India's Electric Vehicle Market Segmentation

Introduction

India is going through a major shift in how people travel, with more and more people choosing to use Electric Vehicles (EVs). This change is being driven by factors like more people living in cities, a growing population, and people having higher incomes. Among EVs, electric two-wheelers (like electric scooters and motorcycles) have become very popular because they are affordable and widely accepted by consumers.

These electric two-wheelers are changing the way people move around in India. They offer a clean and environmentally friendly solution to the problems of pollution and greenhouse gas emissions. The Indian government has played a big role in promoting this change by implementing policies that support local manufacturing and create a strong network of manufacturers, dealers, and service providers.

In 2023, the electric two-wheeler market in India has reached new heights, showing the success of these efforts and the growing acceptance of clean mobility solutions. This study takes a deep dive into this transformation, focusing on the electric vehicle industry, with a special emphasis on electric two-wheelers.

By combining information about consumer behaviour, psychological factors, and detailed vehicle specifications, we provide recommendations on pricing for EVs. This comprehensive approach aims to help consumers, policymakers, and industry stakeholders alike. By understanding the diverse aspects of consumer behaviour and preferences, this study sheds light on the path toward a sustainable, environmentally conscious, and consumer-centric electric transportation system in India.

Abstract

This project provides an in-depth analysis of India's electric vehicle market, focusing on market segmentation based on sales data, customer reviews, and technical specifications. The study highlights the rapid growth of India's two-wheeler market, establishing it as a primary source of revenue. By analysing customer reviews and their behavioural patterns, a thorough market segmentation analysis was conducted using the widely used k-means algorithm. The analysis successfully divided the market into four distinct segments.

Segment 1 emerged as the most crucial segment, constituting a substantial 39% of the consumer base. This segment not only represents a significant market opportunity but also serves as the optimal target for the venture. The analysis guided the recommendation of specific electric two-wheeler technical specifications tailored to meet the preferences of Segment 1 consumers. The recommended specifications align perfectly with the demands of this segment, making them central to the approach.

Moreover, the recommended price range closely aligns with the median values, ensuring affordability and competitiveness. This strategic alignment with Segment 1, identified as the potential early market customer base, positions the venture optimally within India's electric vehicle landscape.

The Problem

Our startup wants to enter the Indian market for Electric Vehicles (EVs). We need to figure out the best way to position our EVs by using data from sales, customer reviews (which show customer behaviour and psychology), and technical specs of EVs. Our goal is to use this information to divide the market into different segments and then recommend which segments we should target with our EVs.

The Process

1. Data Collection: We need to gather sales data, customer reviews for EVs, and technical specifications of EVs. We'll check how reliable and complete this data is.
2. Behavioural Segmentation: Using the customer review data, we'll look for patterns in customer behaviour and use that to divide the market into different segments. We'll estimate the size and characteristics of each segment.
3. Psychographic Analysis: For each behavioural segment, we'll analyse the psychological factors that influence customer preferences and motivations. We'll estimate the psychographic traits and preferences of customers in each segment.
4. Technical Specs and Pricing: We'll look at the technical specifications of EVs within each identified segment. We'll estimate how much impact these technical features have on customer preferences and purchasing decisions.
5. Target Segment Selection: Based on the analysis of customer behaviour, psychology, and technical factors, we'll select the segments that we want to target.
6. Marketing Mix: We'll develop a customized marketing strategy specifically for the selected target segments. We'll estimate how effective different marketing tactics will be within each segment, aligning them with customer preferences.
7. Segment Recommendation: Finally, we'll combine all the analysis and marketing recommendations to decide which segments we should target with our EVs.

The overall goal is to use data to understand the Indian EV market, divide it into meaningful segments, and then recommend the best segments for our startup to focus on.

Data Sources and Collection

For this project, I have gathered data from three different sources. The main dataset came from the Society of Manufacturers of Electric Vehicles, covering sales figures of electric two-wheelers, three-wheelers, four-wheelers, and buses from 2017 to 2023. This dataset gave us a broad view of market trends and customer preferences over time.

The second dataset was from bikewale.com, which contained customer reviews of electric two-wheelers. These reviews provided valuable insights into customer behaviour and psychology. Understanding how customers think and what motivates them was crucial for our analysis.

The third dataset, also from bikewale.com, had detailed technical specifications and pricing information for electric two-wheelers. This data helped us assess the technical feasibility and pricing aspects, which are important factors in our market segmentation strategy.

By combining these three datasets, we were able to develop a comprehensive understanding of the electric vehicle market. Real sales data gave us the hard numbers, customer reviews provided qualitative insights into behaviour and psychology, and the technical specifications allowed us to consider the practical aspects of different vehicle models.

Integrating these diverse data sources formed the foundation of our analysis, ensuring that our approach to market segmentation was data-driven and aligned with real market conditions and customer sentiments.

