

# Outlook towards Electric Vehicles by an Indian consumer

Kedar Basutkar<sup>1</sup>, Tanishka Bhatia<sup>2</sup>, Harshad Avhad<sup>3</sup>, Srushti Yadav<sup>4</sup>, Rohit Virkar<sup>5</sup>, Chhavi Kalra<sup>6</sup>, Piyush Kolhatkar<sup>7</sup>, Dattatray Hulwan<sup>8</sup>

<sup>1234567</sup>Student, Vishwakarma Institute of Technology, Pune

<sup>8</sup>Professor, Dept. of Mechanical Engineering, Vishwakarma Institute of Technology, Maharashtra, INDIA

\*\*\*

**Abstract** – Electric Vehicles are a growing segment in Indian Auto Market. With the disastrous effects climate change and rising costs of conventional fuels such as petrol and diesel, an auto buyer in the market is poised to incline towards buying an EV as compared to an IC engine vehicle. This paper takes into account various aspects that a buyer considers while purchasing an EV. These choices reflect upon the what features are highly prioritized by the buyer and what features a buyer might consider as add-on. Hence, the main objective of this survey-based study is to find the overall outlook of an Indian consumer to EVs, to find out what are the order qualifiers and order winners while buying an EV, etc. This study aims to serve designers to align the preliminary design decisions related to EV based on consumer choices.

**Key Words:** Electric Vehicles, Order Qualifiers, Order Winners, Indian Market, Internet Survey.

## 1. INTRODUCTION

This decade is going to be a transformational one as conventional internal combustion engines vehicles are being replaced by electric vehicles (EV). EVs bring along with them a set of promises for a greener and a cleaner environment, but also a set of drawbacks which hamper their adoption. These drawbacks include a short battery life, high initial cost and many more. The survey performed in the Assignment work aims to find out an Indian consumer's perception of EVs and its current overall market.

## 2. LITERATURE SURVEY

Ricardo Strategic Consulting ("Ricardo") conducted a literature review to better understand how and where consumers drive and recharge their electric vehicles (EVs) and what they would like to experience while recharging in terms of site design, amenities, capabilities, and services. Ricardo has also analyzed existing literature to both understand current consumer behavior and anticipate how it could evolve over the next 10 years as more consumers purchase EVs. This exercise has been focused on answering five questions: Who is the customer? 2. When and where does the customer recharge? 3. Why does a customer choose a particular recharging facility? 4. How do customers interact with charging equipment? 5. What do customers do at facilities while charging? This literature review included various publicly available sources such as existing Ricardo research on consumer preferences; published surveys;

federal, state, and local government publications; cross-functional organization publications; scholarly articles; university/institute publications; national lab publications; public policies; and press reports. This was supplemented with persona interviews to exemplify findings. [1] The Main objective of this paper is to know the willingness of people to buy an electric vehicle. Also, the awareness among the people regarding the electric vehicle. Questionnaire survey is done to satisfy the objective. The study area contains 14 wards of panchavati zone (NMC) Nashik Municipal Corporation. Stratified random sampling is use to find out the sample size in each ward and total 500 samples are taken and the analysis is carried out. [2]

## 3. OBJECTIVES OF THE SURVEY

1. To find out the overall outlook of an Indian consumer towards the current state of the Electric Vehicles mainly pertaining to market maturity and charging infrastructure.
2. To find out the patterns in order qualifiers and order winners while buying an EV.
3. To find out the factors which attract as well as offset a consumer from buying an EV.
4. To find out how an average person perceives the likely growth of the EV market in terms of years.

## 4. RESULTS AND DISCUSSION

### 4.1 AGE GROUP

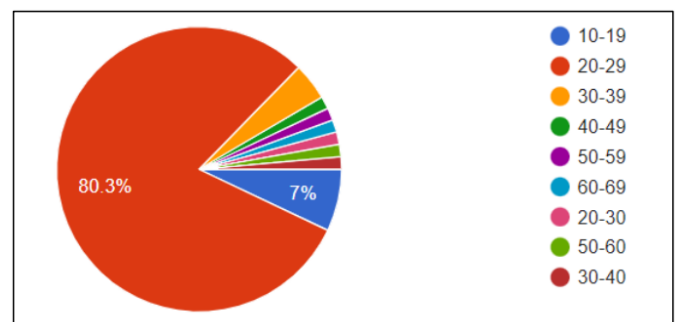


Chart -1: Age of Correspondents

From the pattern found from the respondents' data, it can be seen that over 80 % of the respondents are in the age group of 20 – 29 years old. These respondents are the prime generation of today which are going to be the customers in the EV market tomorrow. Hence, the conclusions and insights drawn from this survey regarding customers choices and preferences holds true and accurately for the upcoming years.

