International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Analysing Consumer Perspectives and Charging Forward on Green Electric Vehicles

Sneha M[1], Dr. K. Lakshmi Priya[2]

[1]Ph.D Scholar (Full Time), Department of Commerce and International Trade Karunya Institute of Technology and Sciences, Coimbatore, India.
[2]Assistant Professor, Department of Commerce & International Trade, Karunya Institute of Technology and Sciences, Coimbatore, India.

Abstract
The rapid advancement and broad adoption of electric vehicles (EVs) represent a significant transformation within the electric vehicle industry, driven by the increasing demand for environmentally friendly and sustainable transportation options. This study aims to analyse consumer perceptions of EVs, identifying key factors that influence their attitudes and decision-making processes. The research explores various dimensions, including environmental consciousness, economic considerations, technological advancements, and infrastructural readiness, that impact consumer acceptance of EVs. Additionally, it addresses the primary barriers to EV adoption, such as cost concerns, range anxiety, and inadequate charging infrastructure. By understanding these perceptions and challenges, the study provides strategic recommendations for policymakers, manufacturers, and marketers to foster greater acceptance and adoption of EVs. In the end, this study aims to help create successful plans that will propel the shift towards a greener electric vehicle in future.

Keywords: Electric Vehicles (EVs), Consumer Perceptions, Sustainability, Technological Advancements, Charging Infrastructure, Range Anxiety, Environmental Concerns, Economic Considerations, Adoption Barriers, Automotive Industry

1. Introduction

Lately, the sector has undergone a major transformation towards eco-friendliness and creativity, mainly fuelled by the introduction of electric vehicles (EVs). As global awareness of environmental issues intensifies and technological advancements accelerate, the demand for cleaner, more efficient modes of transportation is on the rise. Understanding consumer perceptions is pivotal for the successful adoption and widespread acceptance of EVs. This analysis delves into the factors influencing consumer attitudes towards EVs, examining their concerns, expectations, and the barriers hindering adoption. In addition, it explores strategies to overcome these challenges and accelerate the transition to sustainability in the engineering sector. By comprehensively understanding the customer perceptions, stakeholders can 0develop effective policies, marketing strategies, and technological solutions that align with the evolving demands of the market, thus driving the momentum towards a greener, more efficient transportation landscape.

2. Factors Influencing Electric Vehicle Acceptance

The acceptance of electric vehicles (EVs) by consumers is shaped by a range of connectivity factors. Environmental concerns play a crucial role, as increasing awareness of climate change and air pollution drives consumers to consider EVs for their zero-emission benefits. Economic considerations also significantly impact acceptance; while EVs often come with a higher initial purchase price, financial incentives such as tax rebates and subsidies, coupled with lower long-term costs for fuel and maintenance, can make them more attractive. Advances in technology, especially battery technology and charging infrastructure, remove major barriers such as range anxiety nd convenience to pay, thereby increasing consumer confidence. Additionally, consumer perceptions and misconceptions about EVs, such as concerns over performance and cost, can influence adoption rates. Social influences, including peer recommendations and growing societal trends towards sustainability, further drive consumer interest. Lastly, supportive government policies and regulations, such as strict emissions standards and investments in EV infrastructure, create a more favourable environment for EV adoption. Collectively, these factors shape consumer attitudes towards EVs and determine their level of acceptance in the market.

3. Range anxiety

Range anxiety represents a significant obstacle to the broad acceptance of electric vehicles (EVs), highlighting consumer apprehensions regarding the restricted range of these vehicles and the accessibility of charging facilities. This concern stems from the fear that the battery will run out before reaching the charging station, which is exacerbated by the lack of charging signs and charging times. Although advances in battery technology have increased range and faster charging capabilities, range concerns remain due to the uncertainty of charging networks and the varying capacities of EV models. Addressing this concern involves not only improving battery performance and expanding the charging infrastructure but also enhancing consumer education about the actual range of modern EVs and the growing network of fast-charging stations. Reducing range anxiety is critical to increasing consumer confidence and accelerating electric vehicle adoption.

The acceptance of electric vehicles (EVs) by consumers is shaped by a range of connectivity factors. Environmental concerns play a crucial role, as increasing awareness of climate change and air pollution drives consumers to consider EVs for their zero-emission benefits. Economic considerations also significantly impact acceptance; while EVs often come with a higher initial purchase price, financial incentives such as tax rebates and subsidies, coupled with lower long-term costs for fuel and maintenance, can make them more attractive. Advances in technology, especially in battery technology and charging infrastructure, will address major barriers such as range anxiety and comfort with charging, thereby increasing consumer confidence. Additionally, consumer perceptions and misconceptions about EVs, such as concerns over performance and cost, can influence adoption rates. Social influences, including peer recommendations and growing societal trends towards sustainability, further drive consumer interest. Lastly, supportive government policies and regulations, such as strict emissions standards and investments in EV infrastructure, create a more favorable environment for EV adoption. Collectively, these factors shape consumer attitudes towards EVs and determine their level of acceptance in the market.

4. charging infrastructure

Payment structures are an important part of electric vehicle (EV) adoption and approval, as a backbone for the proper use of electric vehicles in everyday life. The availability, accessibility, and efficiency of charging stations directly impact consumer confidence and convenience. A well-developed charging network ensures that electric car owners have reliable access to charging points, reducing range anxiety that can go a long way. The infrastructure includes home chargers, public charging stations, and fast-charging networks that vary in terms of charging speed and capacity. Expansion of this infrastructure is essential to accommodate the growing number of EVs and support the transition to electric mobility Advances in payment technology, such as the speed of payment and the widespread use of efficient payment stations, are important in removing barriers to use and encouraging consumers to switching to electric vehicles.

The infrastructure for charging is a vital element that affects the acceptance of electric vehicles (EVs). It includes the system of charging stations and the necessary technologies that enable the efficient powering of EVs. A robust charging infrastructure is crucial for mitigating range anxiety, which is a significant issue for prospective EV purchasers who are concerned about the accessibility and ease of charging facilities. The infrastructure includes various types of chargers, such as home chargers, public charging stations, and fast chargers, each playing a role in meeting different needs and use cases. The accessibility and reliability of these charging points significantly impact consumer confidence and willingness to switch to electric mobility. Expanding the charging network, improving charging speeds, and integrating smart technologies for real-time information and management are crucial steps towards making EVs a practical choice for a broader audienceAs the infrastructure develops and expands, it will be crucial in hastening the shift towards sustainable transportation.

Objectives:

1. To gauge how consumers perceive EVs, including their beliefs, preferences, and misconceptions.
2. To identify and analyse the factors influencing consumer decision-making regarding EVs, such as environmental concerns, economic cons iderations, and technological advancements.
3. To analyse current market trends and consumer behaviour patterns to forecast future demand and acceptance of EVs.

