EV Market in India

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Some of work are done in **Tableau Software**.

Tableau File and Data File Link: GDrive Link

Rishav Karmakar : GitHub

Dhanamaneni Varenya : GitHub

1 Introduction

Market segmentation becomes a crucial tool for evolving transportation technology such as electric vehicles (EVs) in emerging markets to explore and implement for extensive adoption. As, EVs offer low emissions and operating costs, their adoption is expected to grow significantly in the near future. To facilitate this adoption, academic researchers are exploring distinct buyer segments for EVs based on psychographic, behavioural, and socio-economic characteristics. By employing a research framework that integrates perceived benefits, attitude, and intention, researchers aim to understand the factors influencing EV adoption and develop effective strategies to target specific market segments. This involves analysing the attitudes, values, and lifestyles of potential EV buyers (psychographic), studying their past behaviours and preferences (behavioural), and considering economic and social factors that influence adoption (socio-economic). The 'perceived benefits-attitude-intention' framework serves as the basis for this study, highlighting the influence of perceived benefits on attitudes and intentions towards EV adoption. The findings from this research can inform marketing efforts, policy interventions, and technological advancements to promote the widespread adoption of EVs in emerging markets, contributing to a more sustainable transportation landscape.

In this report we are going to analyse the data and solve the problem using Fermi Estimation by breaking down the problem. Before that first we will see global EV market.

2 Global EV Market

EVs are to play a central role in the ambitious objective of zero-emission targets set for 2050, and the industry is gearing up for it.

The year 2022 came on strong, breaking records. EV sales exceeded 10 million, with 14% of all new cars sold being electric, quite the jump from 9% in 2021 and less than 5% in 2020. That resulted in more than 26 million electric cars roaming global roads in 2022, representing a 60% uptake from 2021.

2.1 Electric Vehicles Initiative

The Electric Vehicles Initiative (EVI) is a multi-governmental policy forum established in 2010 under the Clean Energy Ministerial (CEM). Recognising the opportunities offered by EVs, the EVI is dedicated to accelerating the adoption of EVs worldwide. To do so, it strives to better understand the policy challenges related to electric mobility, to help governments address them and to serve as a platform for knowledge-sharing among government policy makers. The EVI also facilitates exchanges between government policy

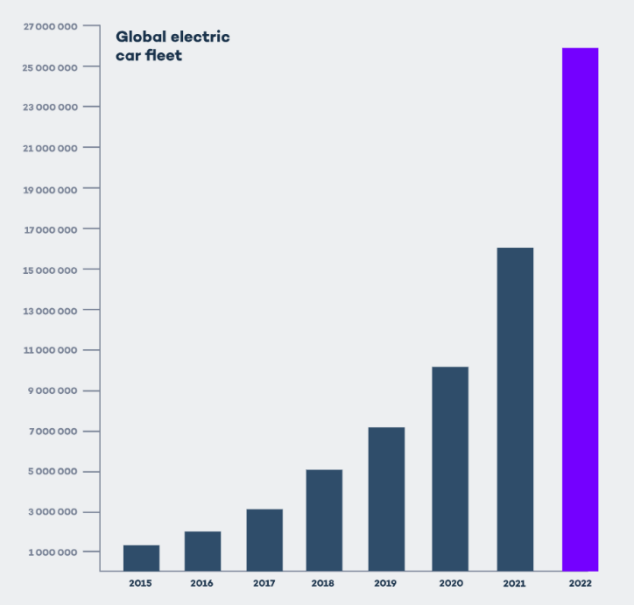


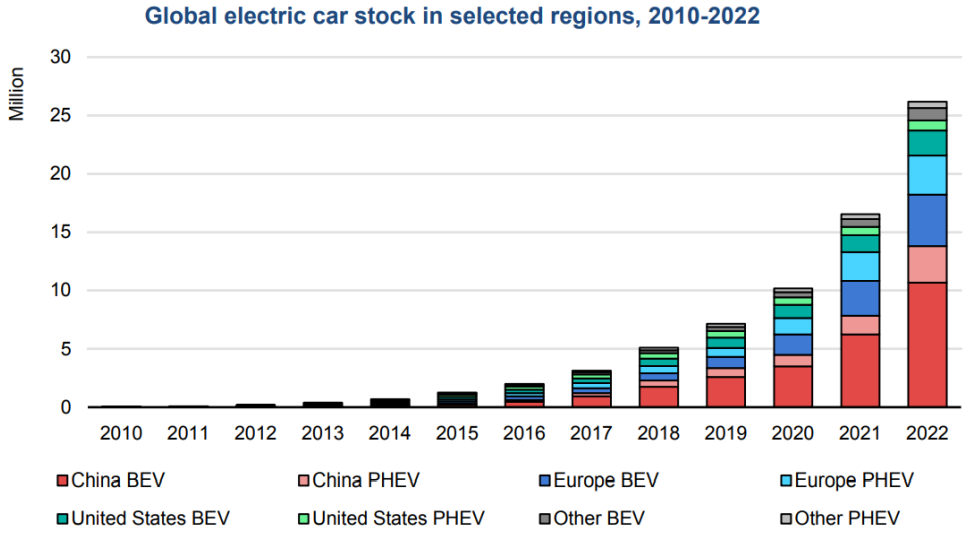
Figure 2: Global EV Market Share and Size

Figure 1: EVI Government

makers and a variety of other partners on topics important for the transition to electric mobility, such as charging infrastructure and grid integration as well as EV battery supply chains. In 2022, Zero Emission Government Fleet Declaration was launched within the EVI, a strong commitment among government to move towards 100% zero emission vehicles in public procurement.

The International Energy Agency serves as the co-ordinator of the initiative. Governments that have been active in the EVI in the 2022-23 period include Canada, Chile, People's Republic of China (hereafter "China"), Finland, France, Germany, India, Japan, the Netherlands, New Zealand, Norway, Poland, Portugal, Sweden, United Kingdom and United States. Canada, China and the United States are the co-leads of the initiative.

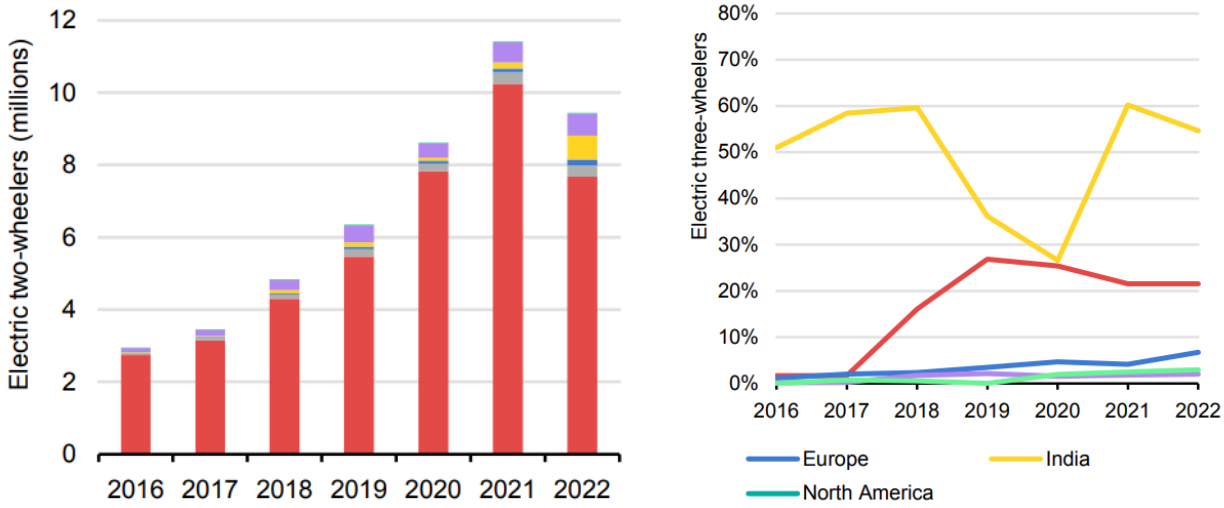
2.2 Trends and Developments in EV Cars Markets



Electric car sales saw another record year in 2022, despite supply chain disruptions, macro-economic and geopolitical uncertainty, and high commodity and energy prices. The growth in electric car sales took place in the context of globally contracting car markets: total car sales in 2022 dipped by 3% relative to 2021. Electric car sales – including battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) – exceeded 10 million last year, up 55% relative to 2021. This figure – 10 million EV sales worldwide – exceeds the total number of cars sold across the entire European Union (about 9.5 million vehicles) and is

nearly half of the total number of cars sold in China in 2022. In the course of just five years, from 2017 to 2022, EV sales jumped from around 1 million to more than 10 million. It previously took five years from 2012 to 2017 for EV sales to grow from 100 000 to 1 million, underscoring the exponential nature of EV sales growth. The share of electric cars in total car sales jumped from 9% in 2021 to 14% in 2022, more than 10 times their share in 2017.

2.3 Trends and Developments in EV Two-Wheeler Markets



Global electric two-wheeler sales totalled about 9.2 million in 2022, a drop of nearly 18% from 2021 (Above Figure). This drop is almost entirely attributable to the dip in sales of electric mopeds and motorcycles in China, which fell from 10.2 million in 2021 to under 7.7 million in 2022, even as the overall two-wheeler market there continued to grow. Supply chain challenges stemming from China's pandemic-related restrictions in 2022 hit the electric two-wheeler market particularly hard, and in spite of growth in sales of premium domestic and imported two-wheelers (e.g., from BMW, Ducati and others), the overall sales share of electric two-wheelers dipped back below 50%.

2.4 India's EV Policy Support

Despite the decline in sales, China continued to dominate the electric two-wheeler market in terms of size, accounting for nearly 85% of global sales.