Data Pre-processing

In the data pre-processing phase, we used Python libraries like NumPy, pandas, matplotlib, seaborn, and nltk to systematically prepare the data for analysis.

First, we had to deal with the sales data, which was spread across 10 separate Excel sheets. Using pandas, we merged all these sheets into one unified dataset. We paid close attention to ensuring the names of electric vehicle makers were accurate by carefully replacing any incorrect names.

After consolidating the data, we performed some essential aggregation operations on the electric two-wheeler sales data specifically. This gave us a detailed view of market trends over time.

The next step was to prepare the data for market segmentation analysis. We combined customer reviews and responses with the corresponding technical specifications of electric vehicles. To maintain data quality, we handled any missing or null values by replacing them with specific logical values, ensuring we had a complete dataset to work with.

We then conducted sentiment analysis on the customer reviews using natural language processing capabilities from the nltk library. This analysis provided valuable insights into how customers felt about different aspects of electric vehicles.

After that, we isolated and prepared key behavioural variables such as Visual Appeal, Reliability, Performance, Service Experience, Extra Features, Comfort, Maintenance Cost, and Value for Money. These variables were crucial for our market segmentation analysis, as they helped us understand customer preferences and attitudes towards electric vehicles in depth.

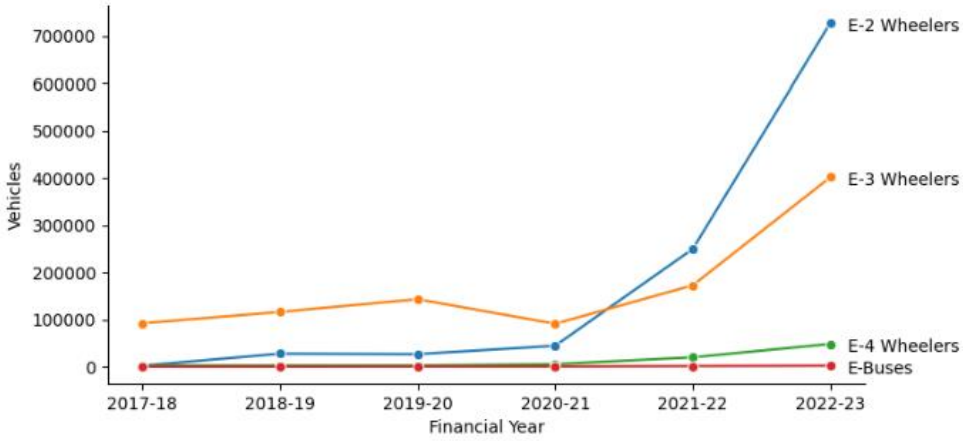
By systematically pre-processing the data, consolidating information from different sources, and extracting relevant variables, we laid a solid foundation for the subsequent market segmentation analysis.

Segment Extraction

Using Sales Data

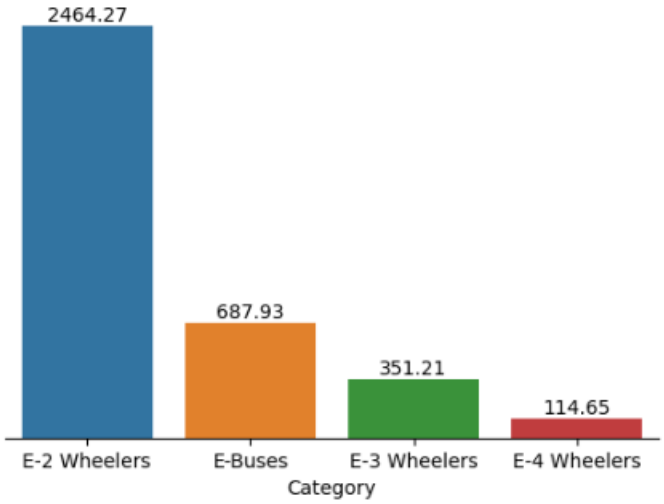
In this section, we performed an in-depth analysis by focusing on three key figures that are significant for understanding India's electric vehicle market.