Literature Review:

Environmental consciousness is a significant factor influencing consumer attitudes towards EVs. Consumers who are more aware of environmental issues, such as climate change and pollution, tend to have a positive attitude towards EVs. Rezvani, Jansson, and Bodin (2015) found that pro-environmental attitudes are strong predictors of EV adoption intentions. Consumers who prioritize reducing their carbon footprint view EVs as a viable alternative to conventional vehicles.

Economic factors, including cost savings and government incentives, play a crucial role in shaping consumer attitudes. While the initial purchase price of EVs is higher than that of internal combustion engine (ICE) vehicles, the lower operating costs—due to savings on fuel and maintenance—can make EVs more appealing over time (Bakker & Trip, 2013). Government incentives, such as tax rebates and subsidies, further enhance the economic attractiveness of EVs (Li, Long, Chen, & Geng, 2017).

Technological advancements in EVs, particularly in battery technology and vehicle performance, have a significant impact on consumer attitudes. Improvements in battery range and charging speed are

essential for alleviating range anxiety and increasing consumer confidence in EVs (Neubauer & Wood, 2014). Additionally, the enhanced performance attributes of EVs, such as acceleration and handling, contribute to positive consumer perceptions (Lane & Potter, 2007).

A common misunderstanding regarding electric vehicles (EVs) is the concern known as range anxiety, which refers to the apprehension that an EV may lack the necessary range to arrive at its intended location. This concern is often rooted in outdated information about early EV models with limited range. Dong, Liu, and Lin (2014) highlight that advancements in battery technology have significantly extended the range of modern EVs, making them more practical for everyday use.

In urban areas, poor air quality is a significant health concern. EVs, which do not emit pollutants like nitrogen oxides and particulate matter, are seen as a solution to improve air quality. Research by Buekers et al. (2014) highlights that consumers who are aware of the health benefits associated with reduced air pollution are more inclined to consider EVs.

Government incentives play a crucial role in making EVs financially attractive. Incentives such as tax rebates, subsidies, and grants can significantly reduce the effective purchase price of EVs. Li, Long, Chen, and Geng (2017) demonstrated that these financial incentives are critical in accelerating EV adoption, particularly in markets where the initial cost remains a significant barrier.

Supportive policies, such as those promoting the development of EV infrastructure or mandating EV-friendly building codes, are crucial. Li, Long, Chen, and Geng (2017) argue that regulatory frameworks that support EV adoption create a more favorable market environment, encouraging consumers to make the switch.

Consumer education and awareness campaigns play a vital role in shaping perceptions. Rezvani, Jansson, and Bodin (2015) highlight the importance of providing accurate information about the benefits, costs, and technological aspects of EVs. Educating consumers about the advantages of EVs can help to dispel misconceptions and drive adoption.

Recent developments reveal a notable rise in electric vehicle (EV) sales worldwide. The International Energy Agency (IEA) (2023) reports that the global EV market has experienced remarkable expansion, achieving unprecedented sales figures in recent years. This growth is attributed to advancements in technology, decreasing battery costs, and supportive government policies. The European Union and China have been particularly notable for their aggressive adoption and market penetration (IEA, 2023).

Consumer preferences are shifting towards more sustainable and technologically advanced vehicles. The rising popularity of electric SUVs and trucks indicates a growing demand for EVs across different vehicle segments. As awareness of environmental issues and the benefits of EVs increases, more consumers are expected to embrace electric mobility (Sierzchula et al., 2014).

Government policies and regulations will significantly influence the demand landscape in the future. Supportive measures such as stricter emissions standards, incentives for EV purchases, and investments in charging infrastructure are likely to drive higher adoption rates. The European Union and China's aggressive targets for EV adoption are examples of how policy can influence market trends (IEA, 2023).

Ongoing innovations in battery technology, autonomous driving, and connected vehicle features are expected to drive future demand. As these technologies become more integrated and accessible, consumer interest in EVs is likely to grow. Research by Neubauer and Wood (2014) suggests that continued advancements in these areas will enhance the overall appeal of EVs.

RESEARCH METHODOLOGY:

The research adopts from both primary and secondary sources. Customers perception about Electronic Vehicle, which was obtained using a questionnaire based on customer satisfaction, customer behaviour, and customer response. A total of 65 people took part in the survey were chosen. A comprehensive questionnaire was developed, incorporating both closed-ended and open-ended questions. The inquiries within the questionnaire encompass all relevant fields of study. Our intended demographic included a diverse group of individuals, comprising students, office employees, and business professionals, as well as those with busy lifestyles. Additionally, secondary data was collected from multiple sources, such as academic journals, social media platforms, newspapers, and various web pages.The data acquired by the survey was interpreted using descriptive analysis questionnaire.

Type of research - Quantitative Research:

This research is a quantitative research. The questionnaire has a structured format.

Types of research design :

Descriptive research design is best research design which best describes. This study can be concluded as based on the facts that is in this study, problem is clearly defined, hypothesis is framed, information needed is clearly defined.

Population:

To study the population chosen is the people from India.

Sampling techniques:

In this study, convenience sampling has been employed. This approach entails choosing a sample from a population of individuals who are easily accessible, classifying it as a form of nonprobability sampling technique.

Sample Size: For this study 100 people responses are taken.

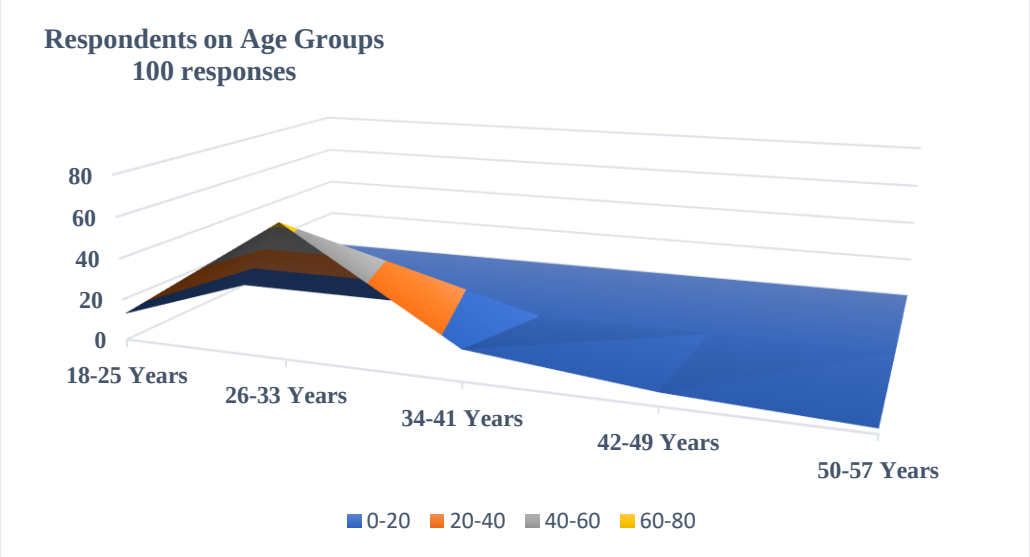
Sample Area: The area of the research is India.