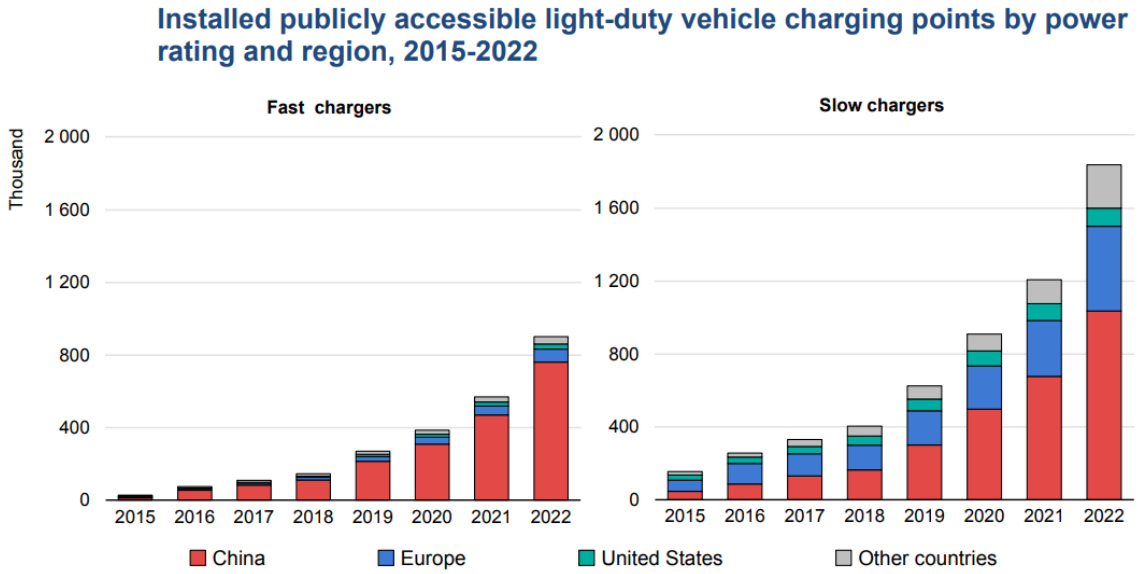
China leads global electric two-wheeler sales, despite a 25% drop in 2022. Battery leasing business models and stronger manufacturing boost Indian electric three-wheeler sales.

India leads on sales of electric three-wheelers thanks to policy support and innovative business models Sales of electric three-wheelers, which play an important role in urban mobility in India for both cargo and passenger services, soared to 425 000 units in 2022. Sales have been strong in India for a number of years, with hundreds of thousands of electric three-wheelers sold every year since 2012, with the exception of 2020, when the Covid-19 pandemic reduced sales volumes to 30% of the previous year.

Policies including the purchase incentives under FAME II, supply-side incentives under the PLI scheme, tax benefits and India's Go Electric campaign all contributed to reducing the higher upfront costs (see Policy developments and corporate strategy for a detailed discussion of these and other policies). A total of 15 Indian states have already adopted EV policies to promote stronger EV deployment, the majority of which include additional demand incentives. Bulk procurement schemes, the emergence of the battery-as-a-service (BaaS) business model and India's draft battery swapping policy all give further impetus to the rapidly rising sales of electric three-wheelers.

China followed India in terms of electric three-wheeler sales, with nearly 350 000 units sold in 2022. Together, China and India accounted for nearly 99% of global electric three-wheeler sales.

2.5 Charging Infrastructure



While most of the charging demand is currently met by home charging, publicly accessible chargers are increasingly needed in order to provide the same level of convenience and accessibility as for refuelling conventional vehicles. In dense urban areas, in particular, where access to home charging is more limited, public charging infrastructure is a key enabler for EV adoption. At the end of 2022, there were 2.7 million public charging points worldwide, more than 900 000 of which were installed in 2022, about a 55% increase on 2021 stock, and comparable to the pre-pandemic growth rate of 50% between 2015 and 2019.

3 EV Market in India

India is the third largest automobile market globally in terms of sales, ahead of Germany and Japan. There is now a push for manufacturers and policymakers to collaborate to shift demand towards greener options. The automotive sector is a major contributor to India's economy, accounting for 7.1 percent of its GDP and providing significant employment. The Economic Survey 2023 predicts that India's domestic electric vehicle market will see a 49 percent compound annual growth rate (CAGR) between 2022 and 2030, with 10 million annual sales by 2030. Additionally, the electric vehicle industry is projected to create around 50 million direct and indirect jobs by 2030.

3.1 Data Collection

Data has been collected from the various sources which are listed below:

- https://www.kaggle.com/datasets
- https://datasetsearch.research.google.com
- https://data.gov.in
- https://www.zigwheels.com/
- https://www.iea.org/reports/global-ev-outlook-2023

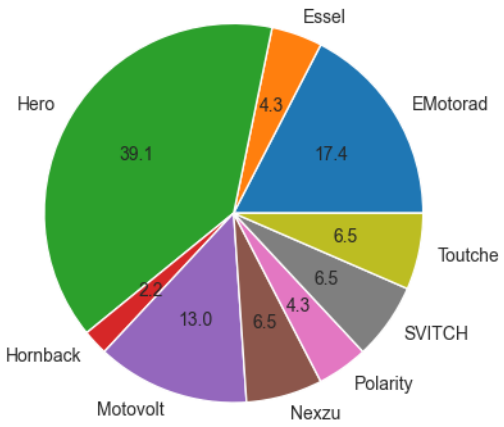
3.2 Two-Wheeler EV in India

In India there are three types of two-wheelers are available. These are cycles, scooters and bike.

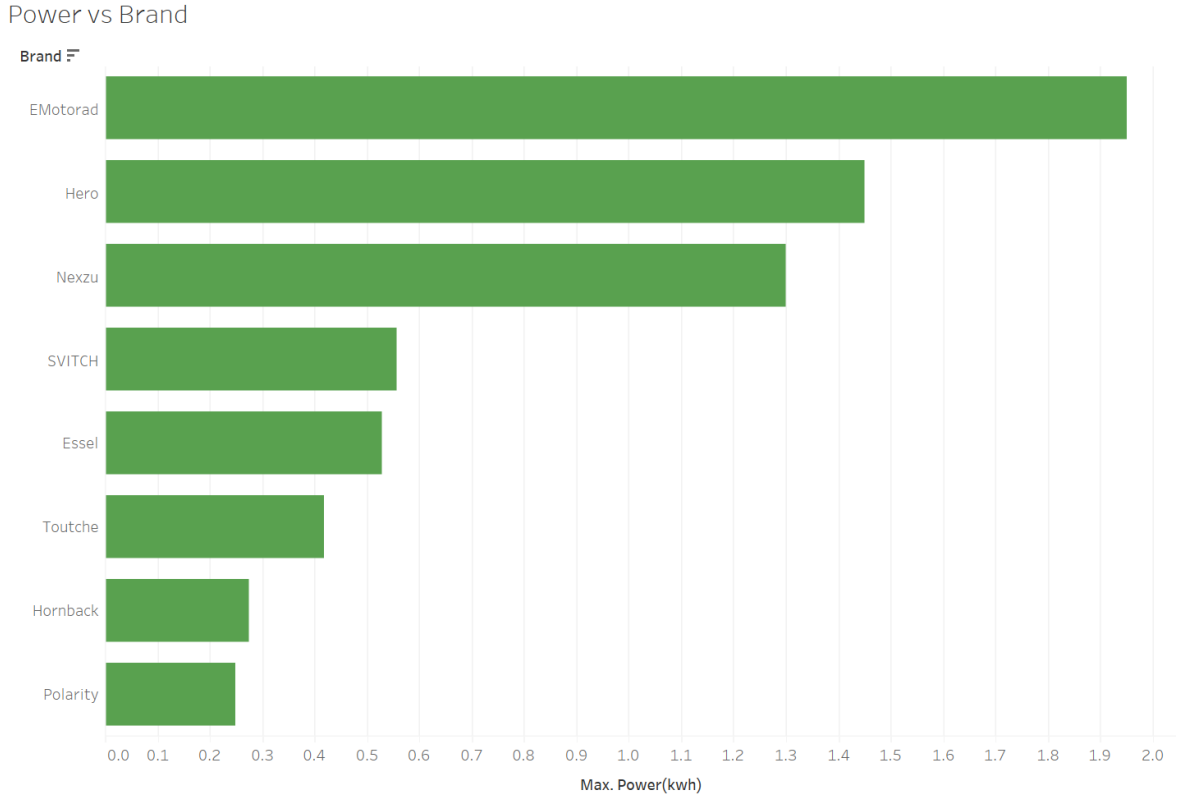
3.2.1 EV Cycles in India

The e-bicycle industry is innovating itself to be the game-changer in getting an advanced and greener world. Thus, we are not very far from seeing futuristic e-bicycles with an on-board computer, a solar-powered backup moto, which present a range of data about the ride such as location, speed, and calorie consumption that will also be robust and safe enough for challenging surfaces which are used widely.

