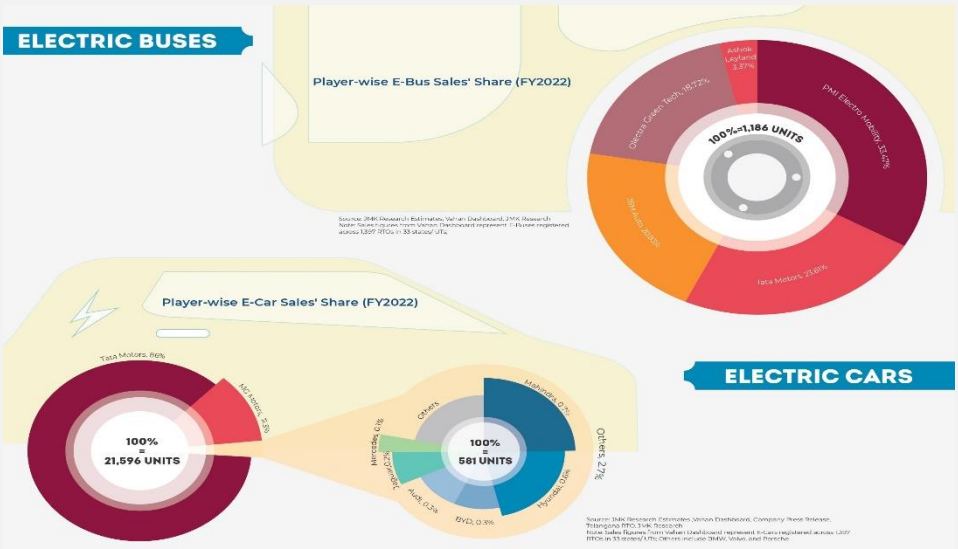
- **Policy Implementation and Support:** While the government has introduced initiatives and policies to support the EV industry, effective implementation and consistent policy support are essential for driving the market forward. Challenges such as delays in subsidy disbursement, evolving policy frameworks,

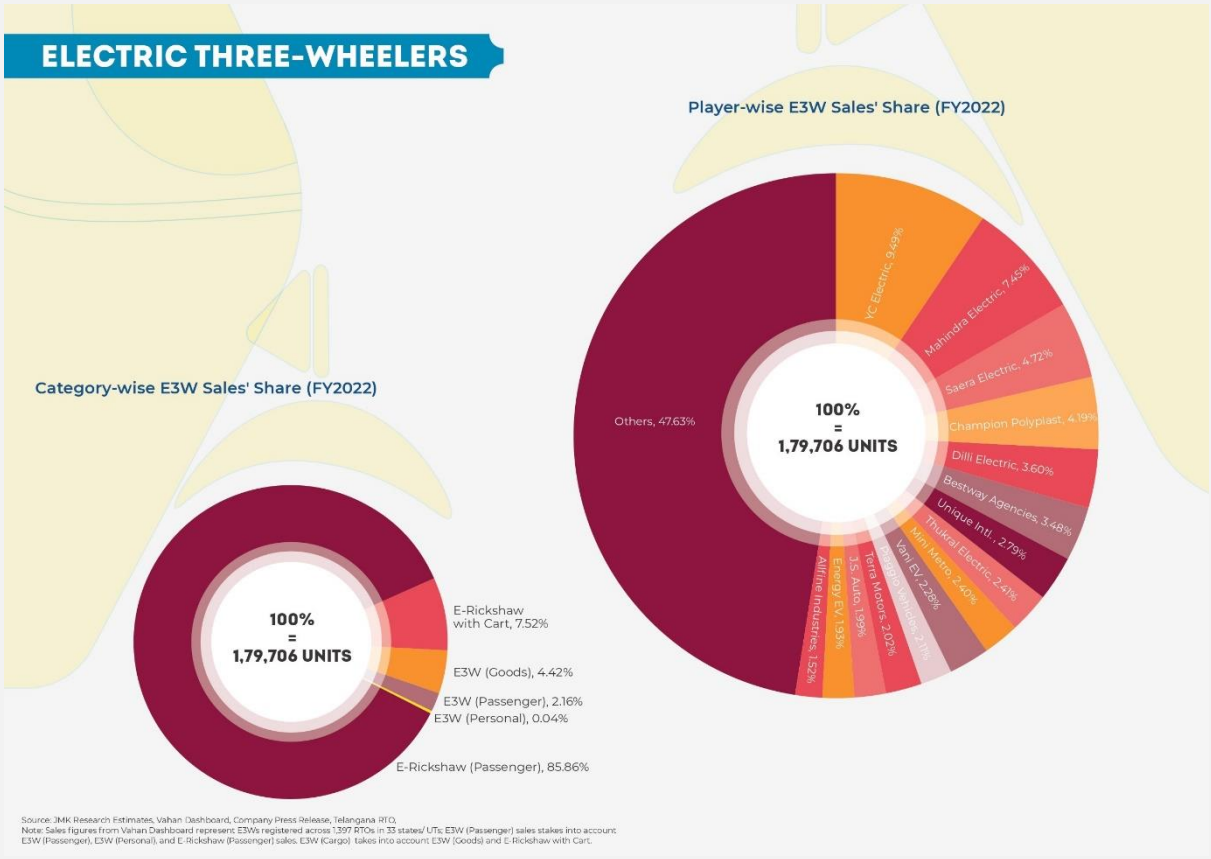
and lack of coordination among various stakeholders can impact the growth and stability of the EV market.

Addressing these challenges requires a comprehensive approach involving the government, industry stakeholders, and consumers. Continued investment in charging infrastructure, technology development, battery manufacturing, consumer education, and supportive policies are crucial for overcoming these obstacles and realizing the full potential of electric vehicles in India.

Positive Outlook for Electric Buses and Two-Wheeler Vehicles: Promising Growth Ahead

India is witnessing a significant push towards the electrification of buses, with several state governments procuring electric buses from both Chinese and local manufacturers. Collaboration between Indian and Chinese bus manufacturers aim to meet the increasing demand. Amidst transportation challenges, the Indian two-wheeler industry holds promise, especially due to stringent government policies addressing vehicular emissions and the availability of affordable electric models as an alternative to conventional fuel-powered vehicles. These factors are driving the growing demand in India's electric vehicle market.