Age Group: From 18 onwards

Data Collection Tool: Questionnaire

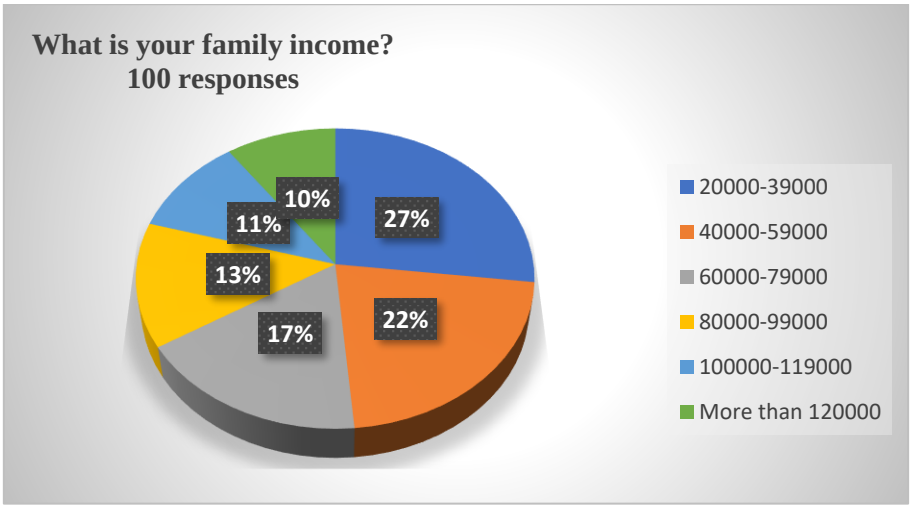
Data Interpretation and Analysis -

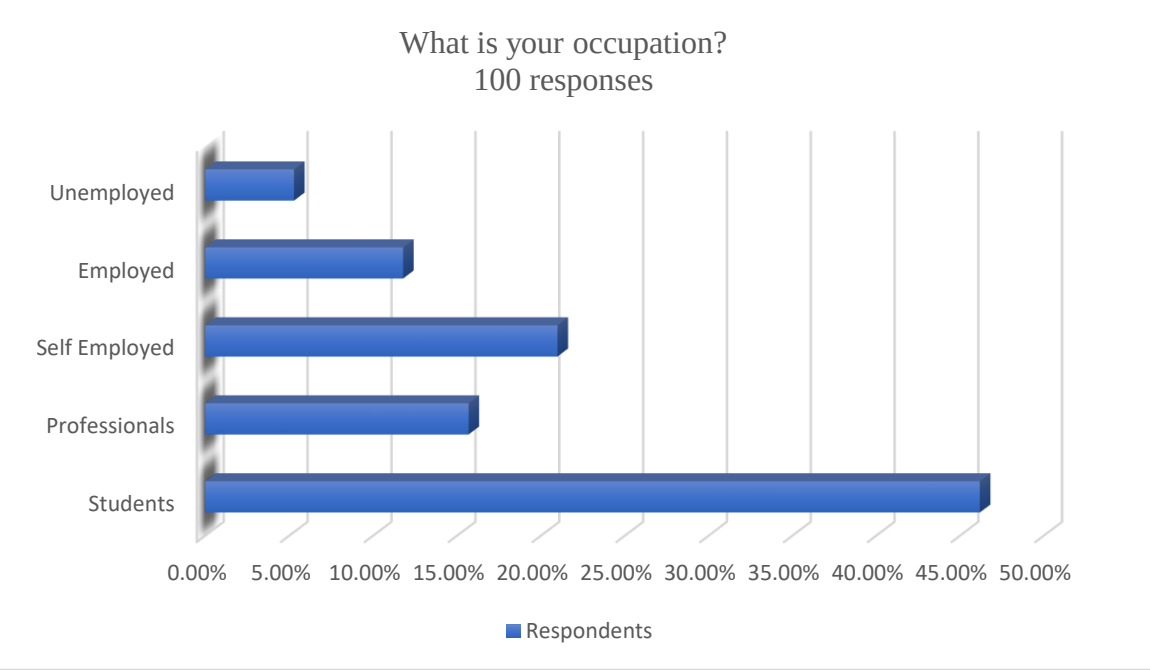
The total number of participants in the study is 100, with 64.1% of the respondents falling within the designated age category of 26-33 yrs., 12.8% in 18-25 yrs., 14.7% in 34-41 yrs., 6.1% in 42-49 yrs and 2.3% in 50-57 yrs.



Profession of the respondents-

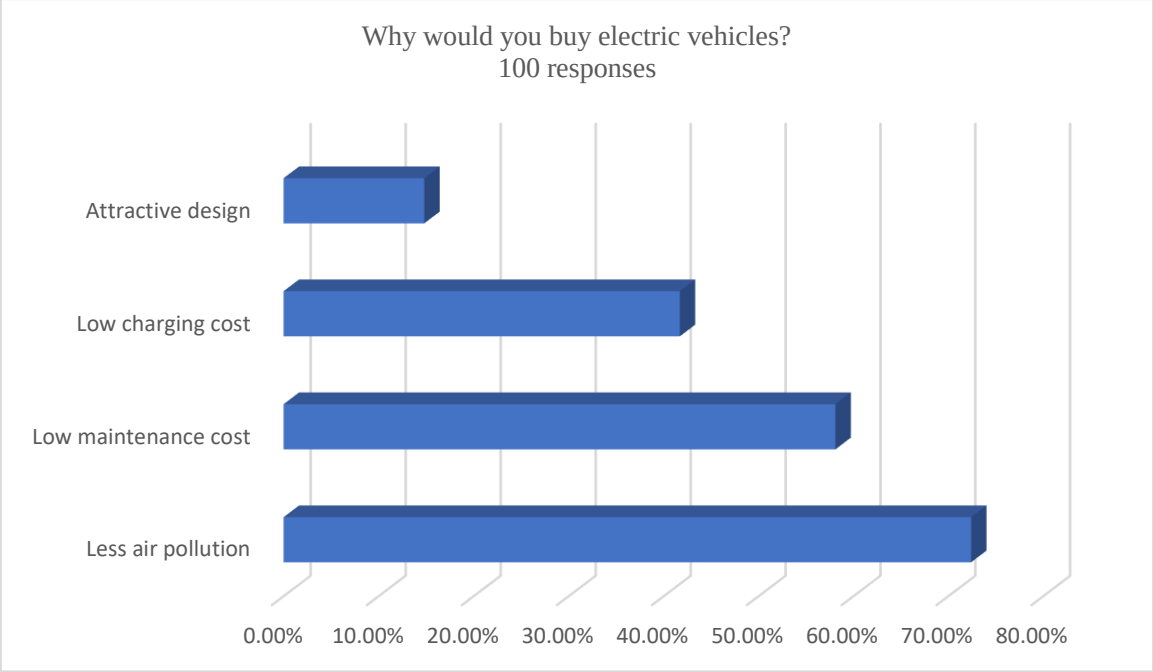
Profession	Frequency	Percentage %
Students	37	46.2
Professional	20	15.7
Self employed	31	21
Employed	7	11.8
Unemployed	3	5.3
Total	100	100