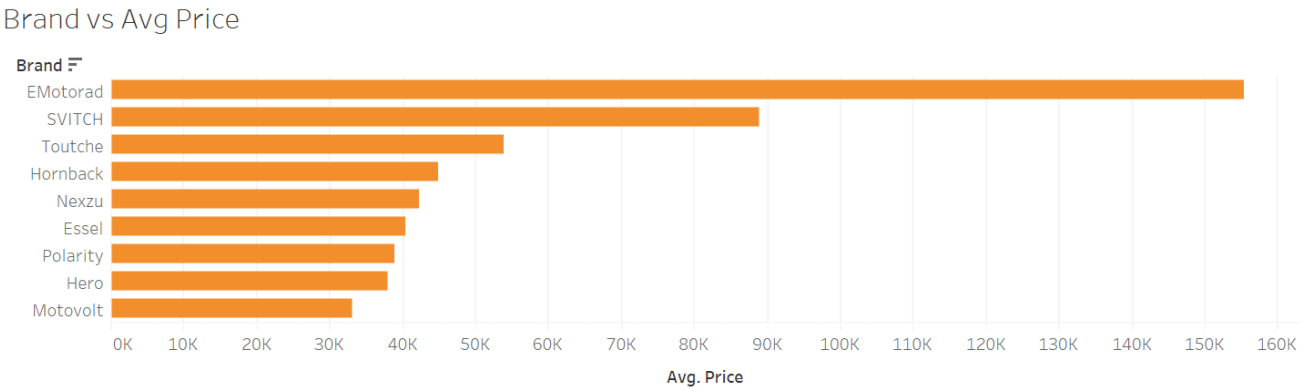
E-bicycles are becoming more costly than standard motorbikes due to wiring, design, motor or mini engine, and battery power. The cost of an e-bicycle mostly depends on its grade and quality. The price can vary from about Rs 20,000 to Rs 1,50,000 and it can go above. The high costs of new e-bicycle batteries and the replacement of the same are also hampering the market's growth because people prefer to spend less money on buying new batteries for e-bicycles.



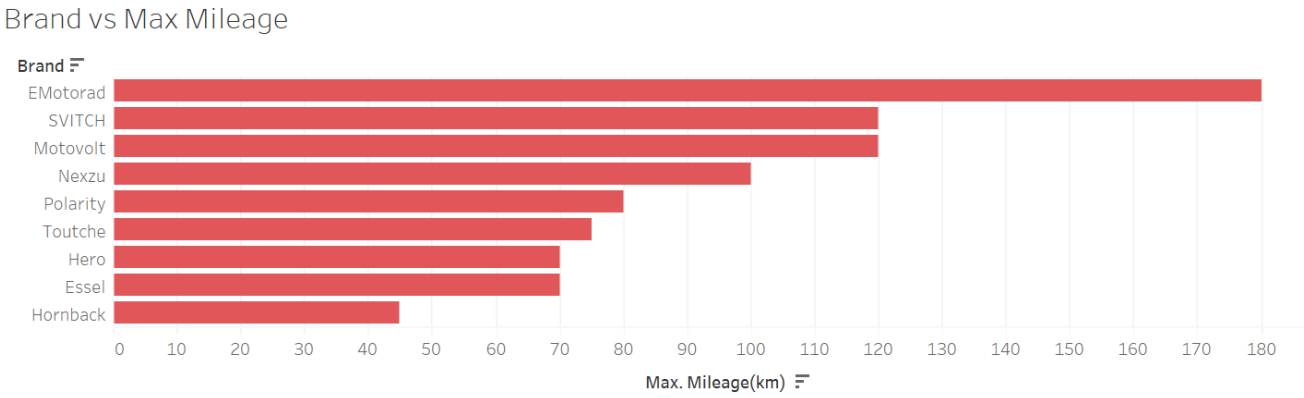
Then by the above figure we can conclude that 40% of EV Cycle market is captured by Hero, after then EMotorad, Motorvolt.



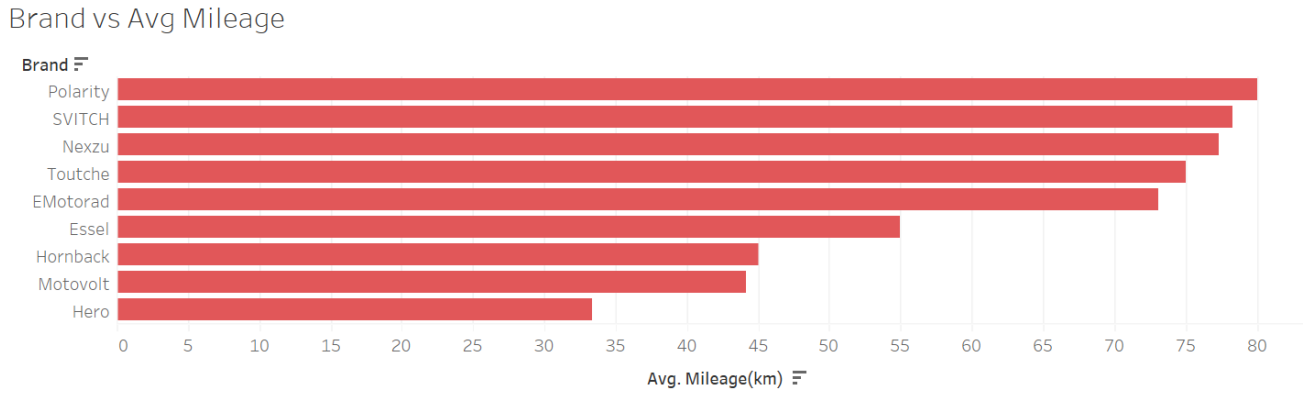
Form the above figure we see that Polarity has the lowest maximum power capacity while EMotorad has maximum power capacity for EV Cycle in India.



From the above figure we see that EMotorad EV cycle are costlier while Motovolt provide cheapest EV cycle on average.



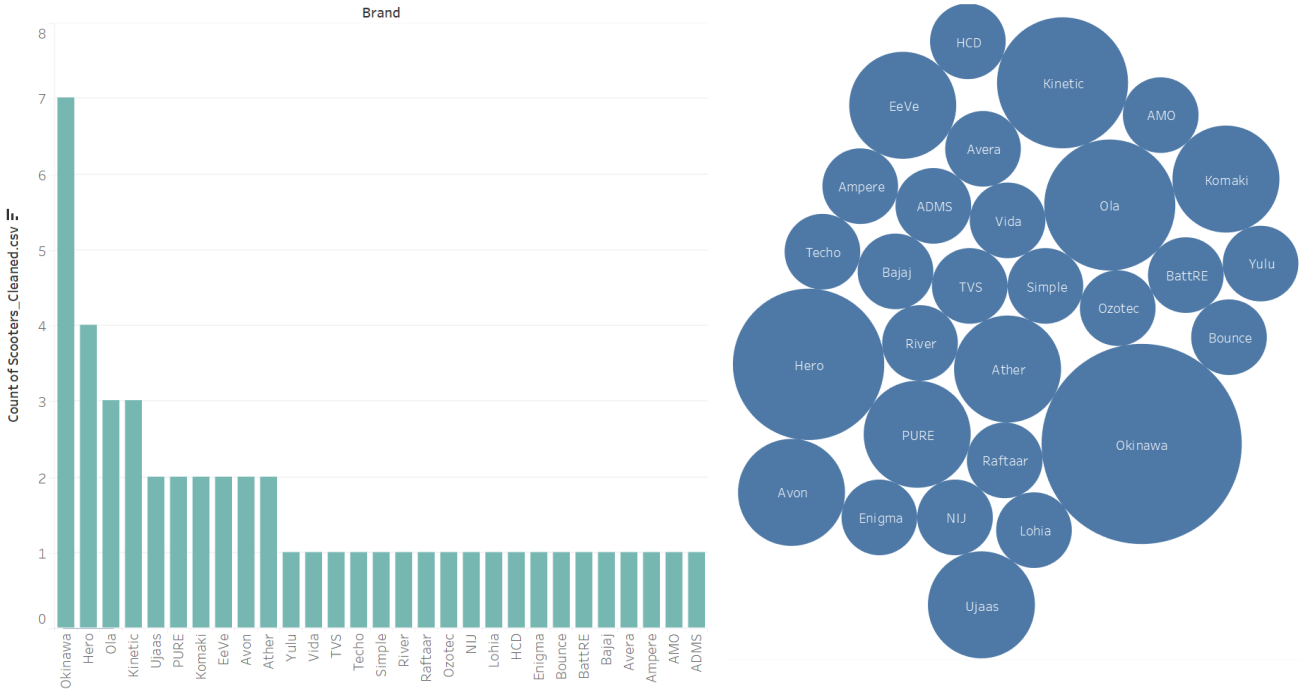
Now when it comes to maximum mileage then EMotorad give maximum mileage and Hornback has lowest maximum mileage.



