Consumer Attitude Towards E-Two Wheeler Vehicles at Vadodara

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Abstract*—This research investigates consumer attitudes towards e-two wheeler vehicles in Vadodara, focusing on factors influencing perceptions, preferences, and purchase intentions. A comprehensive survey was conducted, gathering data on demographics, ownership status, familiarity with e-two wheelers, perceived advantages and disadvantages, factors influencing purchase decisions, and opinions on government incentives and charging infrastructure. Findings indicate a strong interest among respondents, particularly among young adults and students, with over half of the surveyed population owning e-two wheeler vehicles. Environmental friendliness emerged as a primary advantage, while concerns were raised regarding charging infrastructure availability and the limited range per charge. Government incentives and the availability of charging stations were identified as influential factors in purchase decisions. These findings provide valuable insights for policymakers, manufacturers, and marketers aiming to promote the adoption of e-mobility solutions in Vadodara and beyond.

***Indexed Terms*—Consumer attitude, E-two-wheeler vehicles Perceptions, Preferences, Purchase intentions, Demographics**

I. INTRODUCTION

The electric vehicle (EV) industry is revolutionizing the automotive sector, driven by environmental awareness, government support, and advancements in battery technology. In recent years, there has been a significant surge in the adoption of EVs, comprising various types such as Battery Electric Vehicles (BEVs), Plug-in Hybrid Electric Vehicles (PHEVs), Hybrid Electric Vehicles (HEVs), and Fuel Cell Electric Vehicles (FCEVs).

Leading the charge in this transformation are pioneering companies like Tesla, alongside established automakers such as Nissan and BMW, as well as industry giants like Volkswagen and General Motors. This diverse landscape of manufacturers underscores the dynamic nature of the EV industry.

As global attention increasingly shifts towards sustainability, the EV sector continues to innovate, particularly in areas such as battery technology, charging infrastructure, and autonomous driving capabilities. These innovations are driving the appeal and feasibility of electric vehicles as the transportation mode of the future.

Projections indicate substantial growth in the global EV market, with a Compounded Annual Growth Rate (CAGR) of 21.7%. It is anticipated that the market size will skyrocket from 8,151 thousand units in 2022 to 39,208 thousand units by 2030. Factors such as heightened interest in low-emission transportation and government incentives for zero-emission vehicles have spurred manufacturers to ramp up production of electric automobiles through subsidies and tax breaks.

This surge in demand for EVs has been further fueled by countries worldwide setting ambitious emissions reduction targets, tailored to their individual capacities. Governments are bolstering their investments in EV charging infrastructure and hydrogen fueling stations, while incentives offered to consumers are poised to unlock new opportunities, expanding geographic reach and revenue streams.

In essence, the EV industry stands at the forefront of sustainable transportation, poised to reshape the automotive landscape and pave the way for a greener, more efficient future.The SI unit for magnetic field strength H is A/m. However, if you wish to use units of T, either refer to magnetic flux density B or magnetic field strength symbolized as μ0H. Use the center dot to separate compound units, e.g., ―$A{\cdot}m^2$.‖

The automotive world is undergoing a profound transformation, led by the electric vehicle (EV) industry. With a convergence of environmental consciousness, government incentives, and technological breakthroughs, EVs have emerged as the vanguard of sustainable transportation.

In the past decade, the EV sector has experienced unprecedented growth, reshaping the traditional automotive landscape. This growth is fueled by a collective global effort to combat climate change and reduce dependence on fossil fuels. As a result, governments around the world are incentivizing the adoption of EVs through subsidies, tax breaks, and emissions reduction targets.

1.2 Objective of the Study

1) Assess Awareness: Understand how much people in Vadodara know about e-two wheeler vehicles.

2) Explore Advantages and Disadvantages: Find out what people think are the good and bad things about e-two wheeler vehicles.

3) Understand Purchase Intentions: Figure out if people in Vadodara want to buy e-two wheeler vehicles and what influences their decision.

4) Evaluate Government Policies: See how government policies and infrastructure affect people's attitudes towards e-two wheeler vehicles.

Provide Insights: Give suggestions based on what we learn to help policymakers and businesses make decisions about e-two wheeler vehicles in Vadodara.