Market Segmentation

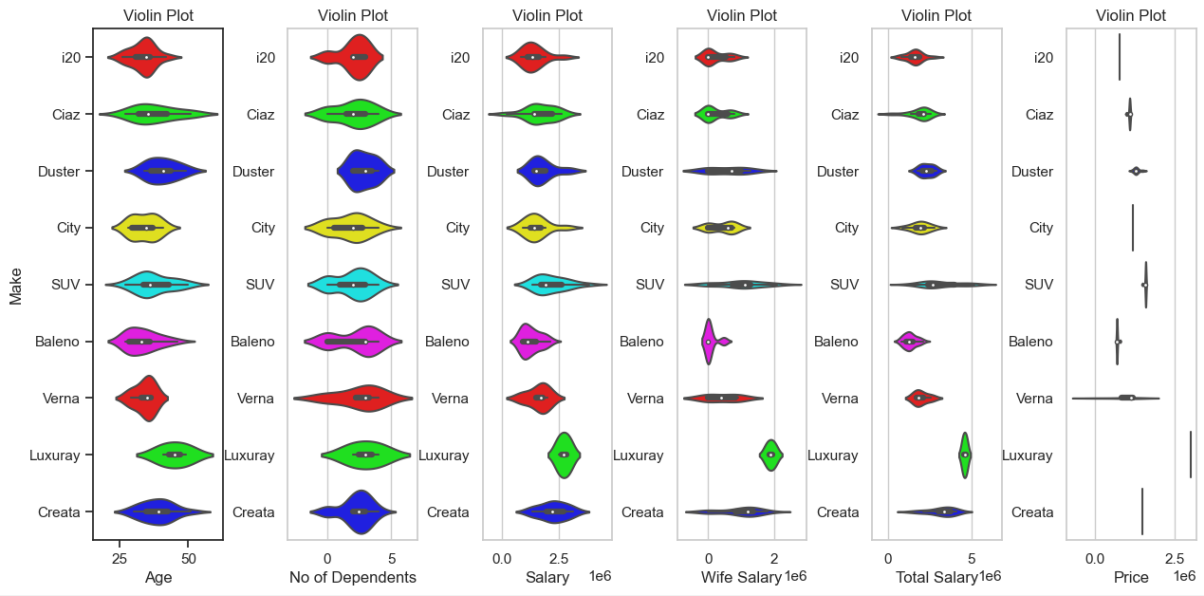
Due to the nascent stage of the Electric Vehicle (EV) market in India, the availability of comprehensive consumer data specific to EVs is limited. Consequently, our approach shifted towards analysing consumer data pertaining to existing fuel-based vehicles. Through simple behavioural and demographic analysis of this data, we aimed to gain insights into the market. To further understand regional preferences, we utilized state-wise statistics to identify potential target markets for different types of EVs.

This analysis allowed us to identify significant attributes within the target segment, which can be leveraged for market segmentation utilizing model-based algorithms.

BEHAVIORAL AND PSYCHOGRAPHIC ANALYSIS

Behavioural segmentation and psychographic segmentation are utilized by businesses for customer segmentation. Behavioural segmentation categorizes customers based on their patterns of behavior while interacting with a company/brand or making purchasing decisions. It considers factors such as their knowledge, attitude, use, and response towards a product, service, or brand. On the other hand, psychographic segmentation involves understanding a consumer's lifestyle, interests, and opinions.

The violin plot below gives us some insight on the relation between the segmentation and descriptive variables in our data.



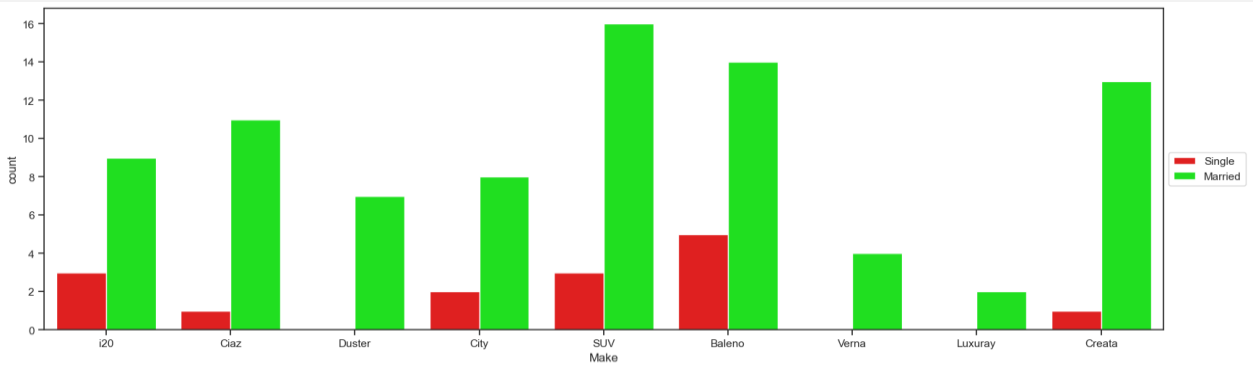
Observations:

● **Age**: Younger consumers purchase less expensive vehicles. This can be explained simply as they have lesser dependents, lesser income and are single, and so they don’t have both the option and the need to buy more expensive vehicles.

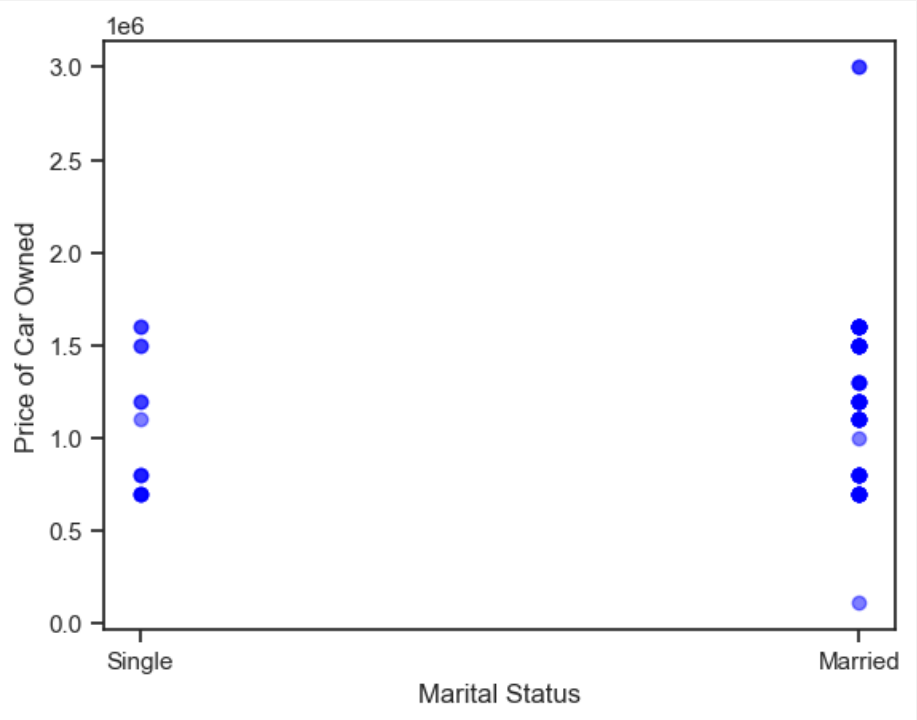
● **Number of Dependents**: Greater number of dependents makes the consumer buy a vehicle with more seats and so they tend to prefer SUVs.
● **Salary**: If you overlap the normalised salary plots with price plot, you would observe the median of salary violin plot matches that of the price of the vehicle indicating a very direct relationship, which makes sense as most people would buy vehicles they can afford.

