ELECTRONIC VEHICLES (EV's) MARKET SEGMENTATION ANALYSIS

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GITHUB LINK: https://github.com/haarsh567/Feynn-Labs-Internship/tree/main/EV%20Market%20Segmentation

OVERVIEW:-

India is an emerging country with a huge market. With the fast-developing infrastructure, the economy is growing rapidly. India is also facing a lot of problems such as air pollution, traffic congestion and accidents, and expensive energy costs. As a result, the Indian government has set a goal to reduce the country's dependence on fossil fuels by increasing the share of electric vehicles in the country's car fleet from less than 1% now to 7% by 2022. To achieve this goal, three types of EV models are available for sale in India: hybrid electric vehicles (HEVs); plug-in hybrid electric vehicles (PHEVs); and battery electric vehicles (BEVs). The BEV is the most advanced technology, with a high-capacity lithium-ion battery that can be recharged from an external source. The objective of the study is to define, elaborate and predict the market segmentation for electric vehicles (EVs) in India. The study will provide an overview of market segmentation for EVs in India. In the end, the study concludes that the market segmentation will be helpful in several ways such as it helps to make your target market clear and also helps to enhance the chances of Electric Vehicles product acceptance in India. In order to increase market share, marketers must develop a strong strategy focusing on the target segment.

KEYWORDS: Market segmentation, electric vehicles, automobile industry, India, renewable energy.

INTRODUCTION:-

The Indian automobile industry is at a crossroads. This industry has been much more resilient to the impact of external economic factors compared to other industries, but the changing demographics in the country indicate that it will face headwinds over the next few years. The rise of new segments like compact SUVs and electric vehicles (EVs) has posed a challenge for automakers looking to compete in this market. The Indian automobile industry has been resilient to external economic factors over the last few years. While other industries have struggled with slow growth, rising input costs, and low consumer demand, the Indian automobile industry has continued to post growth. The reason for this is that India's economic growth rate has been higher than most other countries in the world. The country's GDP grew at 7.6% in the first quarter of 2017, while China's GDP grew at 6.9%. This has helped India to remain one of the fastest-growing economies in the world India is expected to continue its high growth rate over the next few years, with an average annual growth rate of 7.5% expected between 2017 and 2022. The country is projected to be the fastest-growing major economy in

the world over this period, as it benefits from strong private consumption and investment demand.

OBJECTIVES OF THE STUDY:-

- To define, elaborate and predict the market segmentation for electric vehicles (EVs) in India.
- To Study the automobile industry and its competitive structure and growth in India.
- To Study and understand an overview of market segmentation for EVs in India.

MARKET OVERVIEW:-

Financial institutions committed to a pledge that by 2035 all new sales of cars and vans sold in leading markets will be zero-emission vehicles (ZEVs; COP26 2021). Amid the global transition to ZEVs, the case of India is particularly important. Given its rapidly growing economy and its population of almost 1.4 billion people and counting, the country is expected to add an additional 300 million vehicles to its roads by 2040—the largest car market growth of any country in the world, leading to a four million barrel per day increase in its oil demand (IEA 2021b). In response, the Indian government has pledged that by 2030 30 percent of all new vehicle sales in India will be electric. This attempt to make the uptake of electric vehicles (EVs) a strategic objective aligns with India's goal of reducing carbon intensity per unit of gross domestic product (GDP) by 45 percent by 2030 (PTI 2021). It can also act as a green industrial policy to support a post pandemic economic recovery; reduce oil imports and strengthen energy security; and lessen air pollution and mitigate climate change. For India to follow through on its pledge, the Indian EV market will need a considerable inflow of foreign direct investment (FDI). Although investment in EVs and batteries is rapidly scaling up around the world, much more is needed. It is estimated that $2.5 trillion in global cumulative public and private investments will be required to shift to 100 percent EVs, which is about fivefold the current investment levels (Assis 2021). A recent study has estimated that original equipment manufacturers (OEMs), also known as automakers, are planning to spend about $500 billion on EVs and battery production by 2030 (Lienert and Bellon 2021), a significant increase from prepandemic levels of $300 billion by the same year. The main destination for this investment is China, which receives almost half, followed by several EU countries, most notably Germany (Lienert and Bellon 2019). According to the Council on Energy, Environment, and Water, India's EVs and charging infrastructure investment needs will amount to $180 billion in the 2020s alone (Singh, Chawla, and Jain 2020). Meanwhile, total EV investment announcements for 2021

in India reached only $6.5 billion (NITI Aayog, RMI, and RMI India 2022a), leaving a significant gap between required and actual investment. Nevertheless, the National Institution for Transforming India (NITI Aayog), the Indian government's premier policy think tank, believes that cumulative investment in India's EV transition between 2020 and 2030 could be as large as $266 billion, reflecting growing optimism for the sector (NITI Aayog, RMI, and RMI India 2022a).