### 4.2 Occupation Industry

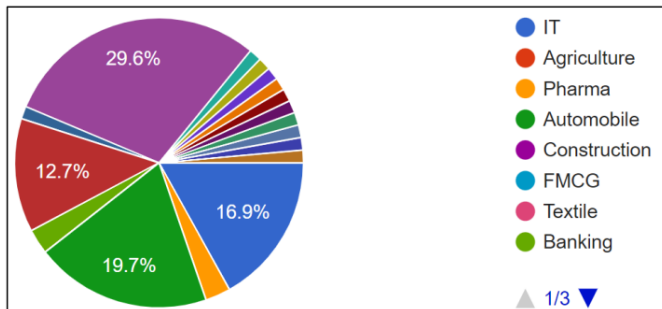
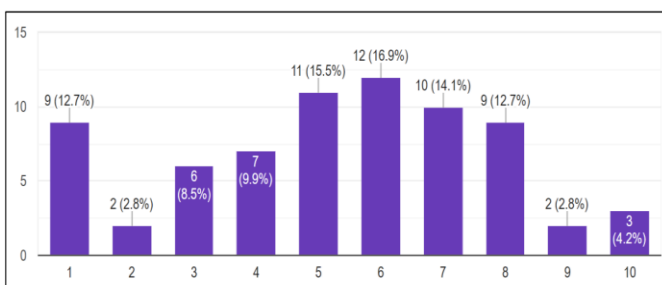


Chart -2: Occupation of Correspondents

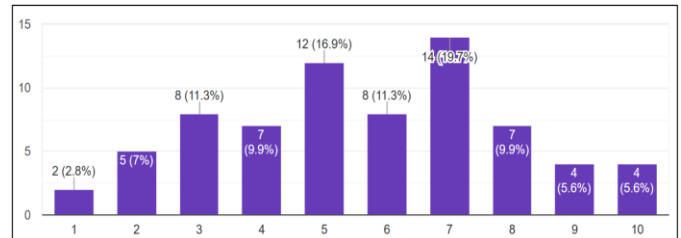
The respondents of this survey come from a wide stratum of the society having different occupations. Hence, the views and insights of the respondents belong to different opinions and backgrounds of different occupational groups. For e.g., 17% of the respondents work in the IT industry. Hence, their opinions expressed in the questionnaire are a result of their work life and income pattern. The same pattern holds true for every other occupation industry as well.

### 4.3 On a scale of 1 - 10, (1 being the worst and 10 being the best). How would you rate the current state of overall EV infrastructure in India?



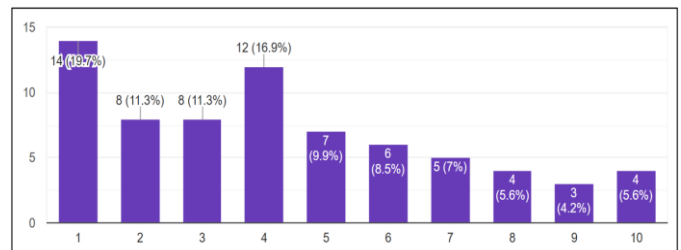
The histogram of this question shows an almost normal distribution having a mode at 6. Despite of this pattern, there is a sharp mode at 1 as well. This indicates the fact that most people consider the current state of EV infrastructure to be adequately mature, while specific strata of people consider it to be early in the infant stage.

### 4.4 On a scale of 1 - 10, (1 being the worst and 10 being the best). How would you rate maturity of EV market in India?



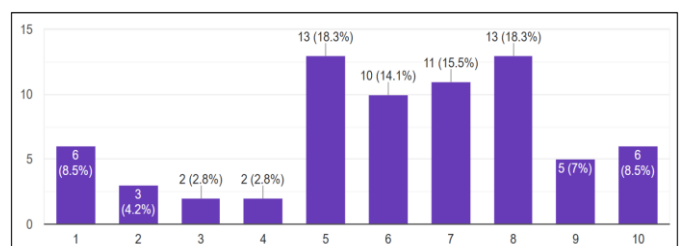
Like the previous question, the responses to these questions also show a normal distribution, but unlike the normal distribution found in the previous question, the distribution in this case is choppy, having peaks are alternate intervals. For e.g., more people rate that the maturity of EV market in India is at level 5 and 7 than at level 6. This pattern attests to the facts that people have stronger opinion for this question. The mode of the distribution at 7 also indicates that people perceive the offerings and price range of vehicles offered by auto companies to be quite mature.

