EV Market Segmentation

SALES ANALYSIS

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MARKET SEGMENTATION CASE STUDY - ABSTRACT

This report explores various aspects of market segmentation, focusing on the process of identifying, analysing, and targeting distinct consumer groups to enhance marketing efficiency and effectiveness. It underscores the significance of strategic planning, robust data analysis, and effective profiling in market segmentation. By combining traditional statistical methods with modern visualization techniques, organizations can create well-defined market segments that inform successful marketing strategies, aligning consumer needs with the organizational value proposition.

DATA PRE-PROCESSING

Import the required libraries

```
[1]  import pandas as pd
     import numpy as np
     import matplotlib.pyplot as plt
     import seaborn as sns
     import warnings
     warnings.filterwarnings('ignore')
     from sklearn.model_selection import train_test_split
     from sklearn.preprocessing import StandardScaler
```

LOADING FIVE DATASETS

Data Set – 1

	EV Maker	Place	State
0	Tata Motors	Pune	Maharashtra
1	Mahindra Electric	Bengaluru	Karnataka
2	Ather Energy	Bengaluru	Karnataka
3	Hero Electric	New Delhi	Delhi
4	Ola Electric	Krishnagiri	Tamil Nadu

Data Set – 2

	State	No. of Operational PCS
0	Andaman & Nicobar	3
1	Andhra Pradesh	327
2	Arunachal Pradesh	9
3	Assam	86
4	Bihar	124

Data Set – 3

	Vehicle Class	Total Registration
0	FOUR WHEELER (INVALID CARRIAGE)	21,346
1	HEAVY GOODS VEHICLE	58,70,865
2	HEAVY MOTOR VEHICLE	1,02,965
3	HEAVY PASSENGER VEHICLE	8,28,189
4	LIGHT GOODS VEHICLE	1,02,49,591

Data Set – 4

	Year	FOUR WHEELER (INVALID CARRIAGE)	HEAVY GOODS VEHICLE	HEAVY MOTOR VEHICLE	HEAVY PASSENGER VEHICLE	LIGHT GOODS VEHICLE	LIGHT MOTOR VEHICLE	LIGHT PASSENGER VEHICLE	MEDIUM GOODS VEHICLE	MEDIUM PASSENGER VEHICLE	MEDIUM MOTOR VEHICLE
0	2001	0	7	18	0	144	315	12	2	0	2
1	2002	0	8	4	8	1936	197	54	3	0	1
2	2003	0	6	6	1	331	294	18	0	6	1
3	2004	0	8	6	1	103	231	12	0	0	1
4	2005	0	7	6	3	86	230	10	2	5	1
5	2006	0	7	18	0	144	315	12	2	0	2

