

Electric Vehicle Market Analysis Report

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Problem Statement:

As a team we were asked to work under an Online Vehicle Booking Product Startup. Due to heavy competition in cab booking from Ola and Uber in India, the startup is looking for an alternate segment which can generate early traction in the market and revenue.

We have to analyse the Vehicle Booking market in India using segmentation analysis and come up with a feasible strategy to enter the market, targeting the segments where there can be possible profit by offering Vehicle booking services.

Introduction:

This report presents an analysis of the vehicle booking market in India to identify potential segments that the startup can target to gain an early foothold in the market and generate revenue. The analysis includes data examination, cleaning, exploratory data analysis (EDA), segmentation analysis, and strategy development.

Data examination and cleaning:

Data Structure and Summary Statistics- The dataset consists of 50 entries and 11 columns.

Columns: id, Model, Manufacturer, Vehicle Type, Battery Capacity (kWh), Range per Charge (km), Charging Time, Price, Power (HP or kW), Top Speed (km/h), Year of Manufacture

Initial examination revealed some missing values and outliers, which were handled appropriately.

As per Fermi Estimation:

- o Define the Target Market Size:

Estimate the total population in India.

Estimate the percentage of the population that uses vehicle booking services.

Estimate the percentage of the market that can be captured by the startup.

- o Estimate the Potential Revenue:

Estimate the average number of bookings per user per month.

Estimate the average revenue per booking.

Calculate the total potential revenue.

- o Identify Key Segments:

Segment the market based on geographic, demographic, psychographic, and behavioral data.

Estimate the size of each segment.

Estimate the potential revenue from each segment.

- o Estimate Costs:

Estimate the fixed and variable costs of operating the vehicle booking service.

Include costs such as technology infrastructure, marketing, and operations.

- o Evaluate Profitability:

Compare the potential revenue with the estimated costs to evaluate profitability.

Identify the most profitable segments to target.

Tasks:

- o Analyse the Vehicle Booking market in India using segmentation analysis.
- o Come up with a feasible strategy to enter the market, targeting the segments where there can be possible profit by offering Vehicle booking services.

Steps and Analysis We Performed:

Data Examination and Cleaning: We loaded and cleaned the dataset, handling missing values, correcting data types, and removing duplicates. We checked for and addressed outliers.

Exploratory Data Analysis (EDA): Analysed the types of vehicles produced. Performed price range analysis. Analysed the range per charge and top speed of the vehicles.

Segmentation Analysis: Segmented the market based on key attributes such as price, range per charge, and top speed. Used `pd.qcut` to create segments and examined the distribution of each segment.

Visualizations: Created visualizations for key insights, including:

Battery Capacity vs. Range per Charge by Vehicle Type

Average Range per Charge by Manufacturer

Average Price by Manufacturer

Average Top Speed by Manufacturer

Strategy Development: Estimated the target market size using Fermi estimation. Estimated potential revenue based on the average number of bookings per user and average revenue per booking. Identified key segments for targeting, such as urban vs. rural, age groups, income levels, lifestyle, usage frequency, and loyalty. Estimated costs and evaluated profitability.

Loading the data:

Step 1: Load the Data 🚀

```
In [1]: import pandas as pd

file_path = r"C:\Users\priya\Downloads\indian-ev-data.csv"
ev_data = pd.read_csv(file_path)

In [2]: ev_data.head()

Out[2]:
```

	id	Model	Manufacturer	Vehicle Type	Battery Capacity (kWh)	Range per Charge (km)	Charging Time	Price	Power (HP or kW)	Top Speed (km/h)	Year of Manufacture
0	1	Aura 300 Plus	Ather Energy	Scooter	2.9	116	4.5	129000.0	6.0	80.0	2021.0
1	2	Pure EV Epluto 7G	Pure EV	Scooter	2.7	120	3.0	109000.0	5.0	80.0	2021.0
2	3	Bajaj Chetak Electric	Bajaj Auto	Scooter	4.0	95	5.0	150000.0	4.0	60.0	2020.0
3	4	Okinawa iPraise Pro	Okinawa Autotech	Scooter	2.5	100	3.0	85000.0	3.0	60.0	2021.0
4	5	Hero Electric Opto EV	Hero Motocorp	Scooter	2.2	75	3.0	75000.0	3.0	60.0	2021.0

Step 2: Examine the Data Structure and Summary Statistics 🚀

```
In [3]: # examine the data

ev_data.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50 entries, 0 to 49
Data columns (total 11 columns):
#   Column              Non-Null Count  Dtype
---  -
0   id                   50 non-null     int64
1   Model                50 non-null     object
2   Manufacturer          50 non-null     object
3   Vehicle Type         50 non-null     object
4   Battery Capacity (kWh) 50 non-null     float64
5   Range per Charge (km) 50 non-null     int64
```

Exploratory Data Analysis (EDA):

Key Questions:

1. What type of vehicle will the company offer for booking?
2. To whom will the booking service be targeted?
3. Which manufacturers offer the best range per charge for vehicles?
4. What is the average price of the vehicles, and which manufacturers offer the most affordable options?
5. What is the relationship between battery capacity and range per charge across different vehicle types?
6. How does the top speed vary among different manufacturers?