Takeaway 1:-

India's recent policies have been successful in incentivizing consumer demand for electric two-wheelers (2W) and three-wheelers (3W), with electric four-wheelers (4W) and buses also scaling up.

India's flagship EV scheme, Faster Adoption and Manufacturing of Electric Vehicles (FAME), has been critical to incentivizing EV demand in the country. The government's commitment to electrifying its transport sector is particularly clear in its move from the first phase of the program (2015–2019), which cost $128 million, to the second phase (2019–2024), which increased government subsidies tenfold to $1.35 billion. Whereas phase I aimed at supporting 280,000 EVs, phase II scaled up vehicle sales by 1 million 2Ws, 500,000 3Ws, 55,000 passenger cars, and 7,090 buses. In support of this ambitious goal, the FAME program's demand-side incentives effectively lower the upfront purchasing price of EVs through a government subsidy to OEMs. FAME II started with an EV purchase subsidy of $134 (10,000 rupees [Rs]) per kilowatt hour (kWh). In 2021, the Indian government increased that subsidy by 50 percent for 2Ws to $201 (Rs 15,000) per kWh, bringing the ratio of subsidy to total vehicle cost from a maximum of 20 percent to a maximum of 40 percent (Government of India Department of Heavy Industry 2019, 2021c). This measure, in combination with state-level incentives in Delhi, Maharashtra, Gujarat, and elsewhere, has sharply reduced the up-front cost of EVs, especially in the 2W and 3W segments, accelerating the electrification of last-mile mobility. Two other policies have likewise incentivized EV demand. In 2019, the Indian government reduced the goods and services tax (GST)—an indirect tax levied on the supply of goods and services that came into effect in 2017 and replaced many indirect taxes such as excise duties and value-added tax—on EVs and chargers from 12 percent to 5 percent (Reuters Staff 2019), while internal combustion engine (ICE) vehicles maintain a GST rate of 28–43 percent. Additionally, it offered tax deductions for first-time buyers of EVs to the level of $2,000 on loans concluded between 2019 and 2023. Importantly, this scheme includes 2Ws (Government of India Income Tax Department 2021), which make up about 75 percent of the total vehicle fleet in India (Statista 2022). The impact of these policies has been reflected in EV sales. Whereas in FY2020–21, India's EV penetration rate (i.e., EV sales as a percentage of total sales) was less than 1 percent, by the

close of FY2021–22, it was up to 2.5 percent (Invest India 2022). Many consulted stakeholders believe that the FAME II scheme amendment played a major role in this shift, though this is difficult to verify without user surveys. From the OEMs' side, major companies believe their marketing efforts have helped to increase public awareness of EVs. The success of demand-side incentives has been especially significant in the 2W segment, where sales more than quintupled from FY2020–21 to FY2021–22. Other segments such as 3Ws, buses, and PVs tripled in size in that same period. Certain metro cities, such as New Delhi, have witnessed EV penetration of over 9 percent in new vehicle sales compared to the national average of 2.5 percent (ibid.). The Indian government is expecting to achieve a 16 percent EV penetration rate in the 2W segment and a 20 percent EV share in the 3W segment (in addition to a 13 percent EV share of transport buses) by 2025. By comparison, the government expects 4W passenger cars to electrify at a slower pace, reaching only a 5 percent penetration rate by the same year (ibid.)

Takeaway 2:-

Financing challenges remain, but solutions are being developed.

