ISSN: P-2455-0515
E- 2394-8450

Educreator Research Journal

VOLUME–XI, ISSUE– I (Special Issue-I) JAN – FEB 2024

Original Research Article

CHALLENGES IN THE ADOPTION OF ELECTRIC VEHICLES: AN ANALYSIS OF NASHIK YOUTH

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Abstract:

In India, transportation is the main factor that helps to increase the GDP continuously because transportation increases day by day and for that, the use of various types of vehicles also increases. This study collected data through an online survey method from 129 youth respondents of Nashik City. On that basis, the study identifies the challenges surrounding the adoption of Electric Vehicles among a specific group of respondents. This research also understands the obstacles faced by the required infrastructure. India has the required infrastructure for Fuel Vehicles but suddenly changes into a quite expensive battery technology through electrical vehicles because of environmental concerns. While respondents acknowledge the cost-effectiveness of EVs, sensitive to future cost considerations, and high replacement costs of batteries, and express a willingness to purchase EVs in the future. Furthermore, the lack of charging infrastructure for EVs in public spaces as well as in residential places, is one of the significant barriers to EV use. The range is also one of the challenges, suggesting a need to improve the range capabilities and charging infrastructure for EVs. The importance of existing challenges to promote the adoption of EVs all over India and achieve the sustainability aims of the Automobile Industry.

Key Words: *Electric Vehicles (EVs), Environmental Challenges, Barriers, Adoption, Infrastructure, etc.*

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Introduction:

The adoption of EVs shows the forward step towards addressing the global challenges of dependency on fossil fuel, pollution, and climate change. The current environmental condition has changed due to the continued emission of Greenhouse Gases (GHGs) and Global warming (GW). Under GHGs, CO2 is under tremendous pressure to reduce carbon footprints. But currently, everyone has an idea that the environmental condition of the whole world is under red alert. So, in the year of 2011, GOI promoted and recommended EVs. The National Electric Mobility Mission Plan (NEMMP) 2020 has come with a detailed report on EVs with the main objective of promoting eco-friendly vehicles. However, the various environmental as well as economic benefits offered by GOI for the adoption of EVs are increasing. Now, EVs can be a major contributor to the successful implementation of the smart grid in the automobile industry. The area of research is limited to only the Youth of Nashik City. This type of vehicle is used for the reduction of air pollution and is eco-friendly. Currently, the use of Electric Vehicles is increasing but needs to be better. So, Nashik also and developing city in Maharashtra, has

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a significant potential market for EVs, and understanding the various challenges came across the adoption behaviour of the Automobile Market with Special Reference to EVs. EVs have been improving momentum in recent years, with the new changes in technology, improved range, and an expanding platform for EV models.

Indian Government Policies for EVs:

A comprehensive policy framework offers different types of financial incentives to make EVs more affordable to all Buyers of Electric vehicles. The government aims to create a conducive environment for EV adoption, reduce reliance on imports, and facilitate a sustainable and green transportation system for the future.

Maharashtra Government Policies & Incentives on EVs:

As per the update that, the Maharashtra Government updated and introduced the Electric Vehicle Subsidy Policy in July 2021, due to this, the main objective is to promote the use of EVs in Maharashtra state and offer incentives to purchase, road tax exemption, Interest Subsidy, and support to manufacturing.

Current Status of EVs in Nashik City:

Currently, the news reported that the 40% rise from 3,718 EVs registered from April to November 2022 to 5,264 in the same period the following year i.e. 2023 reflects a growing interest in sustainable transportation in Nashik city. The detailed number of registered vehicles is like Two-wheelers is 4,829, Three-wheelers is 109 and four-wheelers is 326. So, the numbers show that the adoption of electric three-wheelers and four-wheelers is comparatively less in numbers with two-wheelers.

Literature Review:

P. Muthulakshmi et al., 2023 case study mainly focuses on identifying the obstacles and troubles for India at the time of EV launching**.** This study also discusses the challenges of EVs such as Power Supply shortages, Less Charging Stations, Time required for Charging, Lack of Service, Various Costs, and Issues with Batteries.