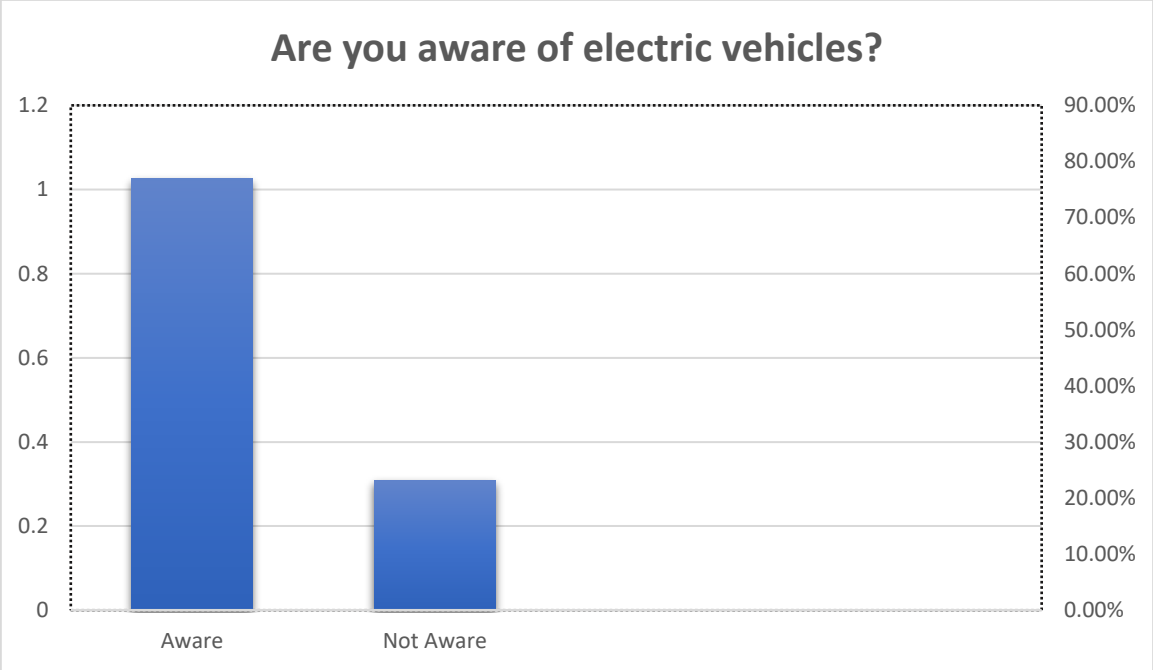


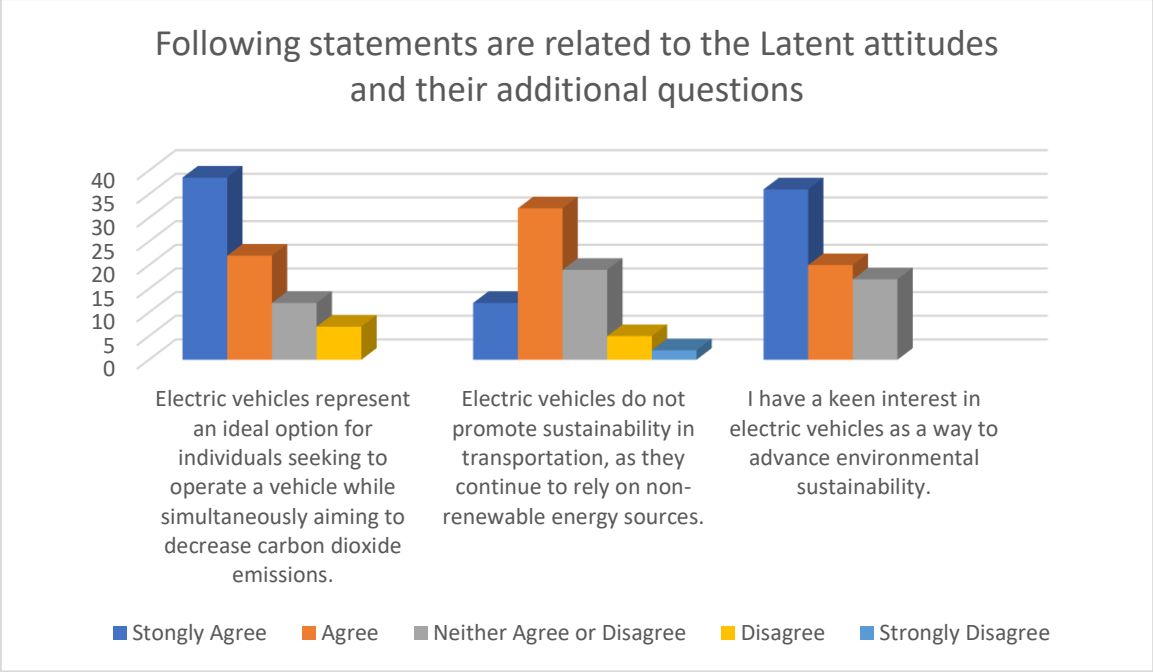
Why consumer want to buy EV's

Most of the respondents are attracted towards less air pollution which is 72.4%, after that Low maintenance cost (58.1%), after that low charging cost (41.7%) and Attractive design (14.8%).