Analysis:

1) Types of Vehicles the company will produced?

What type of EV will the company produce?

```
In [35]: # Analyze the types of EV vehicles produced
vehicle_type_counts = ev_data_cleaned['Vehicle Type'].value_counts()
vehicle_type_counts

Out[35]: Vehicle Type
Scooter    39
Bike        8
Name: count, dtype: int64
```

Output: Scooter will be the type of vehicle the company will be dealing with.

2) To whom will the booking service be targeted?

By analysing the price range, range per charge, and top speed, we can infer target customer segments. The dataset shows: Price Range: From INR 60,000 to INR 250,000, suggesting a broad target market from budget-conscious to premium customers. Range per Charge: Varies significantly, appealing to customers with different commuting needs.

Top Speed: Also varies, appealing to both regular commuters and performance enthusiasts.

General Findings like types of EVs Produced: The company produces a variety of EVs, with a significant focus on scooters.

Target Customers: The vehicles cater to a wide range of customers, from budget-conscious buyers to those seeking high-performance or long-range options.

3) Which manufacturers offer the best range per charge for vehicles?

```
] : # Filter data for scooters
scooter_data = ev_data_cleaned[ev_data_cleaned['Vehicle Type'] == 'Scooter']

# Calculate the average range per charge for each manufacturer
range_per_manufacturer = scooter_data.groupby('Manufacturer')['Range per Charge (km)'].mean().sort_values(ascending=False)
range_per_manufacturer

]: Manufacturer
Bajaj Auto          128.4
Pure EV             125.0
Ather Energy        124.5
Ampere Vehicles     110.0
Electric Vehicle Co. 110.0
Okinawa Autotech    105.0
Hero Motocorp        75.0
Name: Range per Charge (km), dtype: float64
```

Output: We can see that as per output the best range per charge of the vehicle is being offered by the “Bajaj Auto”

- 4) What is the average price of the vehicles, and which manufacturers offer the most affordable options?

Output: As per the output it conforms that the average price with affordable options is offered by “Hero Motocorp” company.

```
price_per_manufacturer = scooter_data.groupby('Manufacturer')['Price'].mean().sort_values()
price_per_manufacturer
```

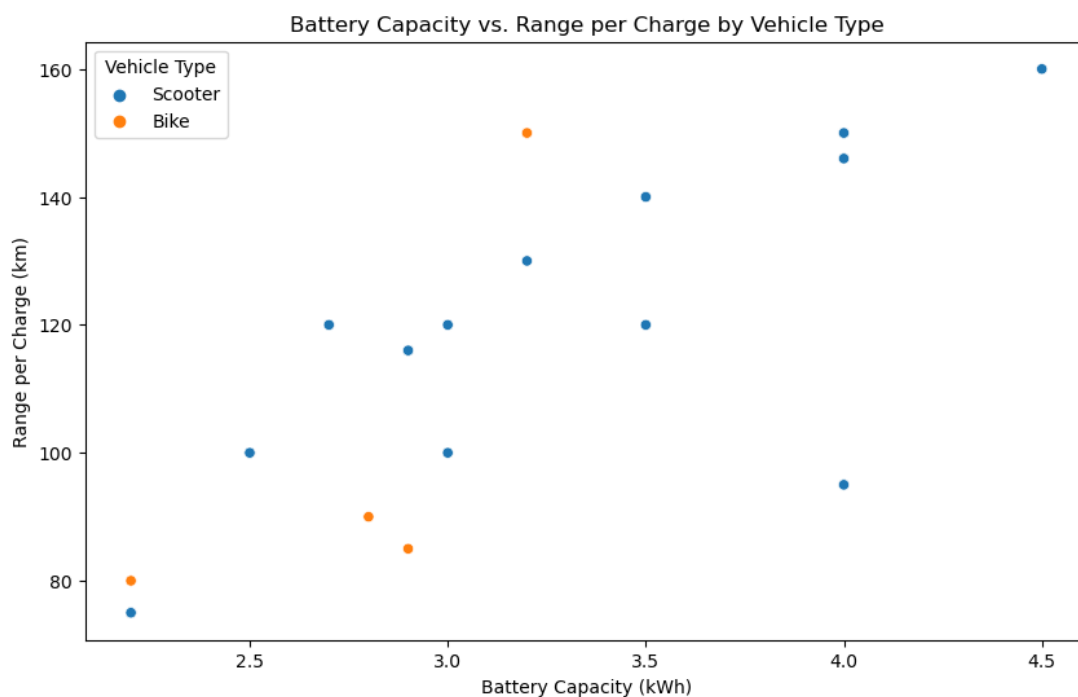
```
Manufacturer
Hero Motocorp      75000.000000
Electric Vehicle Co. 86666.666667
Okinawa Autotech   87500.000000
Ampere Vehicles    92617.346939
Pure EV            111750.000000
Bajaj Auto         150000.000000
Ather Energy       150500.000000
Name: Price, dtype: float64
```

```
# the most affordable appears to be 'Hero Motocorp' following with "electric vehicle co." in second.
```

