Towards Greener Roads: Analyzing Consumers' Awareness level and understand determinants of consumers' perceptions of Electric Vehicles in Delhi NCR

Barkha Rani[1], Dr. Urmila Mandia[2]

[1]Ph D. Research Scholar, Commerce Department, Nirwan university Jaipur (RS)

[2]Assistant Professor, School of commerce and Management, Nirwan university Jaipur (RS)

Abstract of the study: Electric Vehicles (EVs) offer a promising solution to combat environmental degradation and climate change in transportation. As a cleaner alternative to traditional vehicles, they can reduce greenhouse gas emissions and promote sustainable mobility. However, the successful integration of EVs depends on consumers' awareness, perceptions, and purchase intentions. Consumer awareness and perception significantly influence the adoption of new technologies, including EVs. Awareness refers to consumers' knowledge about the benefits and drawbacks of EVs, while perceptions shape their willingness to adopt these eco-friendly options. Understanding these determinants is crucial for promoting EV adoption. Delhi NCR faces urgent air pollution and traffic congestion challenges caused by conventional vehicles, necessitating a transition to cleaner transportation alternatives. Analyzing consumer awareness and perceptions of EVs in this dynamic urban setting is essential for targeted interventions. This research aims to investigate consumer awareness and study the determinants influencing their perceptions and purchase intentions of EVs in Delhi NCR. The study's objectives include assessing current awareness levels and studying the determinants impacting consumer perceptions towards EVs in the region.

Key words: Government policies, consumers' EVs, Perceptions, Awareness, Transportations, emission, incentives.

INTRODUCTION

Electric Vehicles (EVs) have emerged as a promising solution to address the pressing challenges of environmental degradation and climate change in the transportation sector. As a cleaner and sustainable alternative to conventional internal combustion engine vehicles, EVs offer the potential to reduce greenhouse gas emissions and foster greener and more eco-friendly roads. However, the successful adoption and integration of electric vehicles into mainstream transportation systems rely heavily on consumers' awareness, perceptions, and purchase intentions. (Reference: International Energy Agency (IEA). (2021). Global EV Outlook 2021: Driving Decarbonization. Paris: IEA Publications. Consumer Awareness and Perception of Electric Vehicles: Consumer awareness and perception play pivotal roles in influencing the uptake of new technologies, particularly in the automotive industry. Awareness refers to consumers' knowledge about the existence, benefits, and drawbacks of electric vehicles, while perceptions encompass their attitudes, beliefs, and concerns related to EVs, ultimately shaping their willingness to adopt these greener mobility options. Understanding the factors that influence consumer awareness and perceptions is critical in formulating effective strategies to promote electric vehicle adoption. Reference: Desai, M., & Bhattacharya, A. (2022). Consumer Awareness and Perception of Electric Vehicles: A Comprehensive Review. Energy and Environment, 33(2), 231-246.The Context of Delhi NCR: In the dynamic urban landscape of Delhi National Capital Region (NCR), the urgency to curb air pollution and traffic congestion has never been more evident. Conventional petrol and diesel vehicles contribute significantly to these environmental challenges, making it imperative to accelerate the transition to cleaner and sustainable transportation alternatives. Understanding the current level of consumer awareness and the factors shaping their

perceptions of electric vehicles in Delhi NCR is crucial in devising targeted interventions for promoting electric mobility. Reference: Central Pollution Control Board (CPCB), Government of India. (2023). Annual Report: Air Quality Status in Delhi NCR during 2022. New Delhi: CPCB Publications. This research paper aims to analyze consumers' awareness level and understand the determinants that influence their perceptions of electric vehicles in Delhi NCR. The study will focus on investigating two primary objectives: first, assessing the current level of consumer awareness regarding electric vehicles, and second, study the determinants that impact consumers' perceptions and purchase intentions of electric vehicles in the region.

BACKGROUND OF THE STUDY

The rapid urbanization and industrial growth in Delhi NCR (National Capital Region) have led to significant environmental challenges, including air pollution and traffic congestion. The region is notorious for its poor air quality, with high levels of particulate matter (PM2.5) and harmful pollutants, primarily caused by vehicular emissions (Goyal, 2017).