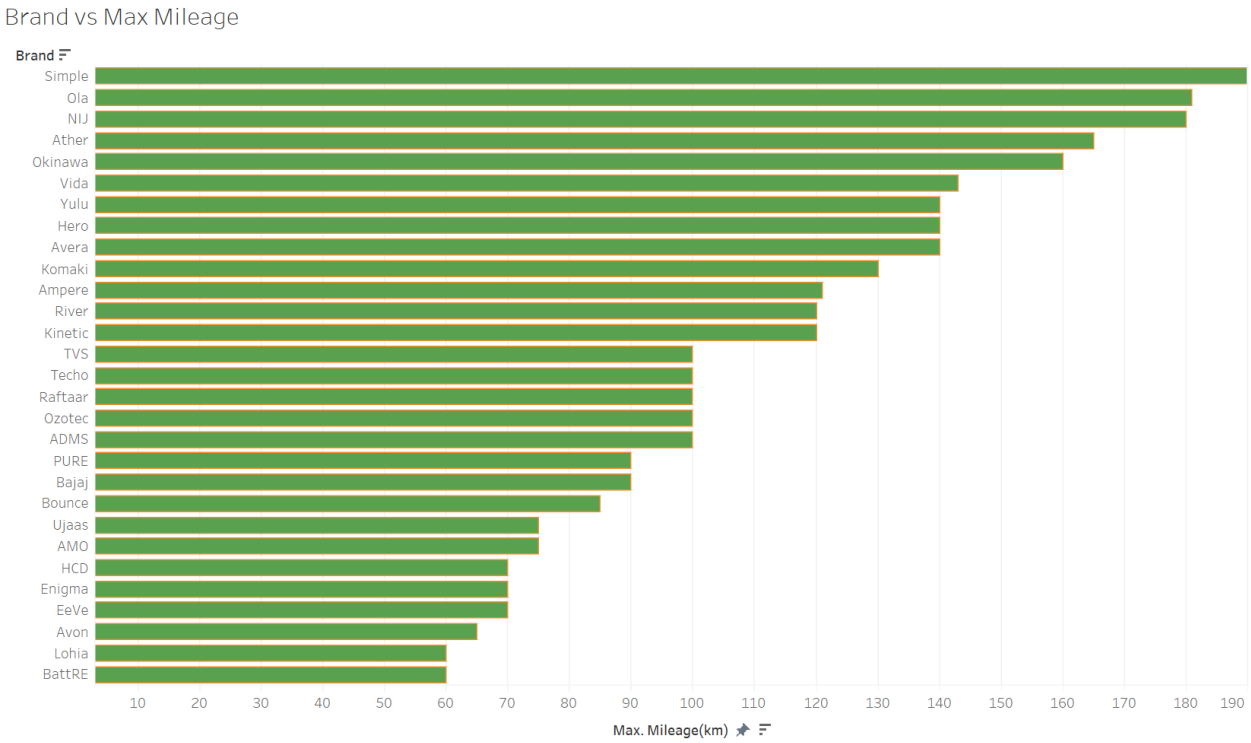
Now when it comes to average mileage then Polarity has the highest average mileage but Hero has the lowest average mileage.

3.2.2 EV Scooter in India

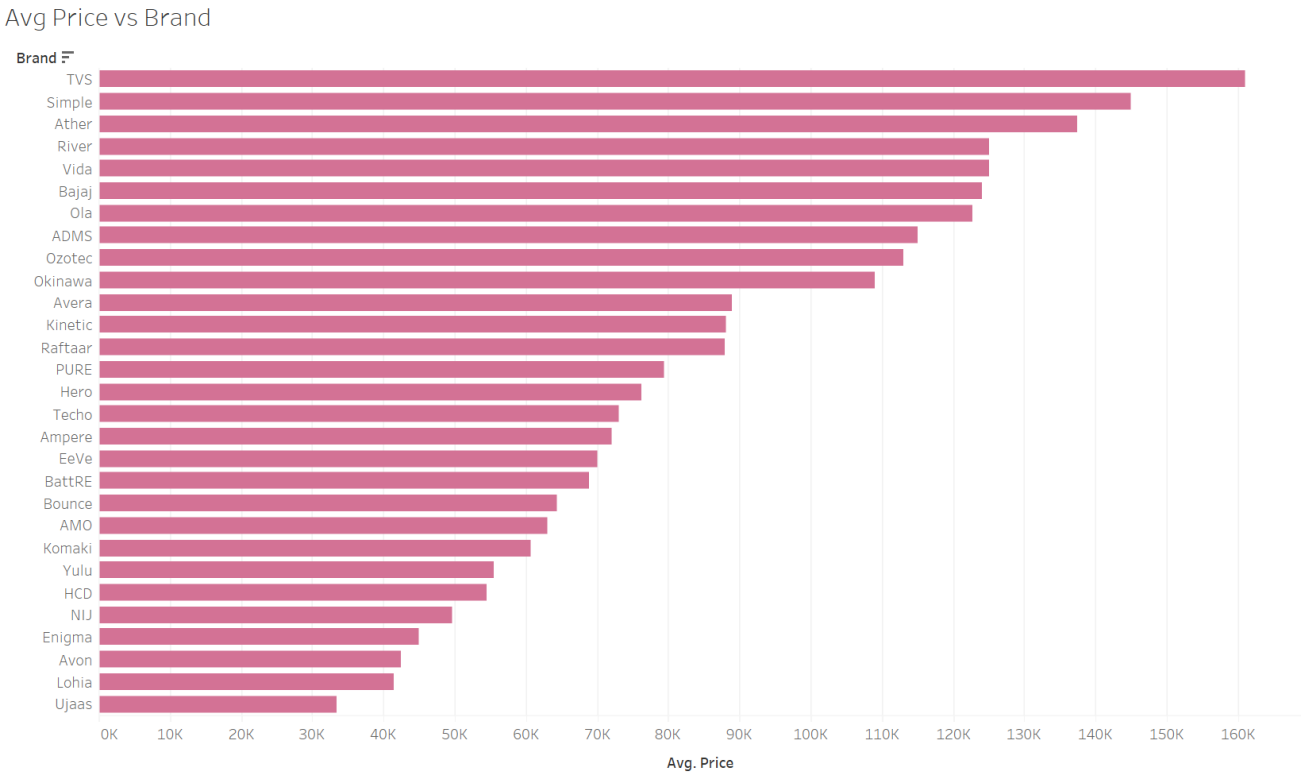
The electric scooters have low operating and maintenance costs and along with government incentives the Electric Scooters Market is anticipated to grow at a rapid pace. The Indian Electric Scooters Market report provides a holistic evaluation of the market. The report offers a comprehensive analysis of key segments, trends, drivers, restraints, competitive landscape, and factors that are playing a substantial role in the market.



From the above figure we can conclude that Okinawa has the highest number of EV Scooters, after that Hero, Ola are in the following lead.



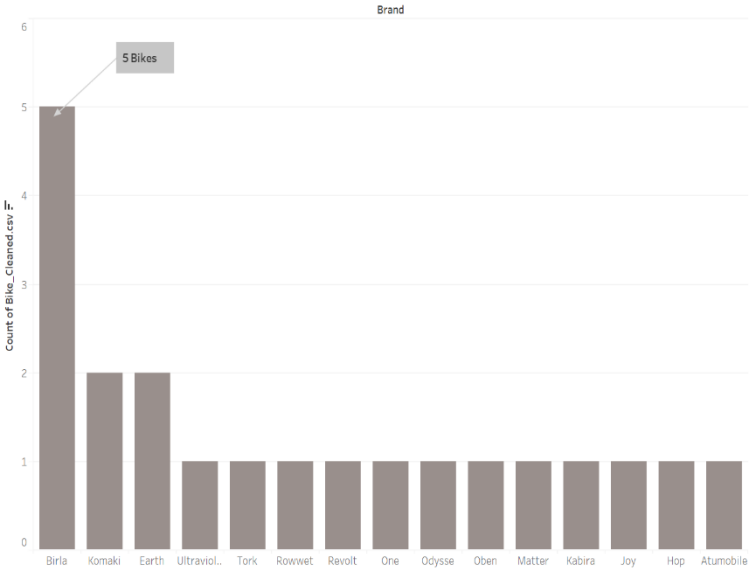
From the above figure we see that Simple give maximum mileage while Lohia and BattrE give lowest maximum mileage.

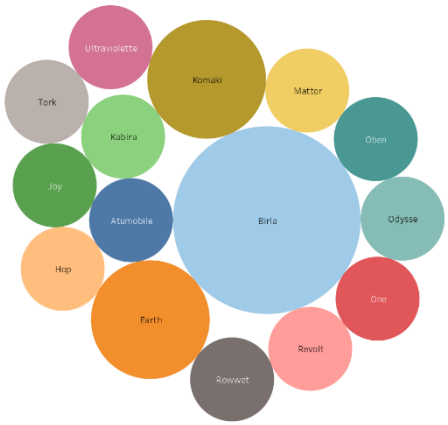


From the above figure we see that the average price of TVS his highest and Ujaas has the lowest average price in EV Scooters in India.

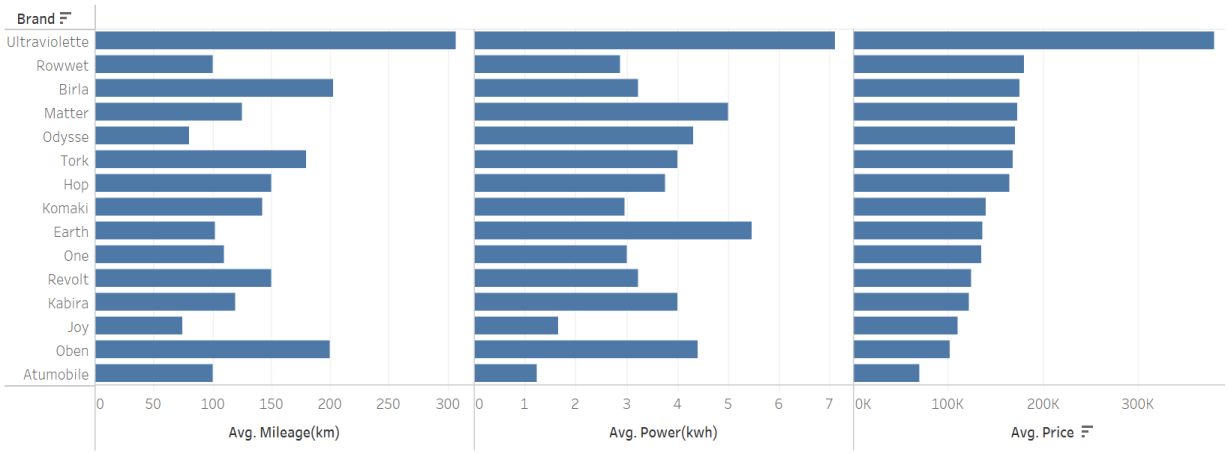
3.2.3 EV Bike in India

Electric bikes, also referred to as e-bikes, are fitted with an electric motor which is used for gaining momentum. They make use of chargeable batteries, which have different capacities depending upon their size. Electric bikes are classified on the basis of the power of electric motor on which they run. Peddle assist, throttle on demand, speed peddle and electric moped or motorcycle are the different categories of electric bikes.