Dependency of make and price of vehicles on other descriptor variables:

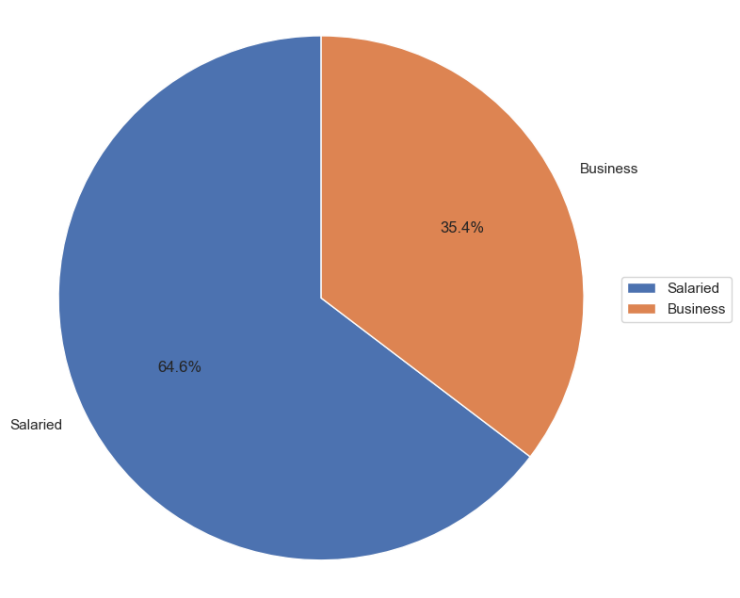
● **Marital Status:**



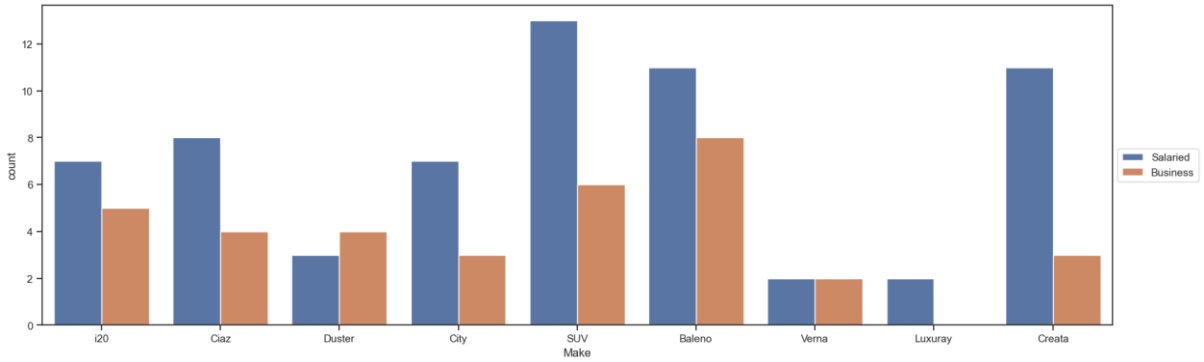
○ **Price of vehicle owned:**



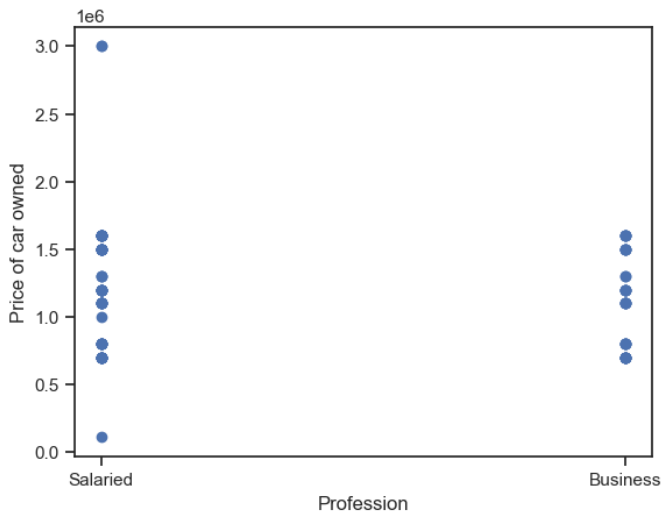
Profession:



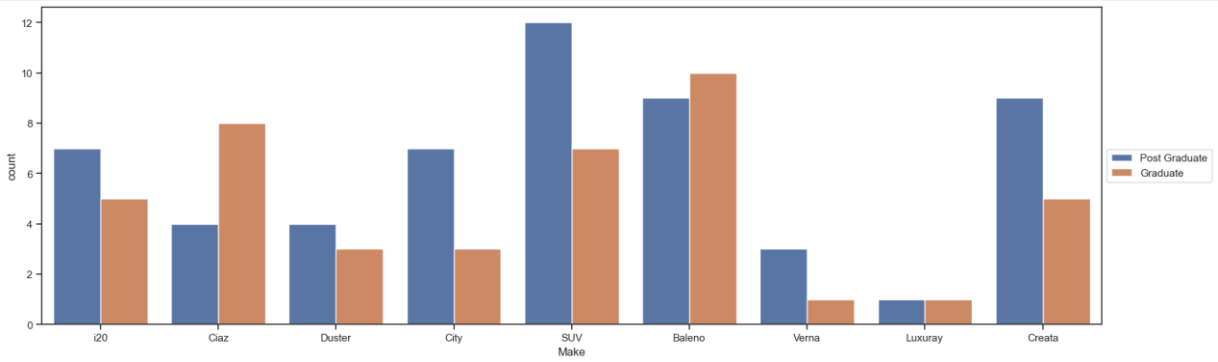
- **Make of vehicles they tend to purchase:**