II. LITERATURE REVIEW

1) Thiel, (2012)

European drivers' attitudes regarding electric cars. This study intends to outline and analyses how drivers in the six nations of France, Germany, Italy, Poland, Spain, and the United Kingdom feel about electric cars, as well as how familiar they are with the idea of electric cars and their key characteristics. Each of the six Member States received an average of 600 responses from drivers. According to the report, European cars Drivers are aware of the potential benefits that electric vehicles may provide, but they also recognize that there are a number of prerequisites that must be met before they can be seriously considered. Cars as a reliable form of transportation.

2) Kenneth (2013)

"Consumer perceptions about battery-powered vehicles." This study summarizes the findings of a comprehensive data collection conducted in Flanders (survey with 1196 respondents) (Belgium). The findings cover opinions on battery electric vehicles' (BEVs) benefits and drawbacks, acceptable driving distances, acceptable charging times (both slow and fast), acceptable top speeds, the government's role in the introduction of BEVs, the preferred governmental tools to increase sales, and consumers' willingness to pay (WTP).

3) Ankit et al., (2018)

"Electric vehicle commercial viability in India." In order to scale up the pilot project across all of India, this study aims to assess the commercial viability of the idea, identify the early barriers, and suggest solutions. In order to do this, the pilot project was carefully examined, and in April and May 2018, all stakeholders participated in interviews and surveys. The report also distinguishes specifically between the commercial electric vehicle charging patterns at various charging stations.

4) Dixon (2010)

"Electric vehicle energy storage" This demonstrates some of the potential ways to shorten charging times and improve energy storage capacity. A comparison of various storage options, including chemical battery systems, ultra-capacitors, flywheels, and fuel cells is made, outlining the benefits and drawbacks of each.

5) Kunihiro (2005)

Journal of the Eastern Asia Society for Transportation Studies article by Keiichi Satoh titled "Evaluation of Willingness to Buy a Low-Pollution Car in Japan" In order to suggest improvements to the introduction of low-pollution cars, this study clarifies consumer understanding on the purchase of a low-pollution vehicle. They conducted surveys in Sapporo to gauge public interest in purchasing a low-pollution vehicle. Sapporo residents are Environmental concern does not, however, result in the purchase of low-pollution vehicles.

6) Mohamed (2007)
Environmental effects of electric and hybrid cars. This study is being conducted to determine how well previous analyses of the environmental effects of hybrid and electric vehicles (EV) account for these technologies' whole life cycles. To compare the global warming potential (GWP) of various EV and internal combustion engine vehicle (ICEV) choices, research results are synthesized.

7) Liu (2015)
"Influences of transportation attitudes and environmental consciousness on intentions to acquire electric vehicles." This study investigates the effects of transportation attitudes and environmental awareness on the intention to purchase an electric vehicle.

The information was gathered through a web-based questionnaire survey in Japan's Chukyo Region. The findings show that an individual's intentions to purchase an EV are highly influenced by their attitudes about transportation and environmental concern. The findings offer guidance for formulating policies intended to encourage the adoption of EVs.

8) Marc (2013)
"The trajectory of electric mobility emerging." In this study, they examine how an electric mobility trajectory emerged. Both before and after 2005, they discuss electric car advances. The paper's main argument is that organized vehicle sharing and intramodality are on the rise, high oil prices have reached a tipping point, and electric mobility is benefiting from numerous advances whose importance is likely to increase. According to the research, changes in mobility, the global auto market, the evolution of energy prices, climate legislation, and changes in the electrical sector all affect how vehicle engine technology develops.

9) Marcello Contestabile, (2012)
According to research, advancements in battery technology, which will lower costs and boost energy density, as well as the supply of an appropriate recharging infrastructure, will have a significant impact on the longer-term adoption of EVs.

10) Dash P. K. (2013)
Instead of making a drastic adjustment, India can invest in small-scale reinforcements to handle the load difficulties locally. Home charging ought to be promoted. Before putting in place the large-scale charging infrastructure, proper planning for location, population, traffic congestion, and safety should be taken into account. It is crucial to integrate activity in the transportation and energy sectors. Development objectives through various cutting-edge policies and programmes, such as the financial consumer incentives offered to drivers of electrical cars, such as tax credits, purchase subsidies, discounted tolls, free parking, and access to restricted highway lanes, will aid in the market's expansion.