Data Set – 5

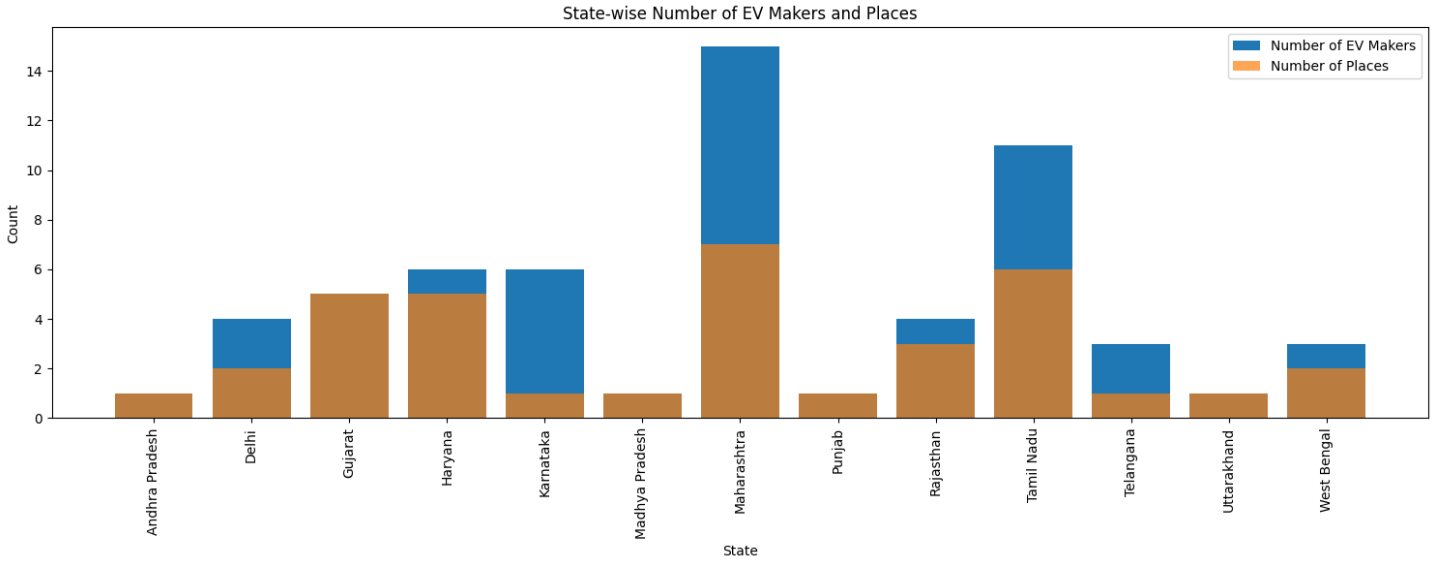
	Cat	Maker	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
0	3W	"VOLVO GROUP INDIA PVT LTD"	0	0	31	12	0	0	0	0	0	0
1	3W	3EV INDUSTRIES PVT LTD	0	0	0	0	0	0	112	390	545	51
2	2W	3GB TECHNOLOGY PVT LTD	0	0	0	1	0	0	0	0	0	0
3	3W	3GB TECHNOLOGY PVT LTD	0	1	1	0	0	0	0	0	0	0
4	3W	3S INDUSTRIES PRIVATE LIMITED	0	0	0	0	48	66	43	68	266	578

EXPLORATORY DATA ANALYSIS (EDA)

Exploratory Data Analysis (EDA) is a data analysis approach that involves summarizing, visualizing, and examining datasets to understand patterns, spot anomalies, and test assumptions before applying machine learning models. It helps in gaining insights and preparing data for further analysis.