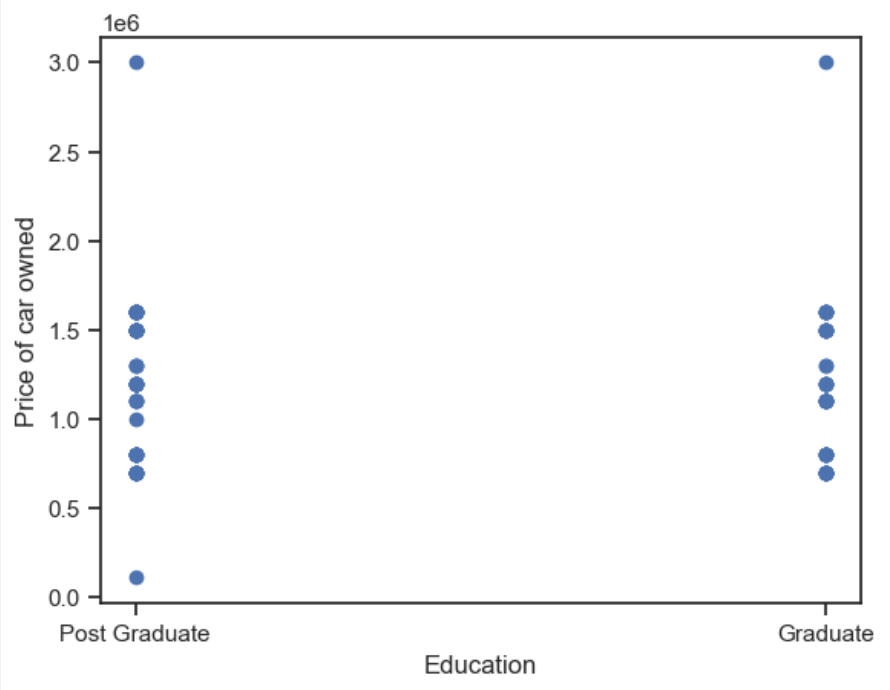
- **Price of vehicle owned:**



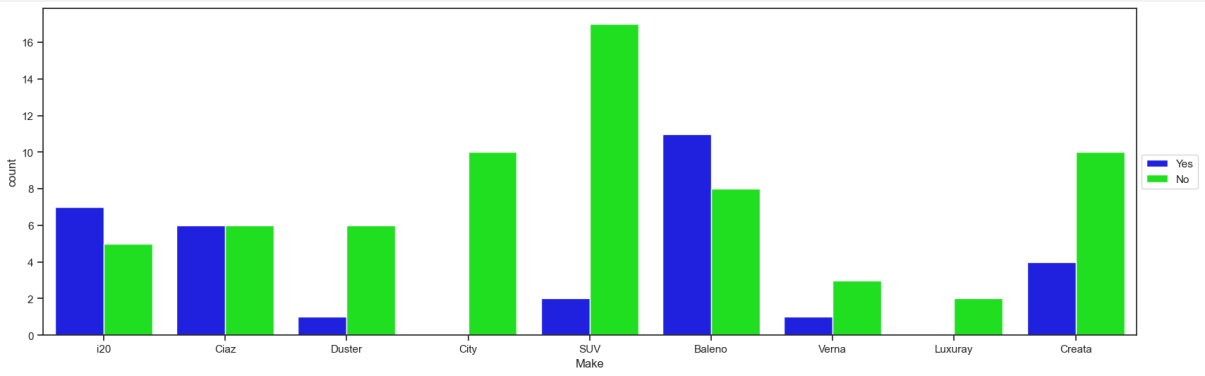
- **Education:**



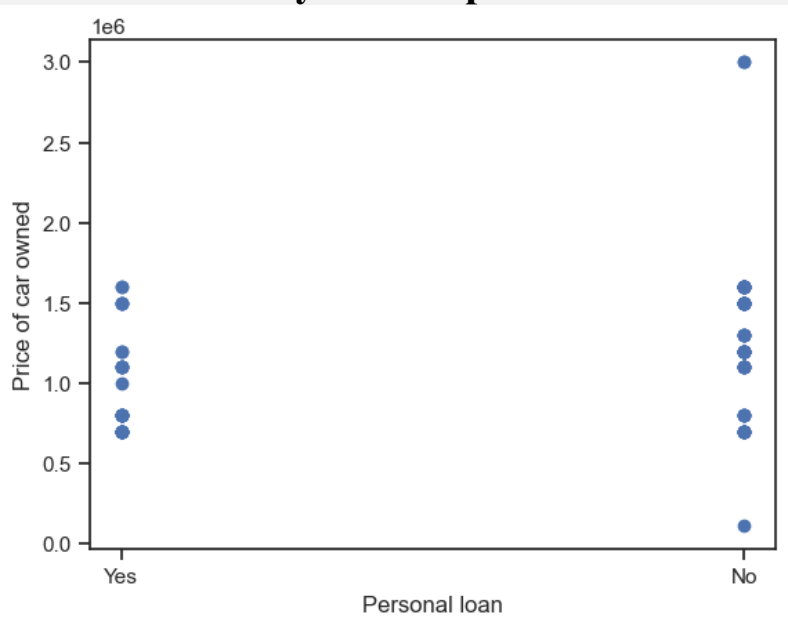
  - Make of vehicles they tend to purchase:



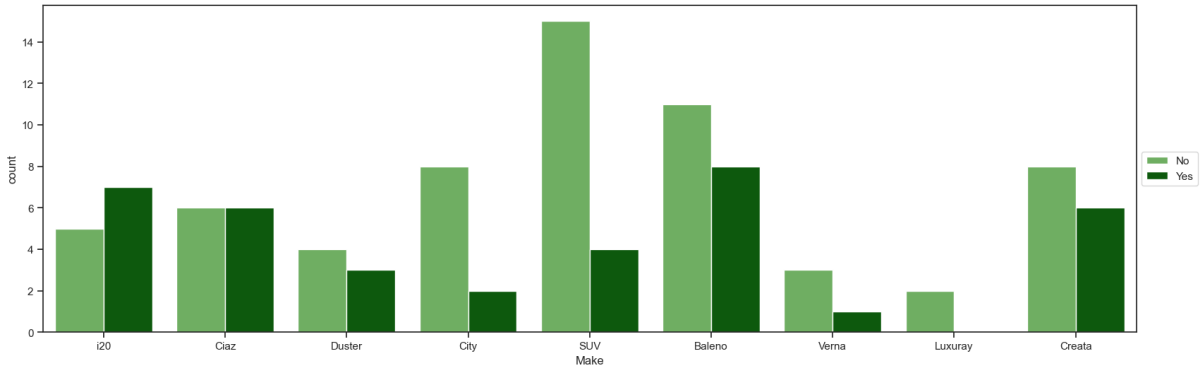
- **Personal Loan:**



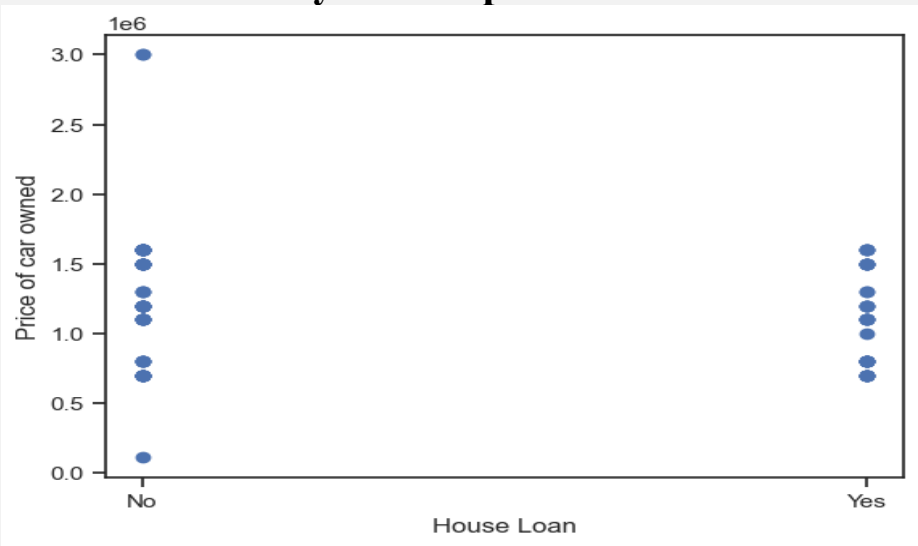
○ **Make of vehicles they tend to purchase:**