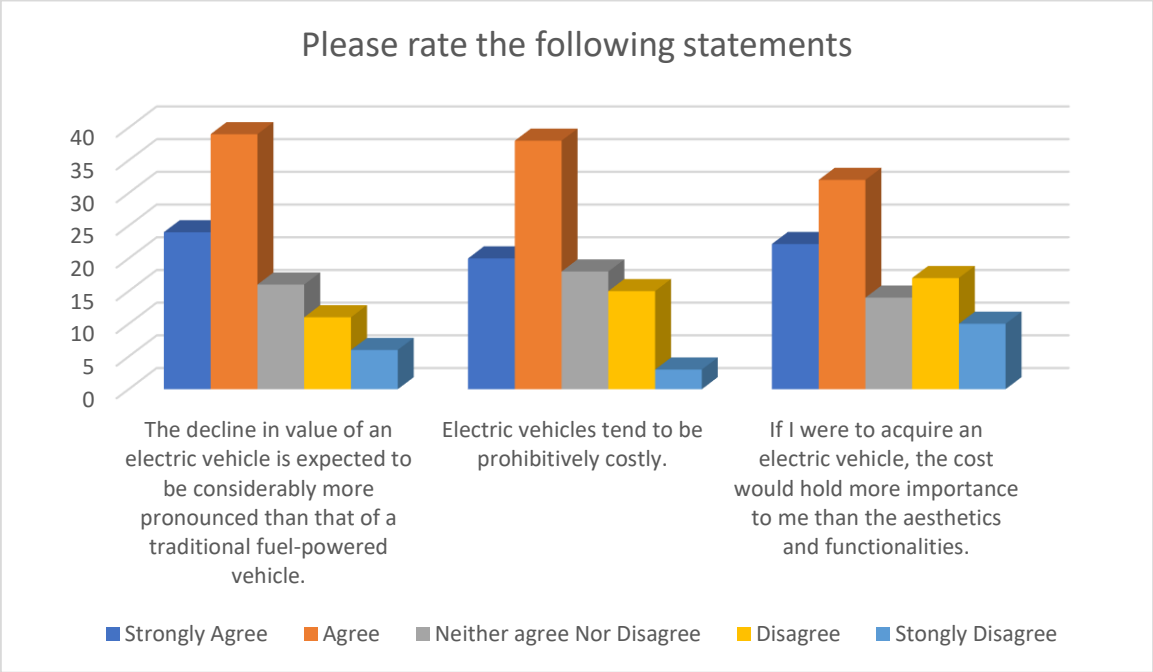


Awareness about Electric Vehicles:
76.9% respondents are aware and 23.1% are not



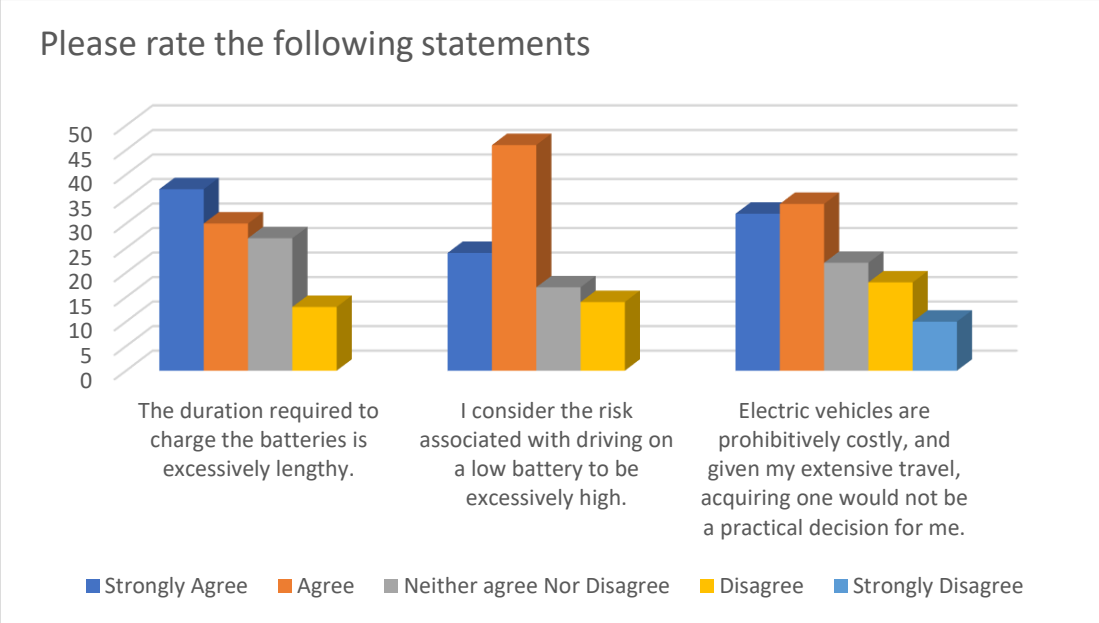


- Electric vehicles represent an ideal option for individuals seeking to operate a vehicle while simultaneously aiming to decrease carbon dioxide emissions. – To this statement most of the respondents Strongly Agree, showing their high interest in development and adoption EV's.
- Electric vehicles do not promote sustainability in transportation, as they continue to rely on non-renewable energy sources. – Most of the respondent Agree on this statement.
- I have a keen interest in electric vehicles as a way to advance environmental sustainability. – More than 50% of the respondents are highly interested in buying electric vehicles.

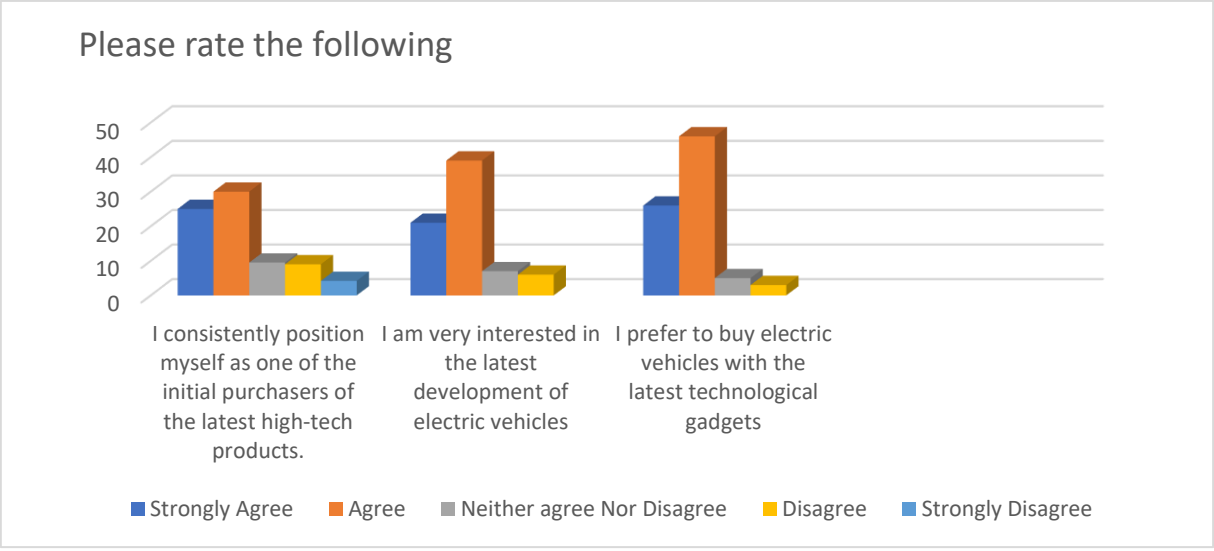


The decline in value of an electric vehicle is expected to be considerably more pronounced than that of a traditional fuel-powered vehicle. – Respondents thinks that value of electric car will go down as it will become common and adoption rate will increase.