### 4.5 On a scale of 1 - 10, (1 being the worst and 10 being the best). How would you rate the current state of charging infrastructure in India?



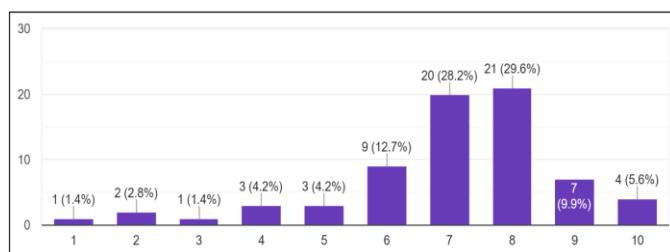
The pattern that emerges from the responses to this question is right skewed. Hence, respondents clearly do not think the charging infrastructure is mature and feel that there is room and immense potential for improvement.

### 4.6 On a scale of 1 - 10, (1 being the worst and 10 being the best). How would you rate the environmental impacts caused by the current EV technology in India?



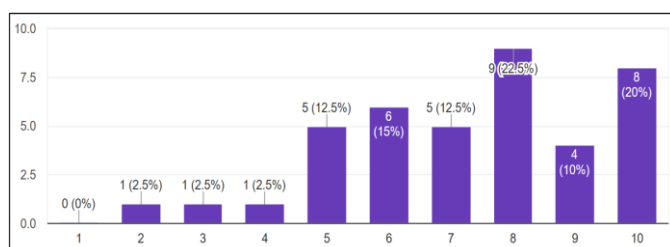
For this question, 65% of the answers lie in the range of 5 - 8. This indicates that people are aware of the fact that EVs are more likely to cause less pollution compared to the current generation of ICE vehicles. However, 8.5% of the respondents have answered 1 to this question, this attests to the fact that these respondents are aware of the fact that during its whole life cycle, an EV leaves behind a significant amount of carbon footprints too.

**4.7 On a scale of 1 - 10, (1 being the worst and 10 being the best). How would you rate the perceived safety of an EV?**



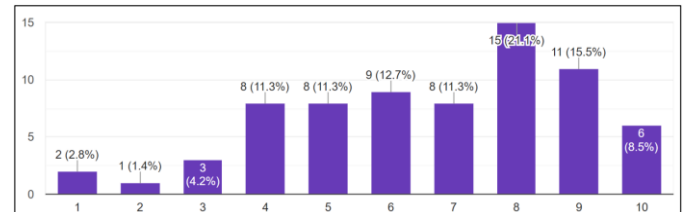
The histogram of the responses for this question is left skewed. This indicates that respondents feel that an EV is just as safe as a typical ICE vehicle despite having different components situated at different places in the chassis. They also feel that dangers of thermal runaway and the battery pack catching fire are mitigated by the OEMs through robust design practices.

**4.8 On a scale of 1 - 10, (1 negligible the worst and 10 being the significant). How would you rate the differences between driving an EV compared to an ICE vehicle?**



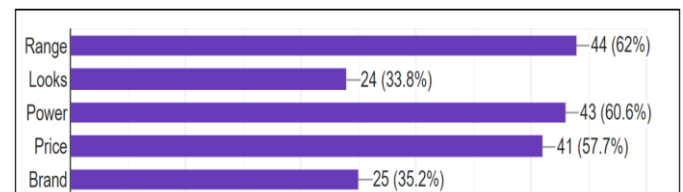
This question was optional to only those respondents who have driven an EV. The responses to this question were left skewed. Hence, the respondents feel that an EV driving experience is vastly different than an ICE vehicle driving experience. This difference in experience can be attributed to the fact that EVs have instant torque available at any given speed. Also, the overall NVH (noise, vibrations and harshness) levels of an EV are lower as compared to an ICE vehicle.