India’s electric vehicle market



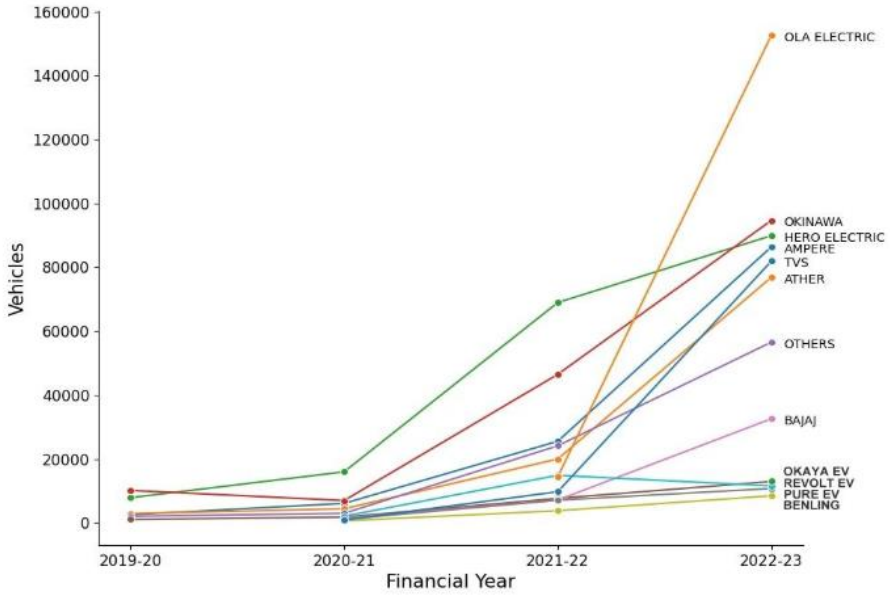
In the above graph we can see the remarkable growth trajectory of India's two-wheeler market in 2023, underscoring its leading position within the industry.

India’s electric vehicle industry in crores



The figure examined the financial aspect of the market, showing the total market value in crores (tens of millions of rupees). Notably, two-wheelers stood out as the primary source of revenue for the industry, highlighting their economic importance.

Top electric two-wheeler companies



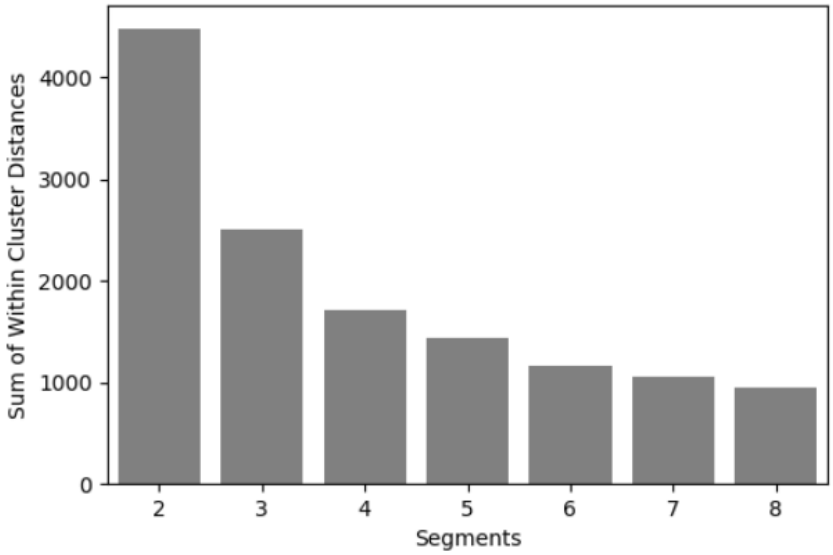
The figure focused on specific electric two-wheeler companies, with Ola Electric standing out as the market leader in 2023. This highlighted the competitive landscape and industry leadership within this segment. After analysing these figures in depth, it became clear that the electric two-wheeler segment was the most promising area for our detailed study. The strong growth, dominant revenue contribution, and established market leaders collectively indicated the prominence and potential of this segment, making it the ideal focus for our in-depth analysis.

Using k-Means

In this next step, we used the standard k-means algorithm to explore how the electric two-wheeler market could be divided into different segments based on customer review data. We systematically tested solutions ranging from two to eight potential market segments. The decision on the optimal number of segments was guided by analysing a scree plot, which showed a distinct "elbow" or inflection point at four segments. This elbow indicated a significant reduction in the distances between data points, suggesting that four segments provided the most natural separation of the data.

By incorporating insights from these analyses, we kept our focus firmly on the electric two-wheeler segment, ensuring that our market segmentation approach was precise and highly relevant to this specific market. The use of the k-means algorithm and the scree plot analysis allowed us to identify the most meaningful segmentation of the customer base within this promising segment.

