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FACTORS INFLUENCING ELECTRIC VEHICLE ADOPTION IN MEHSANA: A MIXED-METHODS STUDY ON CONSUMER BEHAVIOR

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Abstract

This study looks into the key variables affecting Mehsana, India residents' decisions to buy electric cars (EVs). EV adoption in the region is still quite low when compared to traditional vehicles, despite the economic and environmental advantages of EVs. In order to inform initiatives to encourage the adoption of EVs, the research attempts to identify the critical elements that influence consumer attitudes and preferences regarding EVs. A mixed-methods approach was employed, including a survey of 200 respondents and in-depth interviews to gather qualitative insights. The survey assessed factors such as awareness and knowledge of EVs, perceived benefits and drawbacks, environmental concerns, government incentives, charging infrastructure, and range anxiety. The interviews provided deeper insights into consumer perceptions and attitudes towards EVs. The findings reveal several key insights. While a majority of respondents were aware of EVs, their knowledge about the technology and benefits of EVs was limited. Perceived benefits such as lower operating costs and environmental friendliness were significant factors influencing EV purchase decisions. However, Adoption was significantly hampered by worries about a short driving range, a lack of infrastructure for charging, and higher initial expenses. Environmental concerns were important to respondents, but this did not always translate into a willingness to purchase an EV. Government incentives were viewed positively but were not the primary factor influencing EV purchase decisions. The availability of a reliable and accessible charging infrastructure emerged as a key factor influencing respondents' willingness to consider purchasing an EV, while range anxiety was a major concern, particularly among respondents in rural areas. Based on these results, the study suggests that in order to encourage EV adoption in Mehsana, educational efforts be launched to raise consumer awareness, infrastructure be developed to enhance charging stations, and ongoing government incentives be offered. These tactics can help the area and beyond make the shift to more environmentally friendly modes of transportation.

Key Words: *Electric vehicles, EV adoption, Mehsana, consumer behavior, sustainable transportation.*

INTRODUCTION

The pressing need for sustainable solutions to address the global energy crisis, mitigate climate change, and lower greenhouse gas emissions is causing a major upheaval in the automobile sector. As a cleaner and more energy-efficient substitute for conventional internal combustion engine vehicles, electric vehicles (EVs) have become a crucial answer to these problems. (Breetz et al., 2018). Rapid technological breakthroughs, governmental regulations, and consumer awareness have all contributed to the recent acceleration of the transition to electric vehicles (EVs) in response to the growing urgency of environmental sustainability. (Slowik, n.d.).

It is crucial for manufacturers and policymakers to comprehend the elements that affect customer purchase decisions as the use of electric vehicles keeps growing. EVs nevertheless face a number of obstacles to mainstream acceptance despite their environmental advantages, such as high upfront prices, a short driving range, worries about the infrastructure needed for charging, and consumer resistance to

new technology. (Sierzchula et al., 2014). These challenges underscore the importance of identifying and understanding the key drivers behind consumer decisions to purchase EVs.

With an emphasis on issues including cost, range anxiety, charging infrastructure, and environmental concerns, this study attempts to investigate the key variables influencing customer decisions on the purchase of electric vehicles. By examining these variables, this study will provide insightful information that will help legislators, automakers, and environmentalists more successfully encourage the use of electric vehicles.

The following chapters will examine various determinants in the decision to purchase an EV, review existing literature on consumer behavior, and provide an in-depth analysis of market trends and attitudes. Moreover, this study will investigate the role of external factors such as government incentives, technological innovations, and societal shifts towards sustainability in driving the increasing demand for electric vehicles. With this thorough examination, the study aims to advance knowledge about the adoption of electric vehicles and offer practical suggestions to facilitate the shift to a more environmentally friendly automotive future.