● **House Loan:**

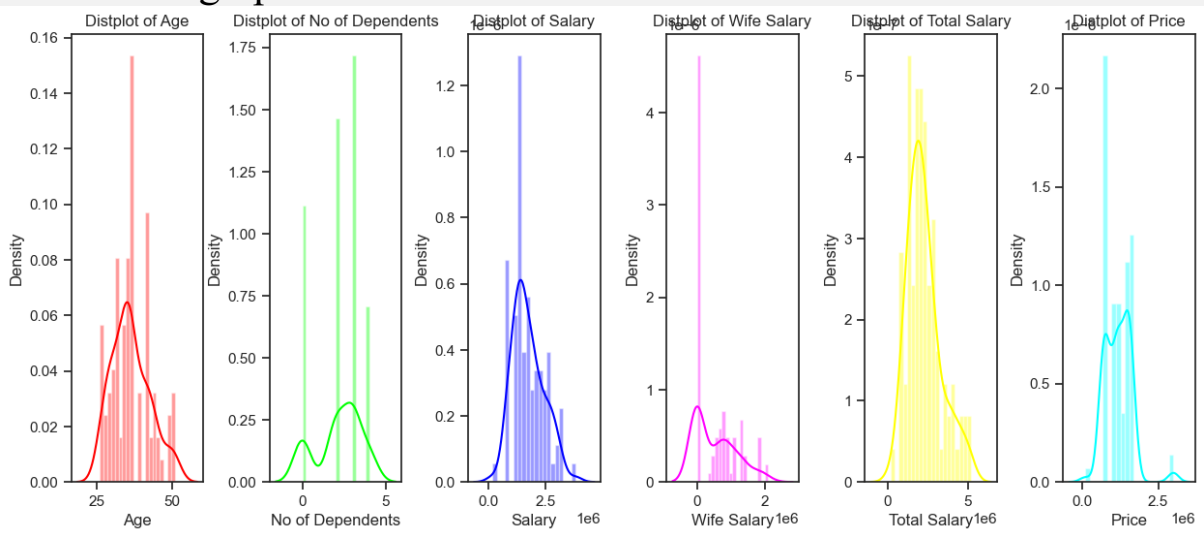


○ **Make of vehicles they tend to purchase:**



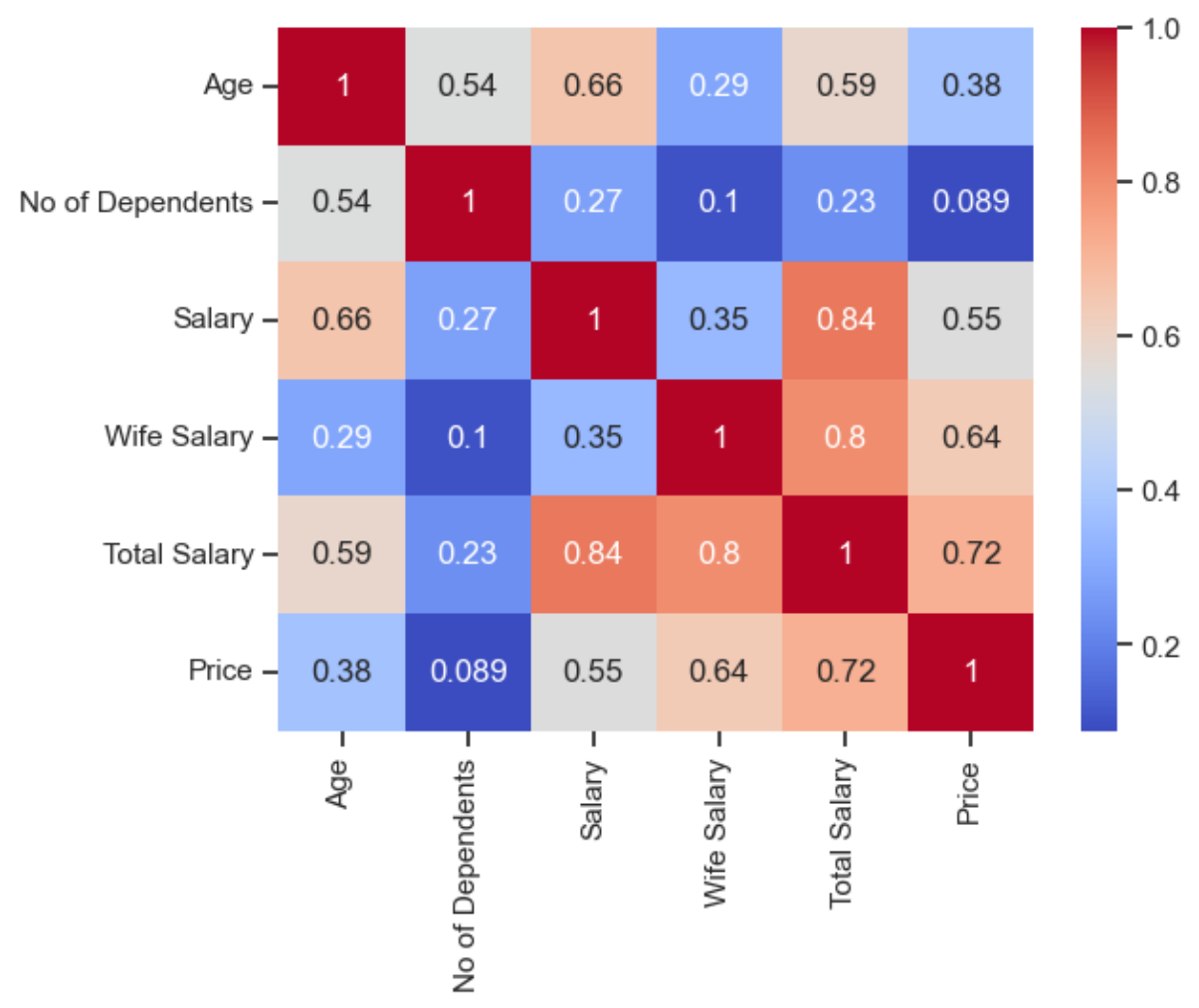
DEMOGRAPHIC ANALYSIS

Demographic segmentation groups customers and potential customers together by focusing on certain traits such as age, gender, income, education, occupation and family status. Demographic segmentation is based on the assumption that consumers in the same demographic group will have similar needs. Demographic customer segmentation helps organizations to develop market outreach for better marketing strategies. When an organization looks at the demographic segmentation, it focuses on the people who are most likely to buy a product. This helps in identifying the target market.
We have used the same dataset we used for behavioral and psychographic analysis and the following plots help us understand the socio-demographic structure of the market:



Observations from the distribution plot:

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

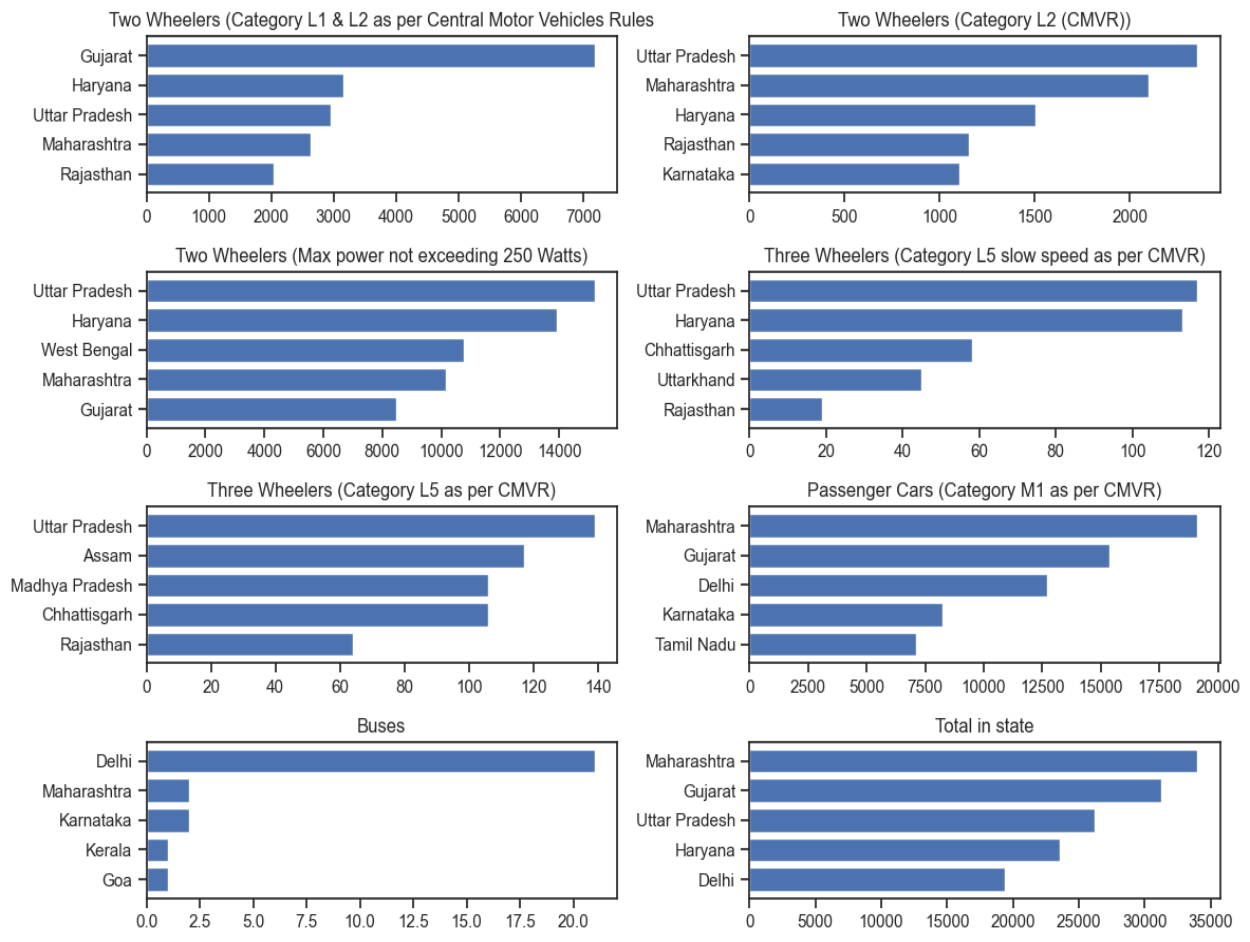


Observations from the heatmap:
There isn't any striking new relation found, but it confirms our previous observations.

GEOGRAPHIC ANALYSIS

Geographic analysis is a valuable component that complements marketing strategies by targeting products or services based on consumers' geographical locations. By dividing the market into countries, states, regions, cities, colleges, or areas, marketers can gain insights into their target audience and effectively promote their offerings. In this case, we have utilized state-wise data on Electric Vehicle (EV) sales in India to understand our target regions. By examining the sales figures for different types of EVs, we can identify

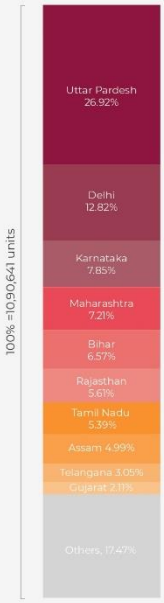
states with higher adoption rates and focus our marketing efforts accordingly.



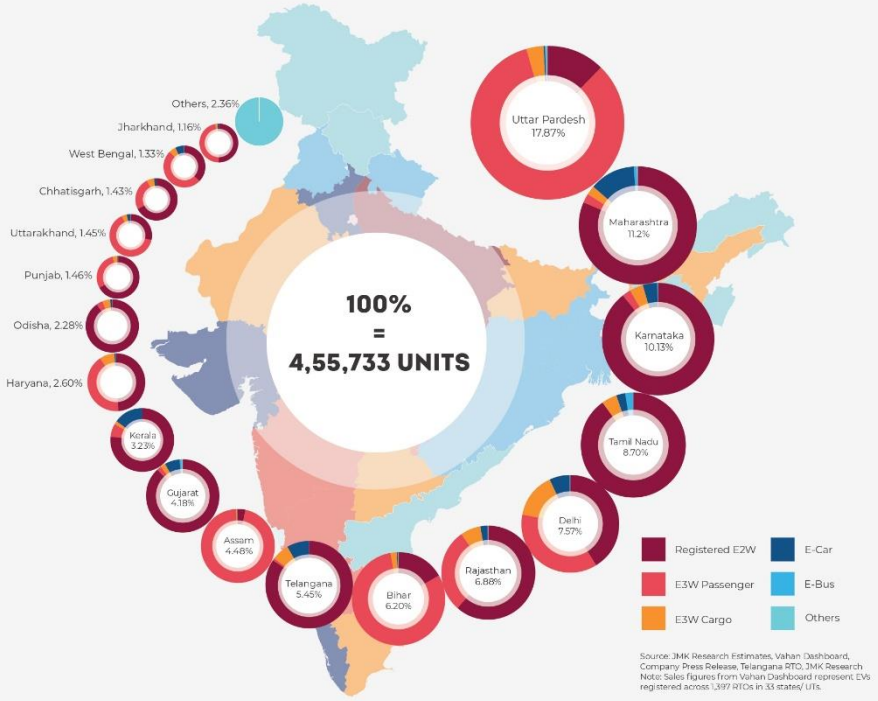
For startups entering the Electric Vehicle (EV) market, it is crucial to target specific states based on the type of EV they offer. However, it is important to consider that the target market within each state would typically be a well-developed city. This is because consumers in these cities are more likely to have the willingness and affordability to purchase an EV. Factors such as the cost of the EV in relation to the average consumer income, the availability of resources such as charging stations, and the ability to maintain the EV are significant considerations. By focusing on these developed cities, startups can effectively cater to a consumer base that is more likely to embrace EV adoption and utilize the necessary infrastructure and support services.