The FAME scheme has been instrumental in improving the affordability of EVs. If India's goal is to exponentially increase EV adoption, however, it will need further policy innovations that address financing challenges for consumers. For example, electric 2Ws currently incur higher interest rates and down payments as well as shorter loan periods than equivalent ICE vehicles. To date, reputed OEMs have offered relatively few electric 2Ws and 3Ws, making it more difficult for financiers to understand the lifespan and depreciation of these vehicles. The limited availability of dedicated financing options keeps up-front costs high for consumers, despite an already low total lifetime cost of ownership (TCO) in certain EV segments compared with ICE vehicles. Reflecting this point, most of the investors consulted for this report saw current financing models to be between weak and adequate (see Figure 1) and ranked the high purchasing costs of EVs as the foremost consumer demand barrier to upscaling investment in electric mobility in India (see Figure 2).
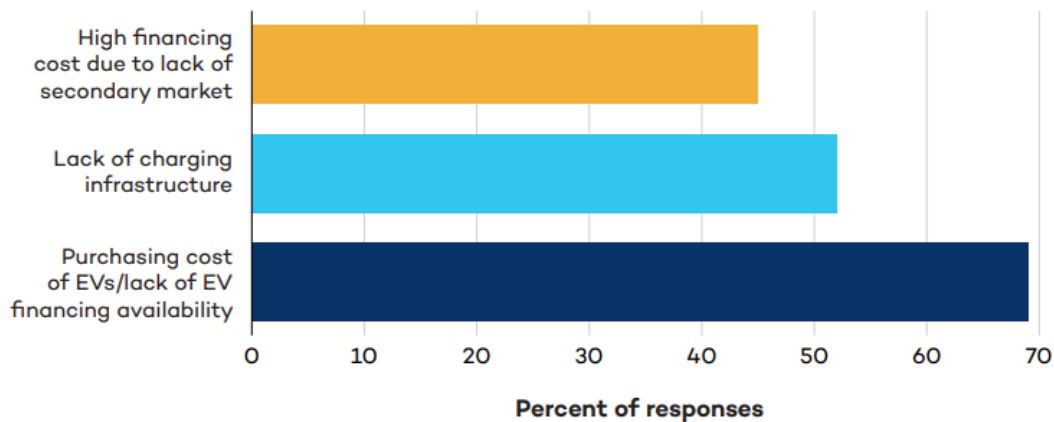
Figure 1. What is your evaluation of current financing models available for EV users in India?

Percent of responses
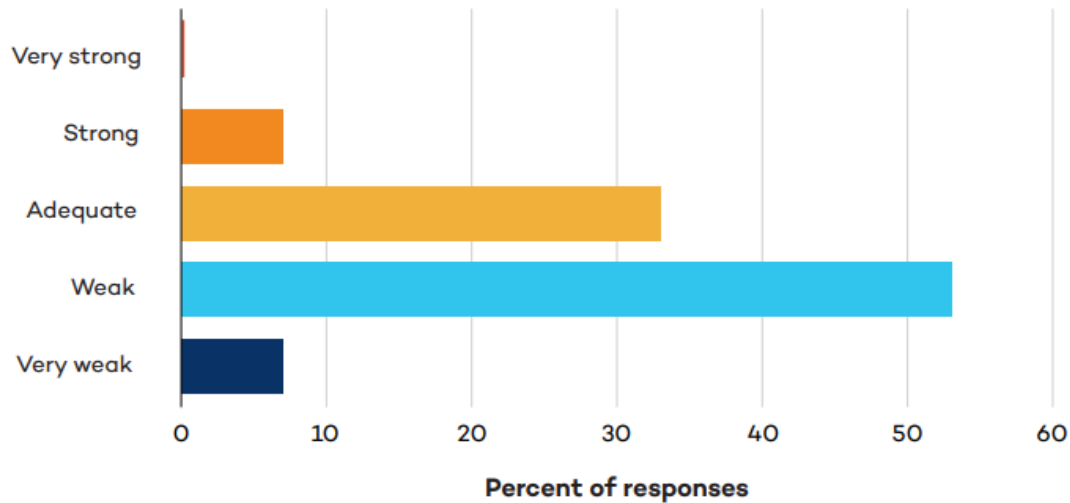
Aware of the purchasing cost challenge of EVs, the Indian government recently proposed two initiatives intended to improve financing for the sector. The first, set up by the Indian government think tank NITI Aayog and the World Bank, is a $300 million, first-loss risk sharing instrument that protects banks from EV-related loan defaults and effectively lowers the interest rate for consumer loans from 20–25 percent to 10–12 percent. It is estimated that under the program the total financing of the State Bank of India—which will act as a program manager—could reach $1.5 billion (Bhardwaj 2021; Philip and Shukla 2021).

The second, recommended by NITI Aayog and the Rocky Mountain Institute (RMI), involves including EVs in the Reserve Bank of India's priority sector lending (PSL), a policy that obliges banks to allocate a certain percentage of their lending to priority sectors. This step would bolster investor confidence in two ways. First, like the World Bank facility, it would increase the availability of capital for EV purchasing, including for segments that are economically rational but where consumers struggle with credit. Second, it would send a clear signal to investors that the government is committed to EVs in the long term (NITI Aayog, RMI, and RMI India 2022a). At the time of writing, this measure has not yet been formally approved.

Figure 2. Select a maximum of three consumer demand barriers to upscaling investment in electric mobility in India.

| Barrier	Percent of responses
High financing cost due to lack of secondary market	~45
Lack of charging infrastructure	~52
Purchasing cost of EVs/lack of EV financing availability	~69

Percent of responses

Addressing the financing of EVs at the federal and state levels can yield significant results across EV segments. One survey found that 90 percent of consumers would consider paying a premium for an EV if the supportive infrastructure was available, including for electric 4Ws (Bureau 2021). This consumer interest could be further bolstered by more transparent data on vehicle performance and the expansion of industry-led buyback programs.