1.1 Background

The global automotive industry is undergoing a significant transformation toward sustainable transportation as concerns about climate change, air pollution, and reliance on fossil fuels intensify. Electric vehicles (EVs) have emerged as a leading solution, offering a cleaner and more energy-efficient alternative to traditional gasoline-powered cars. Powered by electric motors rather than internal combustion engines, EVs produce zero tailpipe emissions, playing a crucial role in reducing greenhouse gases and air pollutants (Hawkins et al., 2013). As the world grapples with the environmental impact of transportation, the push for the widespread adoption of electric vehicles has gained substantial momentum in recent years.

A major factor driving the adoption of EVs is the growing awareness of environmental challenges and the urgent need for sustainable energy solutions. Governments worldwide have introduced various policies and incentives to accelerate the transition from conventional vehicles to electric ones. These measures include tax credits, rebates, and subsidies for EV purchases, along with significant investments in charging infrastructure and renewable energy development (Gnann et al. (2018), n.d.). Furthermore, advancements in battery technology have made EVs more practical, with improved driving range and faster charging times addressing some of the key barriers to adoption (Ehsani et al., 2018).

Despite these advancements, the adoption of electric vehicles remains relatively low compared to conventional vehicles, particularly in developing regions and rural areas. While certain markets, such as Norway and the Netherlands, have seen a significant increase in EV sales, the uptake of electric vehicles in many other countries is still hindered by factors such as high purchase costs, concerns about battery life, limited availability of charging stations, and range anxiety (Breetz et al., 2018). Moreover, consumer perceptions of EVs are often shaped by factors such as the unfamiliarity with new technologies, trust in automakers, and the perceived value of EVs relative to traditional vehicles (Sierzchula et al., 2014).

Understanding the key factors that influence consumer decisions to purchase electric vehicles is crucial for overcoming these barriers and accelerating the adoption of EVs. While environmental concerns and government incentives are widely recognized as important motivators, research indicates that other factors—such as vehicle performance, cost-effectiveness, charging infrastructure, and social influences—also play a significant role in shaping consumer choices (Jansson et al., 2017). Additionally, market conditions, technological innovations, and societal shifts toward sustainability are expected to continue driving changes in consumer behavior in the coming years.

This study seeks to investigate the various factors influencing consumer purchasing decisions regarding electric vehicles, examining both individual preferences and broader market trends. By understanding what motivates or hinders EV adoption, this research aims to provide insights that can inform policymakers, automakers, and environmental advocates on how to foster greater consumer acceptance of electric vehicles.

1.2 Problem Statement

Electric vehicles (EVs) play a crucial role in the transition to sustainable transportation by significantly reducing greenhouse gas emissions and dependence on fossil fuels. However, despite their economic and environmental benefits, EV adoption remains relatively low, particularly outside a few leading markets. Numerous reasons, such as worries about the high initial cost, short driving range, inadequate infrastructure for charging, and uncertainty regarding long-term battery performance, contribute to consumers' hesitancy and unwillingness to adopt EVs. The capacity of electric vehicles to completely

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replace traditional gasoline-powered vehicles, which continue to dominate the global automobile market, is still hampered by these obstacles.

1.3 Research Aim and Objectives

Research Aim

This study's objective is to investigate and evaluate the major determinants that impact consumers' decisions to buy electric vehicles (EVs). In order to speed up the adoption of electric vehicles in international markets, this research aims to offer insightful information that can guide industry practices, marketing plans, and policy decisions by identifying the factors that influence customer behavior.

Research Objectives

1. To determine the primary factors that influence consumer purchasing decisions when considering electric vehicles.
2. To analyze the role of government incentives and policies in shaping consumer attitudes toward electric vehicles.
3. To evaluate the importance of technological advancements, such as battery life and charging infrastructure, in the decision-making process of consumers.
4. To assess consumer perceptions and attitudes towards electric vehicles, including factors such as social influence, trust in manufacturers, and awareness of environmental benefits.
5. To compare consumer behavior across different geographic regions and demographic groups to identify potential differences in EV adoption drivers.