11) Philippe Lebeau (2015)
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12) Fanchao Liao (2017)
The widespread use of EVs could help reduce issues like environmental pollution, global warming, and dependence on oil. Though this EV penetration is rather limited despite governments enacting stringent regulations promotion regulations. They provided a thorough analysis of consumer research. Preferences for EV intended to inform policymakers and provide guidance for further research. They examined the psychological and economic approaches to consumers. Electric car preference the effect of an EV's financial and technological characteristics on its utility, including its acquisition and operation, is typically determined to be considerable. The price, driving range, length of charging, car performance, and brand diversity on the market. The utility and promotion are also favorably impacted by the density

of charging stations of EV. Tax reduction and incentive schemes have a significant impact.

13) Lingzhi Jin (2017)
The early market growth for electric vehicles is still present, but a variety of obstacles are keeping them from becoming widely used. These obstacles include the new technology's higher price, relative annoyance as compared to range and recharge durations, and consumer ignorance of the technology's practicality and availability. This final point—often referred to as "customer awareness"—is extremely important.

II. METHODOLOGY

3.1 Research Design-
There are many types of research design used for research purpose but the research design which will be used for this study will be Descriptive Research design.

Descriptive research design aims to describe the characteristics, behaviors, attitudes, and perceptions of a specific population or phenomenon. In the context of "Consumer Attitude Towards E-Two Wheeler Vehicles at Vadodara," the descriptive research design provides valuable insights into consumer perceptions, preferences, and behaviors related to e-two wheeler vehicles in the Vadodara region.

Utilize surveys, questionnaires, interviews, or observational techniques to collect data from consumers in Vadodara. These methods allow for the systematic gathering of information on consumer attitudes, preferences, and behaviors towards e-two wheeler vehicles.

3.2 Sources of Data
1) Primary Data Collection: We conducted a survey online to gather primary data from participants who met our study's criteria.

2) Secondary Data Collection: We also gathered secondary data from sources like academic journals and previously published research papers. This additional data helped provide context for our study's findings and allowed us to compare our results to existing research.

3) Utilizing Questionnaires: We employed questionnaires to collect information from our target audience. These questionnaires covered various factors such as email, gender, and other pertinent details to gather comprehensive data for our analysis.

3.3 Data collection method
Data collection was done through Questionnaire method of survey. This questionnaire was filled by units of the population. The questionnaire included open ended, dichotomous and multiple-choice questions. The questions were simple so that people can understand and answer to the questions. Some questions interrelated to make sure that, the answers received ware related to the area of research.

Data collection was done through the medium of internet and social media services allowing me to get better and quick responses from the units. Uses of Internet for data collection was also increase diversification in answer and help us to get answer to multiple questions.

3.4 Sampling Method
Non-probability convenience sampling is a method where researchers select participants based on their ease of access and willingness to participate. This approach is convenient because it allows researchers to gather data quickly and inexpensively. However, it may not be representative of the entire population, as individuals who are easily accessible may not accurately represent the broader population. Despite its limitations, convenience sampling is commonly used in exploratory research or when access to the entire population is not feasible.

IV. RESULTS AND DISCUSSION

4.1 Demographic Profile –Vadodara's consumer perception report highlights a predominant age group of 18 to 24 years old, with males constituting 59% of respondents.Students emerge as the largest occupation category, comprising 50.8% of the surveyed population.Over half of the respondents currently own e-two wheeler vehicles.

Table01 ANOVA

	Sum of Squares	df	Mean Square	F	Sig.	Hypothesis
Between Groups	1.432	4	0.358	1.450	0.219	not rejected
Within Groups	48.163	195	0.247			
Total	49.595	199				

Table 2 ANOVA

Table 3 ANOVA

How familiar are you with e-two-wheeler vehicles?

	Sum of Squares	df	Mean Square	F	Sig.	hypothesis
Between Groups	3.137	4	0.784	1.587	0.179	not rejected
Within Groups	96.383	195	0.494			
Total	99.520	199				

Would you be more inclined to purchase an e-two-wheeler if there were more charging stations in Vadodara?