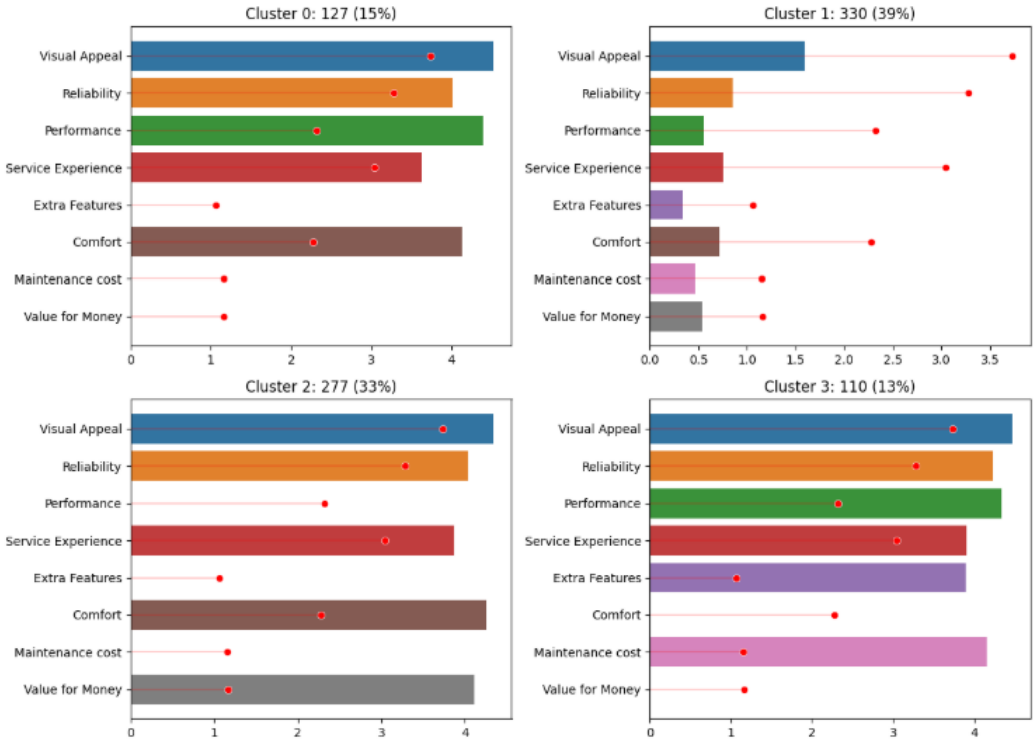
Scree plot for the electric vehicle data set



Profiling and Describing Segmentation

Profiling Segments

Segment profile plot for the four-segment solution.

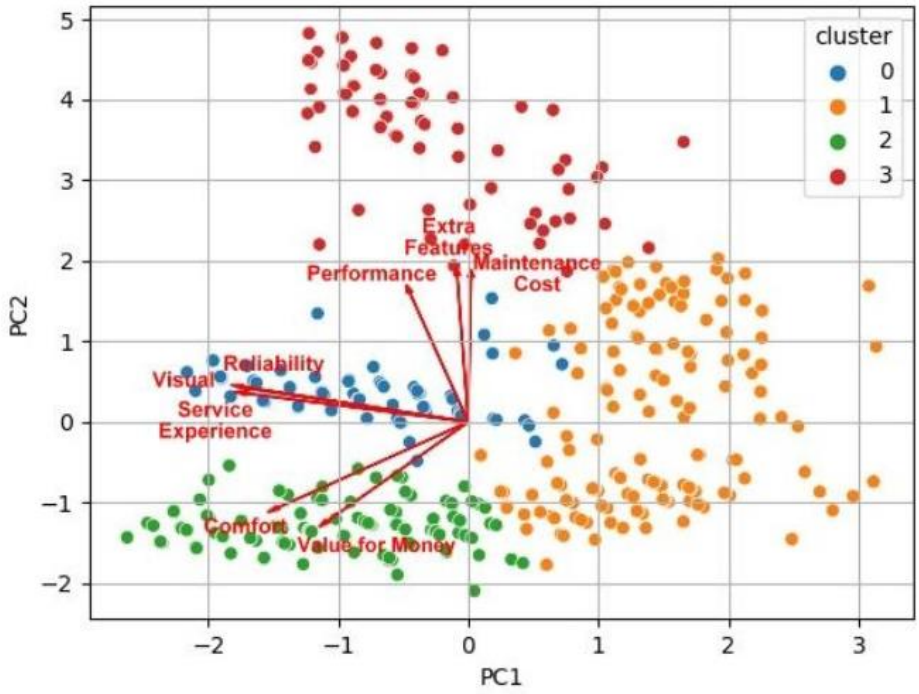


The accompanying figure, which uses principal components analysis, further highlights the differences between the consumer segments. It's noteworthy that Segment 1, despite being the largest group, does not have strong opinions in any particular direction. This lack of satisfaction makes them unique compared to the other segments.

These detailed insights into how each segment perceives and values different aspects of electric two-wheelers play a crucial role in shaping our strategy. By understanding the diverse priorities and values of each segment, we can ensure that our electric vehicle offerings are accurately tailored to meet the specific needs and preferences of different consumer groups in the market.

Analysing these segment differences allows us to align our products and marketing efforts precisely with what consumers in each segment truly want, rather than taking a one-size-fits-all approach. This data-driven understanding of consumer segments is vital for informing our market strategy and offerings effectively.