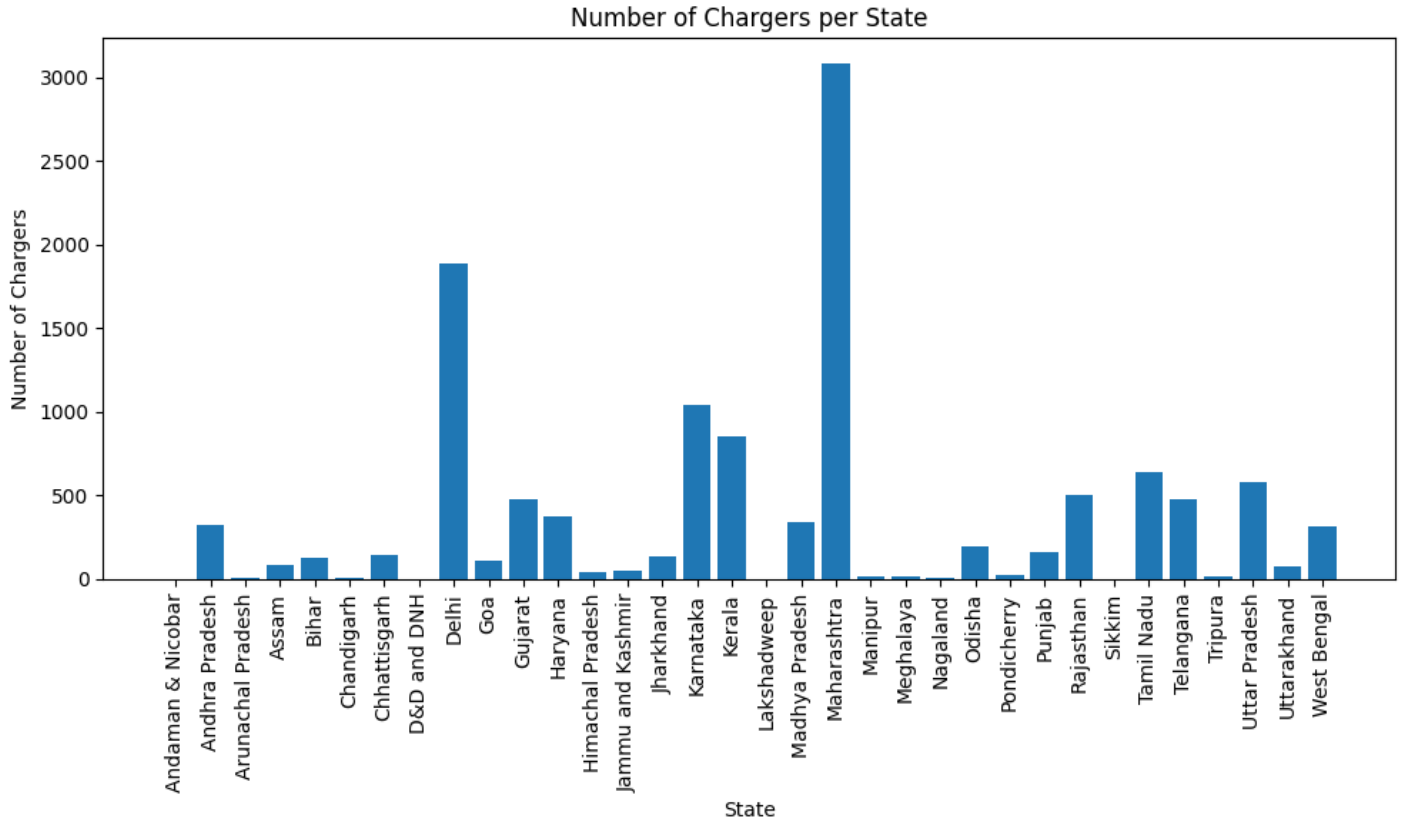
IMPLEMENTING EDA ON DATASETS

- **Analysis of Number of EV makers and Number of Places :**
  Maharashtra and Tamil Nadu lead in the number of EV makers and related places, with Maharashtra having the highest count. Other states like Gujarat, Haryana, and Delhi also