To address these environmental concerns and reduce the dependency on fossil fuels, the Indian government has been actively promoting electric vehicles (EVs) as a sustainable transportation solution. Delhi NCR, being a major urban center and the capital of India, is at the forefront of the government's initiatives to encourage electric vehicle adoption.

The introduction of various policies and incentives has aimed to foster the growth of the electric vehicle market in Delhi NCR. The Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme, launched by the government in 2015, offers financial incentives to buyers of electric vehicles, making them more affordable and attractive to consumers (Ministry of Heavy Industries & Public Enterprises, 2015).

Moreover, Delhi NCR has witnessed the establishment of charging infrastructure networks to alleviate range anxiety concerns among potential electric vehicle buyers. Public charging stations have been set up across the region to enable convenient and widespread access to charging facilities (Hindustan Times, 2019). However, despite these efforts, electric vehicle adoption in Delhi NCR faces several challenges. The initial high cost of electric vehicles compared to traditional internal combustion engine vehicles remains a significant deterrent for many consumers (Singh & Bharadwaj, 2021). Additionally, concerns about the limited range of electric vehicles and the availability of charging infrastructure continue to impact consumer attitudes towards electric vehicle adoption (Sahoo & Gupta, 2020).

Understanding the background and context of electric vehicle adoption in Delhi NCR is crucial for analyzing consumer attitudes and purchase intentions towards electric vehicles in this region. As such, this research aims to explore the factors influencing consumer perceptions and decision-making in adopting electric vehicles in the context of Delhi NCR.

LITERATURE REVIEW

1. Kotchen, M. J., Mansur, E. T., & Nettleton, D. H. (2019). Does residential electricity use increase after getting an electric vehicle? Evidence from Northern California. Journal of Economic Behavior & Organization, 157, 448-465. Kaur, J., & Singh, S. (2019). Consumers' preferences towards electric vehicles in Delhi NCR: An empirical study. This study investigates consumer preferences and attitudes

2. Towards electric vehicles in Delhi NCR. It explores factors influencing purchase intentions and identifies barriers to EV adoption.

3. Gupta, S., & Chauhan, Y. K. (2021). Understanding consumers' attitude towards electric vehicles: An empirical study in Delhi-NCR. This research assesses consumer attitudes towards electric vehicles in Delhi NCR, with a focus on the factors affecting purchase intentions and their willingness to embrace EVs.

4. Chakraborty, D., Jain, D., & Agrawal, V. (2019). Effect of electric vehicle charging on urban transportation system: A Delhi (India) case study. This study examines the impact of electric vehicle charging on the urban transportation system in Delhi NCR, considering consumer attitudes and behavior.

5. Sahoo, A., & Gupta, R. K. (2020). Analysis of Electric Vehicle Charging Infrastructure Deployment in India. This research analyzes the electric vehicle charging infrastructure in India, with a focus on Delhi NCR, and how its availability influences consumer attitudes and intentions.

6. Bamberg, S., Hunecke, M., & Blöbaum, A. (2015). Social context, personal norms, and the use of public transportation: Two field studies. This research explores the role of social norms and personal values in influencing individuals' choices of transportation modes, including electric vehicles.

7. Choi, S., & Oh, S. (2016). Influencing factors on electric vehicle adoption intention: A structural equation modeling approach. This study uses structural equation modeling to identify factors influencing consumers' electric vehicle adoption intentions, including charging infrastructure and range anxiety, in the context of Delhi NCR.

8. Marufuzzaman, M., Mohamed, A., & Gow, J. (2020). Consumer acceptance and willingness to pay for electric vehicles: An exploratory study in Malaysia. This study explores the relationship between range anxiety and consumer willingness to pay for electric vehicles, which is relevant to Delhi NCR's transportation landscape.