Segment separation plot using principal components 1 and 2.



Describing Segments

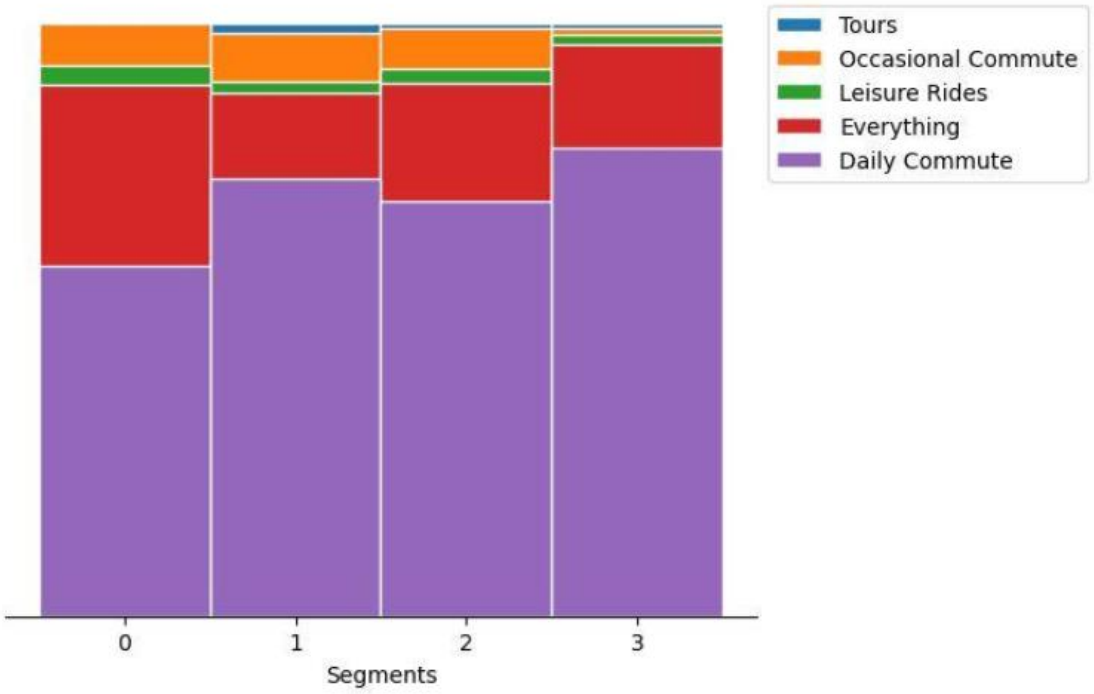
This section provides an overview based on the insights gained from various mosaic plots and graphical representations. Figure 6.3 shows that all consumer segments predominantly use electric two-wheelers for their daily commute, with limited usage for tours, occasional commuting, and leisure rides.

Moving to Figure 6.4, we see how the segments differ in terms of how long they have owned their electric vehicles. Segment 1 stands out as most of these consumers have owned their electric vehicles for more than a year. On the other hand, Segment 0 has

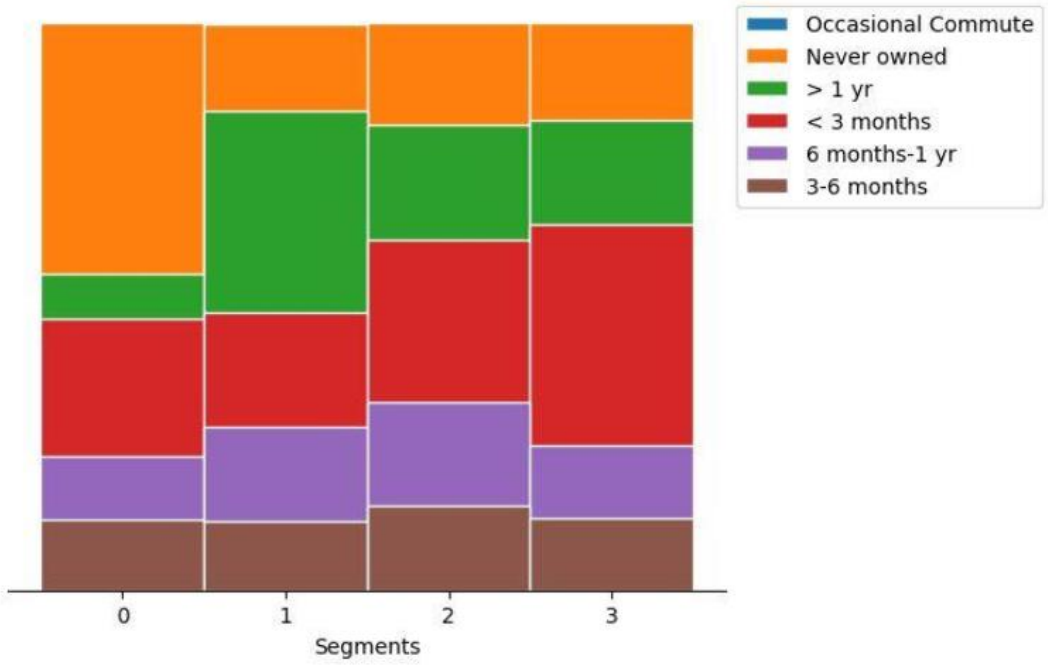
no prior ownership experience at all. Consumers in Segment 2 have a moderate range of ownership duration, from less than 3 months to over a year. Segment 3 consumers are relatively new owners, having had their electric vehicles for only a few days to less than 3 months.