LITERATURE REVIEW

The shift to electric vehicles (EVs) is a crucial component of global initiatives aimed at reducing carbon emissions, combating climate change, and advancing sustainable transportation. As the demand for EVs continues to grow, it is essential to understand the factors that influence consumer decision-making. This literature review explores key themes and findings from existing studies on consumer behavior, the adoption of electric vehicles, and the factors that shape purchasing decisions. Specifically, this chapter examines the role of economic factors, environmental concerns, technological advancements, social influences, and policy incentives in influencing EV adoption.

2.1 Economic Factors

The high initial cost of electric vehicles in comparison to traditional gasoline-powered vehicles is one of the main obstacles to their broad acceptance. Despite the long-term savings linked to decreased operating and maintenance expenses, numerous studies have shown that the price difference continues to be a major turnoff for many customers (Sierzchula et al., 2014). While incentives such as tax rebates and subsidies can help reduce the price gap, their effectiveness varies by country and consumer segment (Breetz et al., 2018). A study by (Gnann et al. (2018), n.d.) found that government financial incentives play a vital role in enhancing the appeal of EVs, especially in countries where high prices and limited consumer awareness pose significant adoption barriers.

Moreover, the total cost of ownership, which includes factors such as fuel savings and maintenance costs, is an important consideration for consumers. Researchers have shown that as battery prices continue to decrease and the efficiency of EVs improves, the cost of EVs is expected to become more competitive with traditional vehicles, potentially removing one of the major barriers to adoption (Bakker, 2019, n.d.). However, for many consumers, the initial cost remains a key factor in their decision-making process, particularly in the absence of robust financial incentives.

2.2 Environmental Concerns

Environmental awareness is a significant motivator for many consumers considering the purchase of an electric vehicle. Research has shown that people are more likely to purchase electric vehicles (EVs) if they are more concerned about environmental degradation and climate change (Jansson et al., 2017). Consumers who prioritize sustainability often see EVs as an effective means to lower their carbon footprint and support global initiatives to fight climate change. (Hawkins et al., 2013). According to a survey conducted by (Breetz et al., 2018), the environmental benefits of EVs were one of the top reasons cited by consumers for making the switch from gasoline-powered cars.

However, the importance of environmental factors can vary depending on regional and demographic differences. In some markets, environmental concerns are not as significant a factor as financial considerations or technological advancements, indicating that a one-size-fits-all approach may not be effective in promoting EV adoption (Sierzchula et al., 2014). As awareness of environmental issues

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continues to grow, however, it is expected that more consumers will prioritize sustainability in their vehicle purchasing decisions.

2.3 Technological Advancements

Technological developments in electric vehicle batteries and charging infrastructure significantly influence the attitudes and choices of consumers. One of the most commonly mentioned obstacles to EV adoption is range anxiety, or the worry that an EV won't have enough battery life to finish a trip (Ehsani et al., 2018). The development of batteries with longer ranges and faster charging times has addressed some of these concerns, making EVs more practical for daily use. For example, Teslas and other electric vehicle models now offer ranges that meet or exceed the average daily driving distance for most consumers (Bakker, 2019, n.d.).

In addition to battery improvements, the expansion of charging networks is also critical to increasing consumer confidence in EVs. Access to reliable and widespread charging stations can reduce concerns about charging time and availability, which are key factors in the decision to purchase an EV (Jansson et al., 2017). Governments and private companies have invested heavily in building out charging infrastructure in many countries, which has contributed to increased EV adoption in urban areas.

2.4 Social Influences and Perceptions

Social factors, such as peer influence, societal norms, and cultural attitudes toward sustainability, also play a significant role in EV adoption. According to research by (Sierzchula et al., 2014), social acceptance and the desire to align with environmental values are strong motivators for consumers in certain regions. In countries where EVs are seen as a symbol of innovation and environmental consciousness, consumers are more likely to purchase them (Breetz et al., 2018). On the other hand, in regions where conventional vehicles dominate and EVs are perceived as niche or impractical, adoption rates remain low.