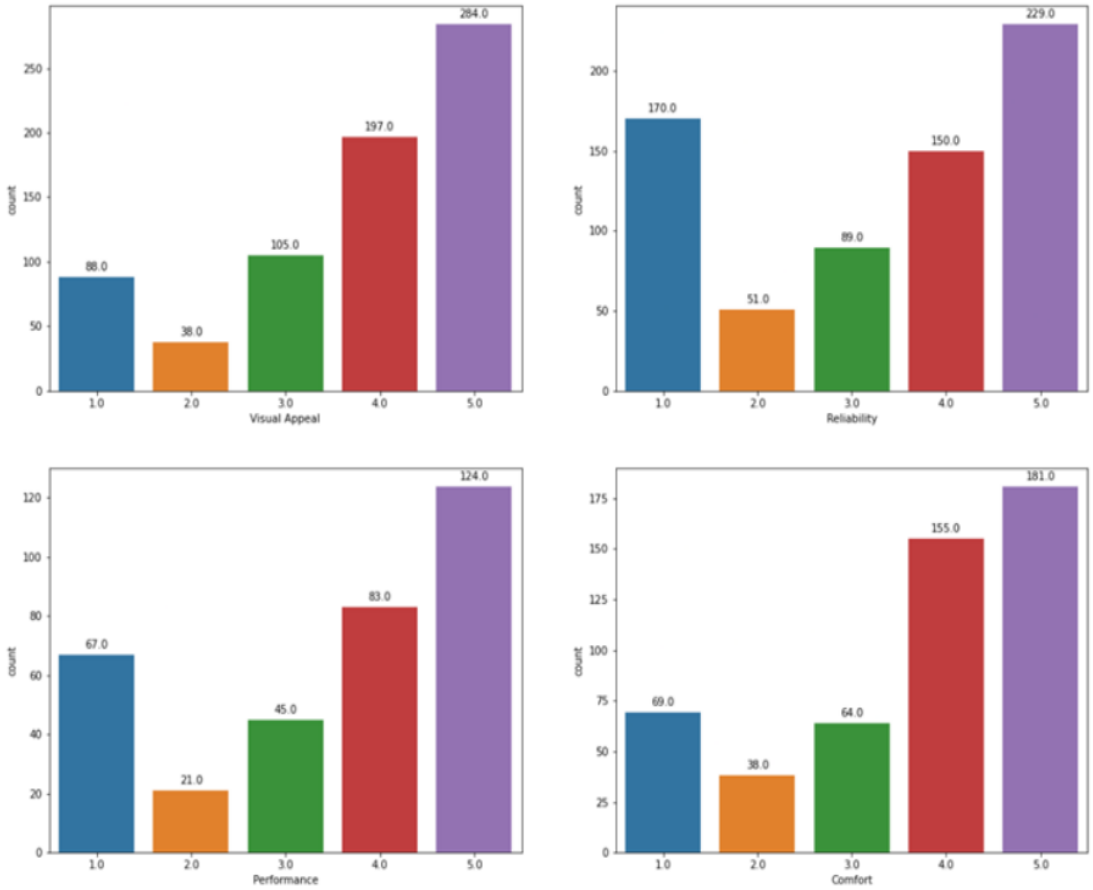


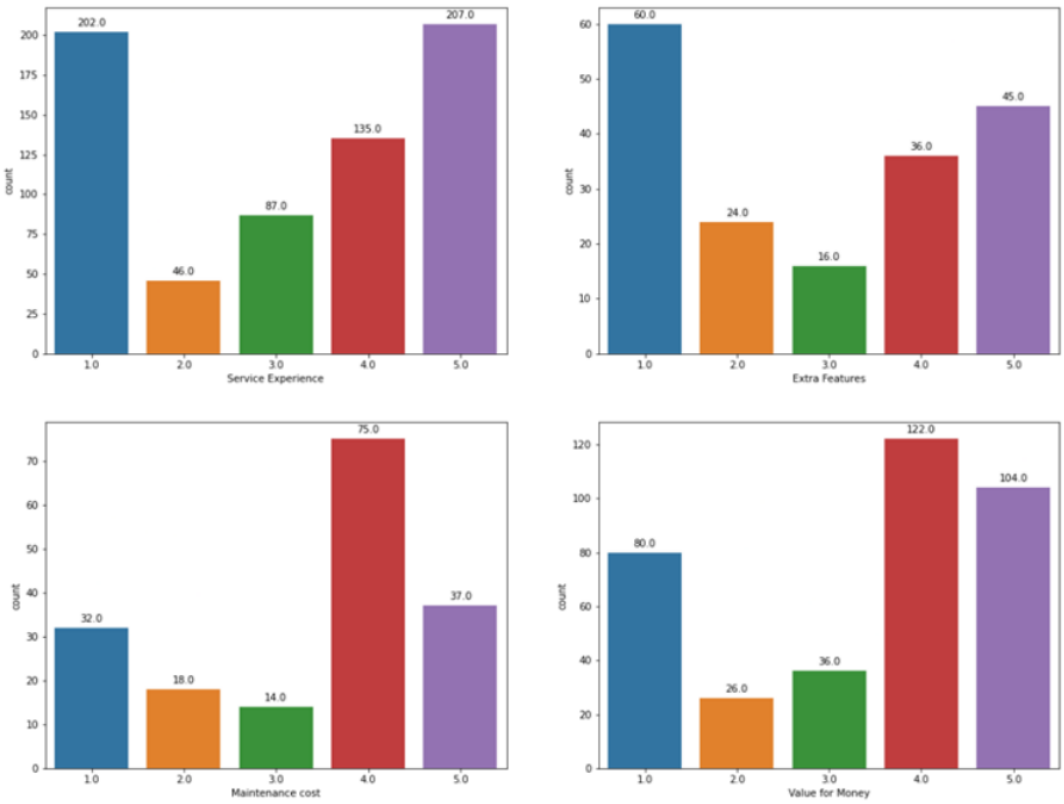
In EV bikes Birla has highest number of variants.



From the above figures we see that Ultraviolette has the highest average price, highest average Power and highest average Mileage.

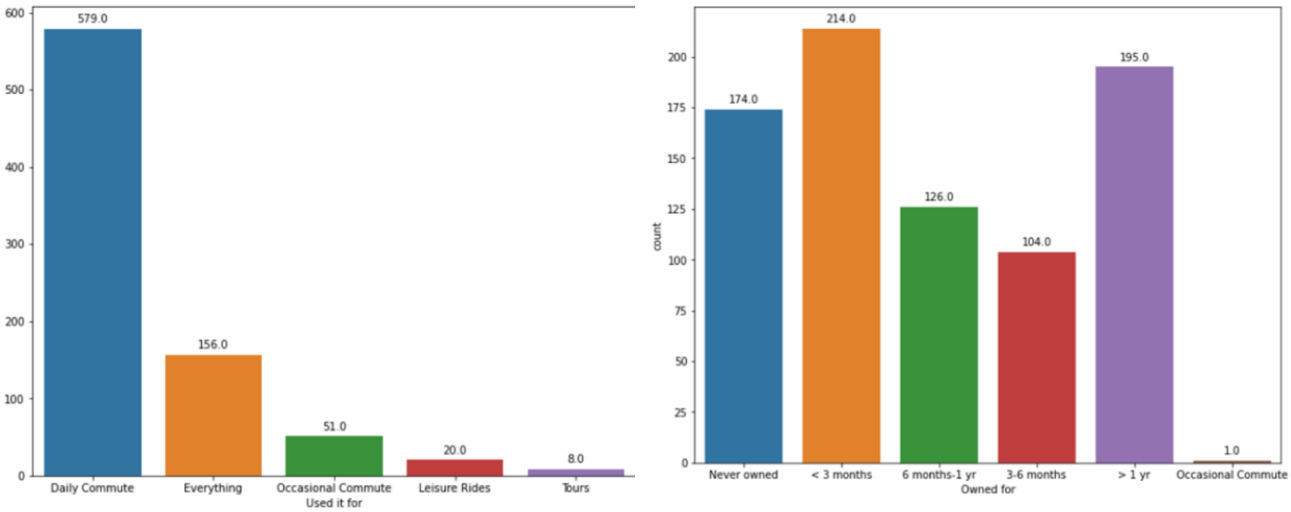
PSYCHOGRAPHIC ANALYSIS



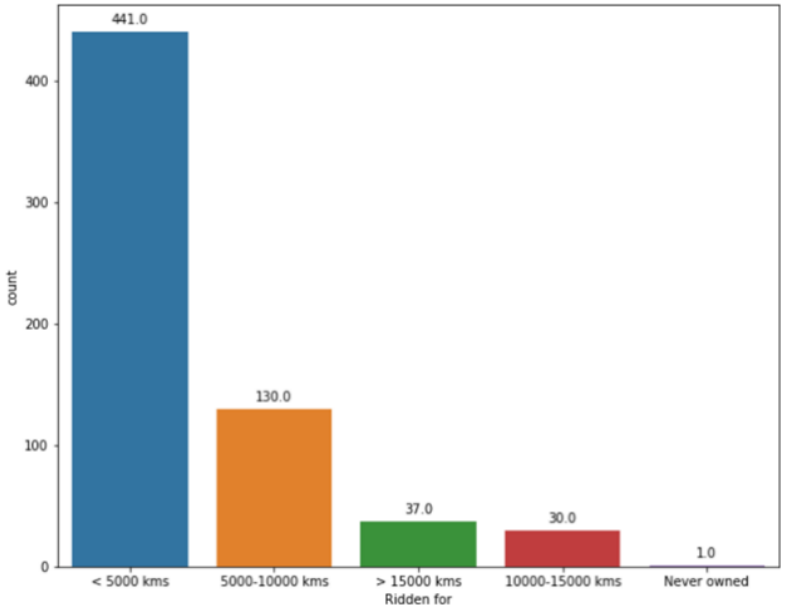


It aims to visualize the rating distribution across different attributes and explore the relationship between ratings and ownership duration or usage purpose. It allows for a quick and concise analysis of user perceptions and satisfaction levels related to various aspects of the bikes. The code explores the relationship between ratings and the duration of ownership as well as the purpose of usage. The annotations on the countplots enhance the readability and provide precise count information for each rating category.