Takeaway 3:-

The availability of sufficient charging infrastructure is of high concern to all stakeholders despite government subsidies.

Infrastructure bottlenecks often stall technology adoption, and the case of EVs is no different. Today, charging infrastructure availability is considered as much of an EV-adoption bottleneck as up-front costs (Foster et al. 2021). The global number of chargers is expected to increase from about 10 million in 2020 to 120 million in 2030, though 210 million are needed to stay on track with the goal of limiting global warming to less than 1.5°C above preindustrial levels (IEA 2021a). Reaching that volume of chargers would require governments around the world to offer public subsidies for charging infrastructure to the level of billions of dollars. Some countries have already adopted this measure. As part of green Keynesian policies since the start of the COVID-19 pandemic, the United States has committed $7.5 billion, Germany $2.9 billion, China $1.5 billion, and Italy $850 million (Energy Policy Tracker 2022). However, many more countries, especially those with large auto markets, will need to follow suit.

Figure 3. Select a maximum of three infrastructure demand barriers to upscaling investment in electric mobility in India
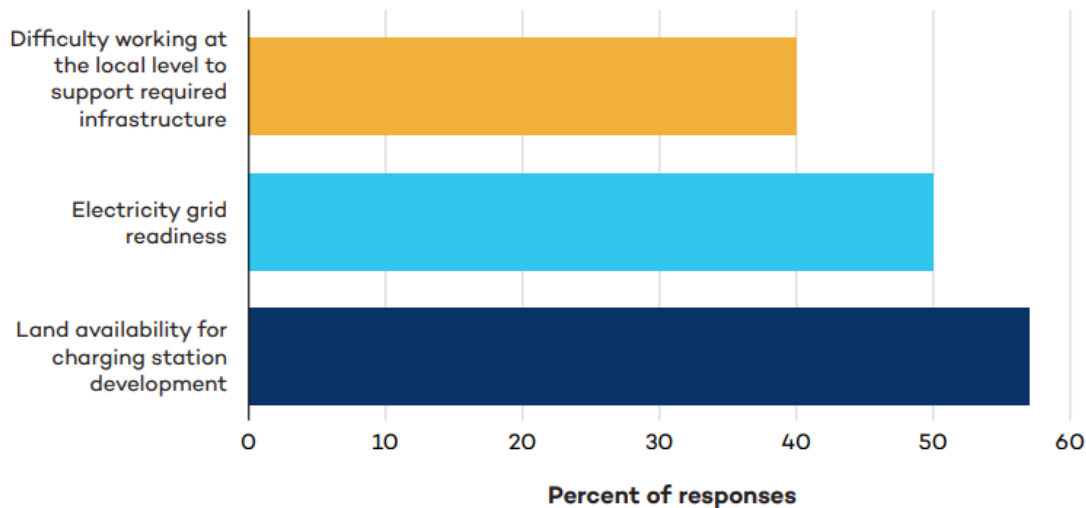
Currently, India has a total of only about 1,800 public charging stations (Gadkari 2022). 2Ws will require 634 chargers by 2025 and 3,866 chargers by 2030, about 10 percent of which are expected to be public; 3Ws will require 2,557 chargers by 2025 and 9,826 chargers by 2030, about 20 percent of which are expected to be public; passenger 4Ws will require 32 chargers by 2025 and 306 chargers by 2030, about 10 percent of which are expected to be public; and commercial 4Ws will require 262 chargers by 2025 and 2,303 chargers by 2030, about 25 percent of which are expected to be public. In total, this additional charging capacity will require 0.45 GWh of extra power by 2025 and 2.4 GWh by 2030 (NITI Aayog et al. 2021).

India's current level of public investment in charging infrastructure also lags behind major EV ecosystems around the world. Under FAME II, India committed Rs 10 billion (equivalent to $134 million) to support the progressive installation of EV charging infrastructure (Government of India Department of Heavy Industry 2019). This amount is in line with the commitment level of Canada, which pledged $112 million for charging infrastructure (Energy Policy Tracker 2022). Like in other countries, achieving deep EV penetration in India will require additional subsidies for and investment in charging in the short term. Indicatively, consulted experts and investors viewed the second-largest EV consumer demand barrier to be a lack of charging infrastructure, behind only the high purchasing cost of EVs and much more important than charging time or range anxiety (see Figure 3). Meanwhile, they identified land availability for charging station development and electricity grid readiness as the two largest charging infrastructure barriers (see Figure 4).