In summary, while all segments mainly use electric two-wheelers for daily commuting, there are clear differences in their ownership experience and duration, ranging from complete newcomers to long-term owners of over a year. Understanding these nuances across segments provides valuable insights for tailoring our products and services.

Mosaic plot showcasing electric vehicle usage patterns across segments.



Mosaic plot depicting the ownership duration of electric vehicles across segments.



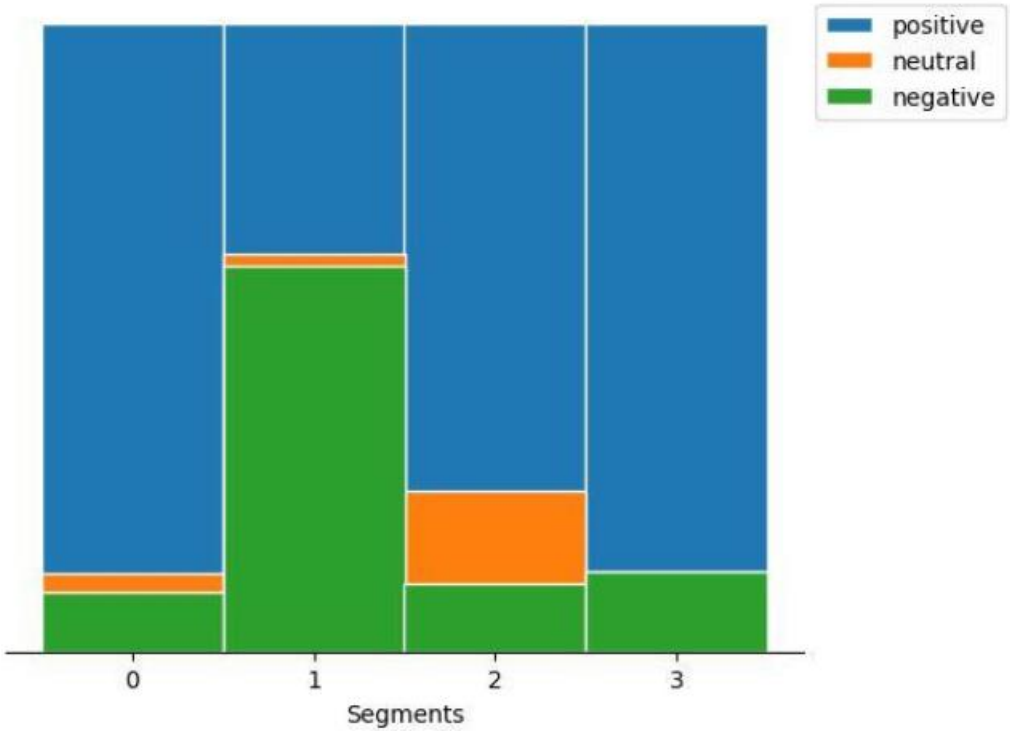
Below figure looks at consumer sentiments and reveals that all segments, except Segment 1, have positive sentiments towards electric two-wheelers. Segment 1 consumers, on the other hand, stand out with negative sentiments, indicating dissatisfaction with various aspects of their experience.

Figure 6.7, a parallel box, and whisker plot, highlights significant differences in average ratings given by each segment. Specifically, Segment 1 consumers express dissatisfaction across all aspects, leading to lower overall ratings from this group compared to others.