Fayez Alanazi, 2023 mainly explored the problems faced by the people and challenges when adopting EVs related to Cost, available Infrastructure, Charging Stations, Limitations in Range, and Battery Performance.

Anthony Anosike et al., 2023 research work starts with the main aim is to explore the challenges for EVs in the final mile parcel delivery and also identify the direction for the future scope. researchers found various challenges like fleet size, capacity and schedule to implement infrastructure as per requirement for the manufacturing process of EVs.

Ramniwas Singh et al., 2023 article explore the various challenges and issues faced like inadequate infrastructure, lack of new technology, unskilled workforce, etc. This study also focuses on the policy framework, battery technology, people acceptance, manufacturing, and supply chain of EVs.

Sonali Goel et al., 2021 research study provides a detailed overview of various types of electrical vehicles and discusses the different approaches of EV models. The study found the essential barriers to EVs by addressing the issues related to charging infrastructure facilities.

G. Krishna, 2021 study understands the people's perception of the adoption of EVs by identifying the barriers. It also focused on identifying the factors that affect on purchase of EVs with the help of thematic analysis. The researcher used the eWOM method for data, which helps to identify all present gaps in the adoption of EVs.

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Ashish Sethiya, 2018 paper presents the current scenario of EVs regarding the Challenges and Opportunities. It also focuses on the adaptability of EVs among the people of India. The researcher identifies the major challenges of EVs through the study like Cost, Infrastructure, Charging Facilities, and reliability.

Research Question:

What are the challenges faced by the youth of Nashik City for the adoption of EVs?

Objectives:

1. To identify the challenges faced by Nashik's youth in adopting EVs.
2. To analyze the attitudes and perceptions of Nashik's youth towards EVs.
3. To explore the role of demographic factors in adopting electric vehicles.

Hypothesis:

Hypothesis testing is a statistical approach used to test an assumption about a population based on a sample of data. In the Context, Challenges in the Adoption of Electric Vehicles: An Analysis of Nashik Youth

H1: There is a correlation between the Perceptions of cost-effectiveness and willingness to adopt electric vehicles.

H2: There is a correlation between the perception of charging infrastructure and willingness to adopt electric vehicles.

H3: There is a correlation between the driving range and willingness to adopt electric vehicles.

H4: There is a correlation between the safety implications and willingness to adopt electric vehicles.

Research Methodology:

This study used the mixed research method approach because research starts with a literature review of the relevant theories or previous research related to the challenges in the adoption of electrical vehicles. Then the factors helped the researcher in the development of a questionnaire. The researcher collected data from representative samples i.e. youth of Nashik City.

The descriptive research method is used for the research which describes what exists and focuses on new facts and meaning so the researcher collects information with the help of questionnaires and using participative observation through Individual interactions. The researcher mainly collected data from 129 youths from Nashik city. The reliability of data is measured through the statistical tool i.e. SPSS 29.

Reliability Statistics	
Cronbach's Alpha	N of Items
.701	7

it is observed that the value of Cronbach's Alpha is 0.7 which is acceptable. The researcher used the non-probability sampling technique i.e. Convenient Purposive Sampling which allows to selection of participants based on their accessibility and availability.