STATE-WISE SALES

State-wise Registered EV Cumulative Sales (Till FY2022)



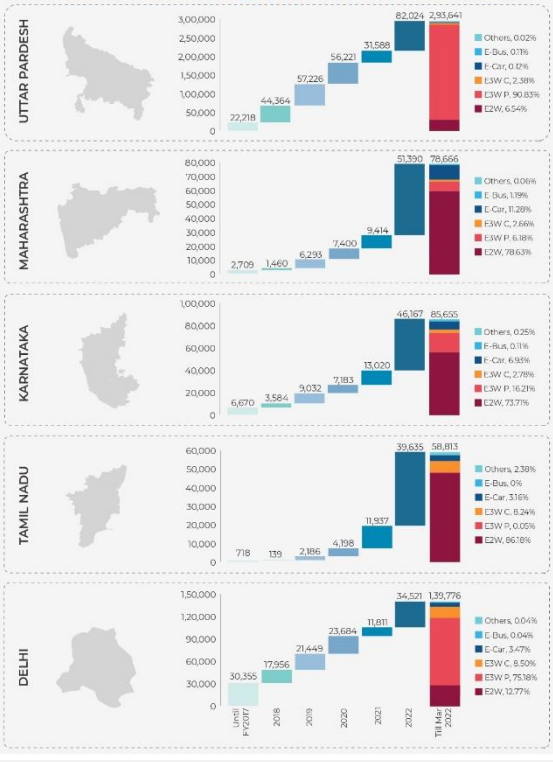
State-wise Registered EV Annual Sales (FY2022)



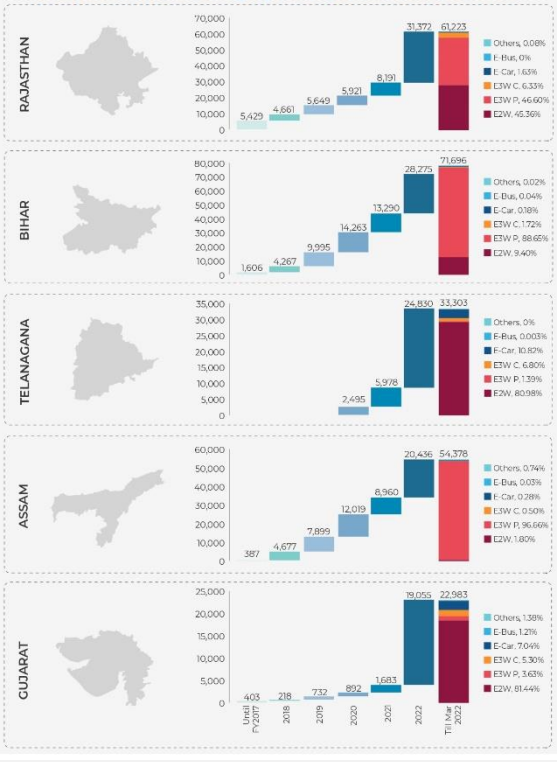
Source: JMK Research Estimates, Vahan Dashboard, Company Press Release, Telangana RTO, JMK Research
Note: Sales figures from Vahan Dashboard represent EVs registered across 1,397 RTOs in 33 state/ UTs.

STATE PROFILES

Year-wise & Vehicle Category-wise EV Sales Trend in India



Year-wise & Vehicle Category-wise EV Sales Trend in India



Approaches Used for Segmentation

To conduct market segmentation, we have conducted a population behavioral study by selecting a sample of 100 individuals. The data collected focuses on their automobile purchasing capabilities, which is essential for identifying the ideal target segment for market penetration. Our objective is to classify the market into different segments, and there are two primary approaches for classification: common sense classification and data-driven classification. In this case, we will be utilizing a data-driven classification method known as K-Means Clustering. This approach allows us to group individuals based on their shared characteristics and enables us to identify distinct segments within the market for targeted marketing strategies.

Target Segment

The younger population, being more environmentally conscious and eager to embrace new technologies, shows a higher inclination towards purchasing products with new technology, particularly Electric Vehicles (EVs). However, our report reveals that the younger population tends to opt for less expensive vehicles, which poses a challenge for EV adoption, as they are often perceived as less affordable. To overcome this barrier, it is recommended to target a segment of individuals aged between 30 and 40 years, who still possess a strong desire to explore new technologies and have a relatively higher financial capacity to afford EVs.

Furthermore, urban dwellers residing in cities with well-established infrastructure and possessing a better understanding of technology and its associated benefits are more likely to embrace electric vehicles. Hence, focusing efforts on promoting EVs in urban areas with a tech-savvy and educated population could yield favorable results.

Moreover, individuals who are married and have dependents exhibit a greater tendency to purchase vehicles, making them a viable target group for EV promotion campaigns.

Considering the financial aspect, the average salary of individuals purchasing vehicles stands around 30 lakh rupees. It is important to note that automobile purchases are predominantly concentrated in the 10-20 lakh rupee range, while the demand for EVs in the two-wheeler segment is relatively lower.

To drive successful EV adoption, these insights regarding the target demographic, urban concentration, marital status, and affordability range should be taken into account.

Conclusion By

RAJEEV T M

Based on our analysis, we have identified the top 3 states where our EV model is likely to generate significant sales:

Maharashtra: With a substantial contribution of approximately 13.90% to India's GDP, Maharashtra stands out as the wealthiest state in the country. The affluent population in this state makes it an ideal market for our EV models, as they have the purchasing power to afford them.

Tamil Nadu: Securing the second spot in our rankings, Tamil Nadu showcases a strong inclination towards eco-friendliness. The environmentally conscious mindset of the people in this state makes them more likely to embrace EV models due to their sustainability benefits. Therefore, Tamil Nadu represents a promising market for our EV offerings.

Uttar Pradesh: As the most populous state in India, Uttar Pradesh holds significant potential for EV model sales. With a notable GDP contribution of 8.35%, it highlights the preference for car ownership among the population. Capitalizing on this trend, we can expect high demand for our EV models in Uttar Pradesh as well.

Additionally, we should target Gujarat and Karnataka, which rank fourth and fifth, respectively, in terms of GDP contribution in India. These states present lucrative opportunities for our EV model sales due to their economic strength and potential customer base.

To maximize sales, it is recommended to kickstart our marketing efforts in these states. By focusing on Maharashtra, Tamil Nadu, Uttar Pradesh, Gujarat, and Karnataka, we can strategically position our EV models in regions with favourable market conditions and increase our overall sales.