have a moderate presence, while several states have minimal representation in the EV sector. This suggests that EV manufacturing and related infrastructure are concentrated in a few states, particularly Maharashtra and Tamil Nadu.



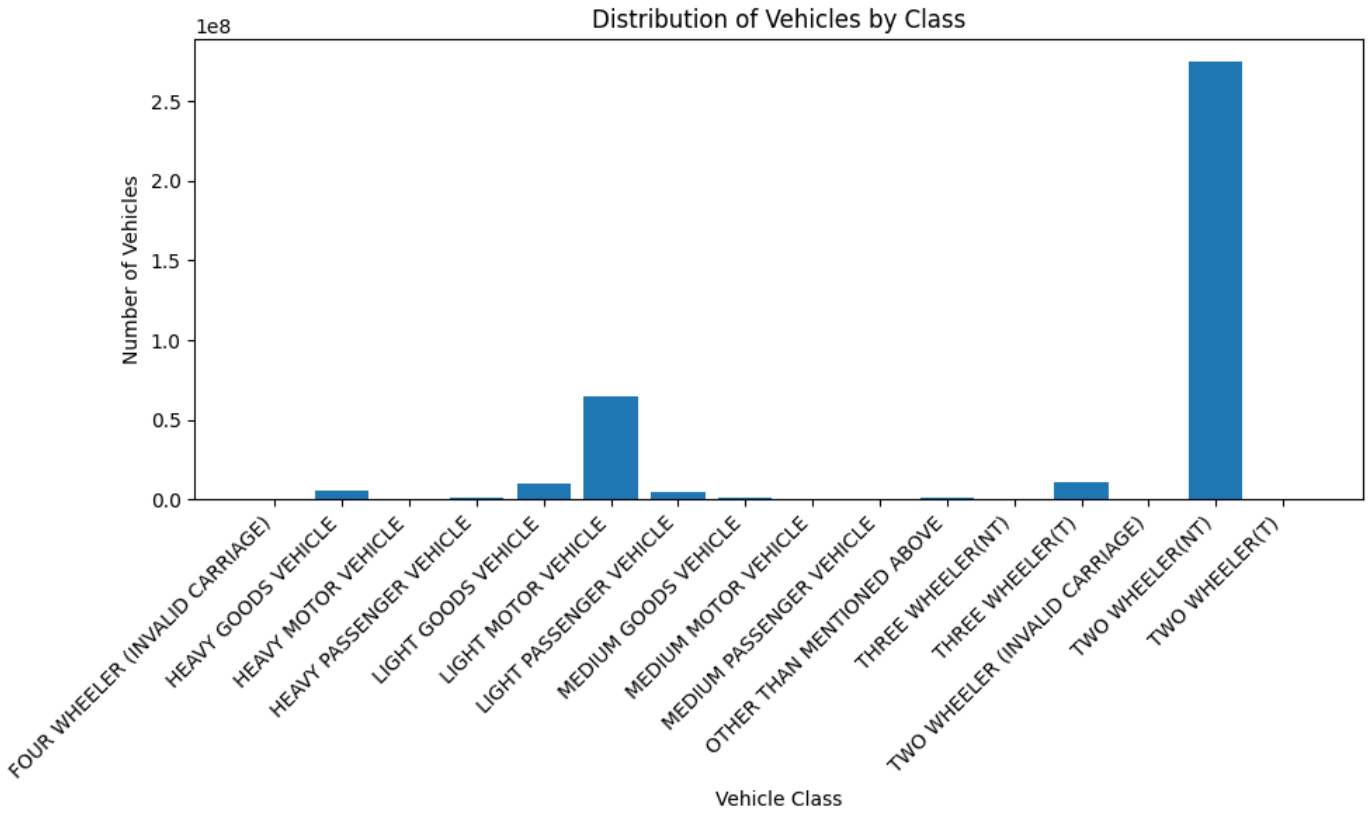
❖ Analysis on Charging Stations:

Maharashtra and Delhi has the more number for charging stations followed by Karnataka and Kerala. As Maharashtra has the most number of ev makers so requirement for the charging stations also more.



❖ Analysis on Distribution of Vehicles by Class based on Total Registrations:

Two-wheelers dominate vehicle registrations, far exceeding other classes, reflecting their popularity and accessibility. Light motor vehicles have the second-highest registrations, while heavy vehicles and three-wheelers have relatively low counts, indicating a smaller market share.



❖ Analysis of Four Wheeler Sales Over the Sales :

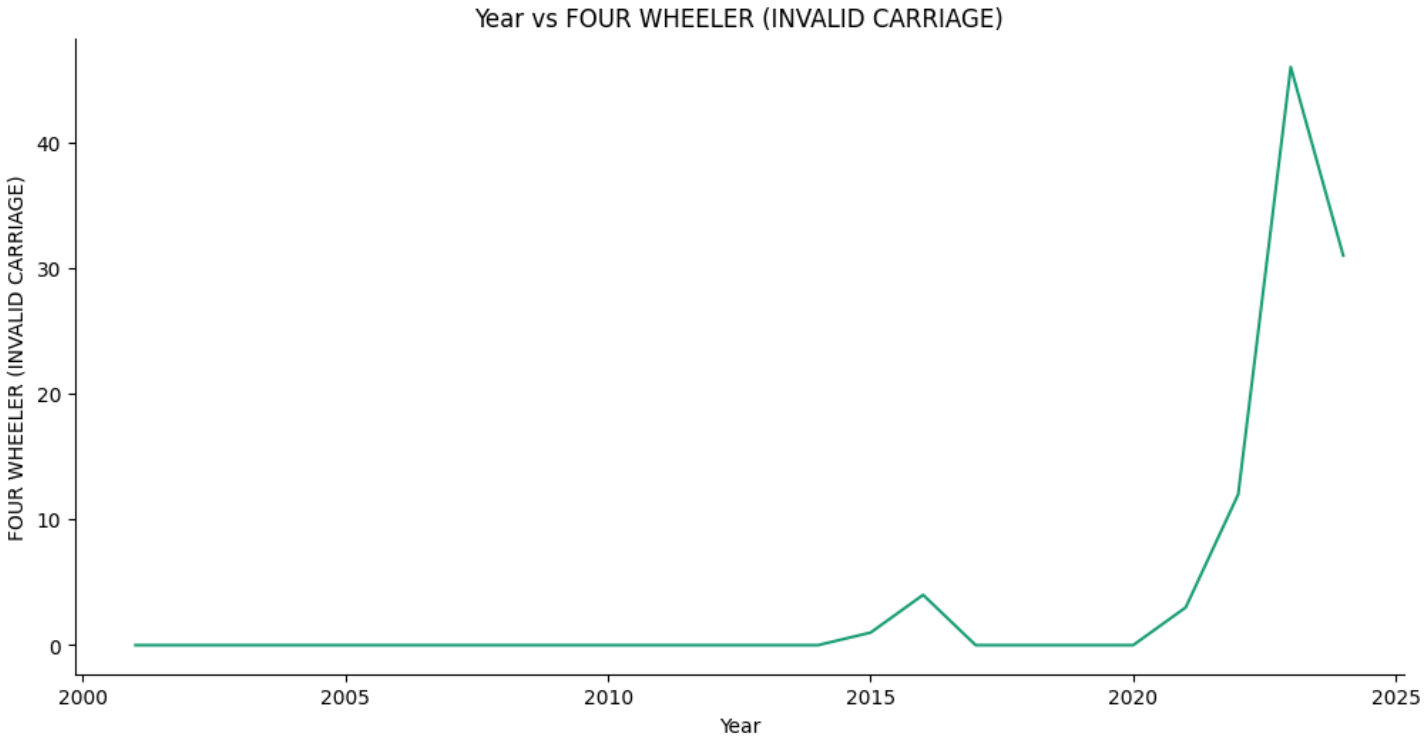
Observations

1. **Steady Growth Until ~2020**: Registrations were minimal before 2015, with occasional small increases.
2. **Significant Spike Post-2020**: There is a sharp rise in registrations around 2020-2021, reaching a peak shortly thereafter.

Possible Reasons

1. **Increased Accessibility Initiatives**: The post-2020 spike may reflect government or organizational initiatives to support people with disabilities by providing accessible vehicles.
2. **Rising Awareness**: Growing social awareness and inclusivity may have led to increased adoption and support for invalid carriage vehicles.
3. **Improved Technology**: Advances in vehicle design, especially for accessibility, could have made these vehicles more appealing and functional.

Overall, the recent spike suggests a trend toward greater inclusivity and support for specialized mobility needs.



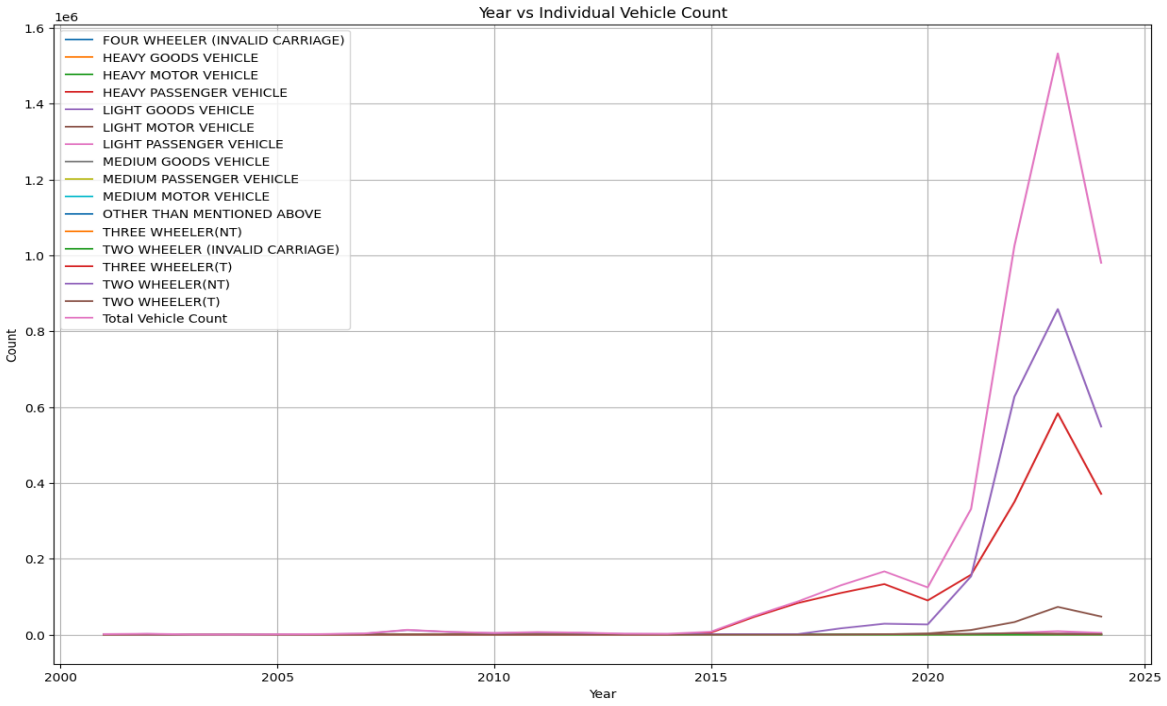
❖ **Analysis on sales of different types of vehicles over the years :**

A rapid increase in the total count of various vehicle classes, especially two-wheelers (both registered and non-registered types) and light motor vehicles, starting around 2015 and peaking post-2020.