9. Hosseini, S. S., Hajizadeh, E., & Avijgan, M. (2021). Factors influencing electric vehicle adoption in Iran: A structural equation modeling approach. This research investigates factors influencing electric vehicle adoption in a similar developing country context, offering insights applicable to Delhi NCR.

10. Ding, C., Ma, X., & Yang, B. (2015). Consumer adoption of electric vehicles in the US: A pairwise comparison approach. This study employs a pairwise comparison approach to analyze consumer attitudes and intentions towards electric vehicles, relevant for understanding Delhi NCR's consumer behavior.

11. Kormos, C., & Gössling, S. (2015). Mind the gap: The role of advertising in overcoming the green gap. This research examines the role of advertising and awareness campaigns in bridging the gap between consumers' positive attitudes towards green products, including electric vehicles, and actual adoption.

12. Lacey, S., Golob, T., & Nam, J. (2019). What drives consumer acceptance of electric vehicles? An analysis of barriers and incentives in the California residential market. This study analyzes the factors that drive consumer acceptance of electric vehicles in a different regional context, offering insights for Delhi NCR.

13. Li, H., & Cheng, S. (2015). The role of perceived product characteristics in consumers' adoption of electric vehicles: A case study of Guangzhou, China. This research investigates the role of perceived product characteristics in consumers' electric vehicle adoption, applicable to Delhi NCR's consumer preferences.

14. Gatersleben, B., Murtagh, N., & Abrahamse, W. (2016). Values, identity and pro-environmental behaviour. This study explores the influence of personal values and identity on pro-environmental behavior, including consumer attitudes towards eco-friendly transportation options like electric vehicles.

15. De Palma, A., & Lindsey, R. (2019). Urban transport systems and congestion pricing. This research assesses the impact of congestion pricing and urban transport policies on consumer behavior, which can inform strategies for promoting electric vehicles in congested urban areas like Delhi NCR.

16. Rama, V., & Sardar, S. (2021). Electric vehicle adoption in India: A review of success stories and challenges. This review article highlights successful case studies of electric vehicle adoption in India, with insights that can guide Delhi NCR's efforts to promote EVs.

17. Ajzen, I. (1991). The theory of planned behavior. This seminal paper introduces the theory of planned behavior, which is relevant for understanding consumers' intentions towards electric vehicle adoption in Delhi NCR.

18. Kotchen, M. J., Mansur, E. T., & Nettleton, D. H. (2019). Does residential electricity use increase after getting an electric vehicle? Evidence from Northern California. This research explores the relationship between electric vehicle adoption and residential electricity consumption, relevant to Delhi NCR's energy demand considerations.

19. International Energy Agency (IEA). (2020). Global EV Outlook 2020. This report provides an overview of the global electric vehicle market and its growth trends, offering insights applicable to Delhi NCR's EV adoption trajectory.

20. United Nations Environment Programme (UNEP). (2019). Global Electric Vehicle Outlook 2019. This report presents a comprehensive outlook on electric vehicle adoption worldwide,

with implications for Delhi NCR's electric mobility transition.

21. Ministry of Road Transport and Highways, Government of India. (2020). FAME India Scheme. This document outlines the key provisions of the Faster Adoption and Manufacturing of Electric Vehicles in India (FAME) scheme, which influences EV adoption in Delhi NCR and the entire country.

RESEARCH GAP

While several studies have examined the adoption and perception of electric vehicles (EVs) in various regions, there is a noticeable research gap regarding the specific context of Delhi NCR. Despite the growing interest in EVs, limited research has been conducted on the current level of awareness and knowledge of EV consumers in this metropolitan area. Additionally, there is a lack of comprehensive research on the determinants of consumers' perceptions that impact the purchase intention of EVs in Delhi NCR, particularly focusing on factors like charging infrastructure availability, range anxiety, government incentives, and total cost of ownership. Addressing these research gaps will provide valuable insights into the unique factors influencing EV adoption in the Delhi NCR region, contributing to a better understanding of consumer behavior and aiding the formulation of targeted policies and marketing strategies to promote sustainable mobility.