BEHAVIORAL ANALYSIS:



We can see that most users use this for daily commute only and many people who haven't owned an electric bike also posted reviews, shows the interest of people towards EVs.



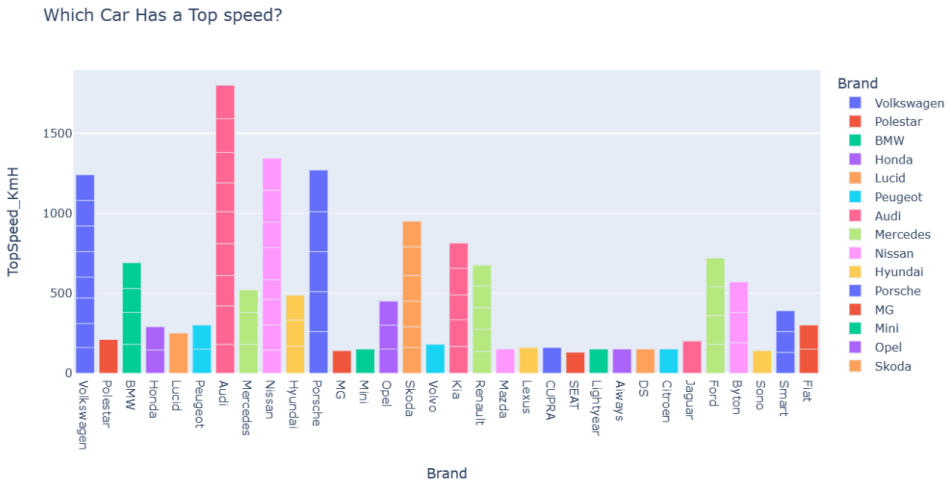
3.3 EV Cars in India

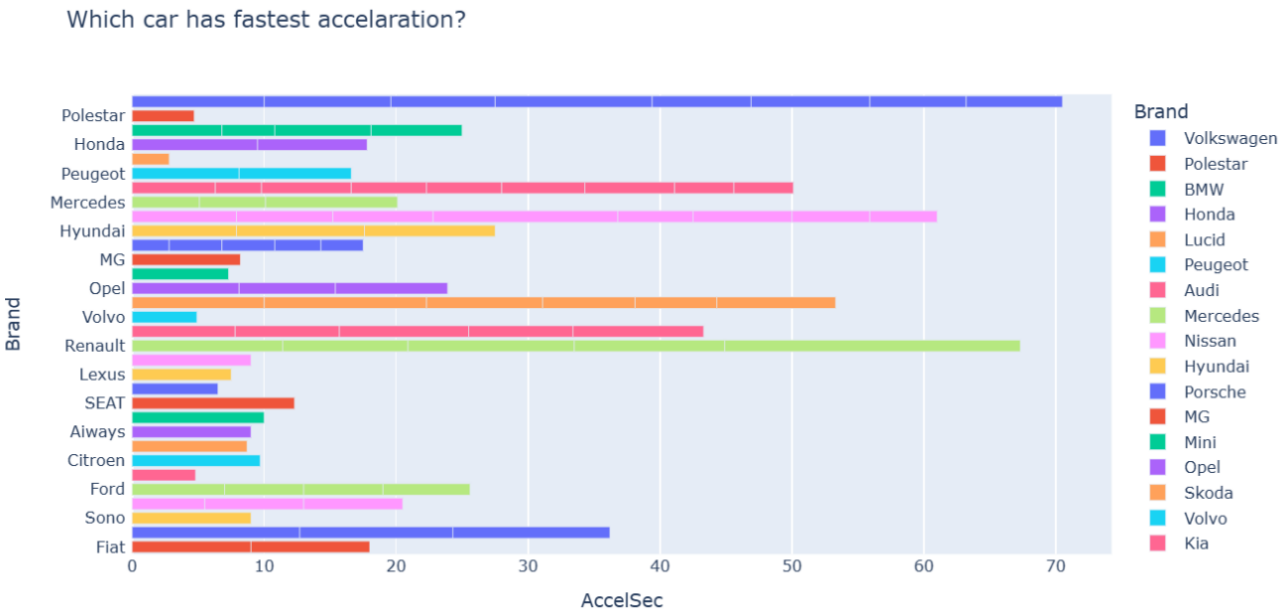
Propelled by robust growth in the two- and three-wheeler segments, electric vehicle (EV) sales surged 2.6 times in 2022-23 to cross the one million-mark for the first time ever. As per the latest numbers, 11.8 lakh EVs were sold during the last financial year. However, data shows that despite tax incentives, the sales of electric-powered passenger and commercial vehicles continue to be tepid.

While EVs are making a dent in the two-wheeler and three-wheeler segments, the share of passenger cars and commercial vehicles is a meagre 4.2 per cent in the total electric vehicles sold.

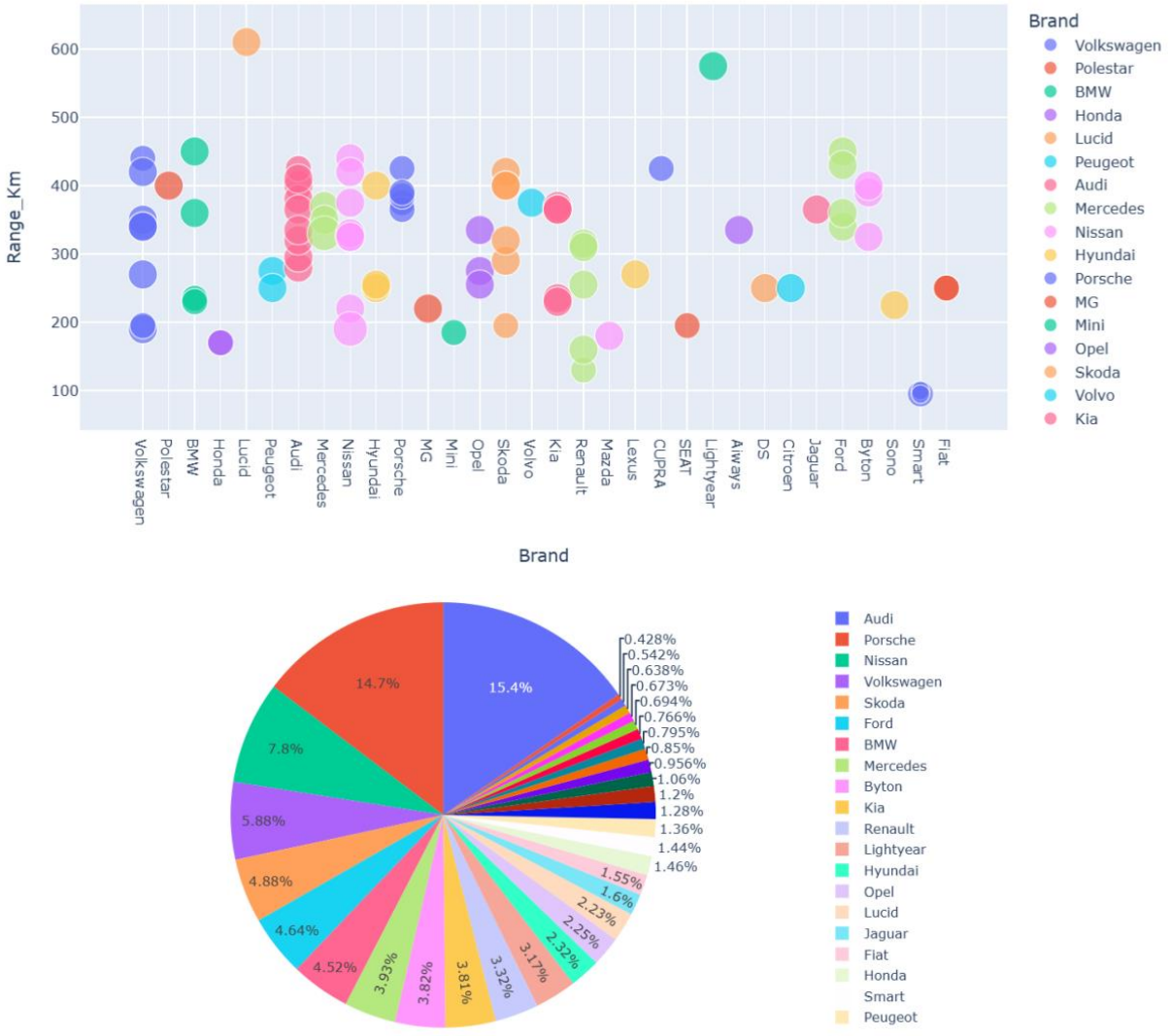
3.3.1 EV vehicles specification segmentation

EV vehicle specification segmentation is a market segmentation approach that categorizes electric vehicles (EVs) based on their specific specifications and features. It involves dividing the EV market into distinct segments based on factors such as battery range, charging capabilities, vehicle size, performance, technology features, and price range. By segmenting EVs based on their specifications and features, marketers and manufacturers can tailor their marketing strategies and product offerings to cater to specific consumer needs and preferences. This segmentation approach helps address the diverse requirements of EV buyers, enabling targeted marketing, product positioning, and the development of EV models that align with specific market segments.