Key Observations and Reasons:

1. Two-Wheelers: Their significant rise suggests increased demand for affordable and flexible transportation, likely driven by urbanization and rising population density.
2. Light Motor Vehicles: The growth here indicates greater private car ownership, perhaps due to rising income levels and affordability.
3. COVID-19 Pandemic Effect: The post-2020 peak could be due to increased individual vehicle purchases, as people sought safer, personal travel options over public transport during the pandemic.
4. Economic Growth: India's economic expansion may have led to increased vehicle accessibility and ownership across different classes.

In summary, economic factors and recent societal shifts are likely driving the growth across vehicle classes, especially two-wheelers and light motor vehicles.



❖ Analysis of Vehicles in 2024:

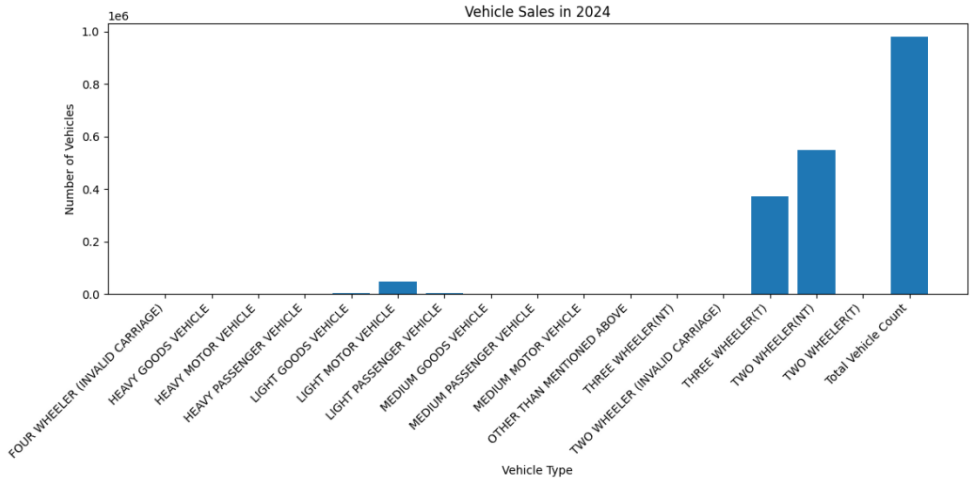
Two-Wheelers Dominate: The highest number of vehicles sold belong to the two-wheeler category, particularly "Two Wheeler (T)" and "Two Wheeler (NT)." This suggests two-wheelers are a primary choice, possibly due to their affordability, fuel efficiency, and convenience in urban areas.

Total Vehicle Count: The "Total Vehicle Count" bar confirms that overall vehicle registrations have significantly increased in 2024, with two-wheelers forming a large portion of this total.

Minimal Sales in Other Categories: Vehicle types like "Heavy Goods Vehicle," "Medium Goods Vehicle," and various "Invalid Carriage" vehicles have much lower sales. This likely indicates limited commercial or specialized vehicle purchases relative to private vehicles.

Trend in Vehicle Preference: The concentration of sales in personal transport vehicles (two-wheelers) over commercial or heavy vehicles may reflect economic conditions favoring individual mobility solutions.

In summary, two-wheelers are the most popular vehicle type in 2024, driven by demand for affordable and flexible transportation options, while commercial vehicle sales remain comparatively low.



❖ EV maker count by category and year:

Overall Trend

- The number of EV makers has been steadily increasing over the years, with a significant surge from 2020 onwards.
- The growth rate has been particularly high in the 3W and 2W categories.

Category-wise Analysis

- **3W:** The number of 3W EV makers has shown a consistent upward trend, with a major jump in 2021.
- **2W:** 2W EV makers have also seen a significant increase, especially in 2021 and 2022.
- **LMV:** The LMV category has witnessed a more gradual growth compared to 3W and 2W.
- **MMV:** The MMV category has the lowest number of EV makers and has seen a relatively slow growth.