Figure 4. Select a maximum of three infrastructure demand barriers to upscaling investment in electric mobility in India
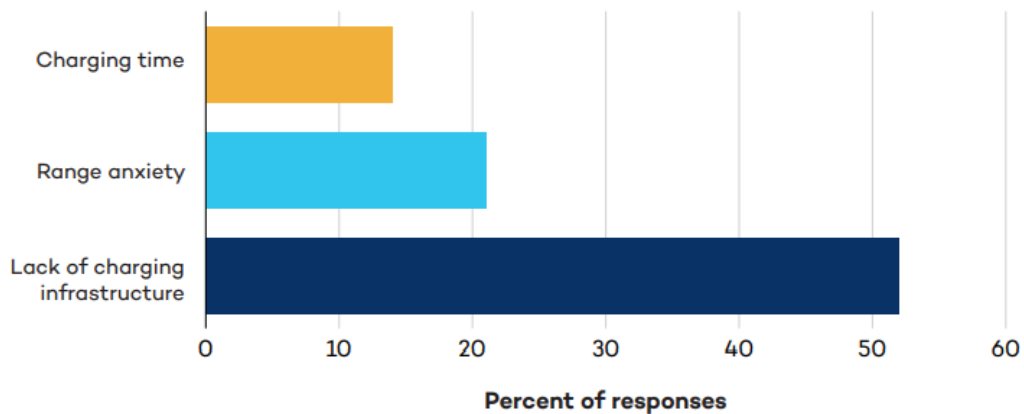
DATA SOURCES:-

The data used in the report are obtained from the following sources-

- **Kaggle (https://www.kaggle.com/code/aaronoakes/electrical-vehicles)**
- **Open Government Data (https://data.gov.in/keywords/Vehicles)**
- **Open Government Data (https://data.gov.in/keywords/Electric)**

IMPORTING IMPORTANT LIBRARIES:-

```
In [1]: import numpy as np
        import pandas as pd
        import matplotlib.pyplot as plt
        import seaborn as sns
        import plotly as pt
```

DATA PRE-PROCESSING AND VISUALIZATION:-

Total Numbers of Electric Vehicles in Each State and UT's

In [3]: `df.head(34)`

Out[3]:

|	S. No.	State Name	Electric Vehicle Count
0	1	Andaman and Nicobar Island	182
1	2	Andhra Pradesh	51322
2	3	Arunachal Pradesh	24
3	4	Assam	94929
4	5	Bihar	128885
5	6	Chandigarh	5533
6	7	Chhattisgarh	40516
7	8	Delhi	203263
8	9	Goa	8710
9	10	Gujarat	99236
10	11	Haryana	56243
11	12	Himachal Pradesh	1877
12	13	Jammu and Kashmir	7080
13	14	Jharkhand	28395
14	15	Karnataka	183536
15	16	Kerala	65545
16	17	Ladakh	47
17	18	Madhya Pradesh	42957
18	19	Maharashtra	226134
19	20	Manipur	1052
20	21	Meghalaya	83
21	22	Mizoram	76
22	23	Nagaland	60
23	24	Odisha	45562
24	25	Puducherry	3376
25	26	Punjab	25597
26	27	Rajasthan	143273
27	28	Sikkim	21
28	29	Tamil Nadu	129153
29	30	Tripura	12229
30	31	Dadra and Nagar Haveli and Daman and Diu	303
31	32	Uttar Pradesh	465432
32	33	Uttarakhand	42308
33	34	West Bengal	57512