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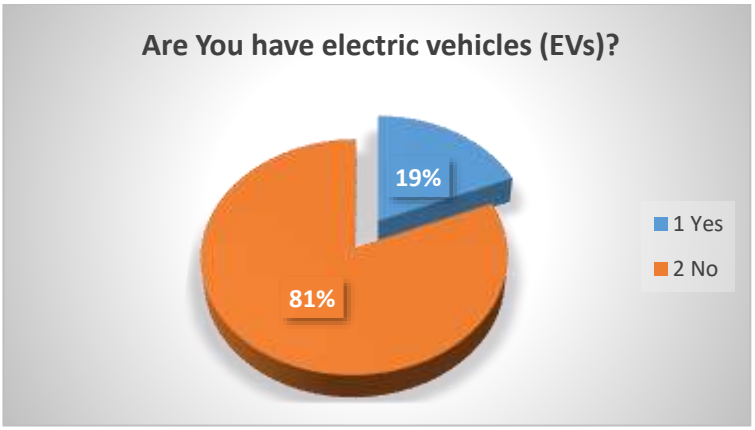
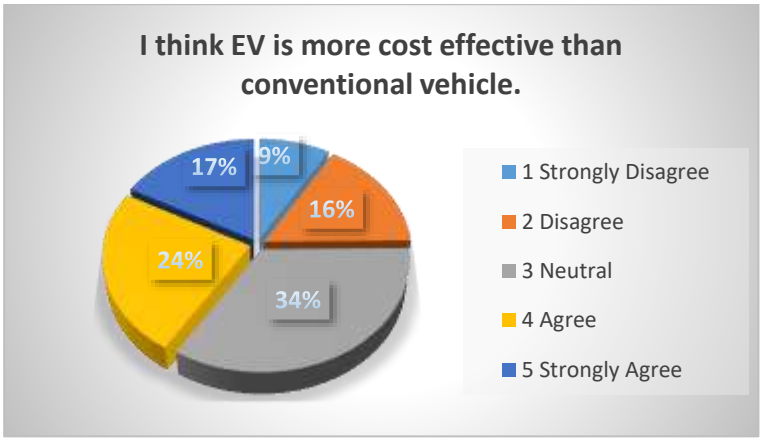
Data Analysis:



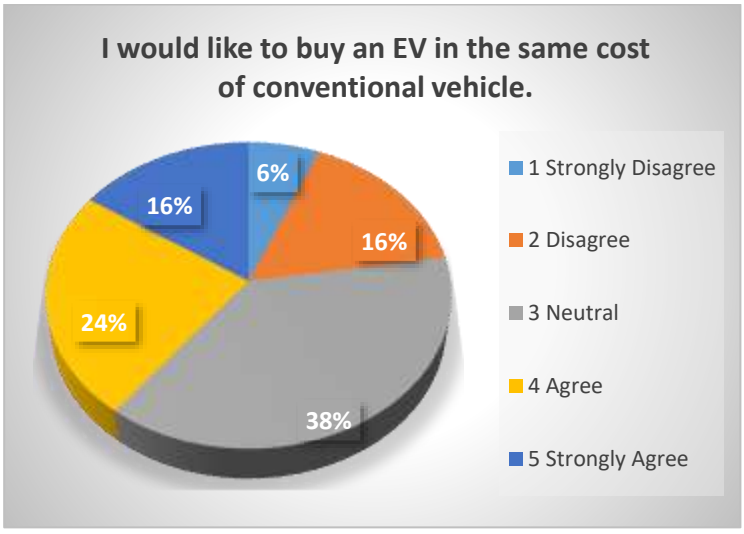
Interpretation:

As per the data shown in the figure, there are 19 % of respondents have electric vehicles and 81% of respondents have non-electric vehicles. So, the above numbers provide insights into the adoption or presence of electric vehicles within the sample group.



Interpretation:

The data provides insights into the perception of the respondents regarding the cost-effectiveness of EVs. Most respondents seem to be either neutral or leaning towards agreement with the statement that EVs are more cost-effective, with varying degrees of conviction.