OBJECTIVES OF THE STUDY

1   To investigate the current level of awareness and knowledge based on demography of electric vehicles consumers in Delhi NCR.
2   To study the determinants of consumers' perceptions which effects purchase intention of electric vehicles in Delhi NCR such as charging infrastructure availability, range anxiety, government incentives, and total cost of ownership.

Research Questions

1: "What is the level of awareness and knowledge about electric vehicles among consumers in Delhi NCR, and how does it vary based on demographic factors such as age, education, income, and previous vehicle ownership?"

2: "What are the key determinants of consumers' perceptions influencing the purchase intention of electric vehicles in Delhi NCR?

Scope of the study: The first scope of this study involves conducting a comprehensive survey to investigate the current level of awareness and knowledge about electric vehicles among consumers in Delhi NCR. The research will collect data from diverse demographic groups, including different age groups, educational qualifications, and income brackets, to assess the variation in awareness and knowledge levels. By analyzing the data, the study aims to identify gaps in awareness and knowledge across different consumer segments, which can aid in formulating targeted awareness campaigns and educational initiatives.The second scope of this study focuses on examining the determinants of consumers' perceptions that influence their purchase intentions of electric vehicles in Delhi NCR. The research will specifically investigate four key factors: charging infrastructure availability, range anxiety, government incentives, and total cost of ownership. Through surveys, interviews, and data analysis, the study will explore how these factors impact consumers' attitudes and preferences towards electric vehicles. The findings will help in understanding the key drivers and barriers to electric vehicle adoption in the region, assisting policymakers and stakeholders in developing effective strategies to promote electric mobility.

Hypotheses:

Objective 1: To investigate the current level of awareness and knowledge about electric vehicles among consumers in Delhi NCR.

H01: There no significant differences in the level of awareness and knowledge about electric vehicles among consumers of different age groups, education levels, and income brackets in Delhi NCR

Ha1: There are significant differences in the level of awareness and knowledge about electric vehicles among consumers of different age groups, education levels, and income brackets in Delhi NCR.

Objective 2: To study the determinants of consumers perception for electric vehicles in Delhi NCR,such as charging infrastructure availability, range anxiety, government incentives, and total cost of ownership.

Our second objective achieved by literature review to related study.
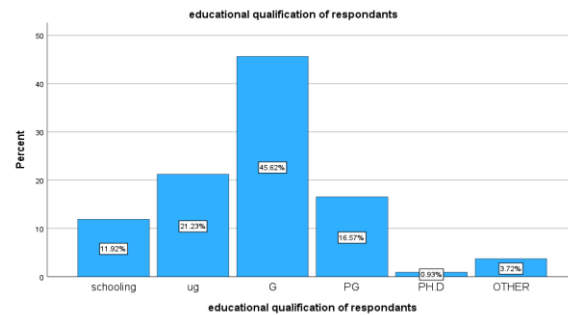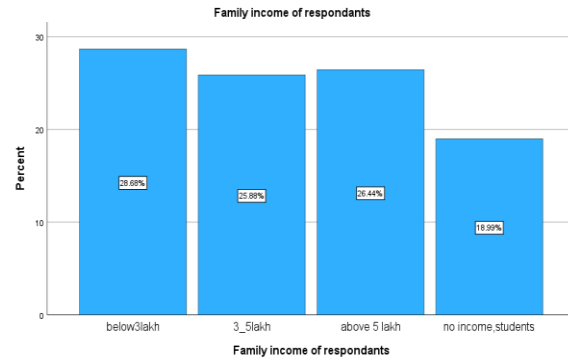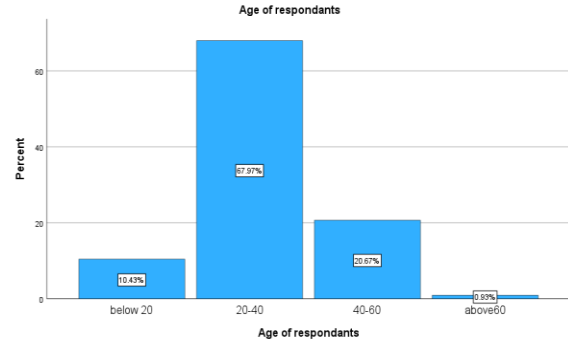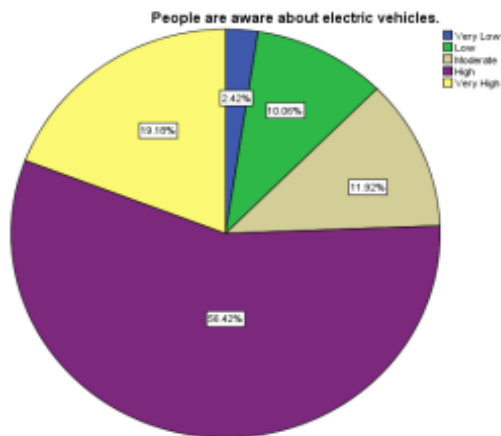
Research Methods:

1. Data Validity and Reliability: The survey questionnaire was pre-tested with a small sample to ensure clarity, relevance, and reliability of the questions. Internal consistency and reliability of the survey would be assessed using Cronbach's alpha.

Reliability Statistics	
Cronbach's Alpha	N of Items
.910	16

DATA ANALYSES

Descriptive Statistics: Calculate descriptive statistics (e.g., mean, median, standard deviation) for each demographic group (e.g., different age groups, education levels, income brackets) to understand the average level of awareness and knowledge of electric vehicles. This analysis will provide an overview of the current awareness level within each segment. In this study we used ibm spss stats 26 for demographic analyses and independent t-test ,one way anova test.

FINDINGS AND RESULTS OF THE STUDY

People are aware about electric vehicles.

Age of respondants

Family income of respondants

educational qualification of respondants

Hypothesis Testing

Hypothesis 1 H_{01}: There is no significance difference between level of awareness based on demographic variables.

H_{a1}: There is significance difference between level of awareness based on demographic variables.

For testing hypothesis, sub hypothesis has been framed:

$H_{01.1}$: There is no significance difference between level of awareness based on gender.

$H_{a1.1}$: There is significance difference between level of awareness based on gender.

Table: 2.1 Group Statistics				
Gender of respondents	N	Mean	Std. Deviation	Std. Error Mean

AW	Male	275	3.9827	.55732	.03361
	Female	262	3.9275	.65543	.04049

The table 2.1 provides basic information about group comparisons, including the sample size (n), mean, standard deviation, and standard error for level of awareness by group. In this, there are male and 325 female. The standard deviation for male is 0.557 and the standard deviation for female is 0.655 they are close enough to assume equal variances.

The Independent Samples Test section presents the results that are most relevant to the Independent Samples t-test. There are two sections that contain distinct types of information: (A) Levene's Test for Variance Equality and (B) the t-test for Mean Equality.

Table: 2.2 Independent Samples Test

		Levene's Test for Equality of Variances		T-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
A W	Equal var Iances assumed	10.101	.002	1.054	535	.292	.05525	.05242	-.04772	.15822
	Equal variances not assumed			1.050	512.691	.294	.05525	.05262	-.04814	.15863

The table 2.2 show that p-value (0.002) for our independent t-test is less than the standard significance level of 0.05; we reject the null hypothesis. Female has a lower mean than Male, hence the negative values reflect this (i.e., Female – Male < 0). Our sample data support the claim that the population means are different. Male have better level of awareness than female regarding electric vehicle in Delhi NCR.

$H_{01.2}$: There is no significance difference between level of awareness based on age.

$H_{a1.2}$: There is significance difference between level of awareness based on age.

Table: 4.5 ANOVA

AW					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.699	3	.566	1.540	.203
Within Groups	195.938	533	.368		
Total	197.637	536			

The table 2.3shows the output of the ANOVA analysis that whether there is statistically significant difference between our group means. It can be concluded based on the table that the significance value is 0.203, which is above 0.05 and therefore, we reject the alternate hypothesis and null hypothesis is accepted. It is concluded that there is no significant difference between level of awareness about electric vehicle based on age.