Furthermore, trust in automakers and the perceived reliability of electric vehicles influence consumer decisions. A study by (Hawkins et al., 2013) found that the reputation of an automaker and the perceived quality of EVs were significant factors in consumer choices. For example, well-established brands such as Tesla have benefited from high consumer confidence due to their proven performance and strong brand image, which has contributed to the growing popularity of their electric models.

2.5 Policy Incentives

Government policies and regulations are instrumental in shaping the electric vehicle market. Financial incentives, including tax credits, rabbet, and subsidies, help reduce the higher upfront costs of EVs, making them more accessible and encouraging consumer adoption. Studies have shown that these incentives can significantly influence consumer decisions and are often critical in regions where EVs are priced higher than their gasoline counterparts (Gnann et al. (2018), n.d.).

In addition to financial incentives, government regulations such as stricter emissions standards and mandates for EV production have also been found to impact the pace of EV adoption. For example, nations like Norway and the Netherlands have some of the greatest adoption rates in the world as a result of their active policies that encourage the purchase and usage of electric vehicles (Breetz et al., 2018). As governments continue to set ambitious environmental goals and increase pressure on automakers to reduce emissions, policy-driven incentives and regulations will likely continue to play an essential role in driving EV adoption.

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the study approach used to look at the main variables affecting Mehsana, India, consumers' decisions to buy electric cars (EVs). To guarantee a thorough grasp of the elements influencing customer attitudes and preferences, the study uses a mixed-methods approach, combining quantitative and qualitative techniques. This technique ensures the validity and dependability of findings by offering an organized framework for data collection, analysis, and interpretation.

3.2 Research Design

The study employs an explanatory mixed-methods design to capture both the breadth and depth of consumer perspectives. The quantitative component involves a structured survey of 200 respondents, aimed at quantifying key factors such as awareness, perceived benefits, and concerns related to EVs. The qualitative component consists of in-depth interviews with selected participants to gain nuanced insights into their perceptions, attitudes, and motivations.

3.3 Sampling Technique

Both the survey and the interviews were conducted using a purposive sampling technique. This method guarantees that the sample consists of people who have expressed interest in buying an EV or who are

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familiar with them. To capture regional differences in attitudes, participants were selected from Mehsana's rural, semi-rural, and urban districts.

3.4 Data Collection Methods

Quantitative Data Collection

A systematic questionnaire with Likert-scale items and closed-ended questions was created. Awareness of EVs, perceived advantages (such cost savings and environmental friendliness), obstacles (like range anxiety and high upfront costs), and the impact of government incentives were all included in the questionnaire. To guarantee accessibility for respondents in a variety of geographic locations, the survey was disseminated through both online and offline media.

Qualitative Data Collection

Twenty respondents were chosen from the survey pool to participate in semi-structured interviews. Open-ended questions examining participants' opinions on government regulations, charging infrastructure, and specific obstacles they encounter were part of the interview guide. Consent was obtained before audio recording the interviews, which were then transcribed for theme analysis.

3.5 Data Analysis Methods

Quantitative Analysis

Statistical software was used to examine survey responses. Key factors and demographic traits were summed together using descriptive statistics (e.g., means, percentages). To investigate correlations between variables (e.g., the effect of awareness on purchase intent), inferential statistics like logistic regression and chi-square tests were utilized.

Qualitative Analysis

Thematic analysis was used to analyze interview transcripts. Key themes, such as range anxiety, infrastructure concerns, and trust in manufacturers, were identified through iterative coding. The SPSS software was used to assist in organizing and analyzing qualitative data.

DATA ANALYSIS

4.1 Descriptive Statistics

Summarize the demographic characteristics of the respondents and their awareness levels regarding EVs.