Perception will shift on other thing as well on EV's once it become common.
Electric vehicles tend to be prohibitively costly. – Consumer thinks that Electric vehicles are Expensive.
If I were to acquire an electric vehicle, the cost would hold more importance to me than the aesthetics and functionalities. – In this question there is tough competition, some of the consumer prefer attractive design, and some look after monetary term.

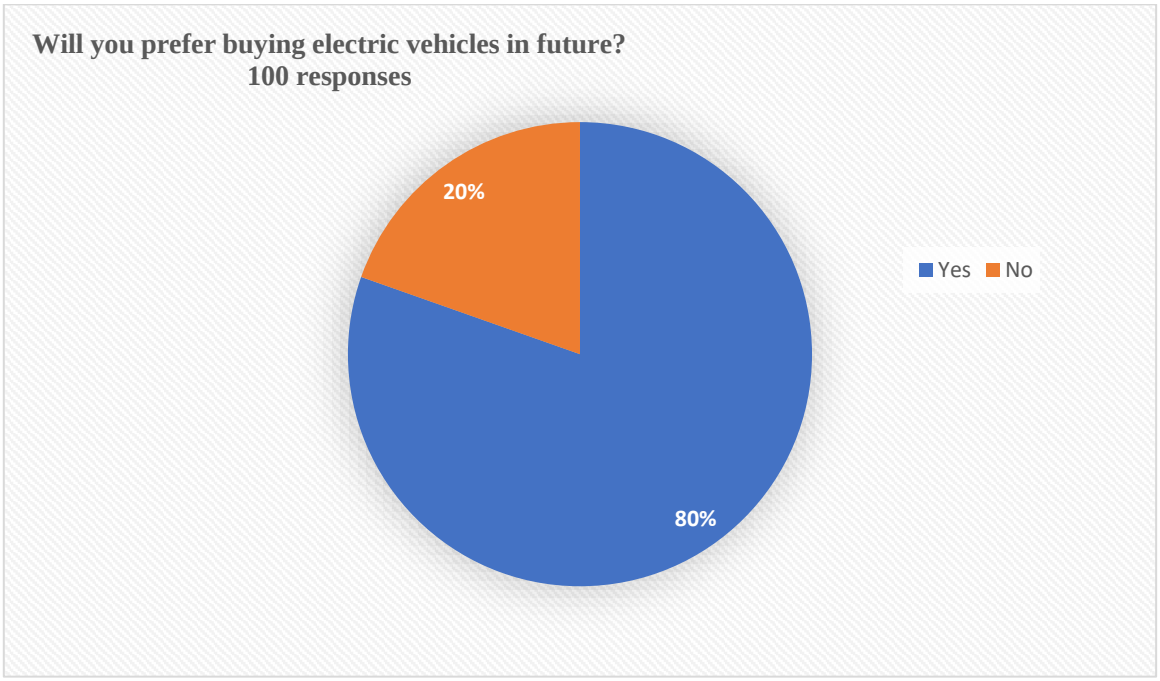


- The duration required to charge the batteries is excessively lengthy – Most of the consumer Agree with the point.
- I consider the risk associated with driving on a low battery to be excessively high – A high number of respondents are being afraid of driving with low battery, so this can be one of the drawbacks of EV's.
- Electric vehicles are prohibitively costly, and given my extensive travel, acquiring one would not be a practical decision for me. - Most of the consumer Agree with the point.

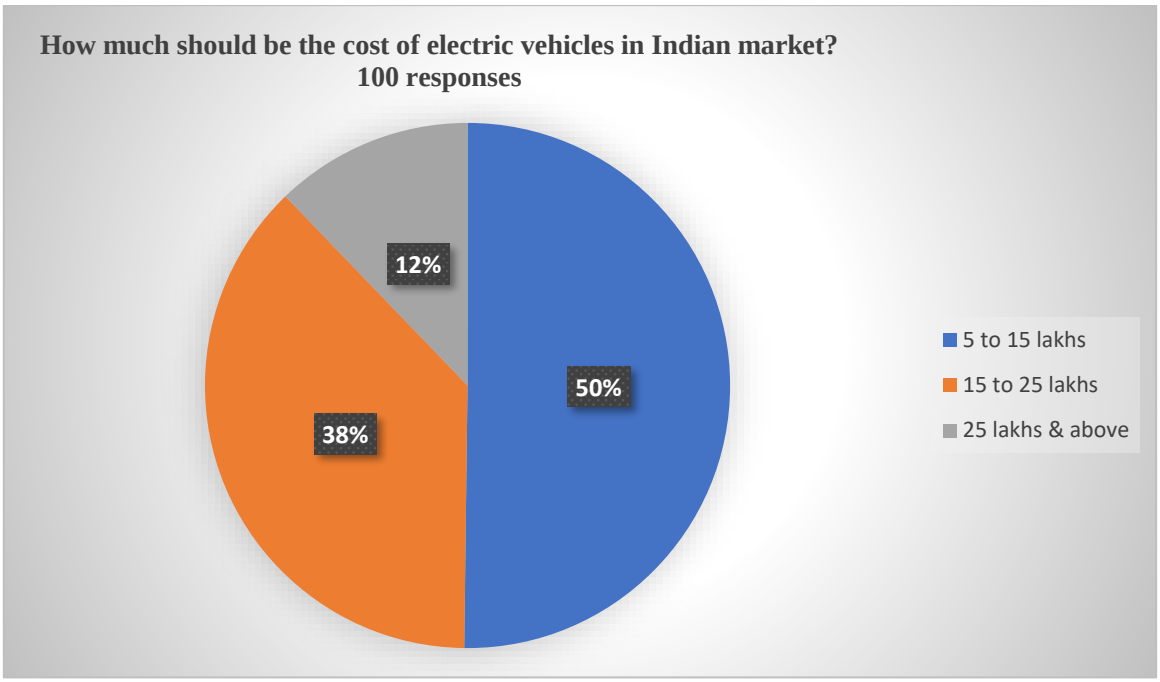


- I consistently position myself as one of the initial purchasers of the latest high-tech products. - Most of the youth respondents are driven towards developing technology.