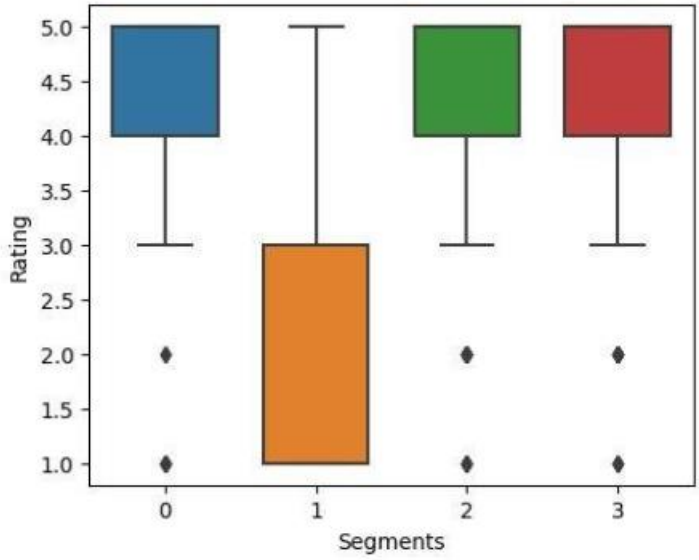
These visual representations provide nuanced insights into the behaviours, emotions, and preferences of consumers in each segment. Segment 1 emerges as a dissatisfied group that requires attention to address their concerns and improve their experience.

Overall, these graphical analyses offer valuable guidance for our strategic decisions, allowing us to tailor our approach in the electric vehicle market more effectively to meet the diverse needs and expectations of different consumer segments.

Mosaic plot displaying consumer sentiments towards electric vehicles



Parallel box-and-whisker plot showcasing consumer ratings across segments.



When analyzing the technical specifications of electric vehicles across different consumer segments, distinct patterns emerge.

Segment 0 tends to prefer higher-priced, premium electric vehicles, as shown in the price range graph. On the other hand, Segment 1 focuses on more budget-friendly

options at lower price points. Segments 2 and 3 also prioritize affordability but with slight differences.

Regarding riding range, Segment 0 prefers electric vehicles with extended ranges, while Segments 1 and 2 focus on moderate ranges suitable for daily commuting. Segment 3 falls in between, catering to consumers who need slightly longer distances.

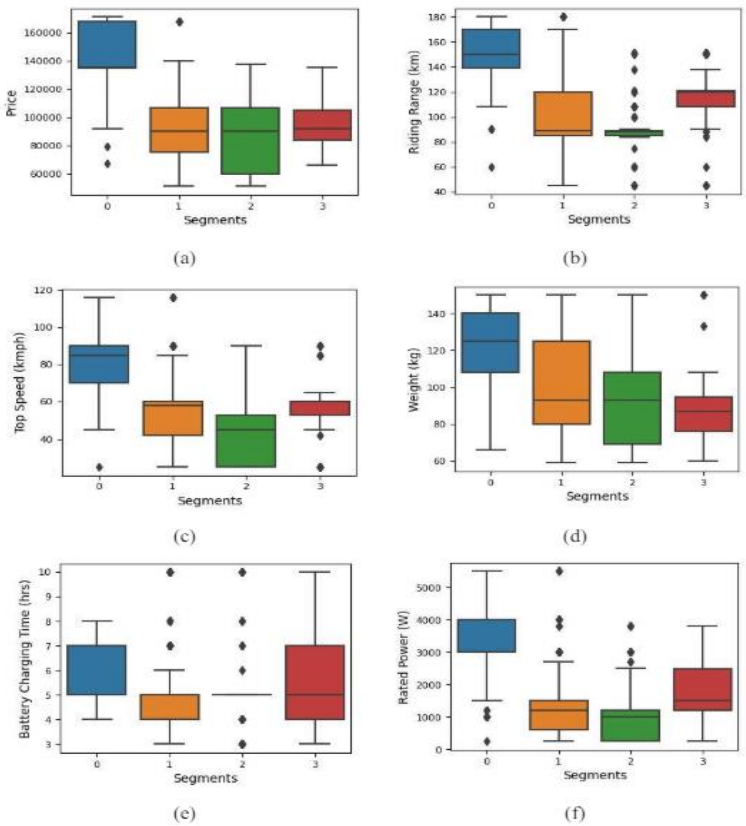
For top speed, Segments 0 and 3 opt for higher-speed vehicles, while Segments 1 and 2 prioritize lower speeds more suitable for city commuting.

When it comes to vehicle weight, Segments 0 and 1 favor slightly heavier vehicles, while Segments 2 and 3 lean towards lighter options, accommodating diverse user preferences.

Lastly, battery charging time shows a notable difference. Segments 0 and 3 opt for slightly longer charging durations, emphasizing the convenience of overnight charging. Segments 1 and 2 prioritize faster charging, catering to users seeking quicker turnaround times.

These technical specification preferences, visually represented in various graphs, underscore the nuanced priorities and needs of each consumer segment, shaping the diverse landscape of the electric vehicle market in India.

Parallel box-and-whisker plot of technical specification of electric vehicle by segment.



Selection of Target Segment

In strategically selecting our target segment for the electric vehicle market, Segments 1 and 2 emerge as potential focal points.