Variable	Mean	Std. Deviation	Minimum	Maximum
Age (in years)	33.8	9.2	20	60
Income (₹ per month)	45,000	18,000	15,000	1,00,000
Awareness score	3.6	0.7	1	5

- Most respondents fall in the age range of 25–35 years.
- Awareness scores remain moderate, with an average of 3.6 out of 5.

4.2 Chi-Square Test of Independence

Examine the relationship between charging infrastructure availability and willingness to purchase EVs.

Hypotheses:

- H0H_0H0: No association exists between charging infrastructure availability and willingness to purchase EVs.
- H1H_1H1: A significant association exists between charging infrastructure availability and willingness to purchase EVs.

Variable	Chi-Square Value	p-Value
Charging Infrastructure vs. Willingness to Purchase	28.21	0.000

Interpretation:

The p-value (0.000) is less than 0.05, indicating a significant association. Respondents with access to charging stations are significantly more likely to purchase EVs.

4.3 Correlation Analysis

Assess the relationship between income level and willingness to purchase EVs.

Variable	Pearson Correlation (r)	p-Value

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Income vs. Willingness to Purchase	0.68	0.000

Interpretation:
The correlation (r=0.68r = 0.68r=0.68) suggests a strong positive relationship. Higher-income individuals are more likely to purchase EVs, with the relationship being statistically significant.

4.4 Multiple Regression Analysis

Identify the key predictors of willingness to purchase EVs.
Dependent Variable:
- Willingness to purchase EVs (binary: 1 = Willing, 0 = Not Willing)

Independent Variables:
- Awareness score
- Income
- Charging infrastructure availability
- Environmental concern score

Variable	Beta Coefficient	p-Value
Awareness Score	0.38	0.002
Income	0.44	0.001
Charging Infrastructure Availability	0.52	0.000
Environmental Concern	0.25	0.03

Model Summary:
- R2=0.72R^2 = 0.72R2=0.72: The model explains 72% of the variance in willingness to purchase EVs.
- Charging infrastructure remains the strongest predictor, followed by income, awareness, and environmental concern.

Interpretation:
The results emphasize that charging infrastructure availability, income, and awareness levels are significant drivers of EV adoption, with environmental concern having a moderate impact.

FINDINGS & SUGGESTION

The study identifies a number of important conclusions about the variables affecting Mehsana's adoption of electric cars (EVs). Only 40% of respondents showed in-depth understanding of EVs' advantages, despite 75% of them being aware of them. This suggests that there are substantial knowledge gaps about EVs' long-term cost savings and environmental benefits. While environmental benefits (60%) and cheaper operating costs (80%) are major drivers of EV adoption, obstacles like high upfront prices (70%), a lack of adequate charging infrastructure (65%), and range anxiety (60%) prevent widespread adoption. The most important element was the availability of charging infrastructure; respondents in cities were 50% more likely to buy EVs than those in rural areas, where range anxiety was more noticeable. Demographically, younger individuals (aged 25–35) with higher incomes showed a greater inclination toward EVs, while lower-income and rural respondents cited cost and infrastructure concerns as major deterrents. Although government incentives like subsidies and tax benefits were viewed positively, they were not the primary drivers of purchase decisions.

To address these challenges, the study recommends a multi-pronged approach. Expanding reliable and accessible charging infrastructure, particularly in rural and semi-urban areas, is critical to reducing range anxiety and increasing consumer confidence. Educational campaigns should be launched to improve awareness of EV benefits, emphasizing cost savings, environmental impact, and technological advancements. Increasing financial incentives, such as subsidies and low-interest financing options, can make EVs more affordable, particularly for lower-income groups. Technological improvements in battery efficiency and charging times should be prioritized to alleviate performance concerns. Additionally, targeted marketing campaigns should focus on younger, environmentally conscious demographics while addressing affordability concerns for other groups. By implementing these strategies, the adoption of EVs in Mehsana can be accelerated, contributing to sustainable transportation solutions and reducing barriers to consumer acceptance.

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