Electric Vehicle Count in Each State
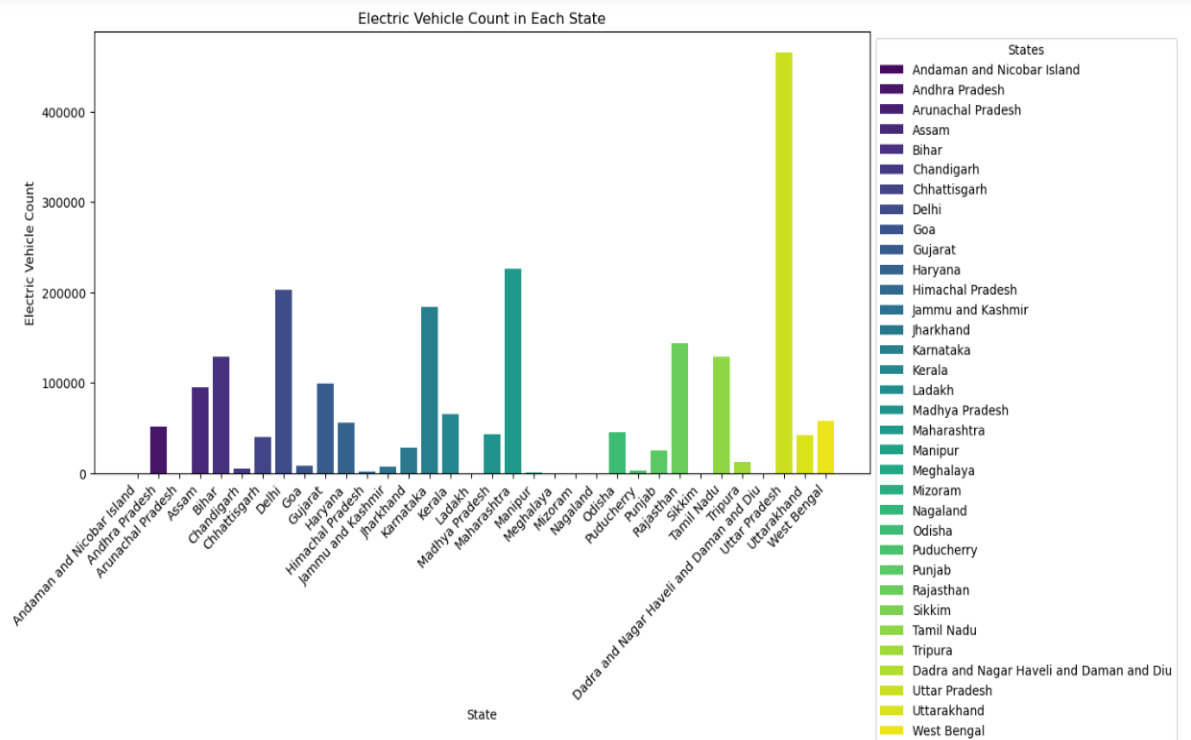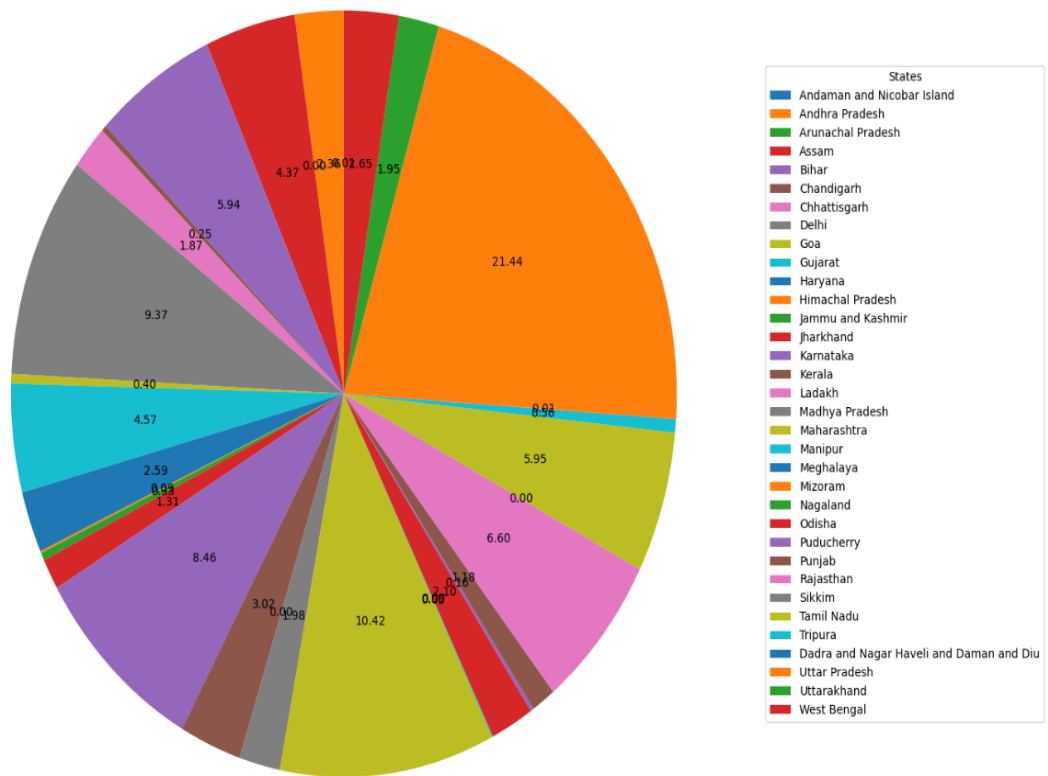
OUTCOME:-

From the above given data we can come on conclusion that 'UttarPradesh' is the most dominating state in terms of EV market any company if planning to come into India's EV market Segment, company must need to first focus on UttarPradesh as its primary Goal.