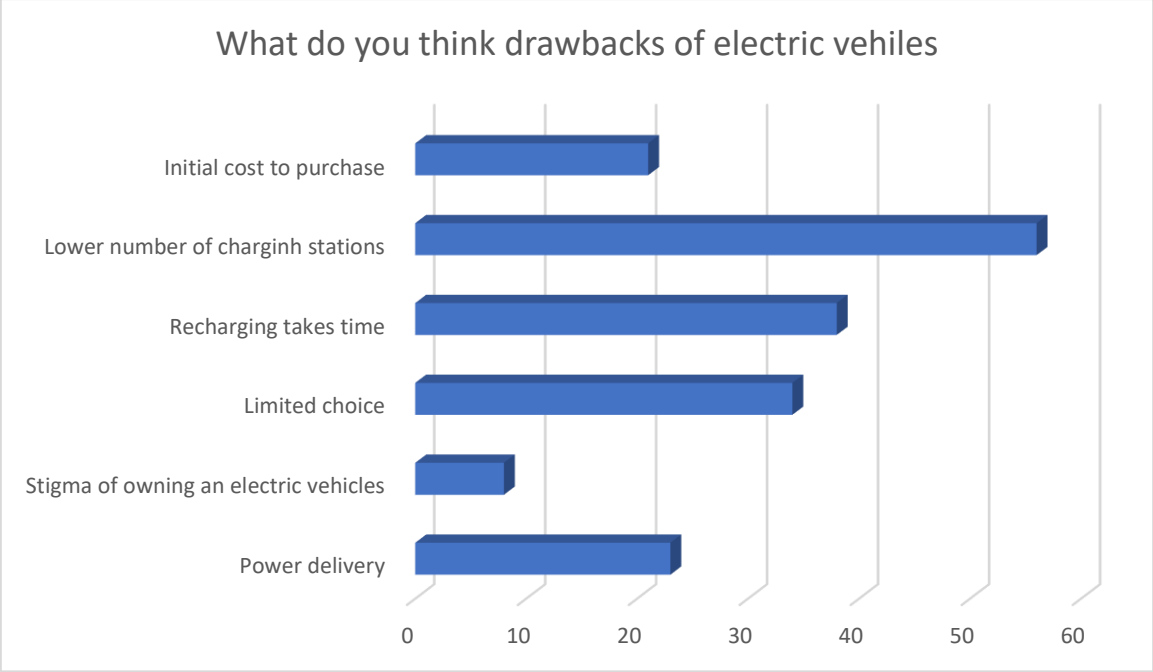
- I am very interested in the latest developments in cars – Respondents Agree on adopting latest developed electric vehicles.
- I prefer to buy electric vehicles with the latest technological gadgets – Respondents Agree on adopting latest technology electric vehicles.



80.4% respondents are ready for EV's in current times. It concludes that more consumers will buy prefer EV's in coming time.



Consumer always want more things in low cost, 50.2% of respondents thinks EV's cost should be between 5 to 15 lakhs.



Scope

The primary and secondary data for electric vehicles in India were used in this study. Though the study discovered a potential market for electric vehicles in India, more research is needed with a larger sample size and more criteria such as battery life, speed provided by EVs, which manufacturer is the best, and what can be done to encourage more people to use EVs.

FUTURE OUTLOOK

Consumer perception of electric vehicles is undeniably evolving, with more people recognizing the benefits of making the switch. As technology advances and charging infrastructure expands, electric vehicles are poised to become an increasingly dominant force in the automotive market. The future outlook for electric vehicles (EVs) appears to be quite promising, with a number of factors contributing to their growing market share and increasing adoption around the world.

As battery technology continues to improve, we can expect to see EVs with longer driving ranges, faster charging times, and more efficient energy consumption.

Furthermore, innovations in power electronics, electric motors, and lightweight materials will enhance the overall performance and efficiency of EVs. The cost of EV batteries has been dropping significantly over the past decade, and this trend is expected to continue. As battery prices fall, the overall cost of EVs will become more competitive with internal combustion engine (ICE) vehicles, making them a more attractive option for consumers. Many countries are implementing policies and regulations to encourage the adoption of EVs. These include incentives like tax credits, rebates, and exemptions, as well as stricter emission standards for ICE vehicles. Some countries have even announced plans to phase out the sale of new ICE vehicles within the next few decades, which will further boost the demand for EVs.

As more consumers become aware of the benefits of EVs, such as lower operating costs, reduced environmental impact, and advanced technology features, the demand for EVs is expected to keep rising. The transition to renewable energy sources like solar and wind power can be accelerated by the widespread adoption of EVs. Smart charging and vehicle-to-grid (V2G) technologies can help balance the electricity grid, allowing EVs to serve as energy storage devices when not in use. The development

of self-driving cars is expected to have a significant impact on the future of transportation. Many experts believe that autonomous vehicles and EVs will converge, as electric powertrains are well-suited for self-driving technology due to their simplicity, reliability, and instant torque.

CONCLUSION

Thus, analysing the whole scenario, the future of electric vehicles (EVs) is on a promising trajectory, fuelled by technological advancements, decreasing costs, and supportive policies. As the world increasingly embraces sustainable transportation solutions, EVs are set to play a pivotal role in revolutionizing the automotive industry and mitigating the environmental impact of traditional internal combustion engines. With improvements in battery technology, charging infrastructure, and integration with renewable energy sources, EVs are poised to become an integral part of our daily lives, offering a cleaner, greener, and more efficient mode of transportation. As the adoption of EVs continues to accelerate, we can expect a more sustainable, eco- friendly, and technologically advanced future for the global automotive landscape.

Overall, regarding the consumer perceptions of EVs continue to improve as awareness of their advantages— such as cost savings, performance, and environmental benefits— grows. The ongoing development of charging infrastructure and the proliferation of electric vehicle options across various price points and vehicle types will further solidify their position as a viable and attractive choice for consumers. With the momentum behind electric vehicles only gaining speed, the future of transportation is looking greener and more sustainable than ever before.

The depletion of fossil fuel resources and the continuous rise in fuel prices necessitate a transition to alternative energy sources for vehicles in India. The government has initiated measures to combat pollution by promoting electric vehicles (EVs) and providing subsidies for their purchase. To enhance production capabilities, the government has relaxed foreign direct investment (FDI) regulations. Numerous emerging brands are now introducing EVs in the Indian market. It is essential for the government and manufacturers to collaborate in developing the necessary infrastructure and fostering a supportive environment for electric vehicles.