Year-wise Analysis

- **2015-2019:** The EV maker landscape was relatively stable during this period, with moderate growth across all categories.
- **2020-2021:** This period marked a significant turning point, with a substantial increase in EV makers across all categories.
- **2022-2024:** The growth trajectory has continued, albeit at a slightly slower pace than in the previous period.

Additional Observations

- The 2W category has consistently had the highest number of EV makers.
- The MMV category has the lowest number of EV makers.
- The growth rate in the 3W and 2W categories has been particularly high.

Possible Interpretations

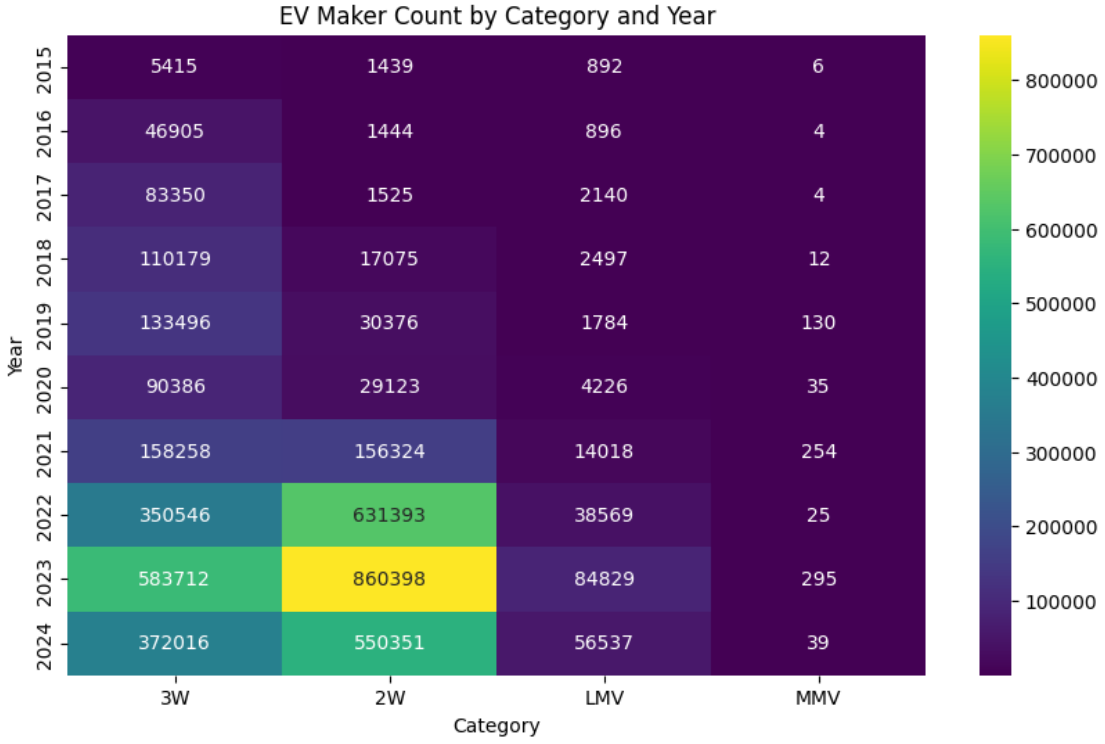
- The increasing number of EV makers across all categories suggests a growing interest and investment in the electric vehicle market.
- The higher growth rate in 3W and 2W categories could be due to factors like lower entry barriers, increasing demand for affordable electric mobility solutions, and government incentives.

- The slower growth in the LMV and MMV categories might be due to higher initial costs and technological complexities associated with these vehicles.