CHARGING STATIONS IN CITIES AND THERE RESPECTIVE HIGHWAYS

In [18]: `df2.head(14)`

Out[18]:

	Category	City/Highway	Charging Stations
0	City	Chandigarh	48
1	City	Delhi	94
2	City	Rajasthan	49
3	City	Karnataka	65
4	City	Jharkhand	30
5	City	Goa	30
6	City	Telangana	57
7	City	Uttar Pradesh	16
8	City	Himachal Pradesh	9
10	Highway	Delhi -Chandigarh	24
11	Highway	Mum-Pune	17
12	Highway	Delhi- Jaipur- Agra	31
13	Highway	Jaipur-Delhi Highway	9

Number of Charging Stations in City/Highway
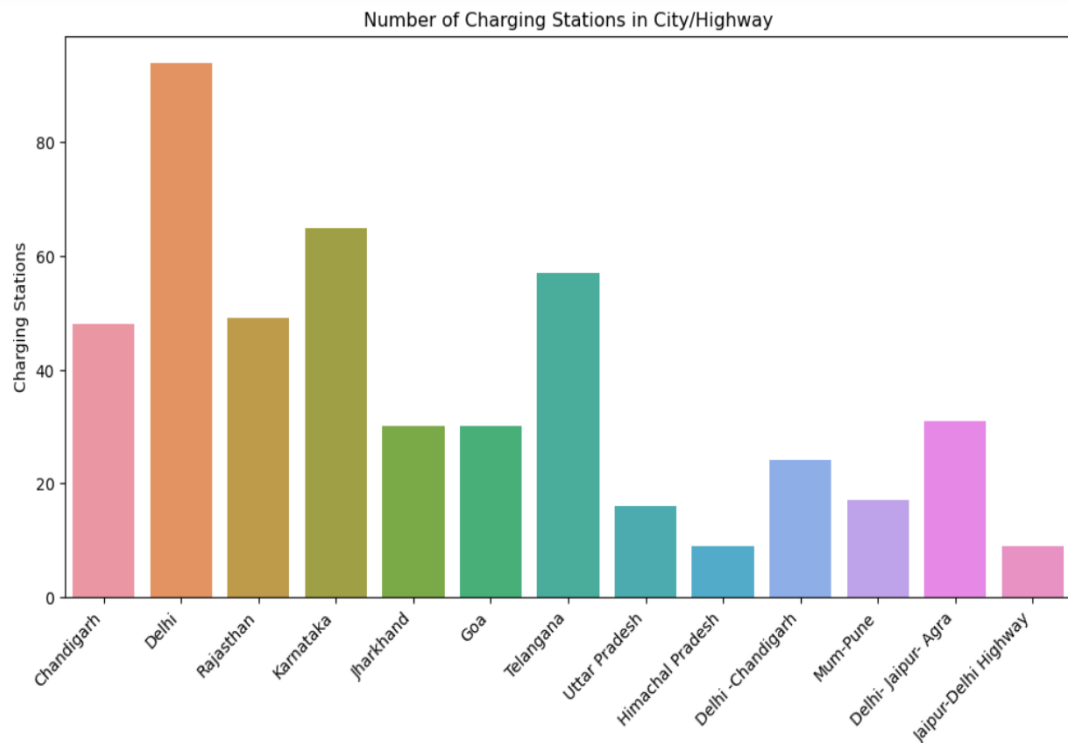
OUTCOME:-

Delhi has most number of charging stations It is important to keep in mind that the more charging station a state or UT has the greater ease the customer of electric vehicle will have , so charging stations play a very crucial role in EV market so company should keep in mind the essence of charging stations.

DataSet containing sales of EVs in the financial year 2021-22-23

```
In [24]: df3.head()
Out[24]:
```

	Category	Fuel Types	Domestic Sales (MoRTH) - 2020-21	Domestic Sales (MoRTH) - 2021-22	Domestic Sales (MoRTH) - 2022-23
0	Passenger Vehicles (e-4W)	EVs	5000	19000	47581
1	Three Wheelers (e-3W)	EVs	88000	178000	402106
2	Two Wheelers (e-2W)	EVs	41000	231000	728027