Consumers are increasingly aware of global climate issues and express a willingness to transition from traditional vehicles to more environmentally friendly options. Price remains a significant factor in the decision-making process when considering the purchase of an electric vehicle. Additionally, other aspects, such as the vehicle's aesthetic appeal, are also taken into account. If adequate infrastructure is established, consumers are likely to embrace EVs as a viable future option. However, challenges such as the high initial purchase cost, the limited availability of charging stations, and the duration required to recharge batteries continue to hinder consumer confidence.

Bibliography

1. Afroz, R., Masud, M. M., Akhtar, R., Islam, M. A., & Duasa, J. B. (2015). Consumer purchase intention towards environmentally friendly vehicles: an empirical investigation in Kuala Lumpur, Malaysia.
2. Vehicles Purchase Behavior in United Arab Emirates: The Roles of Perception, Personality Innovativeness and Sustainability. *International Journal of Economics and Management*, *14*(3), 343– 363.

3. Ingeborgrud, L., & Ryghaug, M. (2016). User perceptions of EVs and the role of EVs in the transition to low-carbon mobility. *ECEEE Summer Study Proceedings*, *1985*, 893–900.
4. Mishra, S. J. (2020). *A case study on the perception of consumers of Bhubaneswar towards electric vehicles*. *December*. https://doi.org/10.2017/IJRCS.2456.6683/202012012
5. Rahahleh, A. H., Moflih, M. A., Alabaddi, Z. A., & AL-Nsour, S. N. (2020). The moderating effect of psychological factors on consumer of electric and hybrid vehicles' response purchase decisions. *Management Science Letters*, *10*(8), 1649–1658. https://doi.org/10.5267/j.msl.2020.1.015
6. Yang, S., Zhang, D., Fu, J., Fan, S., & Ji, Y. (2018). Market cultivation of electric vehicles in China: A survey based on consumer behavior. *Sustainability (Switzerland)*, *10*(11), 1–23. https://doi.org/10.3390/su10114056
7. Byung Cho Kim, Hosun Rhim, Hongsuk Yang. (2021) Price competition or technology improvement? An investigation of green car technology. *International Journal of Production Research* 59:9, pages 2800-2816.
8. Byung Cho Kim, Hosun Rhim, Hongsuk Yang. (2021) Price competition or technology improvement? An investigation of green car technology. *International Journal of Production Research* 59:9, pages 2800-2816.
9. Ruize Ma, Lin Jiang, Tianyue Wang, Xuping Wang, Junhu Ruan. (2022) How do manufacturing companies and service providers share knowledge in the context of servitization? An evolutionary-game model of complex networks. *International Journal of Production Research* 0:0, pages 1-23.
10. Zulqarnain H. Khattak, Asad J. Khattak. (2023) Using behavioral data to understand shared mobility choices of electric and hybrid vehicles. *International Journal of Sustainable Transportation* 17:2, pages 163-180.
11. Michael Wicki, Gracia Brückmann, Franziska Quoss, Thomas Bernauer. (2023) What do we really know about the acceptance of battery electric vehicles? – Turns out, not much. *Transport Reviews* 43:1, pages 62-87.
12. Javier Bas, Zhenpeng Zou, Cinzia Cirillo. (2023) An interpretable machine learning approach to understanding the impacts of attitudinal and ridesourcing factors on electric vehicle adoption. *Transportation Letters* 15:1, pages 30-41.
13. R. Ashokkumar, M. Suresh, B. Sharmila, Hitesh Panchal, C. Gokul, K. V. Udhayanatchi, Kishor Kumar Sadasivuni, Mohammad Israr. (2022) A novel method for Arduino based electric vehicle emulator. *International Journal of Ambient Energy* 43:1, pages 4299-4304.
14. Irfan Ullah, Kai Liu, Toshiyuki Yamamoto, Md Shafiullah, Arshad Jamal. (2022) Grey wolf optimizer-based machine learning algorithm to predict electric vehicle charging duration time. *Transportation Letters* 0:0, pages 1-18.
15. Haoning Xi, Liu He, Yi Zhang, Zhen Wang. (2022) Differentiable road pricing for environment-oriented electric vehicle and gasoline vehicle users in the bi-objective transportation network. *Transportation Letters* 14:6, pages 660-674.
16. Helen Fitt. (2022) Boring and inadequate? A literature review considering the use of electric vehicles in drive tourism. *Current Issues in Tourism* 25:12, pages 1920-1946.
17. Siddhant Jha, Neeraj Kumar, Parinika Singh, Riya Sharma, Sahil Lamba, Bharat Singh. (2022) Design and control of electric vehicle using HOMER. *Journal of Information and Optimization Sciences* 43:3, pages 571-577.

18. Fanchao Liao, Gonçalo Correia. (2022) Electric carsharing and micromobility: A literature review on their usage pattern, demand, and potential impacts. *International Journal of Sustainable Transportation* 16:3, pages 269-286.
19. Chi Xie, Jue Hou, Ti Zhang, Travis Waller, Xiqun Chen. (2022) Modeling and evaluating the impact of electricity price
20. Xiuhong He, Yingying Hu. (2022) Understanding the role of emotions in consumer adoption of electric vehicles: the mediating effect of perceived value. *Journal of Environmental Planning and Management* 65:1, pages 84-104.
21. Seshadri Srinivasa Raghavan, Gil Tal. (2022) Plug-in hybrid electric vehicle observed utility factor: Why the observed electrification performance differ from expectations. *International Journal of Sustainable Transportation* 16:2, pages 105- 136.
22. Li, Timothy J. Wallington, Gregory A. Keoleian, Carlo Ratti. (2021) Understanding Ridesourcing Mobility and the Future of Electrification: A Comparative Study in Beijing. *Journal of Urban Technology* 28:1-2, pages 217-236.
23. Zikai Zhang, Ni Sheng, Daiqing Zhao, Kaihan Cai, Guiming Yang, Qingbin Song. (2023) Are residents more willing to buy and pay for electric vehicles under the “carbon neutrality”?. *Energy Reports* 9, pages 510-521.
24. Yongming Song, Yanhong Li, Hongli Zhu, Guangxu Li. (2023) A decision support model for buying battery electric vehicles considering consumer learning and psychological behavior. *Journal of Retailing and Consumer Services* 73, pages 103303.
25. Bhanu Prakash Sandaka, Jitendra Kumar. (2023) Alternative vehicular fuels for environmental decarbonization: A critical review of challenges in using electricity, hydrogen, and biofuels as a sustainable vehicular fuel. *Chemical Engineering Journal Advances* 14, pages 100442.