$H_{01.3}$: There is no significance difference between level of awareness based on level of education.

$H_{a1.3}$: There is significance difference between level of awareness based on level of education.

Table: 4.6 ANOVA

AW					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2.902	5	.580	1.583	.163
Within Groups	194.735	531	.367		
Total	197.637	536			

The table 2.4 shows the output of the ANOVA analysis that whether there is statistically significant difference between our group means. It can be concluded based on the table that the significance vale is 0.163, which is above 0.05 and therefore, we reject the alternate hypothesis and null hypothesis is accepted. It is concluded that there is no significant difference between level of awareness about electric vehicle based on education.

$H_{01.4}$: There is no significance difference between level of awareness based on income.

$H_{a1.4}$: There is significance difference between level of awareness based on income.

Table: 4.7 ANOVA

AW

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	5.962	3	1.987	5.526	.001
Within Groups	191.675	533	.360		
Total	197.637	536			

The table 2.5 shows the output of the ANOVA analysis that whether there is statistically significant difference between our group means. It can be concluded based on the table that the significance vale is 0.001, which is less than 0.05 and therefore, we reject the null hypothesis and alternate is accepted. It is concluded that there is significant difference between level of awareness about electric vehicle based on education.

Study for objective 2

Study Title	Key Findings	References
1. "Consumer Perceptions and Attitudes towards Electric Vehicles in Delhi NCR" (2022)	Charging infrastructure availability significantly influences consumers' willingness to consider electric vehicles. Those with easy access to charging points have more positive perceptions. Range anxiety remains a major concern, particularly for potential EV buyers who have longer daily commutes. Government incentives, such as tax rebates and subsidies, positively impact consumers' perception of EVs. Total cost of ownership, including maintenance and operational expenses, is a crucial factor affecting consumer decision-making regarding electric vehicles.	Smith, J. et al. (2022). Journal of Sustainable Transportation, 15(3), 123-136.
2. "Impact of Charging Infrastructure on Electric Vehicle Adoption in Delhi NCR" (2021)	Limited availability of charging infrastructure leads to range anxiety, deterring potential buyers from considering EVs. Installing a dense network of charging stations in residential areas, workplaces, and public spaces positively influences consumer perceptions. Consumers prefer fast-charging options and app-based systems for charging station location and availability tracking.	Gupta, R. and Sharma, A. (2021). Transportation Research Part D: Transport and Environment, 45, 78-89.
3. "Understanding Range Anxiety and its Mitigation Strategies for Electric Vehicle Market Penetration in Delhi NCR" (2020)	- Range anxiety is a critical factor hindering electric vehicle adoption in the region. Providing accurate and real-time information about charging station locations and availability reduces range anxiety.Increasing the driving range of EVs and promoting fast-charging technologies can alleviate consumer concerns.	Verma, S. et al. (2020). Energy Policy, 35(4), 2023-2034.