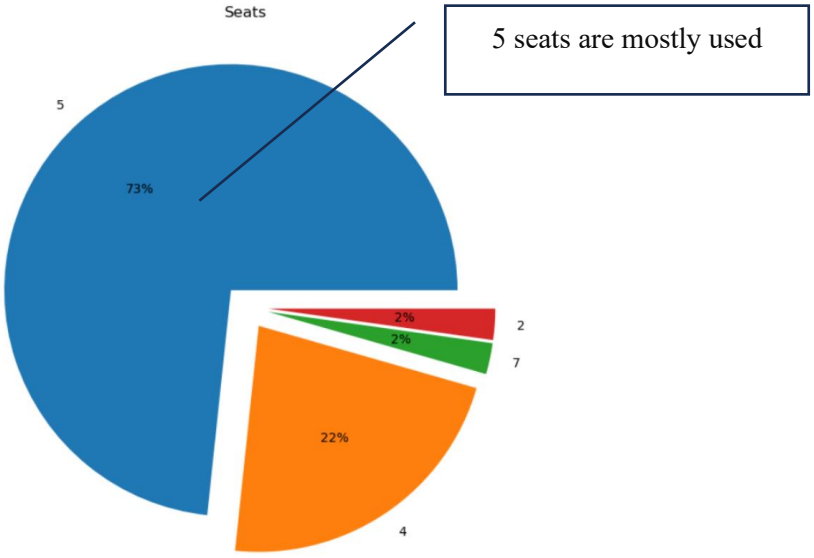


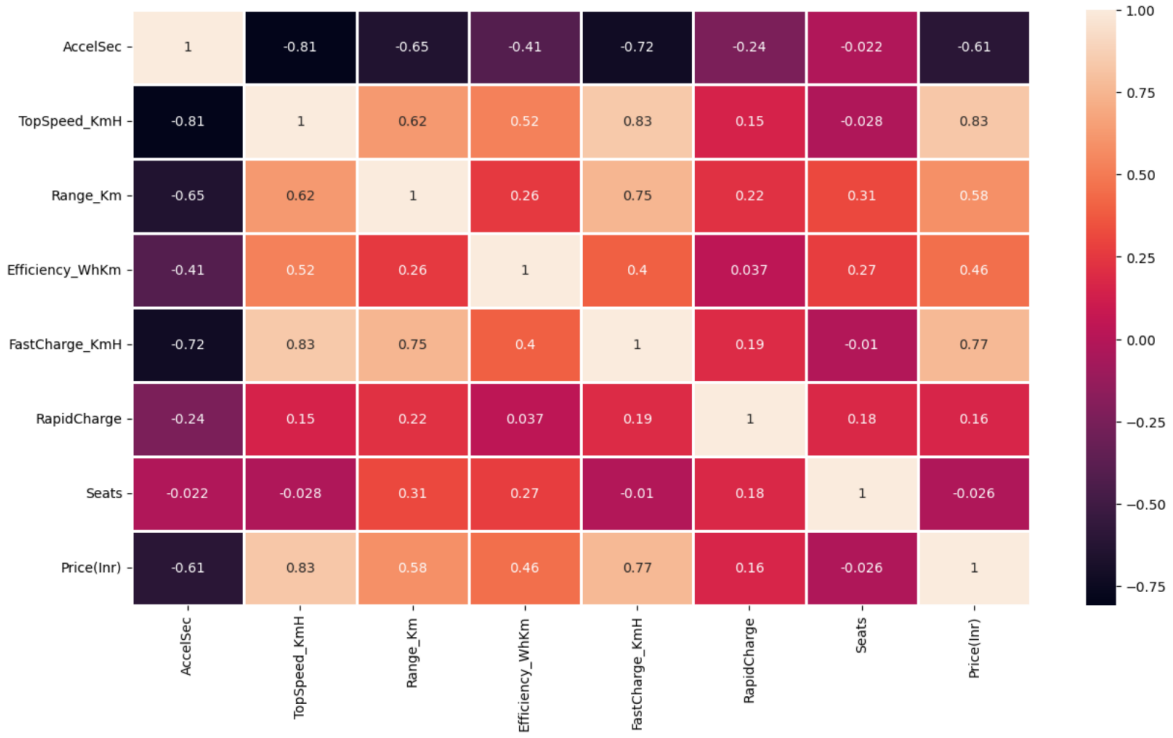


We see that Audi brand car has maximum speed. Also, Nissan, Porsche has high speed car. Volkswagen cars have maximum acceleration per second. Also, Nissan, Renault have high acceleration.

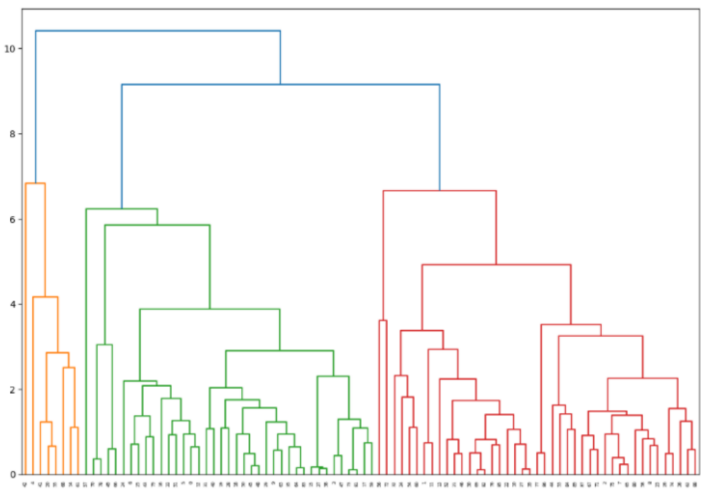


From scatter plot we see that Lucid brand car gives maximum range of journey. Also, Lightyear brand car gives high range journey. In pie chart we see that Audi, Porsche, Nissan brand car has high price.



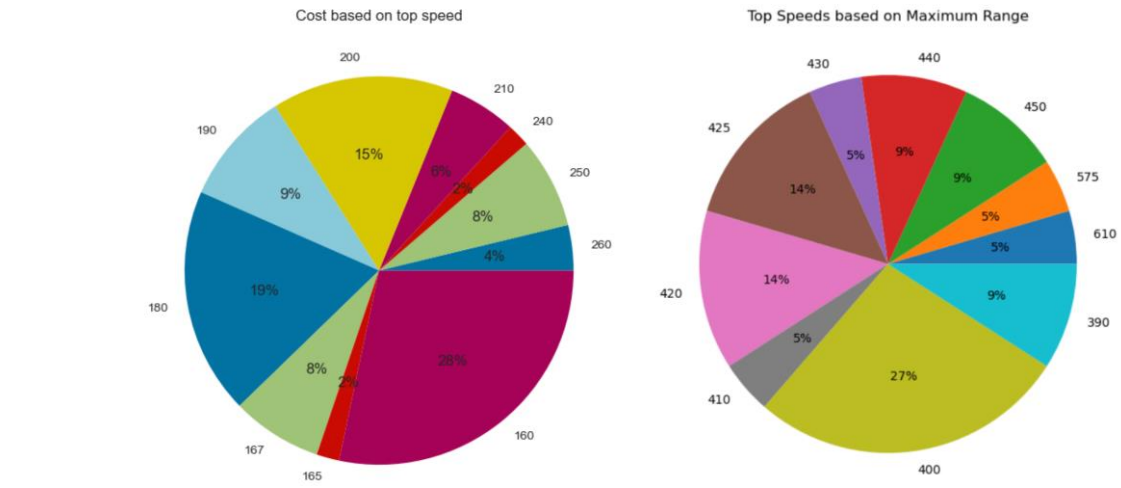


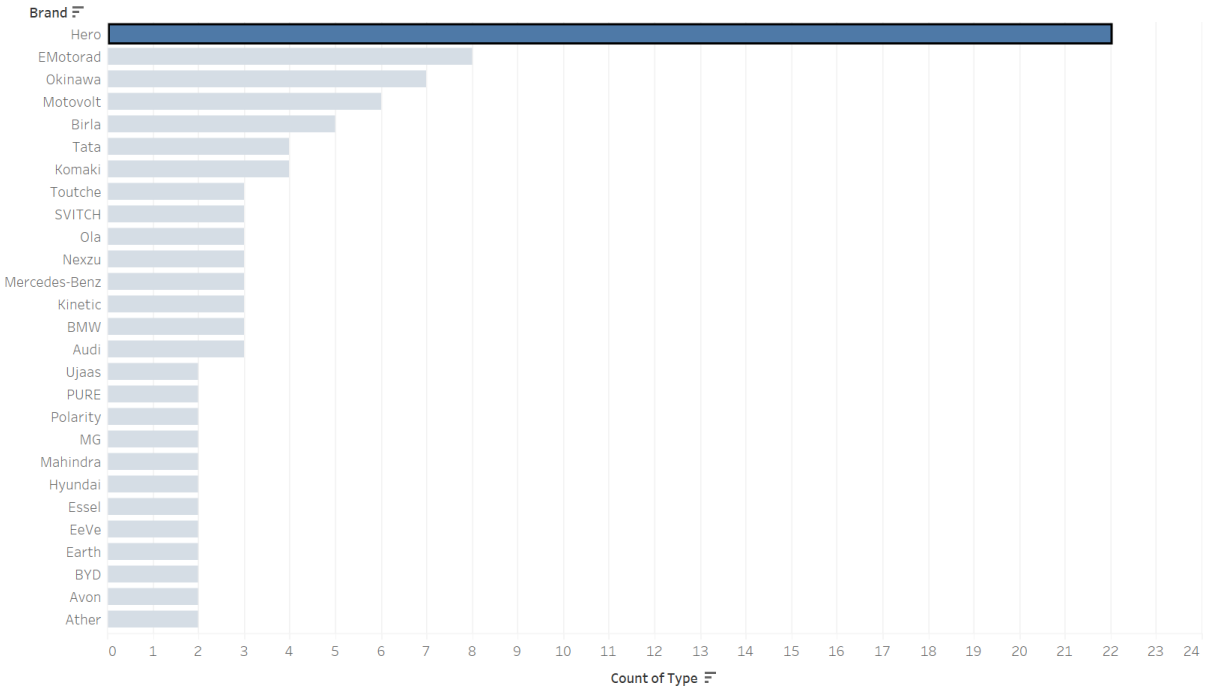
Segment Extraction by Hierarchical Clustering:



Three unique clusters have been discovered by the clustering process:

- Cluster 0 with a business ranking of under 14.
- Cluster 1 with a business ranking of 15 to 24.
- Cluster 2 having a business ranking of at least 24.