Interpretation:

The data provides insights into the perception of the respondents regarding the affordability of electric vehicles compared to conventional vehicles. The data shows that nearly 78% of respondents agree with the statement and suggest a significant interest in acquiring an electric vehicle at a cost similar to that of traditional vehicles

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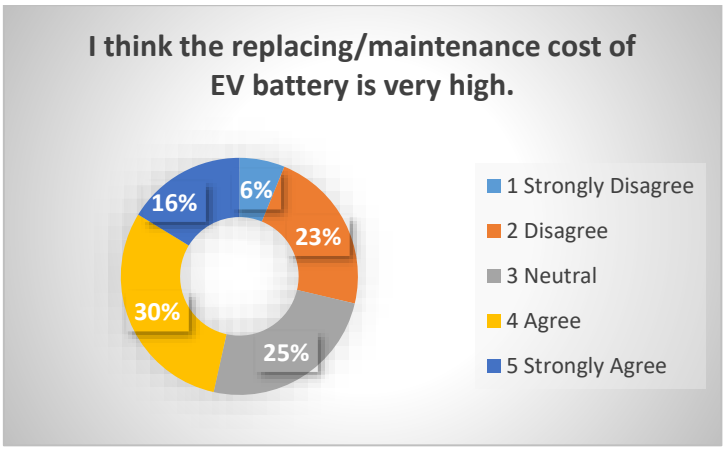
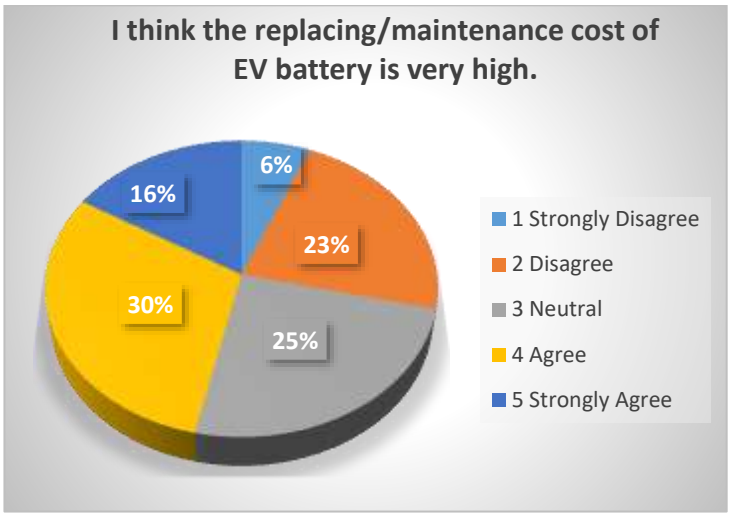


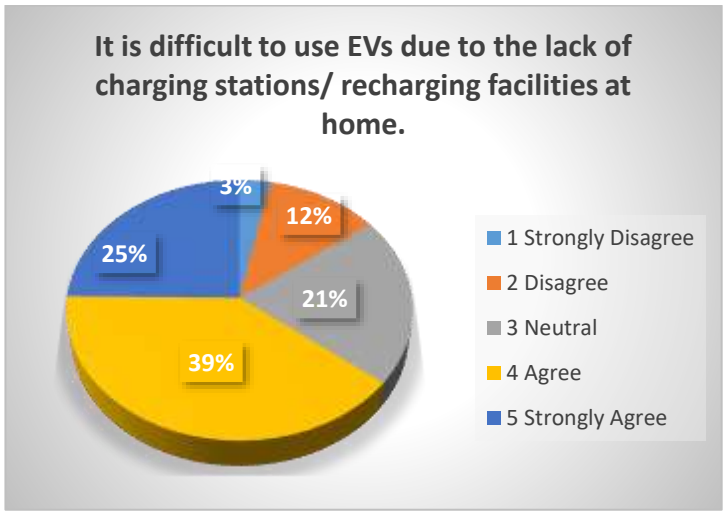
Interpretation:

The data indicate a range of opinions, with a notable number of respondents expressing agreement or strong agreement, suggesting concerns about the perceived high costs. However, some respondents disagree or strongly disagree, indicating a diversity of views on this matter.



Interpretation:

The data shows that the major respondents agree with the statement that the battery replacement and maintenance cost is one of the biggest challenges to adopting EVs.



Interpretation:

From the results, it appears that many respondents agree that the lack of infrastructure facilities makes it difficult to use electric vehicles. This data could be valuable for understanding public perceptions regarding the infrastructure challenges associated with electric vehicle adoption.