Segment 1, comprising 39% of consumers, represents a vast market base with diverse perceptions and preferences. Our analysis revealed varying sentiments within this segment, indicating their specific demands and priorities. The dissatisfaction expressed across multiple aspects presents an opportunity for us to address their concerns directly. By understanding and resolving the unique issues faced by this significant consumer group, we can improve customer satisfaction and build brand loyalty.

Segment 2, with 33% of consumers, is another attractive opportunity. This segment values aspects like visual appeal, reliability, service experience, and comfort, shaping their expectations. Their feedback provides valuable insights to customize our electric vehicles and align them with these specific preferences. By emphasizing value for money, as desired by this segment, our offerings can create a strong connection with these consumers.

While Segment 1 presents a unique challenge, addressing their dissatisfaction points and crafting vehicles that counter these concerns can yield remarkable results. Simultaneously, understanding Segment 2's positive perceptions gives us a foundation to further enhance the features they appreciate, ensuring a positive customer experience and reinforcing brand loyalty.

By incorporating the distinct perceptions of Segments 1 and 2, our strategy will focus on refining existing features, addressing dissatisfaction points, and enhancing positive elements. Aligning our electric vehicles with the unique expectations of these segments will ensure we meet their specific needs, giving us a competitive edge and enabling sustained market growth.

Customizing the Marketing Mix

In our electric vehicle market strategy, customizing the marketing mix is crucial to appeal to our target Segments 1 and 2.

For Product Customization, we plan to enhance features tailored to the specific desires of each segment. For Segment 1, we'll address dissatisfaction points by improving performance and service experience. For Segment 2, we'll emphasize visual appeal and value for money. We'll offer diverse products within each segment to cater to varied tastes and budgets.

Price Customization involves setting competitive and flexible pricing structures. Segment 1 will benefit from affordable options, while Segment 2 might accept slightly higher prices for value-added features.

Promotion Customization demands targeted advertising, focusing on reliability and service improvements for Segment 1, and aesthetics and affordability for Segment 2.

Tailored promotional events and online campaigns will further engage these segments effectively.

For Place Customization, we'll establish accessible distribution channels in urban areas for Segment 1, and in suburban and semi-urban regions for Segment 2. Strengthening our online presence ensures seamless online purchasing experiences, with virtual showrooms and customer support platforms.

People and Process Customization involves training customer service representatives to address segment-specific concerns empathetically. Efficient processes, streamlined for customization requests and service appointments, will enhance customer satisfaction and brand loyalty.

This tailored approach ensures our electric vehicles resonate with the distinct needs of Segments 1 and 2, fostering market relevance and customer preference.

Potential Early Market Customer Base

When looking at potential customers, we found two main groups. One group, let's call them Segment 1, has 330 people, and the other, Segment 2, has 277 people. We looked at how much they might be willing to pay for our product. For Segment 1, it's somewhere between ₹51,094 and ₹1,67,844, and for Segment 2, it's between ₹51,094 and ₹1,37,890.

To figure out how much money we might make, we multiply the number of people in each group by the price range we think they'll pay. For example, if we set a price of ₹1,20,000 for Segment 1, we could potentially make ₹39.60 crores from that group alone. If we set a price of ₹1,10,000 for Segment 2, we could potentially make ₹30.47 crores.

Segment 1 seems more promising because it has more people and a wider range of potential customers. So, we'll focus our efforts on reaching them first. These calculations show us that there's a big opportunity in these groups, helping us make smart decisions about our plans.

Most Optimal Market Segments

After carefully examining different groups of customers, we've found that Segment 1 is the best one to focus on for our electric two-wheeler vehicles. It includes 39% of all customers and offers us a big opportunity to sell our products. Segment 1 has a lot of potential customers, and they seem to be interested in what we're offering.

We've looked at what these customers want in terms of technical features, and we've come up with a range that we think will meet their needs. This range is outlined in Table. It's important for us to offer the right mix of features and price to attract these customers, and we believe Segment 1 is where we can do that most effectively.

Technical specification of electric vehicle two-wheeler for segment 1

Specification	Recommended Range (in INR)
Price	70,688 – 1,29,063
Riding range	89 - 180 km
Top speed	58 - 116 kmph
Weight	76 - 120 kg
Battery charging time	3 - 5 hours
Rated power	1200 - 5500 W

Conclusion

After studying India's electric vehicle market closely, we've pinpointed Segment 1 as our best target. It's got a big chunk of consumers, around 39%, so there's a great opportunity there. By making sure our electric two-wheelers match what Segment 1 customers want, we're setting ourselves up to appeal to a large group of people.

This choice is based on really understanding how the market is divided, what customers like, and what technical features matter. It gives us a clear roadmap for entering the market, focusing on making products and marketing that fit exactly what Segment 1 customers are looking for.

This approach lays a strong groundwork for us, making sure our electric vehicles fit right in as India's electric vehicle market grows and changes.

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