	Sum of Squares	df	Mean Square	F	Sig.	hypothesis
Between Groups	3.422	4	0.856	1.298	0.272	not rejected
Within Groups	128.533	195	0.659			
Total	131.955	199				

Table 4 ANOVA

Do you think the government should offer more incentives to promote the adoption of e-two-wheeler vehicles?

	Sum of Squares	df	Mean Square	F	Sig.	hypothesis
Between Groups	7.870	4	1.967	3.177	0.015	rejected
Within Groups	120.750	195	0.619			
Total	128.620	199				

Table 5 ANOVA

ANOVA stands for Analysis of Variance. It is a statistical method used to analyze the differences between the means of two or more groups or treatments. It is often used to determine whether there are any statistically significant differences between the means of different groups. The formula for ANOVA is F = variance caused by treatment/variance due to random chance. The ANOVA F value can tell you if there is a significant difference between the levels of the independent variable, when $p < .05$. So, a higher F value indicates that the treatment variables are significant. We use the SPSS software to calculate the hypothesis

H0: there is no significant relationship between age of repondent and owning a e-two wheeler vehicle
H1: there is significant relationship between age of repondent and owning a e-two wheeler vehicle

H0: there is no significant relationship between familiarity of repondent and owning a e-two wheeler vehicle

Would you prefer an e-two-wheeler with a removable or swappable battery option to address charging concerns?

	Sum of Squares	df	Mean Square	F	Sig.	hypothesis
Between Groups	3.019	4	0.755	1.270	0.283	not rejected
Within Groups	115.856	195	0.594			
Total	118.875	199				

H1: there is significant relationship between familiarity of repondent and owning a e-two wheeler vehicle

H0: there is no significant relationship between availability of charging stations and owning a e-two wheeler vehicle
H1: there is significant relationship between availability of charging stations and owning a e-two wheeler vehicle

H0: there is no significant relationship between incentives by government and owning a e-two wheeler vehicle
H1: there is significant relationship between incentives by government and owning a e-two wheeler vehicle

H0: there is no significant relationship between preference for a removable or swappable battery and owning a e-two wheeler vehicle
H1: there is significant relationship between preference for a removable or swappable battery and owning a e-two wheeler vehicle

V. CONCLUSION

The survey findings reveal a significant interest in e-two wheeler vehicles among respondents in Vadodara, particularly among young adults and students. While there is a considerable ownership of e-two wheelers and recognition of their environmental benefits, concerns persist regarding charging infrastructure availability and the limited range per charge. Despite these challenges, there is a clear indication of a willingness to embrace e-mobility, contingent upon the resolution of key issues and the provision of government incentives.

Suggestions:

1)Improve Charging Infrastructure: Address the concerns regarding charging infrastructure availability by investing in the expansion and enhancement of charging stations across Vadodara to alleviate range anxiety among potential buyers.

2)Government Incentives: Strengthen government incentives and subsidies to encourage the adoption of e-two wheeler vehicles, including tax breaks, rebates, and subsidies for purchasing and installing charging stations.

3)Consumer Education: Launch awareness campaigns to educate consumers about the benefits of e-two wheelers, dispel myths, and provide information about available government incentives and subsidies to promote informed decision-making.

4)Battery Technology Advancements: Invest in research and development efforts aimed at improving battery technology to enhance the range per charge, reduce charging times, and increase the durability of batteries, addressing major concerns raised by consumers.

5)Collaboration with Private Sector: Foster partnerships with private companies to accelerate the deployment of charging infrastructure and offer innovative financing options to make e-two wheeler vehicles more accessible and affordable to a broader audience.

VI. LIMITATIONS OF THE STUDY

1)Limited Reach: The survey might not reach all kinds of people, so the results might not represent everyone's views.

2)People Might Not Remember Everything: People might not remember all the details about their experiences with e-two wheelers, so their answers might not be completely accurate.

3)Other Outside Influences: Things outside of the survey, like ads or what's popular in the news, might affect how people answer, making the results less reliable.

4)Some People Might Not Trust Surveys: Not everyone trusts surveys, so they might not take them seriously or might not participate at all, affecting the results.

5)Some People Might Not Care: Some people might not care about e-two wheelers or the survey topic in general, so they might not give thoughtful answers.

VII CONCLUSION/SUGGESTIONS

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