Domestic Sales of Electric Vehicles by Category and Year
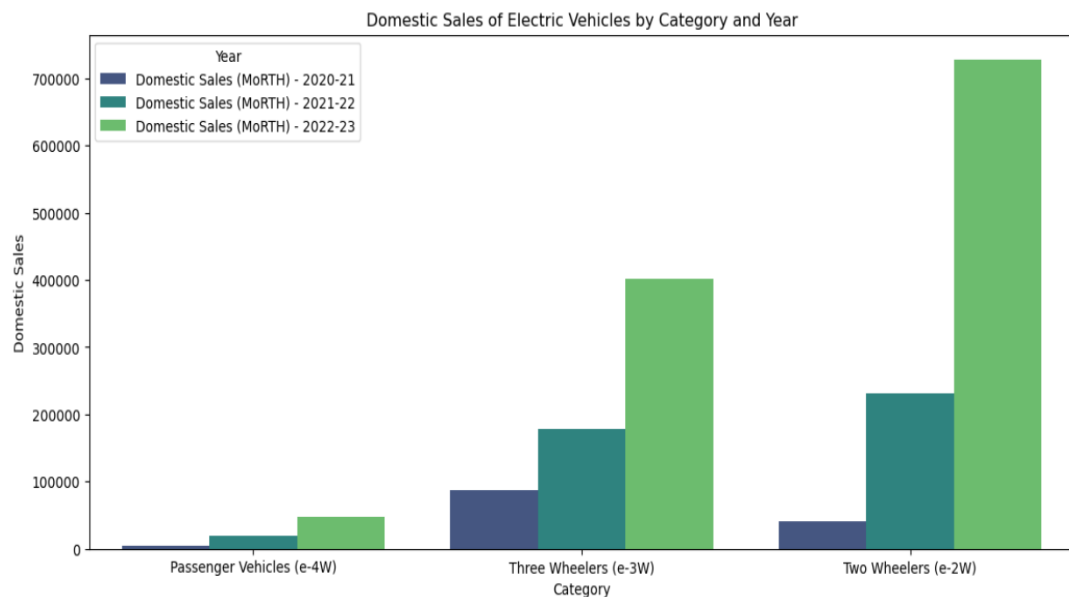
OUTCOME:-

We can clearly see from the data given above in Indian EV market segment the growth of EV's are not rapid in financial year 2021 but in financial year 2022 there's a rapid growth in EV's specially three wheelers and two wheelers but the growth of two wheeler EV's are exponentially high and in financial year 2023 two wheeler EV's growth jump to another stage

so if any company wants to acquire Indian market segment company must need to focus on Two wheeler EV's.

Market Segmentation Techniques:

Segmentation techniques are used to divide the market into smaller groups. Market segmentation is done on the basis of various factors such as demographics, Psychographics, Geography, Behavioral factors etc.

Market segmentation is done on the basis of following:

• **Demographic Segmentation**: Demographic segmentation is based on demographic characteristics such as age, gender, income, family size, occupation, education level etc.

• **Psychographic Segmentation**: Psychographic segmentation is based on consumer's personality and lifestyle characteristics such as lifestyle, personality, values, attitudes etc.

• **Geographic Segmentation**: Geographic segmentation is based on consumer's location such as city, state or country.

• **Behavioural Segmentation**: Behavioural segmentation is based on consumer's buying behavior such as consumer's buying habits, consumer's brand loyalty etc.

Segmentation Strategies:

• **Market Segmentation Strategy**: Market segmentation strategy is based on consumer's geographic location, demographic, behavioural and psychographic factors. Market segmentation strategy is the most important strategy for the companies to develop their products and services.

• **Product Segmentation Strategy:** Product segmentation strategy is based on consumer's need, benefit, price sensitivity etc. Product segmentation strategy is used to develop the product or service which will satisfy the needs of consumers. Target Market: Target market is the group of consumers who are likely to buy a product or service. It is very important for the companies to identify their target market before developing their products and services.

• **Horizontal Segmentation:** Horizontal segmentation is the process of dividing a market indifferent segments based on the type of customer. Horizontal segmentation is done by using variables such as: Geographic location Demographic Factors Product Usage Psychographic factors.

• **Vertical Segmentation:** Vertical segmentation is the process of dividing a market into different segments based on the level of customer. Vertical segmentation is done by using variables such as: Level of demand or volume Level of service required Type of product required.

CONCLUSION:-

Any Company who wants to enter into Indian EV market segment need to understand all these things that which state is capturing the largest segment of EV's and also look at the geographic and Psychographic location whether the location is suitable for market of electric vehicles..which category EV's are dominating the Indian market such as 2 wheelers , 3 wheelers and 4 wheelers and plan according to it, charging stations also play a vital role in ease of selling of EV's so it should be kept into consideration higher charging stations led to higher chances of more selling of EV's...Note Indian market is basically look for affordable EV's big giants like Audi, Porsche etc cannot capture the Indian market because of price enhancement we need to focus on affordable EV's such as developed by TATA as Tata Nexon(which is capturing around 90% of 4 wheelers EV market of India) etc because Indian market is based on affordable EV's in medium price ranges so one company needs to focus on medium price range EV's which provide better functionalities if a particular company understand the market need by considering above points there are high chances of their success in Indian market.

In the end, we can say that the market segmentation will be helpful in several ways such as it helps to make your target market clear and also helps to enhance the chances of Electric Vehicles product acceptance. In order to increase market share, marketers must develop a strong strategy focusing on the target segment. This paper is a detailed analysis of the current conditions and trends in India's automobile industry, as well as its impact on the sales revenue of electric vehicles. The study also explores some of the most effective strategies for marketers and analyses how these strategies can be applied to increase sales revenue in India.

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