**4.9 On a scale of 1 - 10, (1 being the worst and 10 being the best). How would you rate the perceived reliability and longevity of an EV compared to an ICE vehicle?**



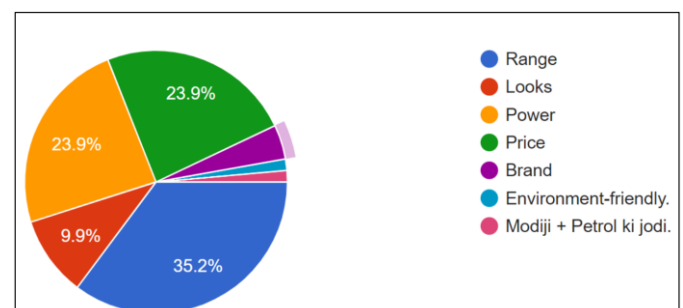
The responses to this question are also left skewed. The mode of the distribution is observed at 8. Despite the fact that the batteries of EVs decay over time and they have to be replaced at around every 5 years, respondents feel that rest of the EV components are reliable over a long duration of time.

**4.10 On a scale of 1 - 10, (1 being the worst and 10 being the best). How would you rate the perceived reliability and longevity of an EV compared to an ICE vehicle?**



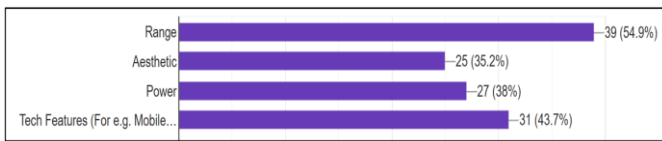
Order qualifiers are necessary attributes that a product must possess for it to enter into competition. According to 44% of the crowd, range of the vehicle is what proves to be an order qualifier for them.

**4.11 Which among the following is an order winner for an EV for you? (Order winner being a characteristic which makes it the best among other shortlisted products):**



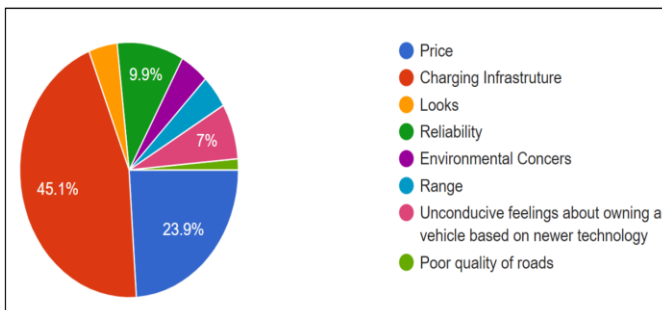
Order winners are the competitive advantages over the rest and is the main reason why customers purchase a particular product. The range of the vehicle proves to win over looks, power, price etc.

**4.12 For which of the following are you willing to pay an add-on amount:**



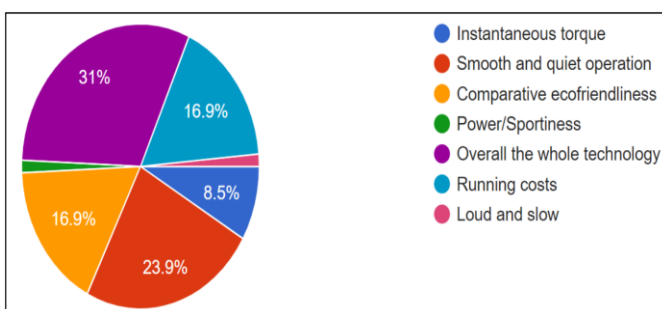
39 out of 71 people, which is over 50% of the respondents, are willing to pay an add-on amount for the range of the EV. Around 43.7% of the people would pay an add on amount for various advanced tech features in an EV.

**4.13 What according to your offsets buying an EV to a regular Indian customer.**



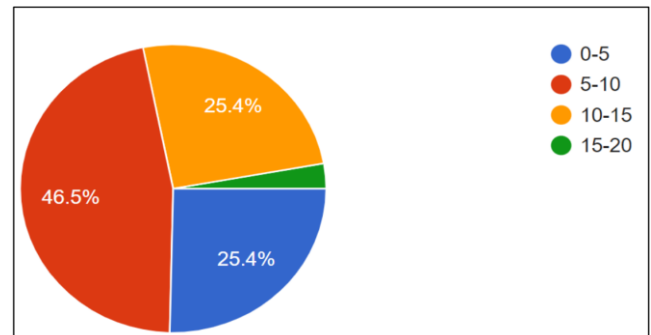
For about 45.1% of the people, charging infrastructure offsets buying an EV over price, looks, reliability, range etc. Nevertheless, the youth ought and hopes to completely eliminate any offset parameters.