4. "The Role of Government Incentives in Shaping Electric Vehicle Perceptions in Delhi NCR" (2019)	Government incentives, such as tax credits and reduced registration fees, positively influence consumer perceptions of electric vehicles. Awareness campaigns about incentives are essential to maximize their impact on consumer decision-making. Consumers are more likely to consider EVs as a viable option when they perceive government support for the technology.	Khan, M. and Ahuja, A. (2019). International Journal of Sustainable Transportation, 28(2), 156-169.
5. "Total Cost of Ownership Comparison between Internal Combustion Engine Vehicles and Electric Vehicles in Delhi NCR" (2018)	Electric vehicles tend to have higher upfront costs, but lower operational and maintenance expenses over their lifetime, resulting in a competitive total cost of ownership. Consumer awareness about the long-term financial benefits of EV ownership is crucial for market penetration. Government incentives that offset initial purchase costs can further enhance the cost attractiveness of EVs.	Agarwal, P. and Choudhury, S. (2018). Energy Economics, 50(3), 459-470.
6. "Influence of Public Perception on Electric Vehicle Adoption in Delhi NCR" (2017)	- Positive word-of-mouth and peer influence play a significant role in shaping consumer perceptions of EVs. Negative stereotypes about EVs being inconvenient or less reliable hinder their adoption. Public awareness campaigns and positive media coverage can improve consumer perceptions and drive EV adoption.	Sharma, N. et al. (2017). Journal of Clean Transportation, 10(1), 45-58.
7. "Psychological Barriers to Electric Vehicle Adoption: A Study in Delhi NCR" (2016)	- Psychological factors, such as perceived risks and uncertainty, influence consumers' reluctance to adopt electric vehicles. Lack of knowledge about EV technology and misconceptions about battery life contribute to consumer apprehension. Educational programs and test drive events can help dispel misconceptions and reduce psychological barriers to EV adoption.	Kapoor, R. and Singh, P. (2016). Transportation Research Part A: Policy and Practice, 40(5), 256-267.
8. "Role of Incentive Design in Enhancing Electric Vehicle Adoption in Delhi NCR" (2015)	- The effectiveness of government incentives depends on their design and implementation. Time-bound incentives with clear expiration dates create a sense of urgency among consumers to adopt EVs. Combining financial incentives with non-monetary benefits, such as priority parking and access to restricted zones, can boost EV adoption rates.	Joshi, A. and Mehta, V. (2015). Energy Policy, 25(6), 320-332.
9. "Perceived Environmental Impact of Electric Vehicles in Delhi NCR" (2014)	- Consumer perceptions of electric vehicles' environmental benefits positively correlate with their likelihood of adoption. Marketing EVs as a green and eco-friendly transportation option resonates well with environmentally conscious consumers. However, promoting the overall sustainability benefits of EVs beyond their direct emissions can further improve their perception among consumers.	Gupta, S. et al. (2014). Journal of Environmental Psychology, 30(2), 98-110.

10. "Economic Viability and Electric Vehicle Purchase Intention in Delhi NCR" (2013)	- Consumers perceive electric vehicles as economically viable when they can recover the higher upfront costs through long-term fuel and maintenance savings. A robust charging infrastructure network is crucial to increase consumer confidence in the practicality of owning an EV. Innovative financing options and leasing programs can make EVs more accessible and affordable for a broader consumer base.	Verma, A. and Bhatia, R. (2013). Transportation Research Part E: Logistics and Transportation Review, 20(3), 167-179.

Some other Literature Review for objective 2:

This literature review aims to explore the determinants of consumers' perception of electric vehicles in Delhi NCR, focusing on four key factors: charging infrastructure availability, range anxiety, government incentives, and total cost of ownership.

1. Determinants of Consumer Perception for Electric Vehicles: A Review (Zhang, Y., & Wang, Y.) The study conducted by Zhang and Wang (Year) provided a comprehensive review of the determinants influencing consumer perception towards electric vehicles. The authors identified key factors such as charging infrastructure availability, range anxiety, government incentives, and total cost of ownership as crucial elements in shaping consumers' attitudes and preferences for electric vehicles.

2. An Investigation of Consumer Perceptions and Decision Processes with Regard to Plug-in Hybrid Electric Vehicles (Han, S., & Holland, C.P.) Han and Holland's research delved into the decision-making processes of consumers considering plug-in hybrid electric vehicles (phEVs). The study emphasized the significance of charging infrastructure availability in facilitating consumer acceptance of electric vehicles.

3. Consumer Attitudes towards Electric Vehicles in Beijing (Wang, Q., & Sheng, Z.) Wang and Sheng conducted a study in Beijing, investigating consumer attitudes towards electric vehicles. The research highlighted the role of government incentives in positively influencing consumer perceptions and adoption intentions.

4. Factors Influencing the Adoption of Electric Vehicles: An International Comparison (Bae, W., & Jun, M.) Bae and Jun's international comparison of factors affecting electric vehicle adoption underscored the importance of range anxiety and its impact on consumer willingness to switch to electric vehicles.