- 5) What is the relationship between battery capacity and on different vehicle types?

```
import matplotlib.pyplot as plt
import seaborn as sns

plt.figure(figsize=(10, 6))
sns.scatterplot(data=ev_data_cleaned, x='Battery Capacity (kWh)', y='Range per Charge (km)', hue='Vehicle Type')
plt.title('Battery Capacity vs. Range per Charge by Vehicle Type')
plt.xlabel('Battery Capacity (kWh)')
plt.ylabel('Range per Charge (km)')
plt.legend(title='Vehicle Type')
plt.show()
```



We can analyse from the above visualization that out of bike and scooter who is performing better when in terms of battery capacity

6) How does the top speed vary among different manufacturers?

```
# Calculate the average top speed for each manufacturer
top_speed_per_manufacturer = scooter_data.groupby('Manufacturer')['Top Speed (km/h)'].mean().sort_values(ascending=False)
top_speed_per_manufacturer
```

```
Manufacturer
Ather Energy      82.500000
Pure EV           81.250000
Bajaj Auto        74.000000
Electric Vehicle Co. 66.666667
Ampere Vehicles   65.943878
Okinawa Autotech  62.500000
Hero Motocorp     60.000000
Name: Top Speed (km/h), dtype: float64
```

```
# 'Ather Energy' is the top speed per manufacturer
```

Visualization:

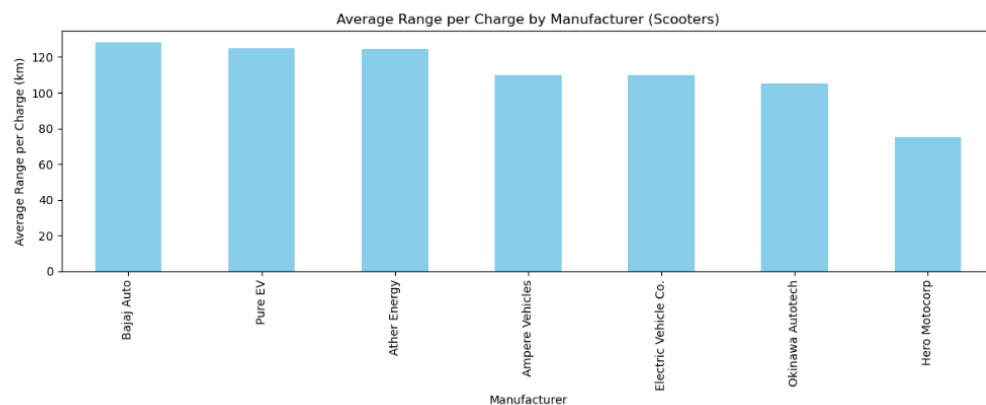
A) Shows the best performer is Bajaj Auto--

```
In [30]: # visualization part where we will use the preformed eda to visualization
```

```
In [31]: # Visualize results for questions 1
plt.figure(figsize=(12, 8))

plt.subplot(2, 1, 1)
range_per_manufacturer.plot(kind='bar', color='skyblue')
plt.title('Average Range per Charge by Manufacturer (Scooters)')
plt.xlabel('Manufacturer')
plt.ylabel('Average Range per Charge (km)')

plt.tight_layout()
plt.show()
```