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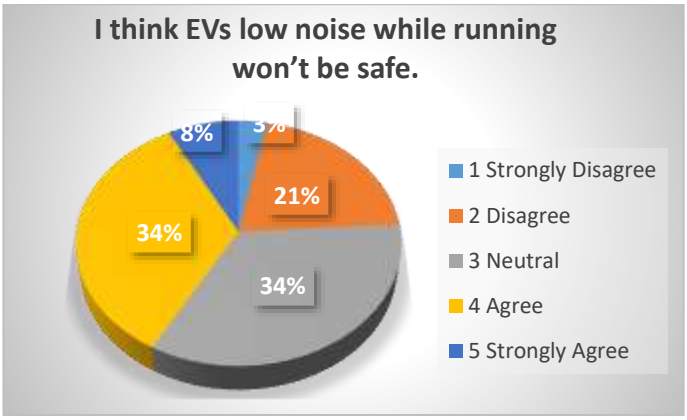
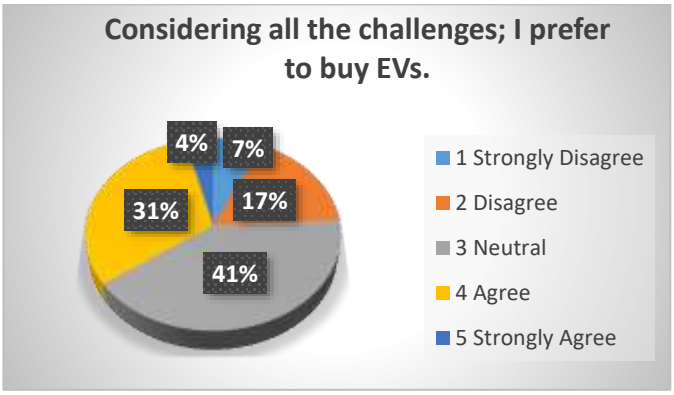


Interpretation: The data shows that the opinions are distributed across the spectrum, with a significant number of respondents stating neutrality. However, an equal number of respondents both agree and disagree with the statement. This suggests that there might be differing perspectives on whether the low noise level of EVs during operation could have safety implications.



Interpretation: Finally, these results show that most of the respondents are either neutral or have reservations about preferring to buy EVs despite the challenges. Some of the respondents suggested that there might be a need for further exploration or understanding of the challenges associated with EV adoption.

Results:

H1: There is a correlation between the Perceptions of cost-effectiveness and willingness to adopt electric vehicles.

Correlations			
		I think EV is more cost effective than conventional vehicle.	Considering all the challenges; I prefer to buy EVs.
I think EV is more cost effective than conventional vehicle.	Pearson Correlation	1	.366**
	Sig. (2-tailed)		<.001
	N	129	129
Considering all the challenges; I prefer to buy EVs.	Pearson Correlation	.366**	1
	Sig. (2-tailed)	<.001	
	N	129	129
**. Correlation is significant at the 0.01 level (2-tailed).			

In the bivariate correlation using Pearson Correlation coefficient for hypothesis testing. The correlation matrix shows that the table with cost-effectiveness correlated with willingness to adopt electric vehicles, and *r* for cost-effectiveness correlated with willingness to adopt electric vehicles is 0.366. With the "Sig. 2-tailed" it provides

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the p-value to compare with α. In this hypothesis, the given p < .01. Since this value is lower than any conventional alpha, we can reject H0. Thus, a significant correlation exists between cost-effectiveness and willingness to adopt electric vehicles.

H2: There is a correlation between the perception of charging infrastructure and willingness to adopt electric vehicles.