**4.14 Which aspect about an EV excited you the most:**



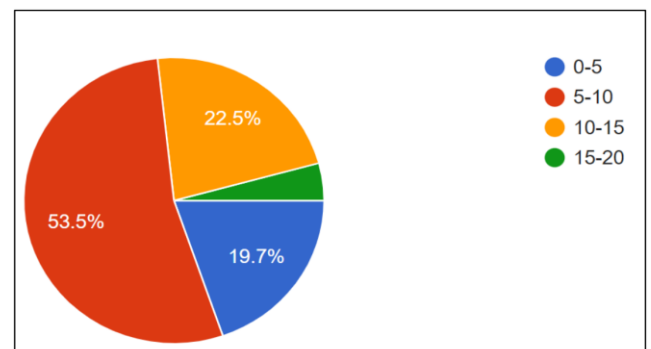
As a budding technology we see a booming response for about 31 % of the people excited about the whole technology altogether. Its smoothness and quiet operation are voted second with about 23.9%. Comparative eco-friendliness and running costs are tied between at 16.9 % votes.

**4.15 How many years do you reckon it will likely take to build a mature and reliable infrastructure for EV charging?**



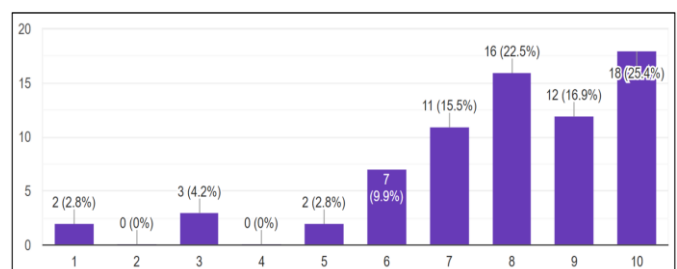
On an average about 46.5% of the total distribution, believe that it would take around 5-10 years to build a mature and reliable infrastructure for EV charging.

**4.16 How many years do you reckon it will likely take for an EV to cost as much as an equivalent ICE vehicle?**



Electric cars are at par or are costlier than ICEs these days. On an average about 53.5% of the total distribution believe that it would take around 5-10 years for an EV to cost as much as an equivalent ICE vehicle.

**4.17 On a scale of 1-10 (1 being the worst, 10 being the best), how willing are you to invest in EV companies in India (considering future growth prospects)?**



Being a new entrant in the market with budding prospects in years to come, investors have bucked up when it comes to EV shares and stocks. With the continuing trend in EVs about 25% of the respondents would surely invest in EVs.

## 5. CONCLUSION

Majority of the respondents are under the age group of 20 - 29 years old. Respondents come from a wide variety of occupational backgrounds which makes the results of the survey more insightful. Current state of EV infrastructure is perceived to be adequately mature by the respondents. Current state of EV market is considered as somewhat mature in terms of product offerings and prices. Charging infrastructure is considered to be in its infancy with a potential scope for improvement. EVs are considered green and ecofriendly by the respondents. EVs are perceived as safe and reliable. They are considered to have long life. Respondents claim the driving an EV feels far different than driving an ICE vehicle. According to 44% of the crowd, the range of the vehicle is what proves to be an order qualifier for them and goes ahead to be an order winner for the same. 39 out of 71 people are willing to pay an add-on amount for the range of the EV. For about 45.1% of the people - charging infrastructure offsets buying an EV over price, looks, reliability, etc. As a budding technology we see a booming response for about 31 % of the people excited about the whole technology altogether. On an average about 46.5% of the total distribution believe that it would take around 5-10 years to build a mature and reliable infrastructure for EV charging and 53.5% of the total distribution believe that it would take around 5-10 years for an EV to cost as much as an ICE vehicle. With the continuing and upcoming advances and trends in EVs, about 25% of the respondents would surely invest in EVs.

## REFERENCES

- [1] EV Consumer Behavior, (June, 2021). Fuel Institute (Electric Vehicle Council), Ricardo Inc. Detroit Technical Center
- [2] P. Dhikale, R. Jain, (June, 2020), Willingness of people to buy an electric vehicle Questionnaire Survey, Journal of Interdisciplinary Cycle Research, Volume XII, Issue VI, June/2020, Page No:601R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.