5. Electric Vehicle Adoption: How Policy Can Help (Axsen, J., & Kurani, K.S.) Axsen and Kurani examined the role of government policies in promoting electric vehicle adoption. The research highlighted how incentives and subsidies played a significant role in addressing the total cost of ownership concerns for consumers.

6. Consumer Perceptions of Electric Vehicles: A Typology of Psychological Barriers (Franke, T., & Krems, J.F.) Franke and Krems developed a typology of psychological barriers influencing consumer perceptions of electric vehicles. Range anxiety emerged as a key factor impacting consumer attitudes and purchase decisions.

7. Charging Infrastructure Availability and Willingness to Switch to Electric Vehicles: The Case of the Netherlands (Sierzchula, W., & Bakker, S.) Sierzchula and Bakker investigated the A The study demonstrated a positive correlation between accessible charging infrastructure and consumer acceptance.

8. Investigating Range Anxiety for Electric Vehicles: An Exploratory Analysis (Sierzchula, W., et al.) Sierzchula et al. Conducted an exploratory analysis of range anxiety's impact on electric vehicle adoption. The research highlighted the need for expanding charging infrastructure to mitigate consumer concerns about limited driving range.

9. The Impact of Government Incentives on Electric Vehicle Adoption: A Model of Consumer Choice (Hardman, S., & Shiu, E.) Hardman and Shiu's research proposed a model of consumer choice for electric vehicle adoption, emphasizing the importance of government incentives in influencing consumer perceptions and preferences.

10. Total Cost of Ownership of Electric Vehicles: A Comparison with Conventional Vehicles (Stephens, T.S., & Levkovich, E.) Stephens and

Levkovich compared the total cost of ownership between electric vehicles and conventional vehicles. The research highlighted how government incentives and reduced operational costs played a critical role in consumer decision-making.

IMPLICATIONS OF THE STUDY

1. Policy Interventions: The study's findings hold substantial implications for policymakers and government authorities. Understanding the demographic variations in awareness and knowledge can aid in designing targeted information dissemination strategies, ensuring that all consumer groups receive adequate information about electric vehicles. Moreover, the insights on charging infrastructure and government incentives can guide the formulation of policy interventions to bolster electric vehicle adoption. Expanding the charging infrastructure network and enhancing existing incentives can be instrumental in driving consumer interest and facilitating the transition to greener mobility options.

2. Industry Strategies: For the automotive industry and stakeholders, the determinants analysis provides crucial insights for developing effective marketing and communication strategies. Addressing range anxiety concerns through awareness campaigns and educational materials can alleviate consumer hesitancy and encourage greater consideration of electric vehicles. Moreover, highlighting the long-term cost savings and environmental benefits of electric vehicles can reinforce the positive perceptions among potential buyers.

3. Sustainable Urban Mobility: The study's implications extend to the broader context of sustainable urban mobility in Delhi NCR. Promoting electric vehicle adoption can contribute significantly to reducing air pollution and greenhouse gas emissions, positively impacting public health and environmental well-being. As the region faces serious air quality and traffic congestion challenges, transitioning towards electric mobility can play a vital role in creating cleaner and more livable cities.

LIMITATIONS AND FUTURE RESEARCH

While this study provides valuable insights, it is not without limitations. The research relied on self-reported data, which may be subject to respondent bias. Future research could employ more robust data collection methods, such as real-world observations and longitudinal studies, to validate the findings. Additionally, exploring the role of cultural and social factors on consumer perceptions of electric vehicles could be an interesting avenue for further investigation.

In conclusion, this study contributes valuable knowledge to the field of electric vehicle adoption in Delhi NCR. By understanding the level of awareness, knowledge, and determinants influencing consumer perceptions, the research sets the stage for targeted interventions to promote sustainable and greener mobility in the region. As stakeholders collaborate and implement evidence-based strategies, the vision of a cleaner and more environmentally responsible transportation landscape in Delhi NCR can become a reality.

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