Correlations			
		It is difficult to use EVs due to the lack of charging stations/ recharging facilities at home.	Considering all the challenges; I prefer to buy EVs.
It is difficult to use EVs due to the lack of charging stations/ recharging facilities at home.	Pearson Correlation	1	.168
	Sig. (2-tailed)		.057
	N	129	129
Considering all the challenges; I prefer to buy EVs.	Pearson Correlation	.168	1
	Sig. (2-tailed)	.057	
	N	129	129

In the bivariate correlation using Pearson Correlation coefficient for hypothesis testing. The correlation matrix shows that the table with charging infrastructure correlated with willingness to adopt electric vehicles, and *r* for charging infrastructure correlated with willingness to adopt electric vehicles is 0.168. With the "Sig. 2-tailed" it provides the p-value to compare with α. In this hypothesis, the given p < .01. Since this value is lower than any conventional alpha, we can reject H0. Thus, a significant correlation exists between charging infrastructure and willingness to adopt electric vehicles.

H3: There is a correlation between the driving range and willingness to adopt electric vehicles.

Correlations			
		I think driving range of EVs is 2t useful for long journey.	Considering all the challenges; I prefer to buy EVs.
I think driving range of EVs is 2t useful for long journey.	Pearson Correlation	1	.419**
	Sig. (2-tailed)		<.001
	N	129	129
Considering all the challenges; I prefer to buy EVs.	Pearson Correlation	.419**	1
	Sig. (2-tailed)	<.001	
	N	129	129
**. Correlation is significant at the 0.01 level (2-tailed).			

The bivariate correlation through the Pearson Correlation coefficient for hypothesis testing is used. The correlation matrix shows that the table with driving range correlated with willingness to adopt electric vehicles,

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and *r* for driving range correlated with willingness to adopt electric vehicles is 0.419. With the "Sig. 2-tailed" it provides the p-value to compare with α. In this hypothesis, the given p < .01. Since this value is lower than any conventional alpha, we can reject H0. Thus, a significant correlation exists between driving range and willingness to adopt electric vehicles.

H4: There is a correlation between the safety implications and willingness to adopt electric vehicles.

Correlations			
		I think EVs low noise while running won't be safe.	Considering all the challenges; I prefer to buy EVs.
I think EVs low noise while running won't be safe.	Pearson Correlation	1	.318**
	Sig. (2-tailed)		<.001
	N	129	129
Considering all the challenges; I prefer to buy EVs.	Pearson Correlation	.318**	1
	Sig. (2-tailed)	<.001	
	N	129	129
**. Correlation is significant at the 0.01 level (2-tailed).			

In the bivariate correlation using Pearson Correlation coefficient for hypothesis testing. The correlation matrix shows that the table with safety implications correlated with willingness to adopt electric vehicles, and *r* for safety implications correlated with willingness to adopt electric vehicles is 0.318. With the "Sig. 2-tailed" it provides the p-value to compare with α. In this hypothesis, the given p < .01. Since this value is lower than any conventional alpha, we can reject H0. Thus, a significant correlation exists between safety implications and willingness to adopt electric vehicles.

Conclusion:

The data supports the notion that a positive perception of cost-effectiveness plays a crucial role in shaping individuals' attitudes toward adoption of electric vehicles. The results from the data analysis suggest a clear need for an expansion and improvement of the charging network, both in public areas and residential settings. the identified lack of charging infrastructure serves as a significant hurdle for EV adoption. Also, the data strongly suggests that addressing range limitations is crucial for overcoming a significant barrier to EV adoption. Initiatives aimed at improving battery technology, increasing the range of EVs, and implementing effective strategies to alleviate range anxiety are essential for promoting the broader acceptance and integration of electric vehicles into everyday transportation practices. Finally, the analysis of data underscores the importance of addressing safety and security perceptions to enhance the acceptability of electric vehicles.

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Cite This Article:

Mr. Pingale A.R. & Dr. Chaudhari N.K. (2024). CHALLENGES IN THE ADOPTION OF ELECTRIC VEHICLES: AN ANALYSIS OF NASHIK YOUTH. In Educreator Research Journal: Vol. XI (Number I, pp. 22–30). **ERJ.** https://doi.org/10.5281/zenodo.10715091