Further Analysis

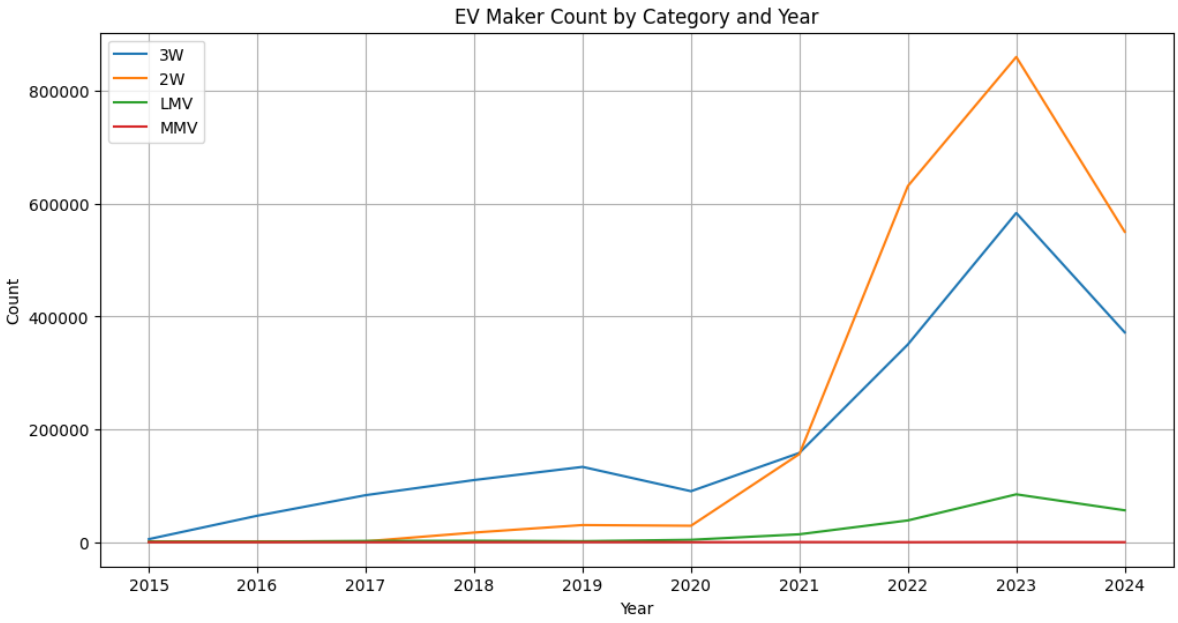
To gain a deeper understanding of the EV market, it would be helpful to analyze additional data points such as:

- **Market share** of different EV makers in each category.
- **Production capacity** and **sales figures** of different EV makers.
- **Type of EV** (battery electric, plug-in hybrid, etc.)
- **Battery technology** used by different EV makers.
- **Government policies** and **incentives** impacting the EV market.



❖ Analysis of Various Vehicle Categories :

The EV maker landscape has witnessed significant growth, particularly in the 3W and 2W categories. While all categories saw a steady increase from 2015 to 2019, a major surge occurred in 2020 and 2021. The 2W category consistently led in terms of EV maker count, while the MMV category remained smallest. This trend suggests a growing interest and investment in the electric vehicle market, driven by factors like lower entry barriers and increasing demand for affordable electric mobility solutions.



Questions and Answers Based on the EV Market Segmentation Analysis

Q: What is the overall trend in the EV market?
A: The EV market has shown significant growth, especially since 2020. The 3W and 2W categories have experienced the most rapid growth.

Q: Which category has the highest number of EV makers?
A: The 2W category consistently leads in terms of EV maker count.

Q: Which states have the highest concentration of EV makers and charging stations?
A: Maharashtra and Tamil Nadu have the highest concentration of EV makers and related infrastructure, including charging stations.

Q: What factors are driving the growth in the 3W and 2W EV categories?
A: Factors like lower entry barriers, increasing demand for affordable electric mobility solutions, and government incentives are likely driving the growth in these categories.

Q: Why is the growth in the LMV and MMV categories slower?
A: Higher initial costs and technological complexities associated with these vehicles might be hindering their growth.

Q: What are some potential areas for further analysis in the EV market?
A: To gain a deeper understanding, it would be beneficial to analyze data on market share, production capacity, sales figures, EV types, battery technology, and government policies.

Q: If government subsidies for EVs were to decrease, how might it impact the market?
A: A decrease in subsidies could potentially slow down the growth of the EV market, especially in the initial stages of adoption. However, long-term trends like increasing environmental concerns and technological advancements might still drive the market forward.

Q: How might the increasing adoption of renewable energy sources impact the EV market?
A: The growth of renewable energy sources could reduce the carbon footprint of EV charging, making it more environmentally friendly and potentially lowering charging costs. This could further boost the appeal of EVs.

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