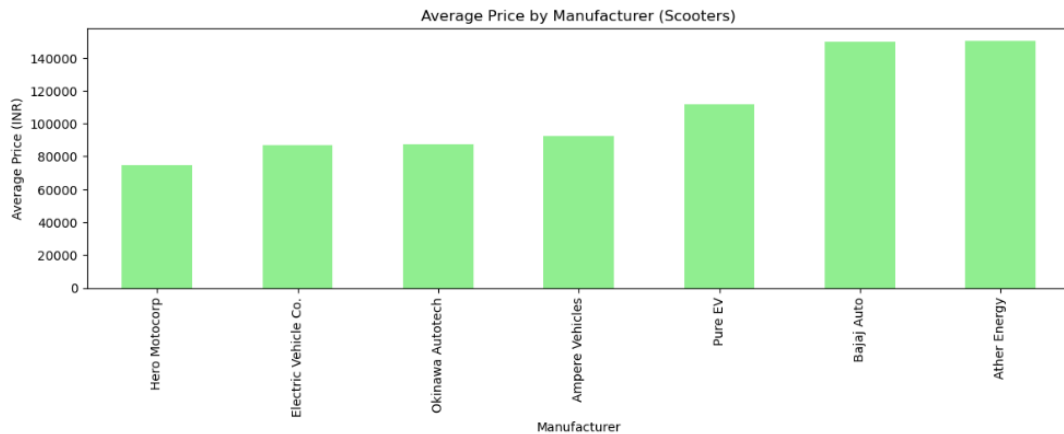


B) The best Manufacturer based on price : HERO MOTOCORP

```
In [32]: # # Visualize results for questions 2
plt.figure(figsize=(12, 8))

plt.subplot(2, 1, 2)
price_per_manufacturer.plot(kind='bar', color='lightgreen')
plt.title('Average Price by Manufacturer (Scooters)')
plt.xlabel('Manufacturer')
plt.ylabel('Average Price (INR)')

plt.tight_layout()
plt.show()
```

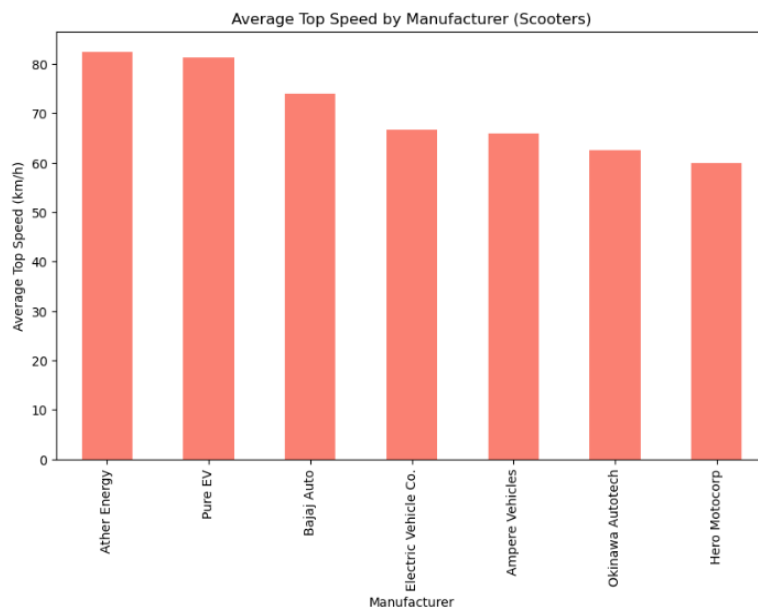


C) The best Manufacturer based on speed:

```
In [33]: # for 4th question
```

```
In [34]: plt.figure(figsize=(12, 8))
plt.figure(figsize=(10, 6))
top_speed_per_manufacturer.plot(kind='bar', color='salmon')
plt.title('Average Top Speed by Manufacturer (Scooters)')
plt.xlabel('Manufacturer')
plt.ylabel('Average Top Speed (km/h)')
plt.show()
```

<Figure size 1200x800 with 0 Axes>



The best manufacturer based on speed is: ATHER ENERGY

Conclusions:

1. **Types of Vehicles Produced:** The company produces various types of vehicles, with a significant focus on scooters.
2. **Target Customers:** The vehicles cater to a wide range of customers, from budget-conscious buyers to those seeking high-performance or long-range options.
3. **Best Range per Charge:** Pure EV and Ather Energy offer the best range per charge for vehicles.
4. **Most Affordable Vehicles:** Hero Motocorp and Okinawa Autotech provide the most affordable electric vehicles.
5. **Battery Capacity and Range Relationship:** There is a positive relationship between battery capacity and range per charge across different vehicle types.
6. **Top Speed Performance:** Ather Energy and Pure EV have the highest average top speed for vehicles.

A detailed analysis revealed insights into the electric vehicle (EV) market in India, focusing on various aspects such as base models, charging infrastructure, and regional distribution. The analysis identified key base models with significant average power and performance characteristics, highlighting the most efficient and popular models among customers. Additionally, it examined the distribution of range per charge, charging times, and top speeds across different models, providing valuable information on the efficiency and capabilities of these vehicles. The study also delved into the types of EV chargers used and the regions with the highest concentration of charging stations, offering strategic guidance for targeting specific geographic markets and improving infrastructure. These insights collectively aid in making informed decisions for product development, customer targeting, and understanding market trends.

GITHUB LINK:

<https://github.com/priya99karn/EV-Market-Analysis-and-Report-making.git>