From the above figure we see that, most of EV cycles, EV bikes, EV scooters and EV cars are from Hero in India.

3.3.2 Target Segments

So, from the analysis we can see that the optimum targeted segment should be belonging to the following category:

- Mostly from our analysis there are cars with 5 seats.
- Top Speed & Range: With a large area of market the cost is dependent on Top speeds and Maximum range of cars
- From above analysis the price range between 1800000 16000000.

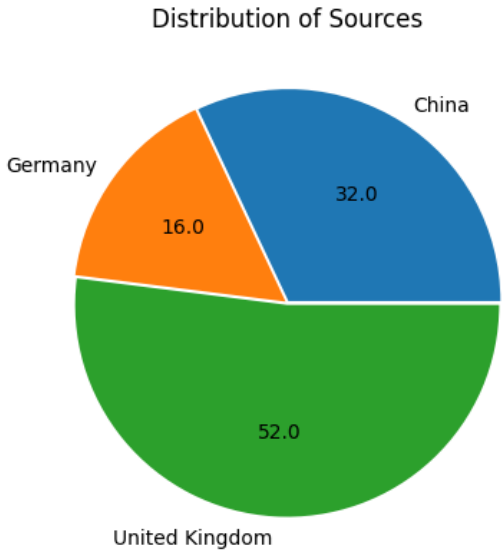
Finally, our target segment should contain cars with most Efficiency, contains Top Speed and price between 18 to 160 lakhs with mostly with 5 seats.

3.3.3 Customizing marketing Mix

It helps understand what our product or service can offer to our customers and helps plan a successful product offering. Helps with planning, developing and executing effective marketing strategies. Help determine whether your product or service is suitable for your customers.

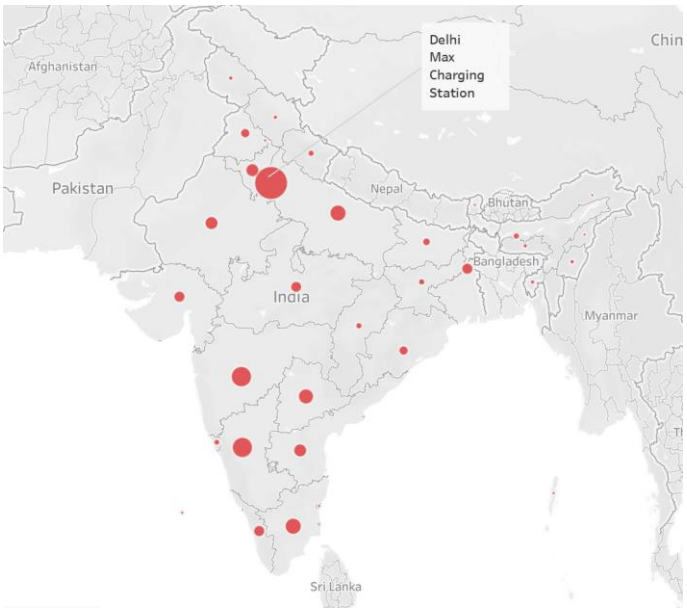
- Product: Since the company is starting with EVs, the product should manage all the concerns that have been mentioned.
- Price: Price will largely depend on service parts and battery cost, i.e., whether company sources them locally or imports them.
- Place: Through the analysis we have seen that southern states are the best suitable for the company to register initial high sales.
- Promotion: Promotion can be based on the analysis. More offers and promotions can be given to the segments that are more valuable to the company. New start up should focus on the range and affordability of the e-vehicle.

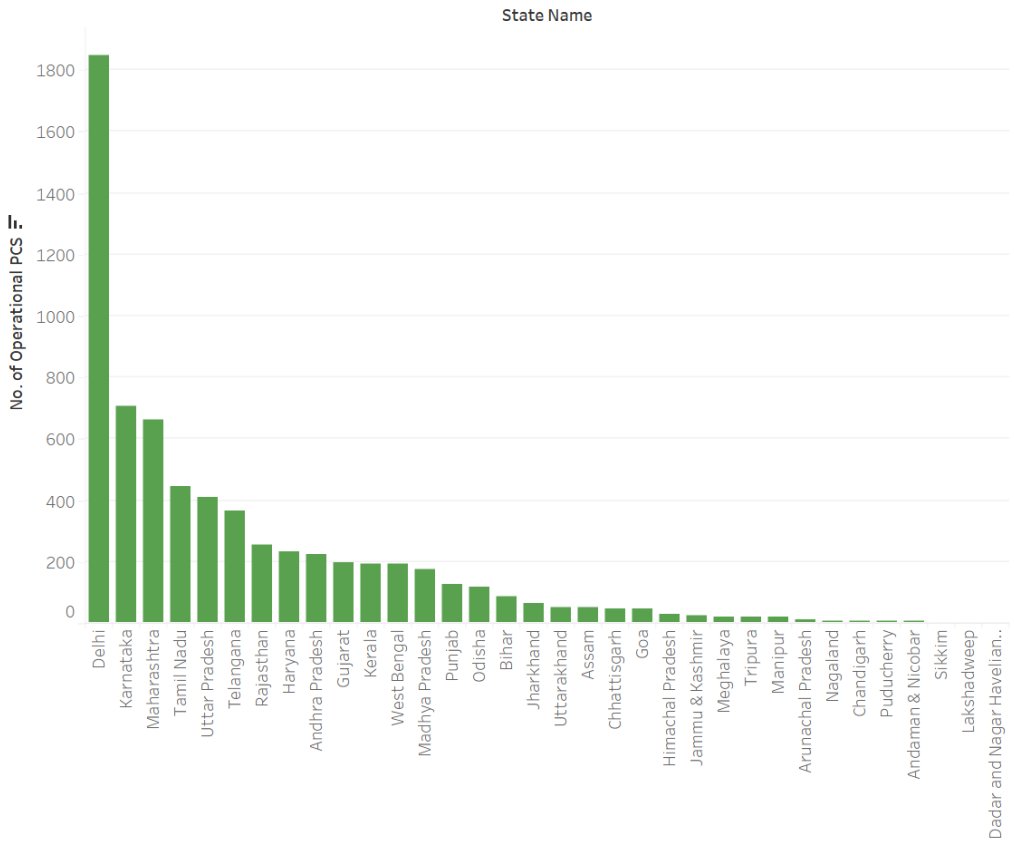
EV Parts Export in India Analysis:



Most of the spare parts are coming from United States.

EV Cars Charging Station:





From the above figures see that Delhi has the maximum number of charging Station.

4 Conclusion

In conclusion, the electric vehicle (EV) market segments in India are experiencing significant growth and potential. Several key factors contribute to the development and adoption of EVs in the country:

- **Government Initiatives**: The Indian government has implemented various policies and initiatives to promote EV adoption. This includes financial incentives, subsidies, and tax benefits for EV manufacturers, as well as the development of charging infrastructure across the country.
- **Increasing Awareness**: There is a growing awareness among Indian consumers regarding the environmental benefits of EVs, including reduced emissions and lower pollution levels. This awareness is driving the demand for EVs, especially among environmentally conscious individuals and organizations.
- **Cost Reduction**: Over time, the cost of EVs, including batteries, has been decreasing, making them more affordable for the Indian market. This reduction in costs, coupled with the availability of government incentives, is making EVs a viable option for a wider range of consumers.
- **Urban Commuting and Ride-Sharing**: India's urban areas, particularly major cities, are witnessing a surge in demand for EVs for commuting and ride-sharing purposes. The lower operating costs and the ability to navigate through congested traffic make EVs an attractive option for urban dwellers.
- **Two-Wheeler Dominance**: The two-wheeler segment holds significant potential for EV adoption in India. With a large population reliant on two-wheelers for transportation, the introduction of affordable electric scooters and motorcycles is gaining traction, particularly in urban and semi-urban areas.

- **Public Transport**: Government agencies and public transport operators are gradually transitioning to electric buses, taxis, and rickshaws. This shift not only helps reduce emissions but also showcases the benefits of EVs to the general public, encouraging further adoption.
- **Charging Infrastructure**: Although still developing, the charging infrastructure for EVs in India is improving. Efforts are underway to establish more charging stations, both public and private, across major cities and highways, addressing the range anxiety concerns of potential EV buyers.

While the EV market in India is promising, there are still challenges to overcome, including battery technology advancements, infrastructure expansion, and public awareness. However, with continued government support, technological advancements, and growing consumer interest, the EV market segments in India have a bright future ahead.

5 References

[1] IEA, "*Global EV Outlook 2023*," IEA (2023), Paris, 2023.

[2] S. Dolnicar, B. Grün and F. Leisch, Market *Segmentation Analysis : Understanding It, Doing It, and Making It Useful*, Springer Singapore, 2018.