Charan Sai Gottipati

1. Data Collection:

- This dataset consists of vehicle specifications such as its range, efficiency, top speed, and the type of drive and used to perform Vehicle Specification Segmentation.
- The code loads the dataset "ElectricCarData_Clean.csv" into a Pandas Data Frame.
- Most of the real-world datasets for machine learning are highly susceptible to be missing, inconsistent, and noisy due to their heterogeneous origin.
- Applying data mining algorithm on this noisy data would not give quality results as they would fail to identify patterns effectively. Data Processing is, therefore, important to improve the overall data quality.
- Duplicate or missing values may give an incorrect view of the overall statistics of data.
- Outliers and inconsistent data points often tend to disturb the model’s overall learning, leading to false predictions.
- Quality decisions must be based on quality data. Data Preprocessing is important to get this quality data.

2. Data Preprocessing:

- Head () is used to return the first n rows for the object based on position. If your object has the right type of data in it, it is useful for quick testing.
- The shape function is used to find the shape of the data frame. It holds the number of rows followed by the number of columns.
- It checks the basic information about the Data Frame using methods like `info () ` and `describe () `.
- The info () function is used to print a concise summary of a Data Frame. This method prints information about a Data Frame including the index dtype and column dtypes
- The describe () method is used for calculating some statistical data like percentile, mean and std of the numerical values of the Series or Data Frame.
- The iloc() function enables us to select a particular cell of the dataset
- Data types of certain columns are converted to the categorical data type to prepare for segmentation.

3. Segmentation Analysis:

- Used various visualizations like bar plots, KDE plots, and scatter plots to segment the data based on different attributes like brand, seats, powertrain, and top speed.
- Used Seaborn and Matplotlib to create various plots to visualize the data distribution and relationships.
- It generates KDE plots to visualize the distribution of numerical variables.
- Bar plots are used to show the frequency of brands, the number of seats in a car, and the top speed achieved by different brands.

- A pie chart is created to display the distribution of plug types in the dataset.
- A scatter plot is used to show the relationship between powertrain and acceleration time.

4. Market Segmentation:

- The code calculates the correlation matrix using `df.corr()` and visualizes it using a heatmap to understand the relationships between numerical variables.
- The code performs k-means clustering on the variables ‘brand’and 'PriceEuro' to identify distinct clusters of electric cars based on these attributes.
- The k-means clustering analysis helps in identifying clusters of electric cars based on their brand and price, which can aid in market segmentation.
- The elbow method is used to determine the optimal number of clusters for k-means.
- The scatter plot with cluster centers shows the identified clusters and their centroids.
- The code generates a dendrogram to visualize hierarchical clustering based on the 'TopSpeed_KmH' attribute.
- The most optimal market segments would be brand and top speed of each vehicle with its respective brand.

SAMARTH RIKHE

Market Segmentation Based on Fuel Type

market segmentation based on types of fuel is a crucial strategy for automotive manufacturers and marketers. It allows them to better understand consumer preferences, tailor their product offerings, and effectively target specific customer segments. The findings from this analysis suggest that there are distinct market segments based on fuel types, each with its own unique characteristics and needs. Gasoline-powered vehicles continue to dominate the market due to their widespread availability, established infrastructure, and

familiarity among consumers. They appeal to a broad customer base, including individuals seeking convenience, performance, and long-range capabilities. However, with the growing concerns over environmental sustainability and the increasing popularity of electric vehicles (EVs), this segment is gradually facing competition.

The emergence of electric vehicles as a viable alternative has created a new market segment. EVs are appealing to environmentally conscious consumers who prioritize reduced emissions and energy efficiency. This segment is expected to witness significant growth as technology advances, battery costs decrease, and charging infrastructure expands. To succeed in this segment, automakers need to focus on improving battery range, charging infrastructure, and affordability.

Another segment worth considering is hybrid vehicles, which combine the benefits of gasoline and electric power. Hybrid vehicles cater to customers who desire both fuel efficiency and long-range capabilities without relying entirely on charging infrastructure. This segment provides a transition solution for consumers who are hesitant to fully adopt electric vehicles.

To effectively implement market segmentation based on fuel types, automakers and marketers need to conduct in-depth market research, analyze consumer preferences, and invest in appropriate product development and marketing strategies. Customizing product offerings, targeting specific customer segments, and addressing their needs will be key to success in the evolving automotive landscape.

In conclusion, market segmentation based on fuel types allows automotive companies to better understand and cater to the diverse needs and preferences of consumers. By recognizing the distinct characteristics of different fuel segments, automakers can position themselves strategically, develop innovative products, and ultimately gain a competitive edge in the evolving market.

FINDINGS BASED ON DATA SET

Based on the data set there are mainly 10 basic types of fuel that are registered which include both hybrid and electric fuel type.
Types of fuel registered for vehicle (sum of usage) -----
1.CNG (3,50,779)
2.DIESEL (1,10,05,099)
3.DISEL/HYBRID (1,29,095)
4.ELECTRIC (9,75,568)
5.LPG only (37,11)
6.PETROL (8,12,27,771)
7.PETROL/CNG (14,66,097)
8.PETROL/HYBRID (3,23,467)
9.PETROL/LPG (3,06,485)
10.ETHANOL (57)

There are various other unapplicable fuel types used for vehicles (3,42,340).

There were about 16,64,965 people using these fuel types in April 2017, which has grown to 18,48,763 in next year with a change to 183,798. In April 2020 this has changed to 17,35,035 and in April 2021 to 3,77,777. This growth shows the usage of fuel has increased year by year which has maximum in November 2019. But in the year 2022 shows about drop of fuel usage to 16,28,490 for vehicle due to high price of fuel.

This shows that the price range of all fuel type has shown a major rise and decrease in fuel usage by people year wise.
The usage of PETROL as fuel is maximum in all these years and has shown a descent variation, this shows people prefer petrol as a good fuel along with its other hybrid types. Ethanol has minimum usage and has very low fuel preference by people. The fuel DIESEL has a good usage as well which has grown in coming years.
The electric vehicle usage has been grown up after year 2020 due to new technology and high price of other fuels.

CONCLUSION AND FINDINGS

According to the dataset and code based on market segmentation there are high chances of PETROL, DIESEL and ELECTRIC vehicle to give a high profitable market benefit. The growth can be advanced if they are made in a hybrid form as this type of fuel has registered a good growth in some years. The main factor which can affect this growth is the increasing price of fuel types which has increased the ELECTRIC vehicle to get good setup for growth due to less money and more energy.

By the process of market segmentation of registered fuel type, we have found our target segment, we just need to work on factors like price, promotion and product quality enhancement which has good marketing statics.

GitHub Link:

RAJEEV T M
https://github.com/rajeevthyagarajan/Market-Segmentation-EV

CHARAN SAI GOTTIPATI
https://github.com/charansai-1608/EV_Segmentation

SAMARTH RIKHE
https://github.com/samarthrikhe

VANUSHUL SHIIKKEWAL
https://github.com/vanshul27/Market-Segmentation